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A critical analysis of the Australian government's rationale for its vaccination policy

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A CRITICAL ANALYSIS OF THE AUSTRALIAN GOVERNMENT'S RATIONALE FOR ITS VACCINATION POLICY

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This thesis is presented in fulfilment of the requirements for the award of the degree of Doctor of Philosophy from the University of Wollongong

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Abstract

Vaccination policies in Australia need to be scrutinised because the use of a medical intervention in the prevention of infectious disease has serious health and social implications. Deaths and illnesses to infectious diseases were significantly reduced due to environmental and lifestyle reforms prior to the widespread use of most vaccines in the mid-20th century. Mass vaccination campaigns were adopted after this time as the central management strategy for preventing infectious diseases, with many new vaccines being recommended in the National Immunisation Program (NIP). The implementation of mass vaccination programs occurred simultaneously with the development of partnerships between academic institutions and industry. The Australian government's NIP, like all member countries of the World Health Organisation (WHO), is recommended by the Global Alliance for Vaccines and Immunisation (GAVI). This is a partnership with the WHO and UNICEF that includes the World Bank, the International Monetary Fund, the International Federation of Pharmaceutical Manufacturers and Associations (IFPMA), the Bill and Melinda Gates Foundation (BMGF), the Rockefeller Foundation, the United Nations Development Fund (UNDF) and other private research institutions. All members of this public-private partnership influence the development of WHO global health policies.

It is important that independent research is carried out to assess whether all the vaccines being recommended today are safe, effective and necessary for the protection of the community. It is also important to have comprehensive evidence that it is safe to combine multiple vaccines in the developing bodies of infants. The framework for undone science is used to analyse the Australian government's claim that the benefits of vaccines far outweigh the risks. Whilst the government claims serious adverse events to vaccines are rare this is not supported by adequate scientific evidence due to the shortcomings in clinical trials and long-term surveillance of health outcomes of recipients. A close examination of the 'Swine Flu' 2009 vaccine and the vaccine for human papillomavirus (HPV), intended to prevent cervical cancer, shows shortcomings in the evidence base and rationale for the vaccines. This investigation demonstrates that not all vaccines have been demonstrated to be safe, effective or necessary. It also concludes that the government's claim that the benefits of vaccines far outweigh the risks cannot be sustained due to the gaps in the scientific knowledge resulting from unfunded research and the inadequate monitoring of adverse events after vaccination.

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Adjuvant

Any substance used in conjunction with another to enhance its activity.

Antibody

A special kind of blood protein that is synthesised in lymphoid tissue in response to the presence of a particular antigen and circulates in the plasma to attack the antigen and render it harmless. Specific antibodies can be produced against antigens such as bacteria, pollen grains and foreign red blood cells and foreign protein etc. It is the basis of immunity and allergy. Antibodies are globulin type proteins that are classified according to their structure and function.

Titre

The extent to which a sample of blood serum containing antibody can be diluted before losing its ability to cause agglutination of the relevant antigen. It is used as a measure of the amount of antibody in the serum.

Immune

Protected against a particular infection by the presence of specific antibodies against the organisms concerned.

Immune Response

The response of the immune system to antigens. There are two types of immune response produced by two populations of lymphocytes. B-lymphocytes (or B-cells) are responsible for **humoral** immunity and T-lymphocytes (or T-cells) are responsible for **cell-mediated** immunity. These include Helper T-cells, Cytotoxic T-cells and Suppressor T-cells.

Immune System:

The organs responsible for immunity. The primary lymphoid organs are the thymus and the bone marrow; the secondary lymphoid organs are the lymph node and lymphoid aggregates (spleen, tonsils, gastro intestinal lymph tissue and Peyer's patches (ocal masses of lymphoid tissue on the mucous membrane lining in the small intestine).

Immunity

The body's ability to resist infection resulting from the presence of circulating antibodies and white blood cells. Healthy individuals protect themselves by means of physical barriers, phagocytic cells, natural killer cells, and various blood-borne molecules. All of these mechanisms are present prior to exposure to infectious agents and are part of natural (or innate) immunity.

Immunity (Active)

When the body's own cells produce and remain able to produce appropriate antibodies following an attack of a disease or deliberate stimulation.

Immunity (Passive)

When ready-made antibodies in antiserum is taken from an immune person or animal and injected into another individual. This immunity is short lived. Babies have passive immunity conferred by antibodies from the maternal blood and colostrums to counter diseases for several weeks or months after birth.

Immunisation

The production of immunity by artificial means. Passive immunity which is temporary or active immunity by the stimulation of the body with treated antigens to produce its own antibodies (called **vaccination** or **inoculation**).

Immunoassay

Techniques used for determining the levels of antigen and antibody in a tissue.

Immunogenicity

The property that enables a substance to provoke an immune response including foreignness, size, route of entry into the body, dose, number and length of exposures to the antigen and host-genetic make-up.

Immunosuppression

Suppression of the immune response usually by disease e.g. AIDS or drugs.

Pathogen

A microorganism such as a bacterium that parasitizes an animal (or plant) or a human and produces a disease.

Pathogenic

Capable of causing disease. The term is applied to a parasitic microorganism (especially a bacterium) in relation to its host, **Pathogenicity.**

Seroconversion

To produce specific antibodies in response to the presence of an antigen (e.g. a vaccine or a virus/bacteria).

Surrogate

An object or criteria that functions as a substitute for another object/criteria. In clinical trials where it is not logistically practical to use one criteria as an end-point for the conclusions another suitable substitute is used.

Vaccination

The act of receiving a vaccine to stimulate antibody production to produce immunity to a disease.

Vaccine

A special preparation of antigenic material that can be used to stimulate the development of antibodies thus conferring active immunity against a specific disease or number of diseases. Many vaccines are produced by culturing

bacteria or viruses under conditions that lead to a loss of their virulence but not their antigenic nature. Other vaccines consist of specially treated toxins (toxoids) or of dead bacteria that are still antigenic. New vaccines contain genetically engineered DNA.

ABBREVIATIONS

AE	Adverse Event
AAP	American Academy of Pediatrics
AAS	Australian Academy of Science
ACIR	Australian Childhood Immunisation Register
ACP	Australian College of Pediatricians
AHPC	Australian Health Protection Committee
AIHW	Australian Institute of Health and Welfare
AMA	Australian Medical Association
ATAGI	Australian Technical Advisory Group on Immunisation
BMGF	Bill and Melinda Gates Foundation
BSEM	British Society of Ecological Medicine
CDC	Centre for Diseases Control and Prevention (USA)
CDNA	Communicable Diseases Network Australia
CDI	Communicable Diseases Intelligence
CSL	Commonwealth Serum Laboratories
CVI	Children's Vaccine Initiative
DALY	Disability or quality-Adjusted Life Year
DHA	Department of Health and Aging
DTP	Diphtheria-Tetanus-Pertussis
DTPw	Diphtheria – Tetanus – Pertussis whole-cell vaccine
dTpa	Diphtheria – Tetanus- Pertussis (adult pertussis vaccine)
EC	Emergency Committee

EH	Environmental Health
EHRA	Environmental Health Risk Assessment
EMA	European Medicines Agency
EPA	Environmental Protection Agency
EPI	Expanded Program on Immunisation
ESWI	European Scientific Working Group on Influenza
EBM	Evidence Based Medicine
FAO	Family Assistance Office
FAQ	Frequently Asked Questions
FDA	Food and Drug Administration
GAVI	Global Alliance for Vaccines Initiative
GOARN	Global Outbreak Alert and Response Network
GP	General Practitioner
GPII	General Practice Immunisation Incentive
HCP	Health Care Practitioners
HIV	Human Immunodeficiency Virus
HPV	Human Papillomavirus
IAC	Immunisation Action Coalition
IAP	Immunise Australia Program
ICD	International Classification of Diseases treaty
ID	Infectious Diseases
IHPC	International Health Promotion Conference
IHR	International Health Regulations

IOM	Institute of Medicine
MIA	Maternity Immunisation Allowance
MBA	Medical Board of Australia
NCES	British National Childhood Encephalopathy Study
NCIRS	National Centre for Immunisation and Research Surveillance
NEHS	National Environmental Health Strategy
NGO	Non Government Organisation
NHMRC	National Health and Medical Research Council
NIC	National Immunisation Committee
NIP	National Immunisation Program
NIS	National Immunisation Strategy
NITAC	National Immunisation Technical Advisory Committee
NNDSS	National Notification of Diseases Surveillance System
OECD	Organisation for Economic Co-operation and Development
OHP	Office of Health Protection
PATH	Program of Appropriate Technology in Health
PHC	Primary Health Care
PHAA	Public Health Association of Australia
PP	Precautionary Principle
PPP	Pandemic Preparedness Plans
PBS	Pharmaceutical Benefits Scheme
PBAC	Pharmaceutical Benefits Advisory Committee
SAGE	Strategic Advisory Group of Experts on Immunisation

SEHN	Scientific and Environmental Health Network
SES	Socioeconomic Status
SIP	Service Incentive Payment
SEDH	Social and Environmental Determinants of Health
SMM	Scientific Medical Model
TGA	Therapeutic Goods Association
UCI	Universal Childhood Immunisation
UNCED	United Nations Conference on Environment and Development
UNICEF	United Nations Children's Fund
UNDP	United Nations Development Program
USAID	US Agency for International Development
VICP	Vaccine Injury Compensation Program
WC	Whooping Cough
WHA	World Health Assembly
WHO	World Health Organisation

CHAPTER 1

INTRODUCTION

1.1 Vaccination in Australia

In Australia many new vaccines have been added to the national vaccination schedule and implemented in coercive policies over the last two decades. The aim of this thesis is to examine the complex relationship between policy development and scientific knowledge in order to assess the adequacy of the Australian government's National Immunisation Program (NIP) in protecting public health. Government vaccination policies are claimed to be founded on scientific evidence for the good of the community and this investigation provides a critique of the evidence and political decisions that are being used to support key claims underpinning current vaccination policies. The project examines the complex issue of scientific evidence and health policy development, and the influence of funding and political/cultural factors on the design of public policy. Vaccines have been shown to result in death and illness in a percentage of the population and, like all drugs, cannot be used without risk (AG IAP 2015). In order to protect public health, I argue that Australian vaccination policies should be founded on detailed historical and epidemiological knowledge of infectious diseases, specific to the Australian situation. This project examines whether comprehensive knowledge of infectious disease etiology or selective knowledge is being used to underpin the claims of safety, efficacy and necessity for using the vaccines recommended in the NIP. Policy development is essentially a political process founded on the available scientific evidence hence another aim is to examine the political structures that influence the integrity, rigour and completeness of the scientific evidence. The information collected will be used to assess the role of vested interests in the development of Australian vaccination policies.

A critique of Australia's vaccination policies is necessary because the government has adopted vaccination as the default position for certain groups in Australian society, even whilst claiming vaccination in Australia is not compulsory. Pressure is being placed on individuals to use multiple vaccines by linking financial incentives in the form of welfare benefits, childcare places and employment to the use of an expanding number of vaccines.

Since the introduction of the first vaccine in the late 18th century, this medical intervention has been vigorously debated in families and communities. In recent times vaccines have been used in global mass vaccination programs directed through the World Health Organisation (WHO) in an attempt to eradicate infectious diseases. These programs are based on the theory of vaccine-created herd immunity and the need to ensure high participation rates in vaccination programs to prevent these diseases. As a member country of the WHO, the Australian National Immunisation Program (NIP) has reflected many of the directives provided by the WHO for global health policies. Since the early 1990's the Australian government has emphasized the need to increase participation rates in vaccination programs. At the same time, new vaccines were added to the schedule and the terminology changed so that infectious diseases became known as 'vaccine-preventable diseases', in line with global policy. The use of vaccines globally is promoted by significant vested interests and their adoption in public health policies is an ethical issue that requires public discussion and consent from the community. This thesis is an examination of the Australian Government's vaccination policies, including an assessment of the underpinning scientific evidence and the stakeholders who have influence in the decision-making process.

Vaccination is a medical intervention that injects weakened pathogens (antigens) and chemical substances into the tissues of healthy individuals to stimulate the production of antibodies (Stern and Markel 2005). This is different to *immunisation* which is the process of obtaining immunity from the artificial stimulation of antibodies against an antigen (Martin 2002). Although these two words are often used interchangeably by the public and on the government Immunise Australia Program (IAP) website, they have very different meanings and it is not appropriate to use them as synonyms. Receiving a vaccine does not always provide immunity and immunity can be gained without receiving a vaccine. Individuals can develop immunity to a disease by either natural exposure to the pathogen or by receiving a vaccine. Sometimes individuals are vaccinated but do not acquire immunity to the disease. This can be a result of the vaccine not working or because an individual is exposed to a strain of the disease that is not covered by the vaccine. Conversely individuals can have immunity to a disease but not be vaccinated. This is because exposure to the pathogen, even without symptoms, results in natural immunity and this immunity is of

longer duration (often life-long) than that gained from a vaccine. This is the case for whooping cough, hepatitis B and measles (AG IAP 2012).

Public health reforms successfully reduced mortality and illness from infectious diseases in developed countries by the mid-20th century yet vaccines were not used as a major strategy for the prevention of disease until after 1953 (CoA 1953). Since that time there has been a significant increase in the number of vaccines being recommended to the public, despite the prior and ongoing reduction in risk from infectious diseases. In this thesis I examine evidence relevant to policy formation, including the role of 'undone science': areas where funding is not provided to collect crucial evidence relevant to the claims that are made. In this thesis I have investigated whether there are political and cultural pressures related to considering alternatives to the accepted wisdom.

In order to assess the founding principles of this policy I have started by clarifying the definition of 'health' and the way in which health is measured in populations. There are many different methods of describing and measuring the health of communities. The definition of health is critical to achieving the desired outcomes of a public health policy. Health, politics and culture are strongly interrelated and this is reflected in the models of health that have been adopted by western and eastern countries. This thesis illustrates the Australian government's priorities in public health policy by its adoption of the scientific medical model of health in the mid-20th century to prevent an increasing number of infectious diseases. Designing public health policy for the control of infectious diseases requires knowledge of the causal factors in the worldwide decline of deaths and illness to infectious agents. Hence the thesis investigates the evidence that exists to demonstrate the influence of vaccines in the control of diseases. This is done by examining the historical perspective in which mortality and morbidity to infectious diseases declined over the past one hundred years. Vaccines target bacteria and viruses which exist in an ecological context within each geographical region. These infectious agents are an essential part of the microflora; the ecological context in which they are found plays a significant role in the control of disease.

Public health authorities have long observed that the characteristics of the environment, the host and the infectious agent interact to produce a variety of health outcomes after exposure

to an infectious agent. I investigate the causal factors in infectious diseases and examine whether full knowledge of them has been used as the foundation for Australian government vaccination policies within the Australian context. Vaccination was adopted as the central management strategy for infectious disease control in the second half of the 20st century. Hence, this thesis includes an investigation of the threat of infectious diseases at the time most vaccines were introduced. The partnership between industry and medical science flourished at the same time as vaccines were adopted as the main management strategy for infectious diseases globally. I have provided a description of this partnership to illustrate how the medical-industry model has influenced the production of scientific knowledge and the promotion of health in the Australian community. Cultural values and ethics are fundamental to health promotion and a description of the ethics adopted in good medical practice is also provided to see if they are consistent with the promotion of current vaccination policies. The thesis examines the effect of the medical-industry partnership on the development of public health policy and the ability of health professionals to provide independent health advice to their patients within this cultural context. Public health policy always involves value judgments of the available evidence, not simple extrapolation or application, and this is explored in the thesis.

Risk assessment for health hazards is influenced by the interest stakeholders have in scientific issues so I have investigated the influence of funding and the perspectives and dominance of different stakeholders in policy decisions about vaccines. This also includes an assessment of the methodology that is used to determine the risks of infectious diseases as well as the risks of vaccines. It is important that these risks are assessed in a systematic manner with transparent assumptions to protect public health. The risk of diseases and vaccines must then be accurately communicated to the public. Health is not the only interest protected in public health policies; the prestige and livelihood of medical practitioners and industry are tied up in the design of public health policies. Hence the public is entitled to be involved and consulted in debates/decisions about public health policy in order to protect their interests in these policies.

In addition, medical clinicians and environmental health practitioners hold different perspectives on health prevention, therefore management strategies for infectious disease

will vary according to who is in charge of the policy: environmental health practitioners (ecological medicine) or clinicians (scientific medicine). I have described the differences in the beliefs held by these professionals. A description of the governance of this policy is also necessary to illustrate the interests that are central to policy development. Most members of the public believe that claims about the efficacy and safety of vaccines are founded on comprehensive evidence that accurately predict health outcomes because this is how the government presents this policy. If necessary research to improve knowledge about health outcomes has been discussed but not funded, it is termed 'undone science'; I have investigated the undone science relevant to the Australian government's vaccination policies. It is important that the funded studies are designed with appropriate parameters to ensure they provide sufficient empirical evidence about the safety and effectiveness of vaccines in the community. Research design influences the integrity and rigour of the conclusions. If relevant research is left undone the science relevant to protecting public health is absent. As policies are founded on value judgments concerning the available evidence, the absence of relevant research puts population health at risk due to the unpredictable nature of the health outcomes.

I have included two case studies, the HPV vaccine and the 'Swine Flu' 2009 vaccine, to illustrate the influence of corporations on the evidence that is being used to promote vaccines as being safe, effective and necessary to prevent infectious diseases. The public is informed that health policies are founded on the best available evidence but they are not informed of the gaps that may exist in the evidence. These case studies examine the reasons why there might be gaps in the evidence and it describes the political framework in which policy is affected by biased science or undone science. The existence of institutional barriers to carrying out independent research, including on topics unwelcome to groups with vested interests, underscores the need for transparency and accountability in government processes and the accurate communication of health issues to the public. Traditionally research institutions have had more autonomy from industry in directing medical research, thus providing greater independence in the assessment of which areas of science would receive funding. This is essential to making balanced decisions on public interest science and health policy design. In this thesis I examine how the privatization of science has altered the values of non-profit research institutions and how industry-directed

research is impacting on the production of knowledge. Government funding can also be aligned with industry interests if structural barriers such as conflicts of interest exist in the process of policy development. The information collected in this thesis has been used to examine the Australian government's claim that the national subsidised schedule of vaccines produces more good than harm in the population. Such a claim is dependent upon the integrity and transparency of the science and whether there is a consensus amongst the stakeholders about the evidence that is being used.

Macfarlane Burnet, Nobel Prize laureate for immunology and Australia's first *Australian of the Year* in 1960, suggested over half a century ago that genetics, nutrition, psychological and environmental factors (ecological medicine) may play a more important role in resistance to disease than the *assumed* benefits of artificial immunity induced by vaccination procedures (Burnet 1952 p106). He suggested that in years to come society may have to reassess the belief scientists were placing in vaccination. He considered that genetic deterioration of the population may be a consequence of universal mass vaccination campaigns and he postulated that 'some of our modern successes in preventative and curative medicine may on the longest view be against the best interests of the state' (Burnet 1952 p107). Burnet (1952) believed that genetic constitution was the most important hidden variable in disease statistics. Gilbert (2004) reinforces this theory with a new definition of environmental health that emphasises the importance of genetic potential to health outcomes from environmental hazards. This is described in chapter 2. It is possible that the genetics and health of the population are at risk if these factors are not considered in the preventative strategies that are adopted in the control of infectious diseases. This theory needs to be investigated because we have observed a simultaneous increase in chronic illness in Australian children, and in children in other countries, as the number of vaccines and participation rates in NIP's has increased (AIHW 2005; PHAC 2007; Burton 2003). Allergies have increased in the Australian population with 10% of infants having a food allergy and 20% of the Australian population: hospitalisations for anaphylaxis have increased 5-fold in the last 20 years (ASCIA 2015). This correlation has not been investigated by the Australian government to demonstrate that the Australian vaccination schedule is not the cause of this significant increase in chronic illness. See section 7.4.

Quality of life is a measure of population health, not just infant mortality rates and vaccination coverage, and as the permanent chronic illness in Australian children escalates governments have a duty of care to demonstrate that vaccination policies are providing more good than harm in the population and that they are indeed in the best interests of the community.

1.2 Research

I have drawn on publicly available documents to probe the justifications for the use of many vaccines to control an increasing number of infectious diseases. The sources I have used are government documents and websites, the Australian Government Immunisation Handbook, medical and scientific articles, books, and websites. Many older sources have been used in reviewing historical knowledge of the decline of infectious diseases and also for the investigation into the HPV vaccine. This has been done to assess the knowledge that was available to authorities at the time the vaccines were introduced. This is particularly important for the HPV vaccine because the etiology of cervical cancer was not firmly established until the late 1990's when new biotechnology was developed and it is possible that recent evidence is being interpreted to conform to preconceived ideas. I have used the framework of political economy and undone science to examine the government's claims that vaccines are a safe, effective and necessary preventative strategy for preventing infectious diseases. The investigation examines the political and economic influences on the evidence that is used to make these claims. It examines the government's vaccination policy to determine whether the decisions to use an increasing number of vaccines are based on evidence from the Australian context or directives from the WHO in line with global health policies. Scientific findings obtained from clinical trials can be biased when funding is provided by companies with vested interests in the outcomes. Therefore an independent assessment of the evidence is required. This project investigates whether an independent assessment of industry sponsored research is included in policy development. In a few places in this thesis some exposition at a basic level is needed to cover ideas essential for developing the overall arguments. In these places I have drawn on fundamental treatments of the subject area.

Further, epidemiological studies in populations are limited because they are mainly observational and many variables cannot be controlled. This underscores the need to ensure that scientific conclusions are founded on all types of evidence. A central feature of the methodology was to determine whether epidemiological, animal, clinical, biological and ecological studies are all being used to form a consensus about the benefits and risks of vaccines. I have examined the risk of infectious diseases from an ecological perspective to investigate the justification for using an increasing number of vaccines in Australia's national immunisation program (NIP). The project was limited by the fact that consumers in Australia are not encouraged to debate vaccination polices. They are designed by expert panels and presented as a 'medical intervention' that should be promoted to the public by health professionals.

1.3 Thesis Structure

The thesis is divided into 2 parts: Part 1 Science and Policy (chapters 1-5) is a description of the historical development of the policy, and Part 2 Corporate Influence and Undone Science in Public Policy illustrates the influence of the medical-industry complex on the production of scientific knowledge and the political decision-making process in the era of privatisation.

Part 1: Science and Policy

Chapter 2 discusses the historical development of Australia's public health policies and the adoption of vaccination as the dominant management strategy for infectious diseases from 1953 to the present. It examines the control of infectious diseases and the main factors that were influential in reducing deaths and illnesses to these diseases. Chapter 3 describes Australia's National Immunisation Program (NIP) and its development within WHO global public health policy. Part 1 of chapter 3 presents the influence of WHO in the development of Australia's NIP. It provides the reasons why the number of vaccines and the emphasis on participation rates in vaccination programs increased during the1990's. Part 2 of chapter 3 describes the development of the NIP over the last three decades and the recent extension of Australia's vaccination policies to mandatory use in many workplaces and in social welfare policies. Chapter 4 describes the implementation of the NIP by the Australian

states. A description of the control and governance of this policy has been provided as well as the methodology for risk assessment for infectious diseases and vaccines. Surveillance of disease in the community is also described, as it is essential for measuring the burden of disease and communication of risk to the public. This chapter describes the concept of artificial (vaccine-induced) and natural herd immunity for community protection and the way in which statistics are being presented by the media to communicate the risk from diseases/vaccines. Chapter 5 describes the model of health that has been adopted by western countries and how it influences policy decisions. It provides a discussion of the guiding principles and cultural beliefs/values underlying public health policy in Australia. Public health is a complex area that involves many political and ethical decisions. The Seedhouse Ethical Grid is presented to illustrate the principles that should guide decisions in health promotion and the way in which current vaccination policies are infringing human rights. The ethical guidelines for good medical practice in Australia are discussed along with the human rights codes that protect our rights in public health policies.

Part 2 Corporate Influence and Undone Science in Public Health Policy

Chapter 6 describes the development of the academic–industry model that is influencing the production of scientific knowledge in the 21st century. It provides examples of the impact the privatisation of science has had on the direction and type of research that is undertaken in academic institutions. The corporatisation of science has led to a change in the integrity and rigour of scientific research and it has also led to the dominance of technical experts on government advisory boards. This chapter explores the effect of corporatizing health on the institutional barriers against citizen involvement in policy design. Chapter 7 provides a discussion of a number of key claims that are made about vaccines to the public to support the government's vaccination policies. These claims are stated on the Frequently Asked Questions (FAQ) page of the Immunise Australia Program (IAP) website. I have discussed these claims in light of the evidence that I have found in the historical and medical literature. I have also discussed some of the claims made by the Australian Academy of Science (AAS) in its document supporting government vaccination policies. Chapter 8 describes the political economy of public health policies and the political framework that results in 'undone science'. I have described a conceptual framework that assists in

assessing the risks and benefits claimed in government vaccination policies. Vaccination policies involve political, ethical and social issues; for example the funding of research is influenced by companies and governments. These issues and the relevance of 'undone science' in public policy are discussed with a case study to illustrate the consequence of undone science to the community. This chapter concludes with the undone science that is relevant to the Australian government's vaccination policies. The case studies in chapters 9 and 10 illustrate how industry-funded research is being promoted to medical professionals and the public without independent assessment. Chapter 9 provides a case study of the Human Papillomavirus (HPV) vaccine to illustrate how vaccines are being developed and promoted to consumers in the era of medical-industry partnerships and globalisation. The framework for undone science is used to assess the claims of safety and efficacy that underpin the use of HPV vaccines. Chapter 10 provides a case study of the 'Swine Flu' 2009 vaccine to illustrate the influence of corporations in WHO/GAVI global health policies and the effect of public-private partnerships on national health policies in member countries. It illustrates the influence of conflicts of interest on vaccine advisory boards and the undone science that exists in the political decisions made in policy design.

Chapter 11 presents the conclusions that are drawn from this study. I discuss the political and cultural influences in the design of public health policies and the institutional barriers that prevent public involvement in vaccination debates and policy decisions. The evidence collected in this thesis is also used to examine the Australian Government's claims that:

I. Vaccines are proven to be a safe, effective and necessary management strategy for infectious diseases and
II. The benefits of vaccines to the community far outweigh the risks of vaccines to individuals.

CHAPTER 2
CONTROLLING INFECTIOUS DISEASES

2.1 Introduction

This chapter examines the main factors responsible for the decline in the risk of infectious diseases in developed countries such as Australia. An understanding of the main influences in the reduction of mortality and morbidity due to infectious diseases is necessary to assess the benefits and risks of vaccines. This chapter outlines the historical strategies that were most successful in reducing illness and death to infectious diseases and it illustrates the political influences in policy design. The chapter examines whether public health policy has been designed in response to threats to public health in Australia or desired political outcomes.

Infectious diseases have traditionally been referred to as a public health problem however from the 1990's onwards the term *environmental health* became popular. These terms have similar meanings so I have introduced this chapter with a definition of these terms. In many countries government public health policies had a change of focus in the mid-20th century. This change was a move from strategies founded on a multi-factorial theory of disease causation (ecological medicine) to the germ theory that underpins western medicine. The western medical model of health is founded on the concept of 'scientific medicine', which includes evidence-based practice, and infectious diseases were re-defined in the second half of the 20th century as a problem that could be addressed with a medical intervention. This was due to the progress in etiological theories based on microbiology. In contrast, the decline in infectious diseases in the first part of the century was brought about through political, social and economic interventions in behaviour and the environment: termed social or ecological medicine.

The direction of Australia's public health policy was influenced by the World Health Organisation (WHO) and UNICEF from the 1970's onwards. This was part of an international effort to vaccinate all the children of the world. This WHO/UNICEF initiative was known as the Expanded Program on Immunisation (EPI). Its primary goal was to achieve maximum vaccination coverage by implementing strategies that were recommended by the WHO. Australia adopted many of these strategies. The scope of

this program and its implementation globally are described in section 3.2. Whilst medical practitioners were influential in policy design during the early 20th century when the Commonwealth Health Department was established (1921), they were not the dominant influence: social medicine dominated public health reforms until the mid-twentieth century. However, from the 1970's onwards the medical-industry model was the dominant influence in the development of public health policy. This resulted in a focus on vaccination - a medical intervention - as the main strategy for *preventing* infectious diseases. Yet for decades prior to this, social medicine had been successful in reducing the risk from infectious diseases. The scientific medical model of health and its adoption in Australian public health policy are described in chapter 5.

The use of childhood vaccines globally and in Australia rose significantly from the 1990's onwards. This was after infectious diseases had become a very low risk to the majority of children in developed countries. A description of the development of Australia's National Immunisation Program (NIP) and the directives provided by the WHO/UNICEF for implementation of national programs is presented in chapter 3. The implementation of this policy into Australian communities is described in chapter 4 and the principles and ethics of public health policies and health promotion are discussed in chapter 5.

2.2 Defining Public Health and Environmental Health

The Australian Federal Government states that environmental health (EH) provides the basis for public health. EH is the study of human diseases that are determined by physical, chemical, biological and social factors in the environment (AG OEH 2012). This includes improvements in sanitation, water quality, nutrition, control of disease, and housing standards, all of which have been essential to the significant improvement in health and longevity experienced over the last century (Stanley 2001). Yet the Australian government provides the following definition of environmental health:

'Environmental health addresses all the physical, chemical, and biological factors external to a person, and all the related factors that can potentially affect health. It is targeted towards preventing disease and creating health-supportive environments. This definition excludes behaviour not related to environment, as well as behaviour related to the social and cultural environment, and genetics' (AG OEH 2012).

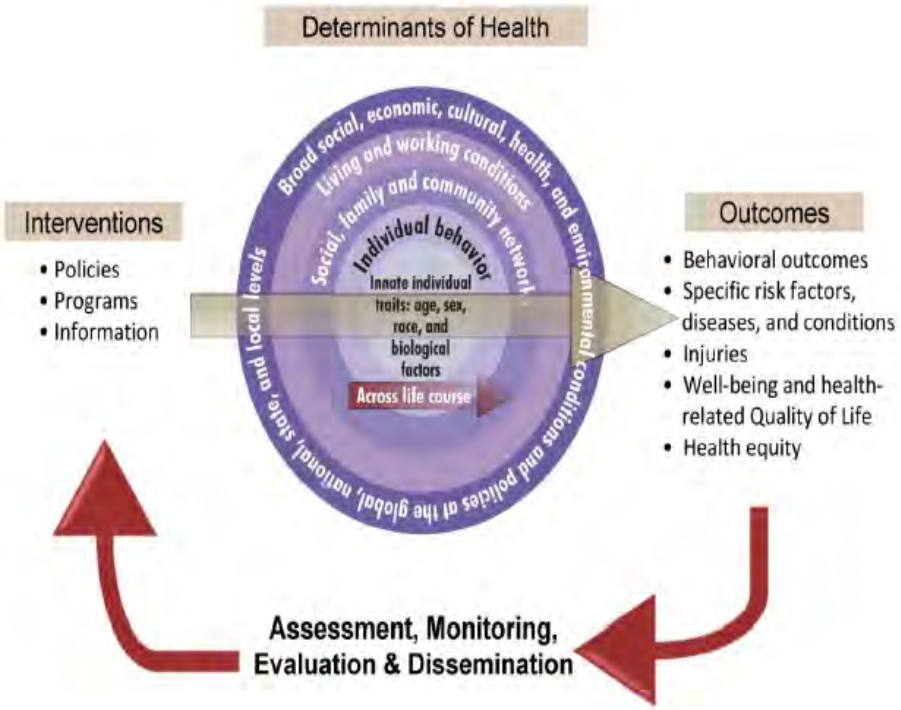
A definition of environmental health that excludes genetics and the social and cultural environment is deficient because these factors are strongly linked to the individual's health and well-being (Gilbert 2004 p16; WHO 1986). This is particularly the case in the context of exposure to environmental toxins or pathogens (CDC NIOSH). Social and cultural factors are strongly linked to environmental causes of disease and in particular the stress and fatigue levels of individuals (CDC NIOSH). Infectious diseases are caused by microorganisms in the environment that can infect the body and have the potential to become pathogenic (AG OEH 2012). One of the main determinants of disease expression is the genetic potential of the host (Gilbert 2004 p16). Recent advances in the toxicological and genomic sciences, have led to a new definition of environmental health that states:

*'*Conditions that ensure that all living things have the best opportunity to reach and maintain their genetic potential*'* (Gilbert 1999 in Gilbert 2004, p ix).

The knowledge gained from new molecular biology techniques has enabled scientists to examine the coding of genes. This evidence is demonstrating that in order to ensure the health and well being of children (and all life) it is essential to protect the genetic potential of the individual. Environmental health practice, or environmental medicine, addresses emerging health risks arising from the pressure that human development places on the environment (BSEM). This encompasses infectious diseases. It is the Australian Government's goal to prevent infectious disease by creating health supportive environments (AG OEH 2012). The area of medicine that addresses environmental health is called *ecological medicine* (BSEM). This is a preventative medical discipline that examines the interactions between the individual and the environment, and the health outcomes that are produced. This includes both the impact of environmental factors on the individual and the individual's action on the environment (BSEM). Ecological medicine examines health outcomes that arise from five interconnected areas: i) nutrition ii) toxins iii) allergy iv) genetics v) environment (BSEM).

In 2002, the Institute of Medicine (IOM) developed an action model for achieving healthy individuals through public health policy. This model, illustrated in Figure 1, incorporates five interacting factors to demonstrate the significance of each aspect to achieving healthy communities through public health policy.

Figure 1: The Individual and Environmental Factors that Determine Health



Source: Institute of Medicine, The future of Public Health in the 21st Century, Washington, DC: National Academies Press 2002.

Many researchers state that wealth and poverty remain the most significant determinants of the health status of all populations (Stanley 2001; Naidoo and Wills 2000 p13; Dubos 1966 p14). It is stated that the large gains in life expectancy in the first half of the 20th century were a result of the implementation of environmental reforms where as the contribution of medical care to this life expectancy is relatively small (Bunker 2001 p1262; Mckeown 1979 p52). Well known health commentator Rene Dubos stated: '…until social and economic changes are made no amount of medical and scientific knowledge can be of much help' (Dubos 1966 p14). Genetic traits are also significant to the health of individuals and different genetic traits will be an advantage in different environments (Dubos 1966 p15; Gilbert 2004). This explains why there is a variety of health outcomes after exposure to an infectious agent in different ecological settings. Similarly genetics results in a variety of health outcomes after exposure to a vaccine.

2.3 The Control of Infectious Diseases

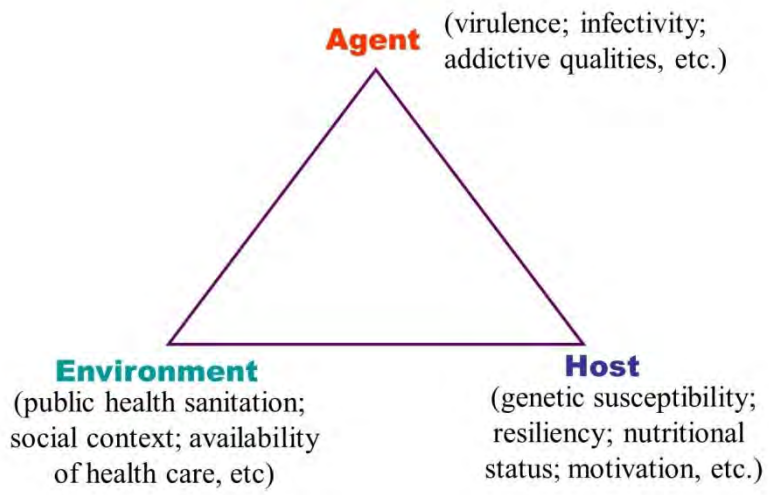
This section describes the multiple factors known to interact in the etiology of infectious diseases. It describes the epidemiological triad that public health authorities use to show the relationship between these factors and an introduction to microbiology and the germ theory, and the use of vaccines to control disease.

Vaccination as a preventative public health strategy was first used by Edward Jenner in the late 18th century (Hays 2000). It was used in the fight against smallpox for ~150 years but its efficacy was never tested in controlled clinical trials that exposed a large number of participants to the smallpox virus and compared the outcome to a control group (Wallace 1898). Consequently there is controversy surrounding the use of smallpox vaccine in the control of smallpox epidemics throughout the history of its use (Wallace 1898 pp218-315; Bashford 2002 p39; Kleinman et al 2005; Allen 2007; Schwenk 2006). Mass vaccination programs against multiple diseases in public health policies have only been practiced for the last 60 years and the combined schedule of vaccines recommended by the Australian government has never been tested for long-term health outcomes in animals or humans (AAS 2012). See section 7.4.

A vaccine is a medical intervention that is promoted to the public as an effective strategy for *preventing* infectious diseases. Yet these diseases are an environmental health issue because they are caused by microorganisms that exist within an ecological context. Therefore the risk from these organisms varies according to the characteristics of the community, the agent and the individual's lifestyle and genetics (Wallace 1889 p316; Cumpston 1989; McKeown 1979 p78; Curry 2002 p33; Stanley 2001 p379; Friis and Sellers 2004 p402). Developing countries have had mass vaccination programs for many decades yet infectious diseases are still prevalent (WHO 2013). Mass vaccination in developing countries began in the late 1970's with the introduction of the United Nations Children's Fund (UNICEF) 'child survival revolution'. The fact that developing countries are still rife with infectious diseases today suggests that depending on vaccines to *prevent* disease in countries with poor environmental and nutritional conditions is questionable (McKeown 1979 p61). This is due to the known synergistic effect between malnutrition and illness. Diet is a major determinant of infection rates and outcomes of disease (McKeown 1979 p61; Gillespie 1991; Gilbert 2004). Disease causality is directly related to host and environmental characteristics and consequently it

is not just a result of infection with a pathogenic organism. The agent is a necessary factor but not a sufficient cause of disease (Friis and Sellers 2004 p402). The expression of disease after exposure to an infectious agent is the result of an interaction of multiple factors. These factors have been incorporated into a model for causality that public health authorities refer to as the Epidemiological Triad (Friis and Sellers 2004 p398). This is illustrated in Figure 2.

Figure 2: The Epidemiological Triad of Agent, Host and Environmental Factors



Source: The Association of Faculties of Medicine of Canada (AFMC), 2007, The Interacting Triad of Causal Factors. AFMC Public Health Educators' Network http://phprimer.afmc.ca/ (accessed October 2013). License: Creative Commons BY-NC-SA.

For many decades, this model has been revered as one of the fundamental public health concepts of disease causality and the best method for determining the cause of infectious diseases (Friis and Sellers 2004 p398). The model illustrates that disease is caused by an interaction between the agent (the pathogenic organism), the host and the environment. More recently scientists have recognized that this is a complex interaction between many variables. Whilst an agent must be present for an infection to occur it is known that not all interactions will progress to disease (Friis and Sellers 2004). Infections can be 'subclinical' which means they do not produce any signs or symptoms, but they still confer immunity to future exposure (Friis and Sellers 2004

p402; McKeown 1979 p46). There are also many outcomes from infection including complete recovery, permanent disability, disfigurement and death. Many diseases are self-limiting and complete recovery can be expected in the majority of cases (Friis and Sellers 2004 p402). The likelihood of an infectious agent causing clinical signs and symptoms of disease is described as its 'pathogenicity'. This characteristic and many others differ from one infectious agent to the next. Therefore the ability of an agent to cause disease in any environment is dependent upon the interaction of many variables within the ecological context in which it is found. It is commonly recognised that this diversity in health outcomes after individuals have been exposed to an infectious agent is not highlighted in the germ theory of disease that is adopted in western scientific medicine. These diverse health outcomes are a result of differences in the host's immunology, physiology, social and emotional environment as well as differences in the ecological and agent characteristics (Doyal and Doyal 1984 p97; Friis and Sellers 2004; Gilbert 2004). In contrast, the germ theory describes disease as being caused by the infectious agent and resulting from internal biological changes. This simplified theory, termed a reductionist theory, is a central belief of the scientific medical model (SMM) and it lends itself to using a vaccine to prevent disease from infectious agents. A more detailed description of the germ theory is provided later in this chapter.

2.4 Developments in Public Health Policy in Australia

This section describes the historical control of infectious diseases and the events that led to the reduction in risk (mortality and disability) from infectious agents in Australia and other developed countries.

Public health is the discipline of promoting health to the whole population. It involves gathering health information and statistics (epidemiology) to support interventions that can improve the health of the population (Naidoo and Wills 2000 p183). It is focused on communities or groups rather than individuals and mostly involves services and directives provided by governments with assistance from private and voluntary organisations (Palmer and Short 2010 p22). These services include environmental health measures, health promotion, health education and vaccination programs. Public health policy is multidisciplinary involving economics, ethics, epidemiology, healthcare, sociology and political science. The purpose of public policy is to serve the public interest in community living and it is intertwined with individual responsibility to

the state and collective action (Pelling 2002 p16). However, as there are many influential stakeholders in this policy, policy design results from a power play between different stakeholders in the decision-making process (Palmer and Short 2010 p xxvi). Hence, political analysis is necessary to understand whose interests are being promoted. Public health policy is not designed on a simple application of the current scientific knowledge, but rather is a result of complex political factors driven by struggles over funding and power within the dominant network of scientists and their theories.

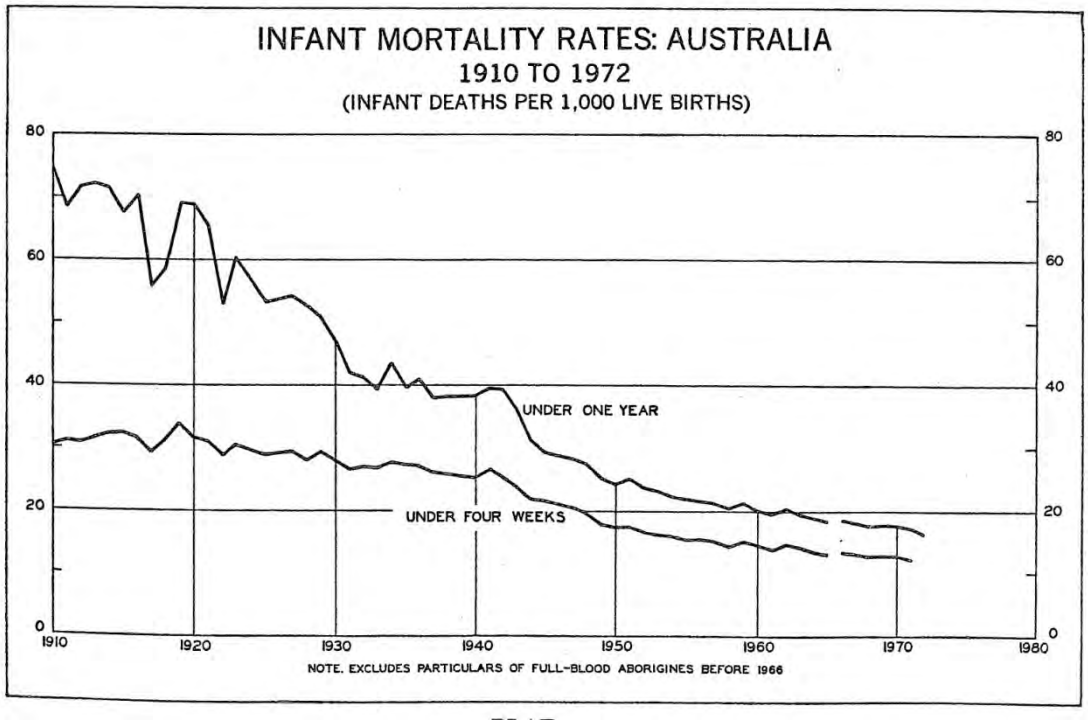
During the 19th and early 20th centuries Australia's public health policy was dominated more by social reform than scientific medicine. The sanitary reform movement of this time involved local governments implementing infrastructure improvements to control infectious diseases in crowded and unsanitary slums (Reynolds 2004 p168; Curry 2002 pp32-33). Sanitary reform was driven by community activists who observed that the poorer classes suffered the greatest burden of disease (Pelling 2002 pp24-25) and they believed it was the government's duty to intervene in this cause. The social reforms implemented were observed to significantly reduce mortality and morbidity in children in England and Australia (Wallace 1889 pp316-324; Feery 1981; Gillespie 1991 p32; Stanley 2001 pp368-369). The developments in public health in Australia reflected the measures adopted in Britain in the Public Health Act of 1848 (Reynolds 2004 p168). Reforms included clean water, adequate waste and sewage disposal, food hygiene and housing. Many public health authorities have stated that improvements in health owe more to changes to the environment and public health measures than to clinical medicine (WHO CSDH 2005; Stanley 2001; Bunker 2001 p1262; McKeown 1979 pp78-79; Cumpston 1989 p312; Illich 1975 p15; Dubos 1966 p14). When the death rate from scarlet fever, diphtheria, whooping cough and measles in Britain from 1860–1965 for children up to 15 is combined, the majority of the decline (90%) had occurred before the introduction of medical interventions. This includes the use of antibiotics and widespread vaccination against diphtheria (Illich 1975 p16). This is supported by McKeown (1979) who stated that immunization or medical therapies, other than smallpox immunization, are unlikely to have had a significant impact on reducing the mortality due to infectious diseases (p92). This is because mortality had significantly declined before vaccines for most diseases were available.

The decline of infectious diseases in England followed a similar pattern to tuberculosis with the vast majority of the decline occurring prior to the introduction of medical

interventions (Winkelstein 1972 p71; McKeown 1979 p92; Doyal and Doyal 1984 p95). This experience of the decline of infectious diseases was similar in Australia and it was described by JHL Cumpston, the first director-general of health in Australia, in the early 20th century (Cumpston 1989 p312). He and other prominent public health officials of the time observed that the decline in the risk from infectious diseases in Australia occurred simultaneously with improvements in public health and prior to the introduction of most vaccines (Cumpston 1989; Burnet 1952; Stanley 2001). By 1950 in Australia infectious diseases had become something that Australians thought of as a problem in other countries. This was due to improved living standards and a lower infant mortality rate (Strahan 1994; Baum 2008 p30). At this time in Australia it was considered that 97 percent of newborns would be expected to survive to one year of age and 96 percent to five years of age (Gandevia 1978 in Goldsmid 1988 p57). In 1956 public health officials stated 'as causes of infant mortality in Australia all the infective diseases have been overcome' (Lancaster 1956a p104). The rates of infectious diseases in Australia were very low from 1945 to 2000; 80% of the fall in the under 5 mortality rates had occurred by 1960, prior to the introduction and widespread use of vaccines (Stanley 2001 p379 and p370).

Lancaster noted that from 1946-1954 'pertussis (whooping cough) was an uncommon cause of death for children in Australia and there is a significant decline in mortality if the age of infection increases' (Lancaster 1956a p104). The vaccine was not credited with the decline of pertussis because vaccination programs with pertussis vaccine were not introduced into mass vaccination campaigns in Australia until 1954. Lancaster also stated that 'mortality rates due to pertussis are used as an index of hygiene or social well-being' (Lancaster 1956b p893). Feery stated that the number of deaths to whooping cough in Australia fell even in the unvaccinated areas (1981 p174). The most significant contribution to the fall in these mortality rates was the decline in infant mortality in the first year of life. This occurred *before* the introduction of widespread vaccination programs in Australia (Stanley 2001 p378; Feery 1981 p174; Commonwealth Yearbook 1953). This decline is illustrated in Figure 3.

Figure 3: Infant Mortality Rates in Australia



Reference - Official Commonwealth Yearbook of Australia, 1973, No. 59, p183

The decline is explained in part by a decline in virulence of the pathogens as public health infrastructure improved and immunity of the population developed. But the most important factor that was recognised at this time was nutrition (Illich 1975 p17; McKeown 1979 p78; Gillespie 1991 p49). However, the knowledge of the significance of nutrition in the prevention of disease would not have been beneficial to the population if there was no political will to implement the infrastructure needed to improve the nutritional health of all socioeconomic groups. Szreter (1988) recognized the critical importance of the state in redistributing the benefits of economic growth to all socioeconomic groups (Szreter 1988 pp34-35). In the 1930's in Australia the state was interested in the health of individuals because they believed each individual was an asset to the productivity of the state (Gillespie 1991 p39). As clean water and sewerage were provided to all Australians in the mid-twentieth century, with the notable exception of many Aboriginal communities, the risk from infectious diseases declined in direct correlation (Cumpston 1989). Mortality to infectious diseases continued to remain high in Aboriginal communities and other socioeconomic groups where this infrastructure was not provided (O'Connor 1989) This example demonstrates the importance of state involvement in healthy outcomes and it emphasises the need for

legislation, political commitment and popular support for public health reform to be successful (Baum 2008 p26).

Public health policies in Australia have been a state responsibility since the establishment of the Commonwealth of Australia in 1901. At this time community health centres had a strong emphasis on social medicine to improve health outcomes. This included changes to political, economic and social aspects of health (Gillespie 1991 p39; Doyal and Doyal 1984 p92; Baum 2008 p18). The Commonwealth Department of Health was established in 1921 and a medical advisory board was established in 1937. This board was called the National Health and Medical Research Council (NHMRC) and its role was to:

i) provide medical advice to the Commonwealth on public health policy and
ii) to allocate funding to medical practitioners and medical research (Gillespie 1991). This body is responsible for deciding which areas of science will receive funding and which will be ignored.

The establishment of a medical advisory board for public health policy was the beginning of the current paternalistic health system that relies on state and federal interventions to achieve healthy communities (Hobbins 2011 p1; Freidson 1970 pp1-17). The early twentieth century was a time of nation building (up to 1940) and this period is noted for the increase in state action that was implemented to improve health outcomes. Medical health officers in each state usually had military or colonial experience and their role was to monitor standards for clean air, water, food and immunization services (Baum 2008 p28). Microbiology was taking hold and giving medicine renewed scientific authority with the theory that vaccines could be used to prevent infectious diseases (Pelling 2002 p32).

At this time there was also an emphasis on ‘improving the human race’ (Baum 2008 pp18-26). The dominant attitude of white Australians was the social Darwinist thinking that superior races would survive and Aboriginal people would ‘die out’. This political orientation included a eugenics movement: the quest for a ‘pure race’. A eugenics program was implemented in Germany with forced sterilisation of mental health patients and others with intellectual disabilities. These measures occurred in other countries such as the US and demonstrate how political decisions in public health policy can remove human rights, such as individual autonomy, whilst being presented as being

in the community's best interests. The emphasis in this era was on the fitness of individuals, and their duty to the state to be healthy and productive. In contrast the emphasis in the second half of the twentieth century was on the responsibility of citizens to be vaccinated for the greater good of the community. The political, epistemological and economic conditions of the time influence which theories about infectious disease control are adopted in public policy and the relationship between the individual and the state (Pelling 2002 p16). The multi-factorial causation of disease was obscured briefly in the medical dominance of the germ theory in public health policy in the twentieth century but it resurfaced in the New Public Health era from the 1980's onwards. The concept that the control of infectious diseases is purely medical is incorrect because infectious agents are linked to many industries and professions involved with fermentation, agriculture and the environment (Pelling 2002 p16).

Governments have used public health policies historically as a tool for achieving political and economic outcomes (Pelling 2002 p21). This was observed in the late 19th and early 20th centuries when the germ (contagion) theory was used to quarantine people and products. Evidence that this was used for political purposes is found in the treatment of the Chinese migrants in Australia during outbreaks of cholera. In 1832 the Quarantine Act in New South Wales was established to control infectious diseases and similar acts were implemented in other Australian colonies soon after. This enabled new migrants to be isolated if they were suspected of having cholera and this was imposed more rigorously on the Chinese than any other group (Reynolds 1995 p161 in Baum 2008 p20). The political nature of public health policies in the 19th century was also observed in the action of British and Australian health authorities who used public health policy to control the poor. Poverty was seen to be the cause of disease however redistributing the wealth was considered a threat to social order and productivity. Hence, public health authorities would address waterborne diseases such as cholera and typhoid that crossed to affluent suburbs before addressing the classic diseases of poverty, such as tuberculosis, in the poorer regions (Baum 2008 p21). Health authorities used the miasma theory, based on spontaneous generation, as the basis for addressing these diseases because it supported cleaning up the environment, whereas the germ theory, with its implications of person to person infection, potentially led to quarantine procedures which could threaten trade and profits (Baum 2008 p21). At this time it was already established that the ability to resist disease was directly related to class and

social position due to environmental and lifestyle factors. That is, changes to working and living conditions were known to have a direct impact in preventing disease. In the 1980's the New Public Health movement was founded on the notion that a strong nation is built by reforming the education system and linking science with government to operate in a more business-like manner (Baum 2008 p28). The development of public health policy from the 1980's onwards was influenced by the WHO and this is described in section 2.7.

2.5 Immunological Theories

This section discusses the theories of human immunology that developed in the 20th century to illustrate the rival theories that fought for dominance in public health policy. Political dominance determined the theories that were adopted in public policy.

Progress in microbiology coincided with Darwin's theory of evolution in the late 19th century. Prior to improved scientific knowledge about microorganisms the etiology of infectious diseases was believed to be from a 'miasma' created by unsanitary conditions: conditions external to the individual (Reynolds 2004 p168; Curry 2002 p32). Treatments were based on the *zymotic theory* of contagion that held that it generated spontaneously from decaying matter (Curry 2002). Miasma theory contended that disease resulted from inhaling bad smells and for political reasons it was portrayed to the public as being 'unscientific'. This theory advocated improved environmental conditions to reduce infectious diseases whilst the germ theory or contagion theory held that microscopic organisms were responsible for the development of disease. Germ theory lent itself to the use of vaccines as a medical intervention for the prevention of disease and this was a politically desirable outcome for the medical/industry model of health that arose in the late nineteenth century (Pelling 2002 p26).

In the early twentieth century sanitary reform driven by the 'miasma' theory was replaced with microbiology and termed 'sanitary science' instead of 'filth diseases'. This was sanitary propaganda which relied on a simplification of the causation of disease (Pelling 2002 p30). A change in terminology was necessary to gain popular support for the germ theory over social reform in the prevention of infectious diseases. The germ theory was adopted in public health policies in Australia from the 1950's onwards and became the foundation for using mass vaccination programs to prevent

disease (Baum 2008 p20). Yet in the early nineteenth century there had been many debates about the specificity of diseases and how they should be classified. For example, at times they were classified on the consistency of the disease from patient to patient (ontological theories) and in other classification systems that took a more holistic approach, where the differences in disease due to individuality and circumstances were emphasised (Pelling 2002 pp22-24). Sydenham, who is described as the 'English Hippocrates', believed that each case of disease and each epidemic was a unique experience resulting from a particular set of circumstances. He described the generic disease process as 'fever' in which the whole body was affected and there were many debates around fever and inflammation at this time. It was commonly believed that disease was a febrile crisis in the body involving the production of diseased matter that should be resolved by excretion through the pores/orifices. Sydenham and others believed that the process occurred naturally and that doctors should not interfere or cut it short because it had a specific course that was significant to development (Pelling 2002 p23).

The germ theory of etiology was based on the Darwinian concepts of individual species, mutation and natural selection (Dubos 1966; Pelling 2002 p23). The capacity of humans to survive in a given environment was described by Claude Bernard as 'the ability to adapt to external changes while maintaining a constant internal environment' (Dubos 1966 p11). This ability was referred to as *homeostasis* and it was observed that infants are not born with the mechanisms of homeostasis. These mechanisms develop over time after experiencing the environment (Burnet 1952; Dubos 1966 p11). Burnet comments on this feature with the following observation 'This effectiveness of internal pattern and control is as much a product of growth and experience-through-function as the skills of a trapeze artist, an orchestra or a statesman' (p98). Research in biochemistry has demonstrated that a constant internal environment in the human body is controlled by the autonomic nervous system and endocrine hormones, and this allows humans to fight environmental challenges (Dubos 1966 p11; Trottier et al 2009). Therefore it is known that an immune response is much more complex than just the production of antibodies in the serum which is the surrogate measure of clinical efficacy used for recommending vaccines. The complexity of the immune response means that the interaction of the immune system with other body systems must be considered when introducing each new vaccine. Historical and current immunological theories do not

think of the immune system as an isolated system. Scientists believe that it works in conjunction with other body systems e.g. the nervous system (Mercae 2003 p28; Tomljenovic and Shaw p2634).

Homeostasis is considered to be well developed in humans by the age of 5 years and this is considered 'the golden age of resistance': the age at which humans are most adaptable to environmental challenges (Burnet 1952 p 98; Dubos 1966 p12). Children between the ages of 5–15 years have the highest resistance to infectious diseases (Dubos 1966 p12). The efficiency of the human metabolism and immune system starts to wane after 30–40 years of age and at 70 it is generally 25% lower than in early adulthood (Dubos 1966 p12). Burnet (1952) described the 'fatal infection' as one that comes too soon (p98). By this he was referring to the fact that exposure has occurred before effective homeostatic mechanisms have developed. In this sense, disease can be described as a failure of homeostasis (Dubos 1966 p13). Consequently the 'virulence' of an infectious agent, indicated by the severity of the disease in the population, is not a standard characteristic like size or shape: it is an expression of the interaction between a particular agent and its particular host within a particular environment (McKeown 1979 p45; Friis and Sellers 2004). A range of health outcomes can be experienced in individuals after infection from the same organism. In other words the genetics, gender and constitution of the host and the specific characteristics of the agent/environment will affect the severity of the infection (Burnet 1952 p106; Magill 1955 p7; Friis and Sellers 2004). During the 1800's it was observed that infectious agents did not always cause disease. For example, it was noted that some agents were only contagious under some conditions. It was known that infectious agents were modifiable by the environment and that their ability to spread was a changeable characteristic. This knowledge was not consistent with the specificity described in the germ theory but it was consistent with historical observation (Pelling 2002 p24).

In the 18th century the health of the inhabitants of the Polynesian Islands was severely damaged by the introduction of the measles virus (Dubos 1966 p14). These populations had never before been exposed to measles and it decimated many previously robust communities. This pattern was also observed in the Australian Aboriginal population after the introduction of smallpox and measles due to white settlement in Australia in 1788. The Aboriginal populations suffered severe mortality after their first exposure to these diseases (Baum 2008 pp22-3). But not all individuals who were exposed to the

pathogens became seriously ill or died. This indicates that causation cannot be simply attributed to exposure to the infectious agent. Similar experiences have been observed with infectious diseases when first introduced to other populations. The pattern of infection is explained by variations in individual genetics and environmental conditions, namely the ecological context of the agent. The virulence of infectious agents is observed to decline with exposure to populations and with changes to environmental and host conditions. For example, the measles virus in a developed country causes relatively benign disease in the majority of children but it can have devastating effects in developing countries where conditions are conducive to disease transmission and children are malnourished (McKeown 1979 p45). The ecological approach to disease was adopted from 1920-1962 when the most significant decline in infectious diseases occurred in developed countries (Languir et al 1962; Baum 2008 p18). In 1962 Langmuir et al described measles in the following way: 'this self-limiting infection of short duration, moderate severity, and low fatality has maintained a remarkably stable biological balance over the centuries.' (p1). At this time there were many epidemiologists who argued that the ecological equilibrium of measles had a solid base that could not be easily disrupted (Languir et al 1962 p1), therefore humans could not expect to eradicate this disease with a vaccine.

In 1962 measles was not considered a significant health problem in developed countries because mortality and disability to this disease had already been reduced (Commonwealth Year Book 1953; Langmuir et al 1962 p1 and p3; McKeown 1979 p56). Yet, despite the ecological equilibrium of measles in developed countries, Langmuir et al (1962) postulated it would be reasonable to attempt to eradicate measles using a vaccine because of the *uncomfortable nature* of the symptoms and because *a vaccine was being developed* and should be used to achieve this goal if it could be done safely (Langmuir et al 1962, emphasis added). Langmuir makes it clear that the reason for supporting measles vaccination at this time was not due to a high rate of death and illness to the measles virus but because 'of the uncomfortable nature of the symptoms'. The suggestion that a vaccine could be used for measles eradication was also based on the *assumption* that it could be used safely in a genetically diverse population. A vaccine for measles was not used in Australia until 1969 (McKeown 1979 p52), after the risk from this disease had declined to very low levels.

It was known in the mid-twentieth century that environmental conditions influenced the virulence of the pathogen and hence the mortality and morbidity from infectious agents (McKeown 1979 p45). Examples of conditions that increase mortality to disease agents include:

i) An inadequate diet which lowers the resistance to infections
ii) Multiple infections and infestations with parasites
iii) Lack of infrastructure for hygiene and sanitation

Measles virus is an example of an infectious agent with high pathogenicity. This means that most cases of infection by the virus will produce clinical signs and symptoms of disease. Measles is an airborne respiratory virus resulting in high infection rates in all social classes. However, there is a large reduction in serious cases and mortality in developed countries due to improved living standards and better nutrition (McKeown 1979 p56). Even when measles infection rates in developed countries are high, mortality and serious disease are low due to improved constitutional changes resulting from interaction with the virus and improved nutrition combined with smaller family sizes (McKeown 1979 p56; Trottier et al 2009). The health of the individual (constitution) and genetics have a significant bearing on resistance to disease (Burnet 1952 p106; McKeown 1979 p56; Gilbert 2004; Friis and Sellers 2004).

When essential nutrients are deficient, diseases which would be mild or unobserved in a healthy child become serious and death can occur (McKeown 1979 p56). In addition, death from measles is mostly a result of infection by secondary bacteria. Anti-bacterial drugs have been used in Australia and the US since 1935 and antibiotics since the 1940's (McKeown 1979 p52; Armstrong et al 1999 p65). Measles has not been a serious risk to the majority of children in Australia since 1950 (Com Year Book 1953); this cannot be due to vaccination because a vaccine was not introduced until 1969 and the acceptance rate did not reach 50% for many years (Feery 1981 p176). After its introduction it was observed that the measles vaccine had no significant effect on the decline of *deaths* due to measles which was already low at the time (McKeown 1979 p52). It is also stated that measles epidemics have been reported with surprising frequency in developed countries where measles vaccination coverage is high (Obomsawin 1998; Nkowane et al 1987; Boulianne et al 1991; De Serres et al 2011). The outbreaks involve from 20% to 80% of fully vaccinated individuals hence we

cannot conclude that random vaccine failures are the cause of these outbreaks. The limited duration of vaccine-induced immunity is known to be a factor in these outbreaks as well as vaccine failures (Ochsenbein et al 2000). Whilst there are reports that measles outbreaks are caused by unvaccinated children these need to be substantiated because many of the outbreaks are known to occur in fully vaccinated communities.

When girls have measles in childhood they acquire long-term immunity and this can be conferred to their children in the placenta and via breastfeeding during the first 6–12 months of life (AAS 2012). This protection is not provided by mothers who have received the measles vaccine in childhood but not experienced the disease (Papania et al 1999; Bale et al 2011). Infants in the first year of life are unable to produce high levels of interferon and therefore they are more susceptible to measles without this passive immune-protection (created by natural exposure) passed on from their mothers (Langmuir et al 1962; Wilson et al 1986). It is observed that exposure to the agent 'changes the immunological constitution of the herd' (Magill 1955; McKeown 1979; Friis and Sellers 2004) and this interaction between the host and agent has resulted in the reduction in prevalence and severity of many previously epidemic infectious diseases (McKeown 1979 p47). This adaptation is known as 'herd immunity' and it was first observed after natural exposure to infectious agents (Colgrove 2006 pp2-5; Friis and Sellers 2004). Colgrove (2006) states that herd immunity was first described in the 1920's when it was observed that an entire community will be protected against a contagion if a large enough proportion of the population is immune. Immunity occurs naturally in humans, and without risk, if the exposure occurs at the right time during childhood. Herd immunity is discussed in more detail in chapter 4.

Disease *severity* is directly related to the host's ability to fight off the infectious agent (Friis and Sellers 2004 p403). Nutrition, genetics, psychology and environment all play a role in the functioning of the immune system and the expression of disease from an infection (Burnet 1952; McKeown 1979 p25; Friis and Sellers 2004 p403). In particular, this involves the 'non-specific' defense mechanisms as well as the 'disease-specific' defense mechanisms of the human immune system. This knowledge is fundamental to the development of a universal management strategy for reducing the risk from infectious diseases for any community (Burnet 1955 p106; Cumpston 1989; McKeown 1979 p24; Curry 2002 p32-34; Friis and Sellers 2004 p401). Effective control of disease in the community requires an in-depth knowledge of the multiple factors that interact in

the causation of disease in an individual. The germ theory of disease causation in the SMM simplifies the many causes of disease from the interaction of multiple factors at different levels of complexity e.g. cellular, body organs/systems and genetics, to a single cause of disease, such as a microorganism at the cellular level (Rogers 1984 p67). By reducing or simplifying the cause of disease to the infectious agent on its own, the medical profession claimed that vaccines could be used to prevent infectious diseases. This theory is based on Koch's postulates which have oversimplified the causation of disease through the concept of 'specificity' (Pelling 2002 p22). Robert Koch (1843–1910) was a microbiologist who described the steps required to isolate disease agents and this led to the belief that if a disease agent was present in a sick individual then this was the cause of the disease and the disease was named after the agent, for example, measles, pertussis or influenza. By reducing the cause to 'the microorganism' the theory lends itself to the idea that the disease can be controlled simply by targeting the infectious agent. The belief can be further enhanced in society by spreading negativity and fear about infectious diseases in the media whilst portraying a positive image of vaccines (Pelling 2002 p15). This simplified theory of disease prevention ignores the fact that infectious agents do not cause disease alone and that a vaccine cannot be used without causing some harm in genetically diverse populations. If the majority of people in a community are not at serious risk from the infectious agent, due to improvements in the environmental conditions, then many individuals will be at greater risk from a vaccine because they were never at risk from the disease agent. This is also the case because combining numerous vaccines in the human body results in synergistic and cumulative adverse effects that vary according to individual genetics/constitution.

The germ theory in the SMM, as applied to the etiology of infectious diseases, has been subject to critical analysis by many, including Bashford and Hooker (2002) and Pelling (2002). The contempory control of infectious diseases has been described as a 'fantasy of controlling contagion' because society's efforts fail so often (Bashford and Hooker 2002 pp2-3). Beliefs about the processes and agents of infectious diseases have been contested throughout history and political decisions have determined the dominant method of disease control during different historical periods. Bashford and Hooker state this is due to the political nature of science. They state that it is necessary to understand what else is being governed in public health policy to understand how the changes in meaning of concepts can obscure some things and create others. Pelling describes the

complexity of infectious disease control as a result of the special relationship between science and politics and the need to produce propaganda (2002 p26). Whilst western medical professions were in agreement with sanitary reform they were against promoting it as an exclusive system. This wasn't simply a conflict of ideas. There was a lot of similarity in the theories; the differences were due to professional investment in the promotion of specific methods of causation (Pelling 2002 p26). In the 20th century the two main phases of the public health movement were portrayed as being opposite viewpoints but in fact there were many similarities. Portraying them as opposites was necessary for the medical profession to emphasise the germ theory and microscopy to present the decline in infectious diseases as being a result of medical science. In order to ensure that the germ theory dominated it was necessary to discredit some ideas and concepts by obscuring definitions or creating confusion over theories. Over-simplification was used as a strategy to force the acceptance of other theories, such as the germ theory, and in this manner medical science was able to restrict and manipulate the number of factors that were promoted as the cause of infectious disease (Pelling 2002 p17). Money and power are involved in determining the accepted scientific belief's in society by domination of the media and political voice. The corporate influence on public health policy is described in chapter 6.

Modern science has progressed by selecting some causes and ignoring others. The focus on germ theory and vaccination ignores environmental and pre-disposing causes of disease and the interaction of etiological factors. Reductionist theories over-simplify and encourage the lay person to believe in 'magic bullets' as cures or preventions for disease (Pelling 2002 p17). It is clear that public health is an inherently political activity and this explains why it is surrounded by controversy. The patterns of disease and health in a community represent broader social inequities (Baum 2008 p21).

2.6 Australian Public Health Policy Since 1950

This section examines the change in direction of Australian public health policy that occurred in the mid-twentieth century and the influences that led to the adoption of vaccination programs to control disease. It provides an assessment of the decline in the infant mortality rates in Australia to see if this decline can be credited to the adoption of vaccination in the second part of the twentieth century.

Public health involves an assessment of different strategies to create health-promoting environments, including the social, economic and physical aspects of the environment (WHO CSDH 2005; Stanley 2001 p400). These were the main strategies that were emphasised in the first half of the 20th century during which time the threat from infectious diseases declined significantly in developed nations (Naidoo and Wills 2004 p12; Armstrong et al 2011 p64). Illich (1975) states with reference to infectious disease mortality 'it is certain the professional practice of physicians cannot be credited with the elimination of old forms of mortality' (p17). An analysis of disease patterns has established that the most important factor influencing the health of any population is the environment (WHO CSDH 2005; Winkelstein 1972 p70, McKeown 1979 p78; Stanley 2001 p369). This includes food, housing, working conditions, community and cultural mechanisms affecting the mental well-being of individuals. Basch (1994) states the historical record of western countries contains a large body of literature that shows a lack of connection between the use of biomedical technology, including vaccines, and the health of communities (p56).

The Australian government's public health policy up to 1950 was a holistic approach that emphasised prevention through nutrition and environmental changes (Feery 1981; Gillespie 1991 p49; Cumpston 1989). During this period health authorities used the media to achieve changes in behaviour and lifestyle through education campaigns that O'Connor (1989) referred to as 'propaganda publicity'. The campaigns were very successful in changing social behaviour to reduce the infant mortality rate of the population. Parents were targeted with health information that was recommended by the NHMRC to state governments to improve health outcomes. This was presented in radio programs, films and newspaper campaigns to advocate changes in diet, national fitness, domestic hygiene and breastfeeding. In 1946 the Australian constitution was changed to give the Commonwealth government power to provide a complete health service to the nation, including medical advice and treatment (Com Yearbook 1953; Palmer and Short 1994 p18). At this time state and local health authorities were responsible for environmental health protection and this included surveillance of infectious diseases and the development of disease prevention programs (Palmer and Short 1994 p11). The Health Acts of all states included the compulsory notification of infectious diseases. If a notifiable disease occurred, the local authority and the Health Department were advised and measures were implemented to contain the disease (Com Yearbook 1953).

By 1950 the Australian government's advisory board on infectious diseases, the NHMRC, had removed whooping cough (pertussis), influenza and measles from the list of notifiable diseases due to the significant reduction in morbidity and mortality that had occurred (Com Yearbook 1953 p278). No vaccines were used for these diseases at this time. The same trends were observed in all developed nations and in 1966 Dubos stated 'Of the 10 leading causes of death in infants and young children in 1850 every one has been brought under control….very few persons of any age die of the acute infections which used to account for the majority of all deaths' (p9). At this time mortality due to infectious diseases was rare even though cases of these diseases were common (Dubos 1966). This was observed to be a result of the adaptation process of humans to the environment. Environmental and lifestyle changes increased the age of exposure to infectious agents and hence reduced the severity of disease (Burnet 1952 p99; Dubos 1966 p10).

Mass vaccination programs for most infectious diseases in Australia were not used widely until after 1952 (Com Yearbook 1953; McKeown 1979 p50). These programs were introduced *after* deaths and illness to infectious diseases had significantly declined. Australia had low rates of mortality and morbidity due to infectious diseases from 1950, before most vaccines were introduced. In 1986 the infant mortality rate was 8.2 per 1,000 live births (Palmer and Short 1994 p14; Stanley 2001 p371) and many vaccines were introduced in the 1990's. An exception to this pattern was the polio epidemics of the 1950's; a full understanding of these outbreaks and the effect of vaccination programs on polio mortality and morbidity requires knowledge of the ecological context in which the outbreaks occurred and the criteria for diagnosis and surveillance of polio at the time. These aspects of disease statistics are described in chapter 4 and illustrated in the case study of 'pandemic' 2009 influenza in chapter 10. It is also significant that vaccination programs implemented from 1953-1993 in Australia were completely voluntary: the government did not use mandatory requirements or financial incentives to increase participation rates in these programs (Com Yearbook 1953; AG IAP 2004). At this time vaccination rates varied in different regions of Australia, yet the risk of infectious diseases *declined* in all regions. The tuberculosis, whooping cough and polio vaccination programs implemented after 1953 in Australia represent the change in focus of public health policies from an environmental/social basis to a medical basis in the second part of the twentieth century (Baum 2008 p28).

The Australian government has stated that mass vaccination has prevented more suffering and saved more lives than any other public health intervention (AAS 2012; AG IAP 2013). However, the historical epidemiological evidence of the decline of infectious diseases does not support this claim. Most vaccines were not introduced when the risk of these diseases was significantly reduced (Cumpston 1989 p312; McKeown 1979 p52; Stanley 2001 p377). Despite this evidence the Australian government has been informing the Australian public since the 1990's that the success of vaccines in preventing disease depends upon *high participation rates* in vaccination programs (AG IAP 2013). Infant mortality rates continued to decline in developed countries as material wealth and living standards improved. The majority of the decline in infant mortality rates occurred in the first half of the 20th century before the widespread use of vaccines. Analysis of the life expectancy figures shows that the most significant increases were made before medical interventions were widespread. In Australia, men gained 13.5 years between 1920-22 and 1953-55 and women gained 14.8 years during this period. However, for the next decade from 1953-55 and 1960-62, the gains for men were only 0.8 years and for women 1.9 years and this was similar in other developed countries e.g. US and Europe (Hetzel 1976 p31). It is known that death and illness were reduced through environmental and lifestyle changes, and vaccines other than those for smallpox and diphtheria, were not in use for most infectious diseases until after 1950 when the risk from these diseases had already been reduced.

As the virulence of infectious agents declined the medical profession's role in developing public health policy increased. There is no other professional body that has the same degree of influence in any policy area (Palmer and Short 2010 p25). When examining policy content it needs to be understood in the political context within which it is developed (Palmer and Short 2010 p33) and in the 1950's a strong partnership was growing between medical science and industry (Krimsky 2003). At this time public health policy in Australia and in other western countries became dominated by the scientific medical model of health (SMM) (Naidoo and Wills 2000 p185). Consequently the definition of health became narrower and vaccines, a medical intervention, rather than social medicine became the main focus for health practitioners. The scientific medical model of health is described further in chapter 5. After 1950 in Australia vaccination policy was driven by the SMM and founded on the 'germ' theory and the belief that the cause of disease originates from exposure to an agent with subsequent

changes within the individual (Freidson 1970 p16; Curry 2002 pp33-34; Stacey 1988). This simplified explanation implies that infectious diseases have only one cause and one health outcome hence a drug may be useful in the prevention of these diseases (Dubos 1966 p13; Pelling 2002 p17). In reality most diseases have more than one cause and it is the interaction of factors that results in the expression of disease (Friis and Sellers 2004). This is illustrated in the epidemiological triad and it is the reason why health outcomes from infectious agents vary between individuals (Dubos 1966 p13; Gilbert 2004). Infectious agents are part of the human flora, including pathogens such as hepatitis B, influenza, whooping cough etc, but alone they are not sufficient to cause disease in humans (Burnet 1952; Dubos 1966 p13; Friis and Sellers 2004 p402). It is the ecological context that results in the development of disease.

The adoption of the SMM resulted in a focus on disease prevention that reduced the emphasis on the external determinants of health; the environment, agent and host characteristics. In earlier centuries before the medical practice of vaccination was introduced it was known that environmental conditions and host characteristics were fundamental to the reduction of disease (Feery 1981 p172; Dubos 1966 p14). The increase in female literacy at the end of the 19th century was also seen as a significant factor in reducing the rates of infant mortality (Stanley 2001; Baum 2008 p21). Public health was reframed in the mid-20th century as an area of 'medical expertise' with a strong alliance between scientific medicine and the government (Freidson 1970 p16; Hobbins 2011 p427). Controlling infectious diseases was also reframed from reducing illness and death due to these diseases to preventing or eliminating these diseases (Langmuir et al 1962 pp1, 3; Hawe 1994 p242; Curry 2002 p34). In areas where the transmission of a pathogen had been cleared and an infectious disease had become a low risk, the term *elimination* was used as the reason for introducing a vaccine for the disease (Basch 1994 p14). This was the justification for implementing vaccination programs in developed countries like Australia, for diseases that were no longer a serious risk to the majority of the population. This included hepatitis b, haemopholus influenza (Hib) b, pneumococcal, meningococcal, varicella (chicken pox), rotovirus. The terminology of vaccination policies changed in the early nineties and infectious diseases were labeled vaccine-preventable diseases. This expression implies that vaccines are the key to preventing disease and thus serves to increase the uptake of vaccines. Framing vaccination in this way assisted governments to promote vaccines to

populations in developed countries where the majority of people were not at risk from the diseases for the new vaccines being developed. This is discussed further in chapter 7.

Around 1950 the focus of public health changed from the environment to individuals and a push was made to focus on vaccination as a method of preventing many infectious diseases. It was suggested that if enough people could be convinced to vaccinate then some diseases could be eliminated due to vaccine-created herd immunity (Curry 2002 p34). Medical training became necessary to practice in the field of public health and vaccination became the specialty of doctors (Naidoo and Wills 2000 p185). Public acceptance of vaccination programs during the 20th century was dependent upon negotiations between local governments, the Commonwealth and the use of promotional campaigns in the media to frame the issues to the public (Hobbins 2011 p427). After 1950 public health was increasingly described as the control of 'communicable diseases' whilst environmental health became a reference to the physical environment in which individuals live, including housing, transport, sanitation, pure water and pollution (Naidoo and Wills 2000 p7). In the 1970's the medical model was extended further as health authorities employed community physicians to replace medical officers (Naidoo and Wills 2000 p14). The image of public health had become medicalised even though infectious diseases had a low profile at this time due to the decline in mortality that had already occurred.

Further evidence of the low profile of infectious diseases in Australia in 1989-90 is the small proportion of the federal budget that was spent on disease prevention at this time. Only 4.4% of the total healthcare expenditure of $33 billion was spent on community and public health services in 1989-90 (Palmer and Short 1994 p14). This represented all expenditure on health promotion and disease prevention at this time. Table 1 illustrates the health priorities of the Australian government in 1989 - prior to the implementation of many new vaccines in the National Immunisation Strategy (NIS) in 1993. The infant mortality rate was very low in 1989-90 and only 7 vaccines were recommended on the government childhood schedule at this time – polio, diphtheria, pertussis (whooping cough), tetanus, measles, mumps and rubella (AG IAP 2004). The implementation of the new National Immunisation Strategy (NIS) in 1993 was estimated to need a budget of $53 million to operate with an initial allocation of $9.6 million (Hawe 1994 p242). The last year that a breakdown of the health services was provided in a summarized

format was in 1989-90 (Palmer and Short 1994 p14). In 1990 the majority of Australian children were not at serious risk from any infectious disease yet this is when the Australian government expanded its national vaccination program. By 2008-2009 funding for the essential vaccines was 'well in excess of $AU400 million' (Nolan 2010 A76). The new National Immunisation Strategy (NIS) implemented in 1993 and the strategies that were adopted to increase participation rates in vaccination programs are described in chapter 3.

Table 1 A Summarized Representation of Australian Health Expenditure by Category in 1989-90 ($ millions)

Category	Total Funds (Commonwealth, State and Private)	Percent of recurrent expenditure
Total Institutional Expenditure	13779	51.6
Medical services	4878	18.3
Dental and other professional services	2442	9.1
Pharmaceuticals	2510	9.4
Community and public health *	1165	4.4
Other recurrent expenditure	1933	7.2

* Community and public health includes the categories of health promotion and illness prevention.
Source: Australian Institute of Health and Welfare. 1993a. In Palmer and Short 1994 p14.

2.7 The New Public Health Movement (1985 –1995)

In the mid-twentieth century, the separation of public health medicine from the broader issues of social medicine and environmental reforms was a result of the influence of WHO/UNICEF in the development of global health policies. Even though it was undisputed at this time that social inequalities were a significant cause of ill health it became politically unpopular to use a definition of public health that included the social,

environmental, cultural and genetic factors of health (Naidoo and Wills 2000 p186). This is observed in the Australian government's definition of environmental health that was provided earlier in this chapter. This notion is compatible with the scientific medical model which focuses on a mechanistic model of the human body that treats the parts separately and ignores external factors as determinants of disease (McKeown 1979 pp7-8; Doyal and Doyal 1984). Decision-making in health is a complex process that involves medical, economic and political influences. In the 1980's the dominant influence was economic analysis due to the rise of neoliberalism globally.

The period from the mid-1980's onwards is referred to as the New Public Health era. At this time the medical dominance of public health was challenged as the limitations of clinical medicine became clear (Naidoo and Wills 2000 p186; WHO CSDH 2005). There was a progressive return to multifactorial causation in accordance with traditional theories in the eighties after most infectious diseases had declined in developed countries (Pelling 2002 p17). McKeown (1979) was one of the most vocal health practitioners in the 1980's providing evidence of the multifactorial nature of disease. The first International Conference on Health Promotion was held in Ottawa in 1986 (WHO 1986) and a charter of goals was presented at this conference aimed at empowering people to have control over their health. There were five important principles that were recognised in the Ottawa Charter as being necessary to achieve this goal: good public policy, developing supportive environments, supporting community action, creating personal autonomy in health and restructuring health services – the foundation of social medicine. These principles encompassed a holistic approach to improving health that included environmental and spiritual factors and greater involvement of the community (WHO 1986). During the 1990's a greater emphasis was placed on social interventions to create sustainable health outcomes in the 21st century (Stanley 2001 p400). Whilst medicine was removed as the primary focus of public health policy in many countries, the prevention of infectious diseases worldwide was still dominated by vaccination. At this time the reliance on epidemiology as the only valid method of public health research was also challenged and methodology was broadened to better reflect the complexity of health issues (Baum 2008 p38).

The era from the mid-1990's to the present has been labeled the Global New Public Health movement because of the limitations that economic globalization is observed to have on the outcomes of government health policies (Baum 2008 p17). Transferring

capital, goods, people and ideas around the world depends upon the political arrangements between countries (Blume et al 2013 p32). Political will is required for an intervention to be adopted. In 1997 the International Health Promotion Conference (IHPC) held in Jakarta focused on the development of partnerships in health promotion with large corporations to expand the use of new technologies and vaccines in public health policies. These were termed public-private partnerships that included sponsorship arrangements with pharmaceutical and other multi-national companies (Baum 2008 p38). From the 1990's onwards the policies and practices of international financial institutions were having an increasing impact on the health outcomes in WHO member countries. This was due to the globalization (privatization) of public health policy and the diminishing role that governments were playing in the design of public health policy (Baum 2008 p19). Infectious disease policy is now designed on complex economical models with inbuilt assumptions for global communities, not context-specific communities.

In 2000, after the establishment of the Global Alliance for Vaccines and Immunisation (GAVI), the focus of public health at the IHPC in Mexico City was changed to an emphasis on new and re-emerging infectious diseases (Baum 2008 p39). It was observed that the spread of AIDS in Africa was wiping years off the life expectancy of Africans and this was used to focus the global public health movement on bioterrorism and increased fear and preparation for pandemic diseases, such as Sars and Swine flu. Public health policies in the Global New Public Health Era from 2000 have been influenced by the representatives of the GAVI public-private partnerships, and presented to member countries through WHO/UNICEF (Blume et al 2013). The privatization of health services is a key threat to global public health. Some of the main concerns listed in the People's Health Movement arose due to the new direction of WHO/UNICEF policies from 2000. These include the fact that policy is now designed by private-public partnerships that advance corporate interests at the expense of the public interest. These partnerships are also founded on the voluntary commitment of corporations to equity, public health and sustainable environments instead of strong regulation through a democratic process (Werner 2005 in Baum 2008 p41). That is, there is no accountability for corporations in private-public partnerships and their primary interest in health promotion partnerships is profits for their shareholders. This

represents a conflict of interest to the purpose of public health policy: protecting public health.

WHO/UNICEF are providing conflicting directives on health promotion. On the one hand they are advocating for human rights and community action to address the determinants of health sustainably but on the other they are focusing on private partnerships in health promotion with profit-making corporations. These contradictory strategies are not compatible and increase the health inequities that are detrimental to populations (Baum 2008 p41). Economic growth in many developing countries has resulted in industrialized areas merging with impoverished rural areas without sanitation, hygiene, healthy air quality or housing. Respiratory and enteric infections flourish when there is unregulated industrialization (Blume et al 2013 p32). Although the WHO established the Commission for Social Determinants of Health (CSDH) in 2005 global public health policy continues to be more focused on governance by technocrats and partnerships with corporations than developing comprehensive healthcare that addresses the environmental and social determinants of health (Baum 2008 42). A focus on profits protects industry interests and not the public interest in government health policies. The influence of GAVI on global health policy development is explained further in section 3.3.

2.8 Measuring the Health of Communities

During the first half of the 20th century it was common practice to use the surrogate of age standardised mortality rates as an indicator of the health status of communities (Palmer and Short 1994 p16). This was because the health of communities is difficult to measure. There are many variations in the definition of 'health' and there are also difficulties in measuring different aspects of health. Mortality rates were a useful and concrete indicator of survival but they provide limited information about 'population health' in terms of morbidity, quality of life and human rights. Mortality rates are unable to provide information about the non-quantitative issues such as disability, pain, stress or family circumstances that are associated with many diseases (Basch 1994 p22). From 1995 onwards, public health authorities adopted vaccination coverage as a key measure of health in communities (Blume et al 2013 p11). This measure was chosen because it reflected the interests and strategies of the dominant stakeholders in global policy: the vaccine manufacturers in collaboration with financial institutions (Blume et

al 2013 p26). However, this measure is inadequate for informing authorities about the burden of chronic disease and disability in populations and it is founded on the questionable assumption that high vaccination coverage improves the health of communities. It also hides the issue of vaccine safety (McNeill et al 2013 p81). This is because there is no systematic surveillance of vaccine safety globally and it is not addressed in the cost-effectiveness models being used by GAVI to promote vaccines to the WHO. This is described more fully in chapter 6 and with examples in the case studies in chapter 9 and 10.

A key measure of health that could be used if the desired outcome was the health of populations is the material well-being of communities. Public health advocates have observed a clear ecological relationship between material well-being measured by income and the health status of families (Palmer and Short 1994 p17; Stanley 2001 pp378-9; Baum 2008). Improvements in mortality and morbidity are directly related to higher disposable income and higher levels of maternal education. These factors are quantifiable indicators of health but they are not used to design global health policy. In contrast, the key measures of health adopted in the era of New Global Public Health are the Millennium Developmental Goals (MDG). These were established in the UN's Millennium Declaration and adopted in 2000 by all WHO member countries (Blume et al 2013 pp25-6). They were designed by the private-public partnerships of the GAVI alliance and the Organisation for Economic Co-operation and Development (OECD). These goals have been based on investment in health to improve economic growth and productivity for private sponsors. Waitzkin describes how this aim reduces the importance of the social determinants of health – income, class and power, and consequently the importance of health as a fundamental human right - because the funding for these public programs that are declared to be for the 'good of the community' is private capital resulting in private profit (Waitzkin 2003 p523). Although the MDG's were adopted in 2000 they originated in the 1990's when economic analysis became the dominant influence in policy design. At this time the concept of the disability-adjusted life year (DALY) was introduced as a measure of health. This was a concept developed by the World Bank in 1993 and used in its report "Investing in Health" (McNeill et al 2013 p63). It is a concept that measures the overall disease burden as the number of years lost to disease, disability or early death and it relies on

many assumptions. WHO adopted this key measure in 2000 under the recommendations of GAVI.

Since this time economists have become more influential than health authorities and health departments in global policy design (McNeill et al 2013 p63). The Bill and Melinda Gates Foundation (BMGF) and the GAVI alliance represent the private-public partnerships that are shaping global health policies through the WHO/UNICEF. Sponsors of health programs have the power to influence public health policies in WHO member countries. WHO is now perceived as having a sub-contractor role in global health policy instead of being responsible for the direction of these policies and being influential in protecting population health (McNeill et al 2013 p65). McNeill et al also state that statistics have been abused to fabricate evidence of success (p84). This aspect of the 'evidence' used in vaccination policies is discussed further in chapter 6.

The initiatives implemented to achieve the MDG's do not address the causality of infectious diseases; they ignore the social determinants of health and focus on the technological solution of vaccination. In fact, there is no correlation between the achievement of the MDG's and decreasing inequalities in mortality between wealthy and poor nations because the progress between countries is inequitable (Moser et al 2005 p1181). If the aims of the MDG's are not decreasing the inequity gap then it could be said that they have been designed to fail to improve health (Blume et al p26). The goals were chosen because they were quantifiable, robust and could provide a concrete measure of performance to justify programs to the international stakeholders. However, they were based on an economic analysis of health driven by donor self-interest and not the health needs of each country. Hence an equity dimension needs to be incorporated into the child mortality MDG (Moser et al 2005 p1181). Examples of the key measures of health that were claimed as successes during 2000-2008 include (McNeill et al 2013 pp75-6):

1. 'Prevented a cumulative 3.4 million future deaths
2. Protected a cumulative 50.9 million children with basic vaccines against DTP3
3. Protected a cumulative 213 million children with new and underused vaccines'

These achievements provide confidence to the donor countries because they are quantifiable measures of health. This increases the funding for GAVI which in turn increases the influence it has over WHO/UNICEF policy (McNeill et al 2013 p75-6).

The use of these outcomes to measure health is justified with economic modeling designed with the underlying assumption that increased vaccination rates improve the health of populations. Whilst the influence of wealth and education on health outcomes has been known for centuries (Winkelstein 1972 p74; Dubos 1966 p14) this information has never been collected in Australia on a regular basis and used in the development of government public health policies (Palmer and Short 1994 p17). Yet many studies have demonstrated the significant differences in mortality and morbidity rates, particularly infant mortality rates, which exist between occupational and socioeconomic status groups (Palmer and Short 1994 p17; McKeown 1979 p60; Stanley 2001 p379). An example of this is Australia's indigenous population. Although these communities have had vaccination programs since 1958 (O'Connor 1989 p74) the indigenous childhood mortality rate from 1994-1996 was 3 times higher than the non-indigenous mortality rate (Stanley 2001 p372). Many of these communities were and still are lacking in sanitation, good nutrition and hygienic living conditions (O'Connor 1989; Stanley 2001 p400). This information is relevant to government vaccination policies that recommend the universal use of multiple vaccines because outbreaks of disease can be controlled through a change in socioeconomic circumstances without the aid of vaccines. This would be a significantly more cost-effective strategy as can be seen by Australia's health statistics up to 1989 (see section 2.6).

2.9 Conclusion

The epidemiological triad illustrates that infectious diseases are a result of the interaction of multiple causal factors in pathogenesis. In other words, infectious agents (bacteria/viruses) are necessary but do not always result in disease; exposure to these agents can result in a diversity of health outcomes. This is why the assessment of the severity of each infectious agent in the community cannot be made outside the ecological context. Global public health policies are resulting in a 'one size fits all' vaccination program that ignores the context in which infectious diseases occur and the diversity of outcomes that are expected. There are a range of health outcomes that can arise after exposure to an agent – no disease, mild or severe disease, or death - and the health outcome is dependent upon the host, environment and agent characteristics. Humans develop immunity by adapting to their environment through a process known as homeostasis. Homeostasis is part of the process by which humans develop resistance

(immunity) to disease and it develops through natural interactions and exposure with the organisms in an ecological context. The immune system interacts with the environment and other body systems in complex ways to develop long-term protection against disease: it is not simply the production of antibodies to an antigen in the process of seroconversion induced by vaccination. In this way communities are protected by herd immunity developed by natural exposure to the agents.

The infant mortality rate in Australia declined primarily due to improvements in the ecological context including sanitation, hygiene, nutrition, breast feeding, smaller family sizes, less crowding and improved infrastructure. The risk of death and illness due to infectious diseases had declined by 1950 *before* most mass vaccination programs were introduced. In 1950 only two vaccines were in voluntary use in mass vaccination programs in Australia, diphtheria and smallpox, and these diseases did not decline any more quickly than other infectious diseases. Whilst outbreaks of infectious diseases still occurred after 1950, the risk of death and severe illness was low to negligible to the majority of Australian children and long-term herd immunity to the diseases was gained by natural infection during childhood. Many mass vaccination campaigns were introduced in Australia from 1952–1990 but participation was voluntary and without coercive government strategies. Infectious diseases continued to decline as living standards and education improved. Despite the low infant mortality rate in the early 1990's and the lack of significance of infectious diseases in Australia at this time, the government implemented a new strategy to increase the vaccination rates in the population and to expand the recommended schedule of vaccines. This policy change was in response to WHO global health directives, and not a specific recommendation for the ecological context of the Australian situation.

A decision was made in the mid-twentieth century to medicate all children to prevent disease, despite the diversity of outcomes that arise after exposure to an infectious agent. At this time the health of Australians was measured using the decline in the infant mortality rate and since 1990 vaccination coverage has been used as the surrogate measure for 'health'. These surrogates have been used even though it is known that mortality rates and vaccination coverage are unable to inform authorities about the illness/disability associated with each disease. The well-being and quality of life of individuals in communities cannot be accurately measured using these surrogates. This

is relevant to vaccination policies because there has been a significant increase in chronic illness in Australian children that has occurred at the same time as the government increased the participation rates and the number of vaccines listed on the childhood vaccination schedule in the 1990's. Authorities that depend upon infant mortality rates and vaccination coverage alone to inform public health policy will not detect or recognize a correlation between vaccines and increased morbidity in the population.

Overview of Chapters

The expansion of the Australian government's vaccination program within the global framework for public health policy directed by the WHO/GAVI is described in chapter 3. Chapter 4 discusses the federal governance of the NIP and the way in which risk assessment for infectious diseases is performed and communicated to the public. A discussion of the principles of public health policies and ethical codes of conduct for health promotion is provided in chapter 5. Chapter 6 investigates the rigour of the science that is produced in academic-industry partnerships in research institutions and chapter 7 provides a discussion of the evidence the Australian government provides to support the claims used to promote vaccines to the public. Public health policies are a reflection of the cultural and political beliefs of the time. Chapter 8 discusses the political framework that results in *undone science* and how public health policy is being designed on political decisions made without complete scientific knowledge. It provides the political framework for the existence of undone science and explains the consequences of its existence in public policies to population health. These influences in the development of global vaccination programs are illustrated in a case study of the Human Papillomavirus (HPV) vaccine in chapter 9 and the 'Swine Flu' 2009 vaccine in chapter 10. An investigation of these vaccination programs demonstrates the political and economic environment in which vaccines are being produced in the globalization era and the effect this has on the research that is produced in academic institutions. Chapter 11 provides the conclusions drawn about the Australian government's claim that vaccines are a safe and effective prevention for many infectious diseases.

CHAPTER 3 GLOBAL HEALTH POLICY AND AUSTRALIA'S NATIONAL IMMUNISATION PROGRAM (NIP)

PART 1 GLOBAL PUBLIC HEALTH POLICY

3.1 Introduction

This chapter provides an overview of global health politics during the 1990's when the Australian government was developing its National Immunisation Program (NIP). Australia's vaccination policies were part of a global vaccination campaign that was directed by the WHO/UNICEF and aimed to increase the vaccination rates of children in all countries. Global health politics in the 1990's provide an explanation for the Australian government expanding its NIP at a time when infectious diseases were a very low risk to Australian children. See chapter 2. The development of global vaccination policies and the Australian NIP from 1990 are described in this chapter.

This chapter also provides a discussion of the strategies that have been adopted in Australia to emphasise the responsibility of individuals to participate in vaccination programs. These strategies pressure the public to use a medical procedure 'for the good of the community'. The theory of 'vaccine-created' herd immunity has been used by the government to suggest that high participation rates in vaccination programs are necessary to *prevent* infectious diseases. A discussion of the Australian government's reason for emphasising participation rates in vaccination programs is provided here as well as the reason for increasing the number of vaccines recommended in the NIP. I have also provided a discussion of the ingredients of vaccines because the increased use of vaccines increases the risk of adverse events due to the excipients and non-human protein combined in the vaccine carrier.

Recently the government has implemented recommendations for vaccines to be mandatory in a number of Australian workplaces. A discussion of the implementation of vaccination policies in occupational settings at a time when infectious diseases are not a serious threat is provided in this chapter. Policies that use financial incentives to pressure individuals to vaccinate for employment and schooling contradict the Australian government's claim that vaccination in Australia is not compulsory. In many cases people cannot afford to lose their jobs by choosing not to vaccinate and some

parents are also dependent upon childcare facilities and welfare benefits for their livelihood. A discussion of the impact of the government's vaccination policies on the freedom to choose a medical procedure for healthy people has been presented in this chapter. Chapter 4 provides a description of the way in which the NIP is implemented into Australian communities and the surveillance methods that are used to assess the risk of communicable diseases to the community. An overview of the governance of Australia's vaccination policies is provided in Appendix 3. There are many ethical implications in a public health policy that recommends a medical procedure to healthy people and a discussion of these issues with the guidelines for good medical practice is provided in chapter 5.

3.2 Global Health Policy

The WHO Expanded Program on Immunisation (EPI)

This section describes the influence of public-private partnerships with WHO/UNICEF that are influential in the development of global and national public health policies. It also describes the influence that global health policy has had on the development of Australian vaccination policies. I have relied largely on Roalkvam, McNeill and Blume (eds) 2013 *Protecting the World's Children: Immunisation Policies and Practice* because this is the most current and comprehensive text on global health policies. The directive to increase the participation rates in Australian vaccination programs from the 1980's onwards was part of a global health initiative and a description of how this developed is provided below.

The WHO is a United Nations multilateral agency and is composed of United Nations member countries who accept the WHO constitution (WHO Countries). Since the 1940's and up to 1990, the WHO and the United Nations Children's Fund (UNICEF) have been the dominant influence in designing international health policy (IOM 1993). In 1974, the WHO established the Universal or Expanded Program on Immunisation (EPI) through a World Health Assembly (WHA) resolution (WHO ISD). At this time the WHO provided policy guidance for people of all ages and UNICEF was involved in implementing childhood vaccines into global programs. After the launch of this program UNICEF/WHO set vaccination policies and standards for vaccination coverage that were to be achieved by each member country (WHO ISD). As of 2014 there were

194 member countries (WHO Countries). The goal of this program was to increase the vaccination rate of children worldwide to ensure that all children benefit from 'life-saving vaccines' (WGO ISD). It was founded on the belief that vaccination programs had been successful in eradicating smallpox globally (WHO ISD). This was despite the warning by the WHO director-General, Halfdan Mahler, in 1980, stating that smallpox eradication had provided important lessons but claiming that other diseases could be singled out for worldwide eradication was not one of them (Blume et al 2013a p7). However, the WHO proceeded to recommend that member states develop immunization and surveillance programs for some or all of the following diseases according to their epidemiological circumstances: diphtheria, pertussis, tetanus, measles, poliomyelitis, tuberculosis and smallpox. The program was formalized by the UNICEF-WHO joint committee in 1975 with an emphasis on member countries taking ownership of their own programs and advice and assistance in obtaining vaccines being provided by the WHO/UNICEF (Blume et al 2013a p8).

In 1976 the WHA assessed progress of the expansion of vaccination programs and observed that they were not reaching the majority of children in developing countries. At this time another health report by the UNICEF-WHO committee was produced that emphasised poverty and ignorance as well as the integration of vaccination in health programs in developing countries. This led to the WHO director-general, Mahler, establishing the goal of 'health for all by 2000' at the WHA in 1976 (Blume et al 2013a). A conference in Alma-Ata, Kazakhastan in 1978 resulted in the Declaration of Alma-Ata that focused on the significance of socioeconomic development and primary healthcare, including community participation and lay health advocates as the cornerstone of public health, rather than a reliance on biomedical technologies such as vaccination (Blume et al 2013a p9). Vaccination programs were seen in this directive as part of a larger program of primary health care, not the main focus. Not everyone agreed with this strategy. Walsh and Warren, from the Rockefeller Foundation, believed it to be unrealistic. They claimed it was impossible to fund the clean water, nutritional requirements and basic primary health care for the world's population (Blume et al 2013a p9). They suggested that selective primary health care with a major emphasis on vaccination was the way to proceed, even though the cost of providing multiple vaccines to developing countries in a sustainable manner most likely outweighed the cost of providing basic healthcare services. The selective primary healthcare would give

priority to 'high risk' diseases and focus on measles and DPT vaccination, tetanus toxoid for pregnant women, encourage breast feeding, provide chloroquine for malaria-infested regions and oral rehydration therapy (ORT). This did not provide a direct focus on the main cause of deaths in developing countries – diarrhea, and was seen by some as a betrayal of the holistic approach agreed to at Alma-Ata in 1975 (Blume et al 2013a pp10-11).

The official launching of the EPI program with an overriding focus on achieving maximum vaccination coverage for the world's children occurred in 1983 (Obamsawin 1998). This program was implemented despite the critical voices describing the destructive effects that EPI was causing at the community level in many countries (Newell 1988 p905; Obomsawin 1998). Vaccination coverage therefore became the key measure that WHO/UNICEF would use to assess the success of the EPI in achieving 'health for all by 2000'. The EPI or Universal Childhood Immunisation (UCI) was promoted in 1982/3 on the initiative called the 'Child Survival Revolution' established by James Grant, the Executive Director of UNICEF, qualified in economics and law, not public health (Blume et al 2013a pp11-12). Other institutions and individuals involved with this initiative included the Rockefeller Foundation and Robert McNamara, former President of the World Bank. In the 1980's neoliberalism was the political and economic model adopted by many countries. This model is based on the assumption that economic growth can be stimulated by freeing markets from government influence (WHO CSDH 2005). Neoliberalism became the dominant influence on global health in the 1990's and policies were controlled by the 'Washington consensus.' This term is derived from the fact that global health policies are dominated by the US government, the World Bank, and the International Monetary Fund – all based in Washington (WHO CSDH 2005).

When neoliberalism was becoming the dominant model in global politics the WHO/UNICEF began to present mixed messages in addressing global health. Whilst the WHO 'Health for All' vision from the 1970's strongly recognised social and environmental determinants of health (SEDH) as the primary influence on health outcomes, this approach was abandoned when neoliberalism became dominant. This ideology focuses on privatisation, deregulation, free markets and technology-based health programs (WHO CSDH 2005). The World Bank had an increased influence in global health policy from the early 1990's onwards. Neoliberal policies were imposed

on developing countries by donor organizations and governments through bilateral arrangements mostly set up through the World Bank and the International Monetary Fund (WHO CSDH 2005). When sponsors provide money for health programs it diminishes the control governments have over their health programs. A nation's autonomy over its own health program depends upon the financial status and medical expertise of the country (McNeill et al 2013 pp66-67). Donors have a major influence on health policies in poor countries.

In 1983 all political leaders of the WHO member countries, 158 at this time, were directed to make a commitment to raising the vaccination coverage in their countries to 80% by 1990 (Obomsawin 1998). In the discussion of the necessity for this program there was no mention of the different risk profiles that infectious diseases had in different countries, only that the strategy was building on the success of the global smallpox eradication program (WHO ISD). A conference was held at the Rockefeller Foundation's Bellagio Conference Centre in 1984 entitled 'Protecting the World's Children'; it focused on childhood diseases that could be prevented by vaccination. UNICEF became a dominant voice on global health policies at this time and the EPI became focused on increasing the vaccination coverage of the world's children even though this strategy conflicted with the emphasis on primary healthcare services advocated by the Director-General of the WHO at Alma-Ata (Blume et al 2013a p11). As a result of UNICEF's influence global health policies for infectious disease became narrowly defined as selective primary healthcare (PHC) programs which removed the focus from the social and environmental determinants of health and targeted only **G**rowth monitoring, **O**ral rehydration therapy, **B**reastfeeding and **I**mmunisation – known by the acronym GOBI (WHO CSDH 2005). In reality these programs were even narrower with most countries only addressing oral rehydration and vaccination (WHO CSDH 2005). By 1990 the program had achieved its goal of increasing the global vaccination rate of children to 80% for all the basic childhood vaccines – polio, diphtheria, pertussis, tetanus, measles and tuberculosis (WHO ISD; IOM 1993). The Institute of Medicine (IOM) states that the EPI raised the global vaccination levels from 5% to 80% during the period 1974-1990 (IOM 1993).

The Child Survival Revolution was celebrated at the UNICEF World Summit for Children in New York in 1990. This program was funded by the US Congress even though it was rare for foreign aid to be given priority by its members or constituents

(Blume et al 2013a pp11-12). The vaccination goal was re-set by the WHO to achieve 90% vaccination coverage by the year 2000 and the child survival campaign was used to continue public support for the program in the political arena. However, vaccination coverage doesn't inform authorities about the burden of disease and disability in a population, namely about the *health* of populations (see section 2.8). This indicator is used on the *assumption* that vaccines prevent disease and that they do this without causing serious or frequent adverse health effects in the population. These assumptions are hidden to the public because there is little or no surveillance of adverse events caused by vaccines in most countries (Obomsawin 1998). See chapters 6, 7 and 9. There is no systematic, active surveillance of long-term health outcomes in any country (CDC VAERS). In the early 1990's there was a digression in public health policies from local initiatives and community action to a focus on medical technologies using sophisticated media campaigns to sell the message. This caused a rupture in political opinion at the international and national level. GOBI was criticised as being poorly conceived and a simplistic approach to complex health problems (Basch 1994 pp45-6).

The Children's Vaccine Initiative (CVI) and GAVI (1990-2015)

Globalisation changed the processes of vaccine development and production from 1990 onwards. In the 1980's there was a realisation that many of the countries that needed vaccines would not be able to afford them. There is little incentive for vaccine manufacturers to invest in the development of vaccines if there is limited commercial value (Basch 1994 p8). This problem was solved with the establishment of public-private partnerships in the 1990's. Prior to globalisation, the vaccine market was unstable and virus strains and production processes were not protected by patents, therefore fewer companies were competing to develop vaccines (Blume et al 2013b p31). A new Children's Vaccine Initiative (CVI) was launched in the 1990's to harness nascent technologies in the development of new combination pediatric vaccines and to continue to reach the 20% of children in developing countries who were not receiving vaccines (IOM 1993). This initiative had a wider range of stakeholders supporting its implementation than the EPI. Whilst the stakeholders still included the WHO and UNICEF they were now joined by the Rockefeller Foundation, the World Bank and the United Nations Development Program (UNDP) (IOM 1993). These organisations worked together with private industry providing directives for global public health policy through the WHO. The CVI consultative group included commercial vaccine

manufacturers, public-sector vaccine manufacturers, donors and national development assistance agencies, research institutes, representatives of national immunisation programs, the US Food and Drug Administration (FDA), US Agency for International Development (USAID) and the US Centers for Disease Control and Prevention (CDC). Rising costs and the complexity of vaccine development were hindering the research and production of new combination vaccines however the new financial partnerships with industry in the CVI, supported by the Vaccine Fund, overcame many of these problems (Muraskin 2004 p1922).

An example of private-public partnerships is the Program for Appropriate Technology in Health (PATH). This group was set up as a non-government organization (NGO) in 1977 and it received 4 of the 20 largest individual grants from the Bill and Melinda Gates Foundation (BMGF) from 1999-2007 (McNeill et al 2013 p68). The new partnerships resulted in global policy being designed in a manner that was contrary to the WHO charter (Muraskin 1998 pp43-5). The WHO has a mandate to promote global health according to the charter for health promotion adopted in Ottawa in 1986. This charter emphasises autonomy and promotes community input and ownership of public health policies. It is required to promote a bottom-up model not a top-down model. Consequently, the goals of private and public organizations are very different and the CVI was constantly in disagreement about global health policy and the WHO controlling the CVI. Private organizations whose goal is profit provided the funding to support the development and research of new vaccines in the CVI that were promoted to governments through global health policies. This initiative resulted in new vaccines being implemented into countries without input from the community and local health authorities. When the health needs of countries are determined by outside experts they do not always fulfill the needs of the community (Basch 1994 p9). Although the CVI consultative group met annually at an international forum many of the organisations were from the USA. The influence of the new stakeholders in the WHO advisory board for global health policy resulted in agendas for national immunisation policies reflecting US interests (IOM 1993 p22).

The US provided assurance for the funding of the CVI through UNICEF in 1991/2 even though the Europeans, particularly the Nordics, did not approve of this sponsorship. They believed that the development, testing and introduction of new vaccines into government programs should be secondary to the support for the EPI. This is because

there was uncertainty about the sustainability of the fundamental vaccines provided to developing countries in the EPI (Muraskin 1998 pp49-50). Hence, UNICEF became the funder for all activities that did not involve research and development. It funded the infrastructure that facilitated the implementation of the vaccines yet at the outset of the design of the initiative UNICEF was seen as the vehicle for funding to be channeled into vaccine product development. This initiative was seen by Europeans as a creation of the US to support multinational corporations in the biotechnological revolution. The WHO also had concerns about working with industry to create the resources needed for vaccine development. For example, the low prices of vaccines offered to countries through the EPI could only be provided because of the profits generated from the commercial market. Companies could pay off the initial capital investment through private sales to make a reasonable profit and this enabled the pharmaceutical companies to sell the vaccines to the public sector at a lower cost than production: a two-tiered pricing system. The mass ordering of vaccines for the public sector resulted in economies of scale that lowered the prices for the private and public sectors. However, the WHO was compromised in this arrangement that allowed companies to gain significant private profit (Muraskin 1998 p62). There was also concern over WHO receiving royalties from private organisations that used WHO research. This included patents, licenses, technical knowledge, trademarks and copyright. It was felt that this conflict of interest in working with private industry would compromise its goals therefore it chose to participate only in joint research projects and not cooperative market agreements.

In the late 1990's the shortage in funding for the CVI resulted in the development of the Global Alliance for Vaccines and Immunisation (GAVI). This alliance was initiated by the Head of the World Bank in 1998 at a summit for the WHO, UNICEF, the pharmaceutical companies, international agencies, health ministers and academics (GAVI HoG). The agenda was driven by the fact that there was no incentive for pharmaceutical companies to supply vaccines to the developing countries because they were unable to afford the 6 new vaccines that had already been introduced into developed countries. The Bill and Melinda Gates Foundation (BMGF) donated US $750 million to the cause and this was matched by the governments of developing countries resulting in US $1.67 billion (McNeill et al 2013 p69). The BMGF joined the GAVI alliance advisory board and the collaborative venture was launched at the World

Economic Forum in 2000 (GAVI HoG). As stakeholders in the alliance, the BMGF, the Rockefeller Foundation and pharmaceutical companies were influential in shaping global public health policies (McNeill et al 2013 p73).

3.3 The Influence of GAVI in Global Policy

After the GAVI alliance was established a working party that included the International Federation of Pharmaceutical Manufacturers and Associations (IFPMA) designed policies with a global focus on new vaccine production and implementation. This direction in public health policy conflicted with the priorities that some countries wanted to choose for their health agendas. Many donor and recipient countries were critical of the singular focus GAVI had on vaccines (Muraskin 2004 p1922). It operates on a top down model that undermines community action and its focus on vaccines is not formed by a consensus in the international public health community. There was discussion that GAVI should be an independent organisation however it became an alliance with the WHO working party issuing global directives from 1998-2008. GAVI increased its governance powers and took over many of the WHO functions in member countries (McNeill et al 2013 p75). Global public health policies are now focused on technocratic governance and technologies and not traditional primary health care. The increased emphasis on vaccination programs has been to the detriment of programs targeting nutrition, sanitation, health education, clean water, child and maternal health, prevention and control of endemic disease and medicines (Obomsawin 1998; Blume et al 2013 p27). This focus on vaccination policies could not have occurred without private partnerships with the Gates Foundation, the input from the IFPMA and the Vaccine Fund supported by the developed nations (Muraskin 2004 p1922). Global public health policies promoted by the WHO are being designed by a governing board that includes the World Bank and members of many commercial vaccine manufacturers whose products are promoted by GAVI (GAVI HoG). Further, GAVI provides representatives to 'educate and financially entice' countries to accept GAVI's vaccination goals (McNeill et al 2013 p82). GAVI has also established vaccine advisory committees to advise governments about the recommendations for policy. These are known as the National Technical Advisory Groups for Immunisation (NTAGI) and their stated purpose is to provide 'informed' and 'transparent' policy advice (WHO ITAG 2008). They are composed mainly of scientific and medical experts, usually with one

consumer representative. The advice provided by GAVI/WHO is influenced by the IFPMA and pharmaceutical companies whose representatives can attend meetings and present information (Gessner et al 2010 A2).

These conflicts of interest in the design of public health policies for the 'good of the community' are hidden from the global population. During the 1990's the WHO distrusted the profit motives of the private sector and there was conflict over the direction of these policies (McNeill et al 2013 pp70-75). This was solved by the establishment of private-public partnerships through NGO's. When Gates became a partner in the GAVI alliance with many transnational corporations he moved the centre for policy development from Geneva to Seattle. In addition to these conflicts of interest, the majority of members of the WHO, UNICEF and EPI advisory boards that are involved in developing vaccination programs come from professional backgrounds with financial links to industry; many are scientists and administrators from developed nations (McNeill et al 2013 p69). Conflicts of interest and the composition of stakeholders on vaccine advisory boards play a significant role in the direction of global and national health policies in the New Public Health era. These are discussed further in chapter 6.

Global health policies have targeted children in both the developing and developed countries with vaccines, even though deaths and illness to infectious diseases had been significantly reduced in developed countries by 1950. Hence the narrow focus on vaccination programs did not address the different risk profiles that infectious diseases had in different countries. They have also been promoted with moral authority to policy-decision makers and the global community. They are framed as 'saving children's lives' in campaigns that are akin to a crusade (McNeill et al 2013 pp67-68). This is because the GAVI alliance has been founded on the claim that 'if a vaccine is available on the international market, to not make it available to all children, particularly those whose poverty makes them most vulnerable, is a form of moral neglect on the part of the international community' (Sandberg and Justice 2013 p87). This policy claim is given further credibility as a 'social justice' program by the Johns Hopkins School of Public Health and the London School of Health and Tropical Medicine (McNeill et al 2013 p68).

GAVI skewed the direction of WHO funding to universal recommendations on vaccination coverage in all WHO member countries despite the knowledge that public health officials had of the etiological factors involved in disease outcomes from infectious agents. It has also funded new vaccine producers in India, Brazil and Indonesia to compete with the large pharmaceutical companies. This presents a further conflict of interest between vaccine producers and WHO global policy directives; GAVI recommends vaccines to the global community that some of its members profit from. GAVI claimed that funding new vaccine manufacturers would result in significant price reductions for vaccines but according to McNeill et al (2013 p69) this never eventuated. In addition, vaccines cannot be used without harming a percentage of the population but this harm is not being systematically monitored or factored into the economic modeling for key measures of health. Vaccine producers and patent holders that profit from vaccines are represented on both global and national vaccine advisory boards (McNeill et al 2013 p69) and this conflict of interest is not made transparent to the public in the recommendations of global health policies by the WHO. Vaccines are described in the 1986 US National Childhood Vaccine Injury Act as 'unavoidably unsafe' (Holland 2011 p12) and the increased risk from the use of an increasing number of vaccines and achieving higher vaccination rates is not quantified in a risk/benefit analysis for each country in the implementation of this global policy (WHO ISD; Obomsawin 1998).

Since the CVI initiative was first launched the policy has expanded to target many more diseases. The vaccines have been introduced in developed countries for diseases that were a low risk to the majority of the population at the time they were introduced. They have also been introduced without discussion of the context in which people get these diseases (AG IAP 2004; Mercae 2003 p197). GAVI is using economic modeling influenced by industry to show health problems that governments are not aware of, and using financial incentives to create the 'political will' for governments to implement new vaccines as the solution. This is despite the health problems not being a priority and it results in unnecessary vaccines with increased risk of adverse health outcomes for some individuals. The cost-effectiveness data for new vaccines is produced by industry - not the WHO - and it is being presented to enhance the possible benefits of vaccines whilst ignoring the risks (McNeill et al 2013 p78-9). In other words, advocacy from GAVI representatives using manipulated statistics and hidden assumptions is being used to ensure countries commit to new vaccines. Chee et al state that GAVI does not always

have strong scientific evidence or universal support for its strategic policies, for example, the introduction of Hib vaccine, and therefore it is perceived to push new vaccines inappropriately (Chee et al 2008 p19).

3.4 National Immunisation and Technical Advisory Groups (NITAG)

The WHO/GAVI alliance places high priority on establishing vaccine advisory boards in member countries for the development of national immunisation programs (Duclos 2010 A18). These groups are referred to as national immunisation and technical advisory groups (NITAG). In Australia this group is called the Australian National Technical Advisory Group on Immunisation (ATAGI). WHO/GAVI assist in their establishment and influence the advice they provide in the following ways (Duclos 2010 A23-24):

- Providing technical guidance in the formulation of immunisation policies
- Providing global and regional policy recommendations and providing the evidence for these recommendations
- Providing the latest developments on vaccines to the chair of ATAGI
- Guidance in providing sources of financial support
- Developing training and educational materials
- Facilitating exchange between global NITAG's and participation of the chair in regional immunisation meetings

These activities are influenced by the US Centers for Disease Control and Prevention (CDC), the ProVac Initiative launched in 2006 and the Supporting Independent Immunisation and Vaccine Advisory Committees (SIVAC) through WHO/GAVI. (Duclos 2010 A24). The influence of pharmaceutical companies in the advice provided by the Australian vaccine advisory board (ATAGI) and in the production of scientific evidence in clinical trials is described further in chapter 6.

The role of NITAG's 'is to facilitate a systematic, transparent process for developing vaccination policies by making evidence-based technical recommendations to the national government' (WHO ITAG 2008 pp2-3). Over the last 15 years evidence-based policy making (EBPM) has been formalised as the foundation for developing public health policy (Belague et al 2009). This is a system of knowledge that aims to use clinical evidence obtained from systematic research to support policy decisions. It

gained prominence in the 1970's due to Archie Cochrane's emphasis on the need for a systematic evaluation of the safety and efficacy of innovative interventions/products in medicine. The Cochrane Collaboration was established in 1993 and the evidence-based methodology is now being applied to many non-clinical areas of policy development such as education, public policy and public health. EBPM implies that the methodology is based on scientific evidence. However, this needs to be examined in the broader political context where the interpretation of research findings can be shaped by the research donor (Belague et al 2009 p1539). EBPM is a move away from the use of common-sense and local knowledge in the formation of policy. This is significant in public health policy design where environmental context plays a significant role in health outcomes and where the scientific knowledge is often not complete. See chapter 4 for the significance of non-technical information in the risk assessment for health hazards.

EPBM is being used by governments to justify new policies that are replacing established policies of proven benefit. This results in a narrower approach to health that does not offer comprehensive solutions to context-specific health issues (Behague et al 2009). Whilst contextualisation of globally recommended policies is acknowledged as being an important factor in promoting health (WHO ITAG 2008) it cannot be achieved in practice because research activities are being dominated by a focus on achieving internationally set agendas. In the New Public Health Era of public-private partnerships local researchers who are familiar with a country's specific health issues do not have access to the government health department. Governments are framing policy on the advice of global sponsors and economic modeling influenced by industry, and not local needs. This is observed in the adoption of the Millennium Developmental Goals (MDG). Many countries are achieving the MDG's at the expense of primary health care and community input into health policies. The interventions being recommended in many countries are reflecting the sponsor's needs and not the local context (Behague et al 2009 p1542). The use of the EB methodology without non-technical input is resulting in limited healthcare practices that have been detrimental to health and environmental outcomes in many countries (Behague et al 1009 p1540; Baum 2008 p101; Basch 1994; Obomsawin 1998).

In Australia the childhood schedule has expanded to include vaccines to protect against 16 diseases with 11 vaccines recommended before an infant is one year of age (AG IAP

2013). This schedule has expanded in line with GAVI's directives in the first phase of its program (2000-2005) to 'save children's lives' and 'protect people's health through widespread use of vaccines' (McNeill et al 2013 p75-6). GAVI uses many strategies to implement its directives. One of them is to provide financial support to each country's vaccination services through a performance-based reward system (Chee et al 2008 p41). Other strategies include supporting the financial sustainability of programs at country level and influencing vaccine supply and demand.

Global health strategies have resulted in a decline in the authority of governments over the control of population health even though governments formally have the right to decide health policies for their own regions and populations (Sandberg and Justice 2013 p88). This is a fundamental principle of the international community and transgressing this principle results in a loss of authority over human rights for individuals. Vaccination is a technological procedure and its adoption in government public health policy, using coercive and mandatory strategies, infringes on the fundamental human right to bodily integrity and informed consent. This right is protected in the Geneva Declaration which includes the physicians oath declaring that they will not use their medical knowledge to 'violate human rights and civil liberties, even under threat' (WMA 1948). Ethics and vaccination programs are discussed further in chapter 5. The EPI has been proven to be ineffective in the long-term in preventing outbreaks of infectious diseases in global communities because the program does not target the social and environmental determinants of health (WHO CSDH 2005 p19; Mercae 2003 p210). In addition, there is no obligation for governments to provide financial and technical resources to support capacity-building (Fidler and Gostin 2006 p88). This situation could undermine the new International Health Regulations (IHR).

Well documented outbreaks of infectious diseases continue to occur in highly vaccinated populations. (Nkowane et al 1987; Boulianne et al 1991; De Serres et al 2012; Lee et al 2004; Lopez et al 2006; Dayan et al 2008; Witt et al 2012; Mercae 2003 p198). This evidence clashes with the claim that vaccine-created herd immunity can prevent infectious diseases. The fact that unexpected outbreaks continue to occur in vaccinated populations has led some health professionals to question the theory of vaccine-created herd immunity that vaccination policies are founded on (Obomsawan 1998). In addition, it is the *severity* of the disease and not just the occurrence of disease that is significant to the health of populations.

The WHO states that an estimated 83% of children less than 1 year of age globally have received 3 doses of Diphtheria-Tetanus-Pertussis (DTP) vaccine (WHO IC 2013). Yet there have been many epidemics of pertussis (whooping cough) reported in highly vaccinated populations over the last two decades (Beherman 1998; Wendelboe 2005; Klein et al 2012; Mihalovic 2012). This includes outbreaks in Australia, the United Kingdom, and the USA where vaccination rates for pertussis have been above 90% since 1995 (Wendleboe et al 2005; Burgess et al 1998). This evidence suggests that vaccine-created herd immunity to whooping cough is not sufficient to prevent whooping cough outbreaks in many populations. Infectious disease epidemics have been reported with surprising frequency in developed countries where vaccination coverage is high due to the EPI (Obomsawin 1998). Muraskin (2004) describes GAVI's focus on vaccination as a major flaw in public health policy. He states that the only reason countries are using so many vaccines is because of the major financial enticements. The core constituencies, including field workers and governments of developing countries, do not prioritise this goal and European bilateral donors have strong doubts about vaccines being the best strategy for achieving healthy outcomes in the developing world (Muraskin 2004 p1925).

3.5 The International Health Regulations (IHR)

Since the mid-19th century governments have maintained international agreements to protect their borders against the spread of infectious diseases. The IHR came into force on 15 June 2007 as an international legal instrument binding on the 194 member countries of the WHO (WHO IHR 2008). The aim of the IHR is to help nations prevent and respond to acute public health risks of global significance. By 1995 the WHO/UNICEF had decided that globalization required a new framework for health and security. Public health, security and democracy were stated to be intertwined in the IHR and the changes were described as 'moving humanity towards larger freedom' (Fidler and Gostin 2006 p85). These changes occurred after private-public partnerships began to dominate WHO policy in 1995 and the new IHR are observed to reflect industry needs and not those of national governments (Sandberg and Justice 2013 p93). Changes to the international regulations in 1998 had allowed data for global health policy to be obtained from non-government sources, including data from industry. WHO was systematically using non-government surveillance information from the Global

Outbreak Alert and Response Network (GOARN) before the new IHR's were completed in 2005 (Fidler and Gostin 2006 p93). The IHR allow the WHO to maintain the confidentiality of NGO sources of data where it is 'duly justified'. However, there are no guidelines to specify when this condition applies (Fidler and Gostin 2006 p88). In 2005, the IHR changed after 10 years of discussion and WHO/UNICEF announced a new global strategy at the same time as the changes to IHR. This policy was to expand current vaccination programs to more populations and new demographics beyond childhood (WHO/UNICEF 2005 p24 in Blume et al 2013a p2).

The WHO supported the IHR's under the belief that timely and open reporting of public health events would make the world a safer place (Flynn 2010). The IHR's gave new powers to the Director-General of the WHO to set up an Emergency Committee (EC) in response to a possible pandemic. Members of the EC are to remain undisclosed to the public. The EC's purpose is to advise the Director-General when to declare the pandemic (WHO IHR 2008). The functioning of the EC in the response to the declaration of a 'Swine Flu' pandemic in 2009 is described in chapter 10. Whilst the old regulations required governments to inform WHO about the transfer of diseases that might be of global concern, the new IHR's require nations to give priority to issues that are of global concern over domestic issues. The new IHR's were stated to be a balance between maintaining the right of governments to protect their people whilst avoiding unnecessary interference with traffic and trade. Essentially the changes implemented were made on the grounds that the IHR's were ineffective against new emerging diseases that presented the threat of pandemics, e.g. AIDS, SARS and Swine Flu. The new IHR's changed the international legal context for the implementation of national public health programs and gave new powers to the WHO (Fidler and Gostin 2006 p86-94).

The new IHR's include the following requirements:

1. An obligation to notify WHO of all events that may lead to a global public health emergency, not just the specific diseases that were previously listed. The list was expanded to include all infectious diseases and biological and chemical warfare. Public health is connected to security concerns because of the potential for terrorism from weapons of mass destruction.

2. Countries must notify WHO of an illness or medical condition irrespective of origin or source that presents or could present significant harm to humans.
3. Increased surveillance of diseases, including the whole territory and not just points of entry and exit.
4. Notifications can be provided to WHO by any source including mass media, the internet and NGO's. This information only needs to be 'verified' by the government concerned.

These changes to the IHR's ensure that global health governance, in partnership with corporations, has authority over national governments, *if they choose to accept them*. The choice to accept these policies is removed for countries that depend upon sponsorship or performance-based reward systems for their health programs. Financial enticements can bind governments to policies. It is noted that the USA has submitted a reservation regarding the acceptance of the IHR's by stating it will implement the regulations in a way that is consistent with American federalism (Fidler and Gostin 2006 p91). The WHO/UNICEF claim that this centralised global strategy is the only way to prevent the threat of emerging pandemic diseases in a way that minimises the disruptions to international trade (Fidler and Gostin 2006 p86). Whilst the WHO claims the strategy is compatible with human rights and state sovereignty, the opposite is true. Global policies are a top-down model that are not driven by community ownership and involvement; a feature that is also contrary to the principles established in the New Public Health statement, declared at the Ottawa Conference in 1986, to address the social determinants of health. See section 2.7.

When the IHR's came into force in 2007 national governments were required to fulfill their obligations by 2012 (Fidler and Gostin 2006 p88). In 2010 Bill Gates declared a 'decade of vaccines' and pledged $10 billion to support this initiative. This led to a Global Vaccines Action Plan that was supported by the WHO, UNICEF and the US National Institute of Allergy and Infectious Diseases (NIAID), a body that is part of the US National Institutes of Health (NIH) (Blume et al 2013a p1). It was claimed in 2011 that the global vaccine market was expected to reach US $34 billion in 2012 with a growth rate of 14% expected for the next 5 years (CVEP 2011 in Blume et al 2013a p2). The growth of the vaccine market has been described as the 'vaccine paradox': a situation where governments control the demand *and* provision of vaccines (Horton and Das 2011 p296 in Sandberg and Justice 2013 p98). Governments are being advised by

GAVI, an alliance with vaccine manufacturers that profit from the vaccines they promote with financial incentives to governments through the WHO. An example of the influence of corporations in the decisions by governments regarding the declaration of a 'Swine Flu' *pandemic* in 2009 is provided in chapter 10.

The introduction of global vaccination programs has not been based on evidence of the epidemiology of infectious diseases in each country, their case-fatalities and limited consequences, but on industry economic modeling and international considerations (Sandberg and Justice 2013 p109). Whilst these programs claim to be 'evidence-based' in high income countries, it is necessary to ask 'who is providing the evidence that is underpinning these policies and how has it been produced?' This question is addressed in chapter 6 and in the case studies provided in chapters 9 and 10.

3.6 Global Preparations for a Pandemic

Under the 2005 International Health Regulations most countries were required to develop Pandemic Preparedness Plans (PPP) (WHO GIP). New and improved tools to prepare and respond to pandemics have become available to the Global Influenza Surveillance Network (GISN) and these have been used by WHO since the emergence of avian influenza A (H5H1) in 1997, to prepare a global pandemic response plan (WHO GIP).

The new tools and technologies that are available include (WHO GIP):

I. Antivirals

II. Nascent technologies to speed the development of pandemic vaccines. These are new patented methods for producing vaccines in a shorter time.

III. Improved molecular and genetic techniques to analyse and track the evolution of influenza viruses

IV. Mathematical methods to model the evolution and spread of a pandemic virus, estimate incidence and prevalence and assess the impact of pharmaceutical and non-pharmaceutical measures on disease transmission and associated morbidity and mortality

The WHO member countries have spent 10 years under the guidance of the IHR's preparing their PPP's for a possible pandemic. Many scientists have expected a pandemic of influenza for a long time and they believe a possible mutation of the swine flu virus poses the biggest danger to the population because it makes existing flu medication and vaccines ineffective (Flynn 2010). Yet there is disagreement on the efficacy of current antiviral medications and influenza vaccines (Cohen and Carter 2010) and their effectiveness in an epidemic is undetermined. The PPP's established by governments globally included strategic stockpiles of antivirals, antibiotics, influenza vaccines and personal protection equipment (WHO GIP). In addition, the IHR's included the surveillance and reporting of all events to the WHO that may represent a public health emergency of international concern. For example, cases of new sub-types of influenza, which were never previously monitored, must be reported (WHO IHR).

A stated milestone for the IHR's was the assessment of member countries' surveillance and response capacities by June 2009 (WHO IHR). Notably the global 'Swine Flu' pandemic was declared on June 11 2009 when the EC changed the definition of a pandemic and removed the requirement for the need to show how severe the impact of the virus would be on the population. Without this change to the definition it would not have been possible to declare a level 6 pandemic. Under the IHR's governments had PPP's that were termed 'sleeping contracts' with pharmaceutical companies, which were to take effect when the WHO declared a pandemic. These contracts required national regulatory authorities to license vaccines developed by various vaccine manufacturers (sometimes following accelerated procedures) to ensure vaccines were available more rapidly than for seasonal flu (Flynn 2010). The events that led to the 2009 'fake' pandemic are described in chapter 8.

3.7 Global Vaccination Policies and Human Rights

The IHR's gave new powers to the WHO. This included:

i) The power to decide if a disease event reported by state parties fits the criteria for declaring an international public emergency and

ii) If an event of international concern is declared, the WHO can recommend non-binding measures for addressing the health risk in each country – temporary or permanent measures.

This gives WHO influence in health measures and in human rights in national policies. The IHR's require that health measures against persons are appropriate to the risk and no more intrusive than available alternatives that would achieve a similar health outcome (Fidler and Gostin 2006 p87). They also require that the measures are applied in a transparent and non-discriminatory way. When implementing compulsory measures for medical examinations governments must apply the least intrusive measure but this is not stipulated in the IHR's for the prevention of disease which include vaccinations, isolation, quarantine or the use of other prophylactics. When governments apply compulsory health measures the IHR's do not require due process protections. There are binding limits on the strategies that governments can take against public health risks and generally they cannot require invasive medical examinations, vaccination or use of other prophylaxis as a condition for entering a country (Fidler and Gostin 2006 p88). However, the IHR's mechanisms for forcing governments to comply with the recommended health measures are weak which means that in practice the 'binding limits' are not enforceable.

3.8 Contraindications to Vaccines

The EPI has been implemented in many countries with little attention to the known contraindications to vaccines. There are many factors known to put individuals at risk from vaccines. These are termed *contraindications,* for example, a family history of a genetic disease (Obomsawan 1998). An example of this is provided with the whole-cell whooping cough vaccine that was linked to neurological adverse events (Feery 1981 p174; Zeigler et al 1991; NHMRC 1954-86; NHMRC 91). In 1978-1990 a family history of neurological disease was considered a contraindication to vaccines (NHMRC 1978-86; NHMRC 91). In 1980 a British survey (The British Childhood Encephalopathic Study [NCES]) estimated the risk of having a severe neurological reaction with persisting sequelae from whooping cough vaccine to be 1 in 310,000 vaccinations (Feery 1981 p174). This data was re-analysed a decade later using different assumptions and criteria to conclude 'the risk of encephalopathy with permanent brain damage was close to zero' (NHMRC 1991). However, the Australian College of Pediatrics (ACP) stated in 1991 that most neurological events (febrile seizures and non-febrile seizures, encephalopathy and other neurological symptoms) occur in children that do not have known risk factors. They also stated that infants/children who have a

history of convulsions in immediate family members (siblings and parents) have a 3.2-fold increased risk for neurological events compared to those who do not have a family history of the condition (Zeigler et al 1991 p17).

In the 1990's there was disagreement between the contraindications for whooping cough vaccine stated by NHMRC, the American Academy of Pediatrics, the Australian College of Pediatrics and vaccine manufacturers (Zeigler et al 1991; NHMRC 1991). In 1994 the NHMRC adopted the guidelines of the American Academy of Pediatrics which did not include a family history of neurological disease as a contraindication to WC vaccine (NHMRC 2003). Contraindications were stated to be encephalopathy within seven days of vaccination (not including febrile convulsions) and immediate severe allergic reaction, for example, anaphylaxis (NHMRC 2003).

3.9 Vaccine Ingredients

In the US, the Vaccine Injury Compensation Program (VICP) has paid over $2 billion in damages to over 2,500 families since 1988: and these are only the cases that were allowed and were voluntarily reported within 4 hours of the vaccination (Habakus and Holland 2011 p2; Obomsawin R preface). Many other claims were refused based on the criteria for acceptance. Although exemptions to vaccination in the US are allowed doctors can be punished if they grant too many and parents are not made award that exemptions exist (Habakus and Holland 2011 p2). Even though vaccines are described in US law as 'unavoidably unsafe' (Holland 2011 p12) Australians are not informed of the ingredients of vaccines or all the known risks from this procedure. The ingredients of Australian vaccines are presented in Appendix 1. In addition, Australia does not have a compensation scheme for its National Immunisation Program (NIP). This is the case even though coercive practices, such as financial incentives, have been introduced to encourage Australians to use an increasing number of vaccines. Medical practitioners do not describe the ingredients of vaccines to Australian consumers before they vaccinate and the ingredients have not been provided to parents on the Immunise Australia Program (IAP) website (AG IAP 2014). Instead the ingredients are listed as 'components of vaccines' in Appendix 3 of the Australian Government Immunisation Handbook (AG IH 10th Ed 2014). Most vaccines contain preservatives, antibiotics and adjuvant (aluminium compounds) that are described on the IAP website as being in 'trace' amounts.

The Australian Government's vaccination policies are considered coercive because they pressure individuals to use vaccines by providing financial incentives for both parents and doctors. They are also coercive because they require individuals to fill out an exemption form signed by a doctor if they choose not to vaccinate. This is being required of parents who wish to claim the government welfare benefits or childcare places and of employees in some workplaces (AG IAP 2014). These requirements place pressure on parents to be 'responsible' by ensuring their children are 'fully vaccinated.' When parents are not informed of the ingredients of vaccines or the potential health hazards of vaccines it is a breach of their right to fully informed consent. Good medical practice requires that doctors fully inform patients about the risks and benefits of medical procedures and they must recognise and respect a person's right to make their own decisions on healthcare (MBA 2010). See chapter 5.

The community is informed that diseases on the childhood vaccination schedule are not a public health risk because vaccines prevent these diseases (AAS 2012). Medical practitioners state that vaccines are one of medicine's greatest achievements (Offit 2003), even though the historical data shows that the most significant fall in mortality and morbidity due to infectious diseases occurred prior to the use of all vaccines other than diphtheria and smallpox. This was discussed in Chapter 2. Patients place their trust in doctors to be acting with integrity, truthfulness, dependability and compassion (MBA 2010). If a public health policy includes a medical intervention on the basis of claims that are not supported by scientific evidence it is a breach of the public's trust. It also breaches the ethical code of good medical practice that has been adopted by Australian doctors (MBA 2010). Doctors in Australia are required to ensure that any procedures they recommend to patients are necessary and beneficial to their patients (MBA 2010). In 2006 the World Health Organisation (WHO) recognized that many non-infectious diseases pose as serious a threat to world health as infectious diseases (WHO CD 2013). Chronic illness is now the leading cause of death in the world resulting in 63% of all deaths. The scientific community is also aware that a large proportion of the chronic illness is due to autoimmune diseases (WHO CD 2013). Vaccines contain aluminium adjuvants which have been associated with causing autoimmune diseases for many years (Greville 1966; Shoenfeld and Agmon-Levin 2011).

The chemicals in vaccines include mercury (mostly prior to 2000), formaldehyde, aluminum adjuvant, antibiotics, stabilisers and preservatives. However, it wasn't until

1999 that the FDA finally stated that the mercury in vaccines exceeds the Federal Safety Guidelines (FDA Thimerosal). Government officials admitted they had not considered the cumulative effects of the increased number of vaccines (FDA Thimerosal). Herbert Needleman's research on the effects of lead in children has led to claims that there is substantial evidence that environmental toxins (even in trace amounts) are implicated in behavior change resulting from disturbances to the prefrontal lobes in the brain (Needleman 2000). In particular, researchers have linked heavy metals with affects on neurotransmitters – chemical substances needed for the proper functioning of the nervous system (Needleman 2000). Alteration of the prefrontal lobes affects decision-making, choices and resisting impulses (Needleman 2000). Autism is a result of immature development and organization of the brain, in particular of the frontal and temporal lobes (Coulter 1990) and mercury is a heavy metal that has been in many childhood vaccines for decades. See Appendix 2. Mercury and aluminium are described as 'neurotoxins' and they are combined with many other compounds in vaccines. When chemicals are combined they are known to have cumulative and synergistic effects with other chemicals and they are known to be particularly toxic in infants and young children. Toxicity also increases when they are injected into the tissues as opposed to entering the body through natural routes of exposure (Gilbert 2004).

In 2000 the Australian Commonwealth Government issued a directive to remove the mercury-based preservative thimerosal from all childhood vaccines. Since then the government has claimed that there is no mercury (other than a trace amount) in any vaccine on the schedule for children less than five years of age (AG IAP 2012)**.** However, in 2013 thimerosal was still listed as an ingredient in the Energix B vaccine for Hepatitis B given at birth and also for the influenza vaccine Fluad and Fluarix (AG IH 9th Ed 2013). In addition, thimerosal was still present in the infanrix-hexa vaccine, the new 6-in-1 vaccine that will be used most frequently in infants to replace 6 separate vaccines (Austin et al 2010). A 'trace' amount of a toxin is not a quantitative measure and parents have a right to be informed truthfully about the quantities of the ingredients in vaccines. This is particularly the case when parents in Australia are being pressured into using many vaccines under the benevolent claim that it is the responsible thing to do for the community.

PART 2 DEVELOPMENT OF AUSTRALIA'S NATIONAL IMMUNISATION PROGRAM (NIP)

3.10 The Australian National Immunisation Strategy (NIS) (1993)

In 1993, under the WHO's declaration of health for all, the World Health Assembly called on WHO to establish partnerships with the commercial sector to assist in the development of national vaccination strategies (Buse and Waxman 2001 pp1-2). Public-private partnerships were outlined as a core function of WHO's corporate strategy to achieve the goal of health for all and this created industry incentive for the research and development of drugs and vaccines. National vaccination programs were designed by partnerships between industry and intergovernmental organisations from this time onwards and referred to as National Immunisation Programs (NIP) (Buse and Waxman 2001). Partnerships with industry gave the UN access to more resources and industry's involvement in the promotion of public health messages gave the commercial sector an improved corporate image that encouraged new investors and markets.

A milestone in the promotion of global vaccination programs was the 1986 report from the Institute of Medicine (IOM) of the US National Academy of Sciences. This report described the diseases of importance in the US and in the developing countries (IOM 1986 in Basch 1994 p12). The report listed three categories of pathogens of importance to global health - high, medium and low - for which vaccines could be developed. The report placed a vaccine against childhood diarrhea in the category of highest importance because of the high burden of this disease in developing countries, not the developed countries, and vaccines for pathogens of lesser significance into category 2 or 3, including hepatits B virus and *Haemophilus influenza* type b virus (Basch 1994 pp12-13). Research and development on vaccines was revitalised in the 1990's because it was recognised that new biomedical technologies might improve the existing vaccines and could be used to create new vaccines for other infectious diseases (Basch 1994 p182). A new globally coordinated effort was initiated to achieve the common goal of Universal Childhood Immunisation (UCI). This brought together national, regional and international development agencies, private foundations, voluntary organisations, academic institutions, and industrial companies. Global and national vaccination programs became a coordinated initiative at this time where the needs of a global

community were established in advance of the development of vaccines. This program could not have been achieved and is not sustainable without significant financial support from the World Bank, the International Monetary Fund, private foundations and developed nations. The program has been promoted by global and national decision-makers on a belief in the value and cost-effectiveness of vaccines and a push for social equity where all populations should have access to the benefits of vaccines. This enabled vaccination to be promoted as a public good, like education, and it was considered unethical to prevent a child from receiving a 'life-saving vaccine'. Thus vaccines were prevented from being framed as a commercial commodity linked to corporate profits (Basch 1994 p182).

Despite the low mortality and morbidity rates in developed countries, achieved by 1950 through environmental and lifestyle reforms, governments globally promoted the idea that 'vaccines prevented infectious diseases' and that 'high participation rates in vaccination programs are necessary to control infectious diseases' (AG IAP FAQ 2013; CDC; Stanley 2001 p380). It has been well established that deaths and illness to infectious diseases were reduced in developed countries *before* the widespread use of vaccines (Stanley 2001 p370). See chapter 2. Therefore, 'vaccine-created herd immunity' was not responsible for the decline in these diseases. Yet in the early 1990's the Australian government decided to increase the vaccination rates in the population on the basis that 'vaccine-created herd immunity is necessary to control infectious diseases' (AG CDIJ 1997). This was in response to WHO directives for global health policies. The Australian government justified this strategy on the premise that it might be possible to eliminate outbreaks of these diseases if vaccination rates were 85-90% (Hawe 1994 p241; Curry 2002 p34). This was despite the Australian College of Pediatricians (ACP) stating in 1991 that the prediction that whooping cough disease could be eradicated by achieving an uptake of the vaccine of 95% was probably wrong (Zeigler et al 1991 p16). This paper (Zeigler et al 1991) was authored by Margaret Burgess who became the founding director of the NCIRS in 1997 and Peter McIntyre who became the director of NCIRS from 2004 until the present time. The risk from these diseases had already been reduced so increased vaccination rates were emphasised in an effort to *prevent* these diseases. Hence the new terminology: *vaccine-preventable diseases.* This was part of a WHO directive that claimed to be 'building on the success

of the smallpox eradication program and ensuring that all children globally benefited from vaccines' (WHO EPI; IOM 1993).

The conclusion that higher vaccination rates would be cost-effective was founded on the theory of *vaccine-created herd immunity*. It was theorised that vaccination rates of 94–97% could interrupt the transmission of the pathogenic organisms and make it possible to eliminate many infectious diseases, particularly measles (Hawe 1994 pp241-2). As measles is a more contagious disease than smallpox it was argued that vaccination rates needed to be much higher than the 50% rate required to eliminate smallpox (Hawe 1994 p241). This theory was based on the observed herd immunity that was obtained after natural infection that resulted in the reduction in the risk of infectious diseases by 1950. The new NIS did not just emphasise higher vaccination rates for measles vaccine but higher vaccination rates for *all* the vaccines recommended on the government schedule; even new ones that had not yet been introduced. It was a 'package deal' (Hawe 1994 p242). In other words, even though the vaccines listed on the national schedule were implemented *after* deaths and illnesses from infectious diseases greatly declined in Australia, the government included all of them (plus new ones) in a new national campaign insisting that 'high participation rates (90%) in vaccination programs are necessary to control infectious diseases.' The NIS was a strategy that was estimated in the 1990's to cost $53 million to operate (Hawe 1994 p242). At this time the infant mortality rates in Australia were low at 8.2 per 1,000 live births and infectious diseases were not considered to be a serious risk.

Although the WHO stated in 1989 that measles 'was not eradicable' the new NIS was promoted by the Australian government on the claim that 'measles could be eliminated'. This was defined as meaning 'constant vigilance could prevent outbreaks' and measles could be controlled (Hawe 1994 p243). The Australian Government claimed that highly contagious diseases such as whooping cough and measles could be *eliminated* if very high vaccination rates were achieved. However, the strategy in the early 1990's also involved introducing new vaccines to the schedule and ensuring that the uptake of these vaccines was also above 90% (Hawe 1994 p242), for example, the triple antigen MMR vaccine, *Haemophilus influenza* type b (Hib) and hepatitis B (AG CDIJ 2007). When the NIS was implemented in 1993 infectious diseases were re-named *vaccine-preventable diseases* and the public was informed through the media that high

participation rates were needed for all vaccines to prevent death and illness from infectious diseases (AG IAP 2004).

In the early 1990's a new pertussis vaccine was developed using novel technologies. This was an acellular pertussis formula developed without thimerosal (a mercury compound and preservative) to reduce the adverse events that were associated with whole-cell pertussis vaccination (Basch 1994 p196). The acellular pertussis vaccine was introduced into Australia's national program in 1999 and the whole-cell pertussis vaccine phased out over a number of years. The measles vaccine was reformulated to enhance the immunogenic quality in younger infants because maternal antibodies neutralise the live vaccine virus as well as the 'wild' disease-causing virus (Basch 1994 p15). New biotechnology was also used to improve the oral polio vaccine by increasing its tolerance to heat. These vaccines had an assured market because they were approved for universal use in all populations.

3.11 Australia's National Immunisation Program (NIP) (1997-2012)

In 1997 the initiative to increase vaccination rates was formalized and re-named the Immunise Australia Program (IAP) (AG IAP 2004). This strategy had been gradually implemented since 1993 and aimed to coordinate activities across many areas in order to control epidemics through higher childhood vaccination rates. This included an emphasis on a range of different strategies to attract parents to vaccination and on building infrastructure to improve access and delivery of vaccines. Essentially it required more cooperation between public and private sector interests with the removal of financial barriers to vaccination (Hawe 1994 p241). A 'Seven Point Plan' was implemented to attract parents to vaccination and encourage the uptake of the recommended childhood vaccines. It was believed that the reason vaccination rates weren't high enough was because parents were complacent (Hawe 1994 p242). The vaccines recommended on the NIP schedule were subsidized by the government because they were claimed to be essential for community health. Vaccines to prevent 9 diseases were listed on the NIP in the early 1990's and were provided free of charge in the public and private sector from 1997-2000 in all jurisdictions (AG CDIJ 2007). Vaccination was promoted to parents as being a safe and effective way of protecting children against targeted diseases. It was also stated that the risks of these diseases are far greater than the very small risk of vaccination (AG IAP FAQ 2013).

3.12 Strategies Adopted in the Seven-Point Plan

The strategies adopted in the Seven Point Plan (1997–2013) include initiatives for parents to increase the timeliness and coverage of vaccination as well as education campaigns for the general public and health professionals. The following points have been referenced from the Australian Government's Immunise Australia Program (IAP) website.

1. Central features of this strategy include a contribution from the Commonwealth Government to provide subsidised childhood vaccines, improved standards of maintaining vaccine quality and improved surveillance and reporting of vaccine preventable diseases.

   Although contraindications to vaccines are a significant area of concern for health providers (Obomsawin 1998; Hawe 1994 p242) the focus of the government's concern when the new initiatives were introduced was more about 'marginal cost and marginal benefit' (Hawe 1994 p242). In other words, the contraindications due to genetic predisposition were secondary to economic considerations from a 'one size fits all' policy.
2. A General Practice Immunisation Incentive Scheme (GPII) was established to encourage doctors to participate in the program. Until 2013 the GPII scheme offered a Service Incentive Payment (SIP) to medical practitioners who notified the ACIR of children who had completed the vaccination schedule according to the National Immunisation Program. This payment changed in May 2013 and it is now paid to medical practices that monitor, promote and provide appropriate immunisation services to children under 7 years of age. A service provider education strategy is also provided in the seven-point plan. This is aimed at increasing the service provider's commitment to actively promoting age appropriate childhood immunization.
3. An Outcomes Payment was introduced in 1997 to practices that achieved 90% or greater vaccination coverage of children less than seven years of age who attended their practices. This is now called the GPII described above.
4. There was also an Immunisation Infrastructure Fund that provided funding for divisions of general practice, state-based organisations and funding for a

National GP Immunisation Coordinator to increase the proportion of children who are vaccinated at local, state and national levels.

5. Further incentives to increase the vaccination rates included the establishment of the Australian Childhood Immunisation Register (ACIR). This is a national register that is administered by Medicare Australia to monitor children's vaccination status and to notify parents when a vaccine is required. It also provides a database to inform the government who is eligible for immunisation welfare benefits.

   The ACIR is used to administer the GPII effectively. The GPII is an incentive payment to GP practices to encourage all practices to fully vaccinate at least 90 per cent of children under seven years of age that attend their practices. By registering children on the ACIR the vaccination status of children can be followed and the required amount can be paid to GP practices when the target vaccination rates are achieved. GP's are also expected to consider each consultation with a child as an opportunity to update vaccination status. Medicare Australia subsidizes private consultations that involve vaccination.

6. Children's vaccination status is linked to the eligibility for family assistance payments to remind parents to keep up-to-date with vaccination. In 1997 this payment was called the Maternity Immunisation Allowance (MIA) and it was paid to parents when a child was aged between 18 months and 24 months of age. Parents of unvaccinated children could still receive this benefit if they filled out a conscientious objector's form signed by a doctor. Exemptions were provided for medical, religious or philosophical reasons. Since 2009 the MIA has been provided to parents in two payments. The first payment ($129) is when the child is aged between 18–24 months old and the second payment ($129) is between 4-5 years old. This benefit ceased on 1 July 2012 and was replaced by the *Family Tax Benefit Part A supplement*.

   This benefit was increased to $2,100 and from July 2012 has been paid to parents in three installments of $726 (AG IAP 2013). In order to obtain this welfare benefit parents are required to have their children assessed by the Family Assistance Office (FAO) at one, two and five years of age. Children must be either fully vaccinated, be on a recognised vaccination catch up schedule, or have a signed exemption form for parents to be eligible to claim this benefit. The assessment of the vaccination status of children must take place during the

financial year that each child turns one, two and five years of age in order to receive the benefit.

After increasing the welfare payment linked to vaccination in 2012 the government added *three more vaccines* to the recommended schedule for a child to classify as 'fully vaccinated'. The three new vaccines were meningococcal C, pneumococcal and varicella (chickenpox). Although these vaccines were available to parents for several years prior to 2012 they were not recommended on the NIP. These diseases are a low risk to the majority of children in Australia, however as of 1 July 2013 these vaccines are required for children to be described as 'fully vaccinated' in order to obtain the government welfare benefit. The definition of 'fully vaccinated' in 2013 means inoculation against 11 diseases before a child is 12 months of age. See Appendix 3.

Another welfare payment that was introduced in 1997 was the Child Care Benefit. This payment is to assist with the cost of day care centres and other childcare facilities. Again the benefit applies to children who are fully vaccinated or have an approved exemption from vaccination. The Childcare Rebate was worth approximately $7,500 per child in 2014. This benefit is to assist with childcare and is adjusted according to family income. In 2015 the Australian government proposed removing the right to philosophical and religious exemptions to vaccination. This would be implemented from 1 January 2016 and it means that vaccination will no longer be a choice for parents who depend on welfare payments or childcare benefits for their livelihood (AG DHS 2015). Vaccination with the full schedule of vaccines would be mandatory to receive childcare and welfare payments in 2016. Only medical exemptions will be accepted if this legislation is passed.

7. Regulations have been introduced to require parents to present evidence of their child's vaccination status when they enroll in schools. The regulation requires that a child that is not vaccinated due to medical or conscientious objections can be asked to stay home during outbreaks of an infectious disease. In NSW in 2013, the Public Health Act of 2010 was changed to ban unvaccinated children from childcare centres if parents do not provide an up-to-date certificate of vaccination or a valid exemption form signed by an approved doctor (Gerathy

2013). Exemption forms are allowed for medical, religious or philosophical reasons but they must be signed by an approved doctor.

Educational materials for doctors and other immunisation providers are supplied by the Immunisation Action Coalition (IAC) (IAC 2012). This is a non-profit organization set up by the US CDC with health professionals to distribute information globally on vaccination. The IAC assists in raising vaccination rates globally by facilitating communication about the safety, efficacy and use of vaccines to health professionals and the public (IAC 2012). The IAC receives funding from pharmaceutical companies in the form of 'educational grants' (IAC 2012). In 1997 the seven-point plan was promoted through an 'Immunise Australia' media campaign that targeted parents of children aged 0-6 years of age. The campaign aimed to raise awareness of participating in vaccination programs to control infectious diseases. Other sources of funding for this program, apart from the government, include the pharmaceutical companies. Vaccine manufacturers are providing funding to health professionals to increase the number of children they vaccinate. One example of this type of funding was the Infanrix Immunisation Awards that were presented at the National Public Health Association of Australia in 2006 (PHAA 2006). GlaxoSmithKline, the manufacturer of the Infanrix combination vaccine for diphtheria, tetanus and acellular pertussis vaccine, offered $10,000 to commend professionals who had implemented programs to successfully achieve the following outcomes:

- An increase to 90% coverage in the 4 year old cohort
- An increase in vaccination coverage in populations of hard-to-reach children and/or adolescents

3.13 The Reason for Increased Incentives in 2012

The government believes vaccination is the safest and most effective way to protect against infectious diseases. It is stated that vaccination reduces the spread of the disease so that individuals who are not vaccinated will also be protected by the vaccine through the establishment of 'vaccine-created' herd immunity. The government states that 'immunization rates in 2012 are at the highest on record and as a result notification rates of vaccine-preventable diseases are low' (AG IAP 2012). Sixty-six cases of measles in children under 10 are cited as the reason for the need to increase incentives for

vaccinating (AG IAP 2012). The government has not provided supportive information on the vaccination status of these measles cases, their severity or the context (e.g. socioeconomic status) in which these cases occurred. This is significant for understanding the factors contributing to the risk from measles that exists in Australia for the majority of children.

This evidence is also inconsistent with the epidemiological literature that indicates there are significant problems with the vaccination campaigns to control measles in the developing countries. Despite high measles vaccination coverage in many countries due to the EPI there are regular epidemics of measles in these countries (Obomsawin 1998). Australian parents are informed by the government that 'measles can have serious consequences including death' (AG IAP 2012). This is the reason provided for the increased incentives to vaccinate in 2012. This statement does not represent comprehensive information about the risk of measles to the majority of children in Australia. Poverty and nutritional status influence the risk of this disease and these factors need to be considered when designing public health policies for the good of the *majority* of the population.

In addition, the government claims parents who do not vaccinate their children are risking their child's health as well as the health of other children. Again the government does not quantify or even identify all the factors contributing to the risk from infectious diseases, yet the statement has been used to justify increasing the incentives for parents to vaccinate. In addition, the government has not provided a risk/benefit assessment for each vaccine to justify implementing strategies that make vaccination the default position for *all* the diseases for which there is a vaccine. This default position is enforced by requiring parents to get a vaccine exemption form signed by a healthcare provider in order to choose not to vaccinate.

3.14 The National Immunisation Program (NIP) Since 2012

Whilst the Australian government states 'vaccination is not compulsory', the recommended schedule of vaccines has now been linked to government welfare benefits, some workplace requirements and school entry. Many Australians feel pressured to vaccinate their children because they are required to get a doctor's signature to refuse a vaccine. Participation is further emphasised by encouraging the

public to believe that it is their responsibility for the 'community good'. See chapter 7. This has the effect of increasing the vaccination rate of the Australian population. The NIP schedule since 2013 now includes vaccines against 16 diseases. See Appendix 3. This is an increase from 7 at the program's inception in the early 1990's**.** Children are now recommended to have 7 vaccines by 2 months of age and 14 vaccines by 4 years of age. This results in approximately twenty-four inoculations/doses to complete the full vaccination schedule at four years of age. Varicella became available in a new combination vaccine - Priorix-Tetra - at 18 months of age from July 2013 in Australia. This vaccine includes measles, mumps, rubella and varicella combined in one vaccine. The vaccines that have been introduced into the NIP schedule since 1990 are for diseases that at the time posed only a low risk to the majority of children. Therefore it is incorrect to claim that high-participation rates are needed to protect community health for these vaccines. See chapters 4 and 7.

Funding for the NIP is provided by the Australian Government and industry sponsors to establish the following services (AG IAP 2013; PHAA 2006):

1. Free vaccines recommended in the NIP
2. The Australian Childhood Immunisation Register (ACIR) that records details of vaccines given to children under seven years of age
3. Notification payments to immunisation providers that report vaccines administered to the ACIR
4. The General Practice Immunisation Incentives (GPII) Scheme to provide financial incentives for monitoring, promoting and providing immunisation services to children (ended May 2013).
5. A facilitation and reward payment to states and territories to deliver the NIP in their jurisdictions.

3.15 Vaccination in the Australian Workplace

In 2006 the Federal government implemented a new Policy Directive requiring students studying health at tertiary institutions to be fully vaccinated before commencing or completing their practical work (NSW DH 2005). This was a mandatory directive requiring the updating of vaccination status against 10 diseases. The policy directive states that all health students who are affiliated with the hospital system or with NSW

Health are required to be vaccinated. In 2007 this initiative was extended to include all health professionals and employees of the NSW health system and in 2008 this was extended to other Australian States (AG IH9 2012). See Appendix 3. The Australian Government recommends that employers in occupations where workers are at significant risk of infectious diseases should implement a vaccination program. This program should include a vaccination policy, current staff vaccination records, provision of relevant information about infectious diseases and the management of employees who refuse vaccination (AG IH9 2012). The government emphasizes that this policy should include reducing the risk of a healthcare worker transmitting disease to a patient (AG IH9 2012). It is recommended that employers should take all reasonable steps to encourage unvaccinated workers to be vaccinated and if an unvaccinated person is exposed to a vaccine-preventable disease then they should be given any agent (prophylaxis) that prevents the development of the disease (AG IH9 2012).

The reason for extending vaccination programs to healthcare workers, childcare centres, schools and emergency services is the belief that individuals are at greater risk from infectious diseases in these occupations (AG IH9 2012). There has been no evidence provided of a heightened risk of these diseases to Australian workers in these occupations. However, it is stated that these professionals have greater capacity to transmit these diseases to other individuals because they work in close contact with communities. Public policies are based on 'best judgment' and the current thinking is that individuals in some workplaces are at greater risk from infectious diseases therefore vaccination policies should be enforced. Academic institutions are insisting that health students be vaccinated to complete their courses, even though the Australian Government policy states that vaccination in Australia is not compulsory and that these directives are recommendations, not regulations or legislation (AG IH9 2012). Since 2012 some childcare centres, schools and institutions have been discriminating against healthy individuals by selecting against their enrolments or by preventing their placement in clinical situations in the workplace because they are not fully vaccinated. Parents and health professionals are losing welfare benefits and work/school placements if they do not follow the recommended procedures and several court cases have arisen due to the pressure placed on individuals to vaccinate (Hansen 2012).

3.16 The Evidence for Workplace Vaccination Policies

I have relied on Sepkowitz 1996 and Sepkowitz and Eisenberg 2005 for this information because these are the only sources cited by the government in the Australian Immunisation Handbook to support this policy.

The Australian Government has based its vaccination policy for the Australian workplace on evidence that has been collated from US workplaces and not Australian workplaces (AG IH9 2012). Statements about this policy in the Immunisation Handbook are based on evidence provided in two documents:

1) An analysis of occupationally acquired infections in healthcare workers in the US in 1996 and
2) The recommendations that were provided by the US Advisory Committee on Immunisation practices (ACIP) in 1997 (AG IH9 2012).

With reference to occupationally acquired infections in the US, the literature states that the last assessment of this issue occurred in 1986 (Sepkowitz 1996). There are few historical studies that have examined the incidence, prevalence or exposure-associated rates of infection in any country. Prior to 1996 the issue of preventative measures to improve worker safety had not been a matter for consideration (Sepkowitz 1996). Although there is a recognised risk to healthcare workers, a system to track fatal, occupationally acquired infections to determine an accurate estimate of the risk to healthcare workers had not been established in any country by 2005. Consequently, the actual occupational death rate from infections acquired in the workplace in any country was unknown when this policy was introduced (Sepkowitz and Eisenberg 2005).

In 2005, the CDC performed another analysis of the risk to US workers and estimated that 17 – 57 per million US healthcare workers die annually from occupational infections and injuries (Sepkowitz and Eisenberg 2005). However, the researchers admit that this figure is an educated guess at best. The figure was based upon ‘the projected potential consequences’ of only 4 diseases based on the prevalence, transmission rate and natural history rates of these infections (Sepkowitz and Eisenberg 2005). The 4 diseases were hepatitis B, hepatitis C, HIV and tuberculosis. These diseases are relevant to specific environments and the risk characterisation from these studies should not be assumed to represent the risk to all US and Australian healthcare workers. The

risk is dependent upon the social and environmental context in which the diseases are observed. In addition, the risk assessment includes the risk from HIV, which cannot be prevented with a vaccine, and it does not include diseases that present a risk to Australian workers.

This death rate was also based on data with significant limitations so it is impossible to know if the figure was an over- or underestimation of the risk to US healthcare workers (Sepkowitz and Eisenberg 2005). In 2005, there was no national tracking system in any country to define the need for extra measures for healthcare worker protection. This also means that it was not possible to estimate the cost-effectiveness of introducing mandatory vaccination policies for any occupation – either in Australia or the US - at this time. Vaccination polices in Australian workplaces have been implemented *before* the size of the risk that workers face has been quantified, therefore preventative policies for healthcare workers cannot be claimed to be evidence-based practice. These policies have been based on the current belief in the necessity for vaccines as opposed to empirical evidence of risk established by a national tracking system of worker's health. In 2005, the CDC recommended that national organisations introduce nationwide tracking systems to determine the magnitude of the problem resulting from acquired infections and death in healthcare workers (Sepkowitz and Eisenberg 2005). This demonstrates that the introduction of this policy in Australia in 2006 was based upon unrepresentative data from another country, and the Australian government had not quantified the risk that infectious diseases in Australia pose to healthcare workers. The US data uses the example of experiences with SARS and smallpox vaccination in the early 2000's to illustrate the potential risk of infectious diseases to healthcare workers. These are interesting examples to use particularly as the risk of smallpox was greater from the vaccine than from the disease itself (Sepkowitz and Eisenberg 2005). In 2003, the US government was concerned about bioterrorism and implemented a policy requiring all healthcare workers to be vaccinated against smallpox *in case* of a terrorist attack. This program had to be aborted after vaccinating only tens of thousands of workers because of the significant side-effects (including death) caused by the smallpox vaccine.

Healthcare workers were refusing to get this vaccine because of the known fatal reactions. As a result of this harm, the US government extended financial compensation for workers to include those who have become disabled from a vaccine in the line of

duty (Sepkowitz and Eisenberg 2005). A compensation scheme is not available to the Australian public and this represents a safety issue for employees who are harmed by a vaccine in the line of duty. The lack of information regarding the magnitude of risk due to infectious diseases in the workplace has been confirmed by an Australian doctor who commented 'I can't recall a single case of a student or clinician getting tetanus, diphtheria or mumps from a patient. The diseases we do fear catching – HIV, hepatitis C and most viral respiratory diseases – have no vaccines' (Iannuzzi 2012). This doctor also commented that he now gets numerous visits from a 'new category of patient': healthy young adults. These students are visiting doctors to get forms signed and to update with multiple vaccines in order to complete their practical placements for their tertiary courses (Iannuzzi 2012).

In addition to the lack of information on the risk of infectious diseases to healthcare workers there is a lack of information on the magnitude of the risk from the required vaccines for occupational use. Due to the lack of adequate surveillance of post-vaccination adverse events there is no quantitative data on the risk that is imposed on healthy adults by updating with a combination of 10 recommended vaccines. It is known that vaccines present a serious risk to some individuals yet Australia, unlike the US, does not have a vaccine compensation scheme for the victims of vaccine adverse events. Hence, introducing mandatory directives regarding the use of vaccines in the Australian workplace should have been preceded by the collection of evidence of the necessity for this action, a public debate on the pros and cons of this regulation and a compensation scheme for individuals who are harmed by this mandated medical procedure.

3.17 The Impact of Coercive Strategies in Vaccination Policies

Whilst government welfare benefits are also available for parents who choose not to vaccinate their children, there are certain requirements they must meet in order to receive these benefits. In 2013 these requirements include a certificate from a healthcare provider that states one of the following reasons (Ag IAP 2013):

- 'There is a medical reason why the child should not be vaccinated
- The child has already had the disease or has natural immunity
- A particular vaccine is unavailable'

- Conscientious objection

To obtain the welfare allowance without vaccinating their children parents need to complete the *Immunisation Exemption: Medical Contraindication* form or the *Conscientious Objector's* form that is available on the Health Department website. The *Conscientious Objector's* form can be used by parents choosing not to vaccinate their children for personal, philosophical or religious reasons. To refuse vaccination parents must complete the form with the assistance of an approved healthcare provider. This means the government has set a default position of vaccinating rather than not vaccinating in Australia. The significance of this is that healthy children are now recommended to use multiple vaccines before their first birthday yet doctors are not obliged to inform parents of the ingredients of these vaccines.

The Conscientious Objector's form became known as the 'vaccine refusers' form in June 2013 (Hartley 2013). Many parents experience difficulties in getting GP's to sign refusal forms in order to claim the government welfare benefit of $2,100 (Bradley 2013). One poll found that 54% of doctors would only sign 'vaccine refusers' forms on medical grounds (Bradley 2013). The Australian Medical Association (AMA) has stated there is 'no legal obligation to do so' (Woodhead 2013). Brian Morton, chair of the AMA's Council of General Practice, states that his decision not to sign refusal forms is backed by advice from the medical defence organisations (Woodhead 2013). Although the government's official line is that vaccination in Australia is not compulsory, in reality it results in financial and employment penalties for individuals who choose not to vaccinate.

There is currently confusion over whether doctors are obligated to sign conscientious objector's forms. The government provides a directive to doctors requiring them to counsel parents about the pros and cons of vaccines before signing the forms. The expectation that doctors will sign the forms is also supported by the government's statement that 'vaccination is not compulsory' and the fact that welfare benefits are linked to the signing of this form. However, the Australian Medical Association (AMA) informs doctors that if they do not feel they have adequately explained the risks and benefits of vaccination during the consultation then they are within their rights to not sign a conscientious objector's form (Woodhead 2013). Consequently many parents and employees in Australia feel pressured to vaccinate by doctors who will not sign the

vaccine refusal forms and by employers that require employees to update with the recommended vaccines. This is resulting in discrimination in some aspects of Australian society on the basis of vaccination status, even whilst the government continues to claim vaccination in Australia is not compulsory. As of 2015 the Australian government has proposed removing the conscientious objector's form and the right to refuse vaccines on philosophical and religious grounds. Only medical exemptions will be accepted in the new legislation for social welfare policies to be implemented in 2016 (AG DHS 2015).

3.18 Conclusion

The Australian government's NIP has been set within the framework and directives of the WHO's global health policy. It has not been developed within the specific environmental context of the Australian community but to comply with directives from the WHO on global vaccination policies. These policies have been developed by WHO/UNICEF since the 1970's and inspired by the campaign to eradicate smallpox. Although there was disagreement at this time about the value of vaccination in eradicating diseases, WHO/UNICEF decided to expand the program to many other infectious diseases. This was initiated as the Expanded Program on Immunisation (EPI) and since the 1970's has developed through many phases in all WHO member countries, both developing and developed. The campaign has been promoted on the moral principle of 'saving the world's children with life-saving vaccines'. During the 1980's the influence of neoliberalism resulted in economic and political experts dominating the development of global health policies. Mixed health messages began to be presented through WHO directives as neoliberalism focused public health policies on technology-based interventions such as vaccination. This was done in many developing countries at the expense of primary healthcare programs that targeted the social and environmental determinants of health. In the 1990's the World Bank, the International Monetary Fund and the Rockefeller and Gates Foundations became partners with the WHO/UNICEF to sponsor global vaccination programs. A shortage of funding in the 1990's for the research and development of vaccines led to the development of public-private partnerships that were influential in the direction of global health policies in WHO member countries.

Economics and politics began to dominate the design of public health policies from this time, with health statistics obtained from non-governmental economic models of the cost-effectiveness of implementing vaccination programs. Global health directives were based on industry modeling for global communities instead of the specific ecological conditions of each country. In 2000 the direction of global public health policies changed with the establishment of the Global Alliance for Vaccines and Immunisation (GAVI), a body that consists of public-private partnerships with governments and corporations jointly influencing global health policy decisions. At this time vaccines became the sole focus of global policy: GAVI promoted vaccines to WHO member nations using financial incentives as well as by controlling the supply of vaccines to these countries. This resulted in the 'vaccine paradox' where governments, in alliance with corporations, control the supply and demand of vaccines. This represents a clear conflict of interest that is not transparent to the public. Since 2000 global public health policies have protected industry interests through the sole focus on vaccination programs and many authorities within the WHO, and developed nations, have expressed concern at these technology-based health programs. This has been at the expense of broader primary healthcare needs.

Australia's NIP expanded in the 1980's and 1990's according to WHO goals for achieving high participation rates for all the recommended vaccines. The goals were set to increase childhood vaccination rates to ninety percent for all the vaccines in Australia even though there was no significant threat to the majority of the population from the targeted infectious diseases. The decision to use vaccines for many diseases was a universal directive to both the developed and the developing countries, without risk/benefit assessments for the use of each vaccine in specific countries and populations. In addition, national governments did not provide an adequate surveillance system for the accurate determination of the frequency of causally related adverse events from vaccines. The harm caused by vaccines, either individually or in the combined schedule, has not been included in the economic modeling for the cost-effectiveness of vaccination programs. These programs have been based on the assumption that vaccine-created herd immunity can prevent infectious diseases, if enough people participate in these programs, without causing significant harm to the population. The lack of empirical evidence for these assumptions is discussed in chapters 4 and 7.

During the 1990's government's re-labeled infectious diseases as *vaccine-preventable diseases*, a label that implies vaccines can prevent infectious diseases. The public has been informed through the mainstream media that high participation rates in vaccination campaigns are needed to *prevent* infectious diseases but the empirical evidence to support this claim has not been provided. The evidence the Australian government provides to support vaccination policies is discussed in Chapter 7. The government has introduced many new vaccines since the 1990's and emphasised the need for high vaccination rates for all infectious diseases for which there is a vaccine. New vaccines are continually added to the national recommended schedule. Each vaccine carries a risk to some individuals yet the Australian government does not provide a separate risk/benefit assessment for each disease and vaccine, nor for the combination of vaccines that are recommended in the children's schedule. The vaccines have been added to the recommended schedule without public consultation or participation in policy development, and without informing the public of the ingredients of vaccines. Financial incentives have been used to pressure parents and doctors to use all the recommended vaccines and to assist the government to track the vaccination status of children. These strategies were implemented in 1993 and formalized in 1997 as the Immunise Australia Program (IAP). These coercive practices have increased in 2015 with many employees now being required or expected to vaccinate even though the government continues to claim that vaccination in Australia is not compulsory.

The Australian Government's program does not make any reference to the historical evidence of the control of infectious diseases in Australia or the risk/benefit of using an increasing number of vaccines in children/adults. Mainstream media has been used since the 1990's to influence public behaviour by informing the public that high participation rates in vaccination programs are important in controlling infectious diseases without providing evidence for this claim. In contrast, the media was used in the early 20th century to successfully promote social (ecological) medicine to the public to reduce the threat of infectious diseases through environmental and lifestyle changes. The media message changed in the second half of the century when the focus of public health was directed to vaccination policies. Since this time the mainstream Australian media has emphasised the benefits of vaccines, without providing empirical evidence, and without informing the public of the known risks associated with each vaccine or the long-term health effects of the combined schedule of vaccines.

Overview of later Chapters

Chapter 4 provides a discussion of the implementation of vaccination policy in Australia and the methodology used for assessing environmental health risks in infectious disease law. It examines the way in which health risks for vaccines and infectious diseases are being characterized and framed to the public. Chapter 5 examines the principles that underpin good medical practice and health promotion in public health policy. A description of the influence of corporations in the supply and demand for vaccines in government vaccination policies is provided in chapter 6 and chapter 7 is a discussion of the evidence the government provides to the public on the Immunise Australia Program (IAP) website to support vaccination policies. Chapter 8 describes the concept of undone science and the political framework that increases areas of undone science in public policy. In chapters 9 and 10, I have provided examples of the corporate influence and undone science in two global vaccination programs, the Human Papillomavirus (HPV) vaccine and the 'Swine Flu' 2009 vaccine. In chapter 11 I have drawn conclusions about the development of Australia's vaccination policies and the integrity of the scientific evidence being used to make claims about the safety and efficacy of vaccines.

CHAPTER 4
IMPLEMENTATION OF THE AUSTRALIAN GOVERNMENT'S VACCINATION POLICIES

4.1 Introduction

This chapter describes the development and governance of infectious disease control in Australia. It provides an overview of the federal committees responsible for developing government policy and the responsibilities of the states and territories in implementing these policies. The strategies for assessing the risks and surveillance of infectious diseases in Australia are also described. More information on the governance of the policy can be found in Appendix 3**.** There are two different perspectives on assessing the risk posed by infectious agents and hence two different theories regarding the best method for reducing the risk:

1. An **ecological** perspective of risk from infectious agents. This risk is assessed by environmental health practitioners and addressed by social (ecological) medicine. This includes an assessment of the external causes of infectious diseases e.g. environmental, economic, cultural and political factors. These practitioners recognize that disease outcomes from infectious agents are associated with the environmental context and that the risk and health outcomes from an agent will vary between geographical regions and genetically diverse populations.

2. A **medical perspective** of risk from infectious agents. The risk of disease is addressed in the scientific medical model using the germ theory of disease. This theory focuses on the internal biological cause of disease and uses a medical intervention to control infectious diseases, regardless of the environmental context. The risk of infectious diseases to the community is assessed by medical practitioners and it is addressed by mass vaccination campaigns that assume all individuals are at the same risk from an infectious agent/vaccine in all geographical regions.

This chapter explains the difference in the practices of these practitioners and the management strategies they promote. The strategy that is adopted in public policy is a result of political decisions that are influenced by the dominant scientific network and current cultural beliefs and values. The policy of universal vaccination treats all individuals as being at the same risk from an infectious agent and from a vaccine. This is not the case in reality due to the environmental and genetic diversity of different geographical regions and communities. See Chapter 2. These risk factors are discussed in this chapter to address the question of whether universal vaccination policies can produce more harm than good in the population if the *majority* of individuals in the community are not at *serious* risk from the infectious agent. Vaccines also cause adverse health outcomes and death in some individuals and the genetic diversity of the population is a determining factor in the risk associated with both infectious agents and vaccines.

Herd immunity is discussed in this chapter in the context of *naturally-obtained* herd immunity and *vaccine-created* herd immunity. The type of evidence the government is using to support the claim to the public that *vaccine-created* herd immunity prevents infectious diseases is discussed in Chapter 7. A description of the factors that influence disease statistics is presented and illustrated with the example of the 2009 swine flu pandemic. This is further illustrated in a case study of the 'swine flu' 2009 pandemic in chapter 10. The case study has been chosen because it is a recent example of how information can be produced and framed by the media to create fear of a disease in the community. Communication and the framing of risk to the public in the media is a major consideration for public health policy because this is the main channel for influencing social behaviour. In this chapter I have discussed the consequences to human population health if risk is not presented in an honest and transparent manner with the participation of the community upon which the policies will be enforced. Chapter 5 presents the ethical code for medical practitioners and the values that are used to guide health promotion in the community and chapter 6 describes the influence of corporations in the production of scientific knowledge and public health policy in the era of privatisation.

4.2 The Governance of Vaccination Policies in Australia

In this section I have relied largely on information from the text by Cromar, Cameron and Fallowfield (2004) because this is the first comprehensive text that describes current environmental health risk assessment (EHRA) and management practices in Australia and New Zealand. The text is titled *Environmental Health in Australia and New Zealand*. The methodology that is being used in Australia to address public health issues is representative of current global practices and these methodologies have been described by local contributors in the Cromar et al edited version. Financial support for the text was provided by the Public Health Education and Research Program and it was approved by the Commonwealth Department of Health and Ageing to further education in environmental health in Australia.

Australia's National Immunisation Program (NIP) has been developed by the Office of Health Protection within Australia's Federal Department of Health and Ageing. This program is recommended to the states and territories for the control of infectious diseases (AG IAP 2013). The National Immunisation Committee (NIC) develops the policy through the Communicable Diseases Network Australia (CDNA) and this is communicated to the Minister for Health by the Australian Technical Advisory Group on Immunisation (ATAGI) (AG IAP 2013). The responsibilities and composition of ATAGI are described in more detail in chapter 6 and Appendix 4. State Governments in Australia are responsible for implementing vaccination policies through the state public health acts which are guided by the federal NIP. Local government is the third level of governance and it provides the infrastructure for implementing policies at the community level. Inspection and action against infectious diseases involves environmental health practitioners in local government as well as the provision of education and health promotion programs to the community (Stoneham et al 2004 p128).

State and territory public health acts specify the regulations for the control of infectious diseases. This includes the requirement that medical practitioners and pathology laboratories notify relevant public health authorities of any case of a notifiable disease. The acts also list a subset of diseases called 'controlled notifiable diseases' which are subject to more specific controls. When cases of these diseases are identified health authorities have

powers to carry out compulsory medical examinations and place restrictions on an affected individual's activities. Authorities can also place them under surveillance if their behaviour is considered a risk to the community. Environmental health issues are effectively managed by three key factors - legislation, funding and education. The development and implementation of environmental health policy changed significantly at the state level in the mid 1990's. At this time corporate partnerships were introduced into government policies and a *purchase-provider* model of administration was adopted. This model involves the separation of the purchaser of health services from the funding and provision of these services to the community. Corporatisation in this model has been defined as the restructuring of public health services into public sector and private (not for profit) corporations (Dwyer and Eagar 2008). Many government administrations globally have adopted this form of service delivery for health promotion.

There are two components of this purchase-provider model:

i) A purchasing agency that ensures the needs of the population are met (e.g. government committees) and
ii) A service provider that delivers the service and has some autonomy and responsibility over the delivery of the service (e.g. public or private (not for profit) corporations) (QDH).

The corporate planning process ensures that community needs that do not come into core legislation are included in policy development (Stoneham et al 2004 p136). Examples of these types of issues include vaccination, physical activity, sun protection, food safety and other education programs. The corporate plan sets goals to be achieved over a specified time period with outcomes set for the providers. State governments have mandated legislation to ensure community needs are incorporated into the planning process for local governments. In these models, it is important that regulations exist to ensure the funding for these health promotion campaigns is transparent to the public. This is because public health is put at risk if community education campaigns can be influenced by corporations that profit from the products they are promoting. One strategy adopted under this corporate planning model includes establishing partnerships with organizations to access funding for

health promotion programs. The roles and responsibilities of the purchaser and the providers are described in the contracts that are drawn up between the partners.

4.3 The National Environmental Health Strategy

Traditionally public health policy has been managed by the states and territories, however, changes in the nature of environmental hazards in the 20th century led to the belief that a national environmental health policy would be a more effective in addressing these issues. Australia's first national environmental health (EH) strategy was implemented in 1999 (CoA 1999 in Stoneham et al 2004 p131). Environmental health policy encompasses any policy decision in any level of government that directly involves health impact concerns and accountability for the community. The Australian government's definition of environmental health has been provided in Chapter 2. EH policy is multidisciplinary because health outcomes are affected by all aspects of our lifestyle. The national strategy is also stated to be designed to increase public participation in the health outcomes of the community. Prior to 2000 the federal government did not have a significant role in public health legislation other than quarantine, directives provided in international health treaties and controls on the use of chemicals (Stoneham et al 2004 p130).

The National Environmental Health Strategy (NEHS) has been developed in Australia by the enHealth Council, a subcommittee of EH authorities from government and environment/public health sectors who have collaborated to produce a national approach to risk assessment (AG EHRA 2012). These guidelines provide an outline of the principal roles and responsibilities that are fundamental to achieving good health outcomes in the community. Guidelines for the assessment and management of environmental health issues have been set in the NEHS for implementation by the states and territories. The guidelines present a general methodology for EHRA that focuses on chemical, physical and microbiological hazards. This methodology is described in the *Health Impact Assessment Guidelines (2001)* and *Environmental Health Risk Assessment Guidelines (2002)*.

The main objectives of the guidelines provided to the states and territories for EHRA are:

- Involvement and agreement from all stakeholders
- Establishing partnerships to bring about change
- Creation of energy and empowerment to change

Public health law was extensively reformed from 1985-1997. Prior to this time control of infectious diseases and environmental legislation were regulated under the same legislation and implemented by the states and territories (Reynolds 2004 p171). The new reforms placed the regulation of infectious diseases under different sections of the Public Health Law Act. The new regulatory sections are: 1) public and environmental health law 2) infectious disease control law 3) food law 4) drugs and therapeutic law 5) tobacco law (Reynolds 2004 p169). This separation was significant because traditionally the control of infectious diseases was a result of public health reforms to the environment. That is, control of the environment resulted in the control of infectious diseases. In this new classification the control of infectious diseases has been separated from the control of the environment and other environmental health problems.

Sanitation and hygiene are now regulated under *public and environmental health law* and communicable diseases are covered under *infectious disease law* (Reynolds 2004 p171). A consequence of this new separation is that the risk assessment for infectious diseases is not determined by the systematic methodology of the EHRA framework that is applied to many other environmental health hazards in Australia. This is consistent with global practice whereby the risk and cost-effectiveness of infectious diseases is determined by computer modeling and not a systematic methodology (Habakus 2011). The EHRA framework is accepted by environmental health practitioners globally to be the most systematic and transparent methodology for assessing the health risks of environmental hazards yet it is not adopted for the determination of risk from infectious diseases and vaccines.

Another consequence of the separation of infectious diseases is that infectious disease law is founded on a different set of values and principles (Reynolds 2004 p171). An example of one principle that has been adopted in public and environmental health law but not in infectious disease law is the *precautionary principle* (PP) (Reynolds 2004 p172). In 1992 the use of the PP in public policy was described in the United Nations Conference on Environment and Development (UNCED). It was stated that whenever there is doubt about

the impact of an activity (or a procedure) then the responsibility for managing the impact lies with the proponent and not the general public (UNCED 1992 in Stoneham et al 2004 p134). Population health requires that regulators use caution when basing policy decisions on toxicological data. This is because political decisions can be made in policy design and future research may prove the data to be wrong or misleading. The PP is relevant to vaccination policy because there is a risk from the chemicals used in vaccines as well as a risk from infectious agents. It is important that the characterisation of risk - for vaccines and infectious agents - that is used in computer modeling for policy development is determined by a transparent and systematic process. Currently the most transparent and systematic process used by environmental health practitioners is believed to be the EHRA framework. This methodology is used for many environmental health hazards in Australia but not for infectious disease control. The PP is also adopted for environmental protection in Australia but not for infectious disease control.

Adopting the PP in infectious disease law in the format stated by the UNCED would require the medical profession to prove that the combined schedule of vaccines does not cause harm before the vaccines are recommended to the public in government policies. When the onus of proof is on the *public* and not the *proponent* of the procedure it is not necessary for governments to provide proof that the procedure is not harmful. This is because funding can be directed away from appropriate studies that may find evidence of a causal link. When the onus of proof is not on the proponent, it is possible for governments to claim 'there is no proof of harm and therefore no action needs to be taken'. This claim can be made on a lack of evidence because the appropriate studies have not been carried out. This is discussed further in chapter 8.

Whilst the Federal Government has little responsibility in implementing control measures in the states and territories it is involved with the national surveillance of diseases and designing the framework and legislation for the control of diseases in the states and territories (Cameron 2004 p204). Surveillance systems assist authorities to develop public health policy and they must also be used to evaluate the changes that are introduced as a result of government policy. The EHRA framework requires that management strategies

that are implemented to reduce health risks to the population are constantly evaluated to provide evidence that the policy is achieving the outcomes that are set.

The body which oversees all environmental and public health policy in Australia is the Australian Health Protection Committee (AHPC). Advice is provided to this body by the CDNA, the enHealth Council and the Public Health Laboratory Network (PHLN) (AG IAP 2013). The CDNA is a national body that informs state and territory governments about changes to disease patterns in their area. Local government is then responsible for implementing preventative strategies that are recommended in the NIP to reduce the incidence of disease in the states and territories. Whilst the health impact from most types of environmental health hazards are being assessed using the systematic methodology of the EHRA framework and a set of values, risk assessment for infectious diseases is being analysed by computer models (Cameron 2004 p207). Computer models are dependent upon the assumptions and parameters that are chosen by the research scientists and these are not always made transparent to policy advisers (Michaels 2008). It is essential to know if an accurate estimate of the harm from vaccines has been included in the computer modeling of cost-effectiveness for their use in infectious disease control.

4.4 Measuring the Risk of Disease to the Community

There are two very different viewpoints in determining the risk presented by an infectious agent to the community. These are the viewpoints of the medical practitioner and the environmental health practitioner (Cameron 2004 p202):

1. **Environmental Health Practitioner:** This viewpoint contends that many infectious agents circulate through subclinical infections that do not produce much (or any) obvious signs of disease. Environmental health practitioners acknowledge the influence of the environment and host characteristics in the expression of disease in the community. These practitioners use ecological (social) medicine to control disease. Risk from infectious agents is assessed by observing the severity and age-incidence of the disease in the community, not just the incidence or notifications of cases regardless of the severity.

2. **Medical Practitioner**: This viewpoint is consistent with the scientific medical model that considers 'health' restricted to the action of the microorganism on the human body. In this model the influence of the external environment in the expression of disease are reduced and the focus is placed on a universal medical intervention for all individuals. This viewpoint emphasizes the need to record all cases of the disease regardless of the severity and pattern of the disease in the community.

In the environmental health viewpoint the incidence of infection is only a valid indicator of the risk of disease if the majority of cases are severe or fatal. In situations where the majority of cases are mild or sub-clinical, it is necessary to weigh up the benefits of longer-term community protection from natural exposure against the shorter term protection of a vaccine that comes with a risk for a percentage of the population. The two viewpoints described above are important in the development of public health policy. Different strategies will be recommended depending upon which group of practitioners has the most influence in policy design. Clinicians and environmental health practitioners will have differing viewpoints about the monitoring of different pathogens because one examines the ecological context and severity of cases and the other examines incidence rates of infection without regard to context and severity.

4.5 The Australian Government's Environmental Health Risk Assessment (EHRA) Framework

This section draws especially from the Australian government's document titled *Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards (June 2002).* The document was compiled by the Environmental Health Council (enHealth Council).

The purpose of health risk assessment is to provide comprehensive health information to risk managers, policy-makers and regulators in order to implement the most effective measures of mitigation. To achieve this goal, both scientific and non-scientific information is required. Gaps in the scientific knowledge can lead to incorrect assumptions about safety if they are not addressed in a transparent manner with technical and non-technical input.

The various elements that need to be considered in the risk assessment are:

- the source of danger (hazard)
- the uncertainty of outcomes
- possible adverse health outcomes
- the target
- the time-frame and
- the importance of the risk for the people that are affected by it.

The US National Research Council (NRC) emphasises the need to include a broad representation of participants in the risk assessment process. In particular, the needs of the community and affected parties must be included in the analysis: 'The process must have an appropriately diverse participation, or representation of the spectrum of interested and affected parties, of decision-makers and of specialists in risk analysis, at every step' (NRC 1996 p3). This is to ensure that all risks are included in policy decisions and that vested interests cannot be protected in the policy. It is observed that experts and consumers often disagree over the degree of risk involved in a situation (Finucane 2004 p151). However differences can be a result of access to different information or it can depend upon the financial or political interest the stakeholder has in the selected management strategy. Financial interests, livelihood or status can affect a stakeholder's view on policy. Therefore conflicts of interest are required to be declared if individuals are participating on policy advisory boards. This information is required to be publicised because it is relevant to the validity of the knowledge used in political decisions. See chapter 6 for a discussion of COI in Australian policies.

The suggestion by some that the public should just trust the experts puts public health at risk because the public is dependent upon health being the primary interest in the development of public policy. Other interests in public policy include profits and prestige and experts with financial ties to industry may be influenced by these connections in the decision-making process. Research and experience have shown that risk assessment that is approached without the proper involvement of the public will not provide the best outcome for the community (Finucane 2004 pp151-153). There are three main principles that

environmental health (EH) authorities accept are necessary for the successful implementation of public health policy (NRC1996 p7):

1. Broad support from the public in the decision-making process.
2. Decisions must not be based on technical (expert) advice alone. It must include non-scientific value judgments.
3. The government requires consent from the community on whom the policy will be enforced and they have the right to full participation in the decision-making process.

These three principles emphasise open and transparent debate of the underpinning knowledge that public health policies are designed on. Acceptance of the policy by the public depends upon free and informed debate about policy decisions as opposed to an authoritarian policy that is based on selective and controlled information. The government's EHRA framework provides the most comprehensive and transparent assessment of all the known and perceived risks to ensure that the management strategies that are implemented for environmental hazards do not result in more harm than good to the community. The framework for this methodology is set out in Figure 4.

EH Risk Assessment can be defined as 'the process of estimating the potential impact of a chemical, biological, physical or social agent on a specified human population under a specific set of conditions and for a certain timeframe' (Langley 2004 p93). This process is necessary for informing the decisions made by EH risk management teams. The decision-making process incorporates scientific, technological, social, economic and political information which underscores the need for a diversity of participants on advisory boards, not just technical experts. Traditionally it has been believed that risk management decisions are subjective and founded on value judgments on the tolerability of the risk weighed against the cost-effectiveness of the preventative action (Langley 2004 p93). An essential part of the risk management process is to monitor and audit the efficacy of the selected strategy to evaluate health outcomes. This feedback is essential for ensuring that the implemented strategy is kept updated and remains effective.

Figure 4: An Australian Environmental Health Risk Assessment Framework

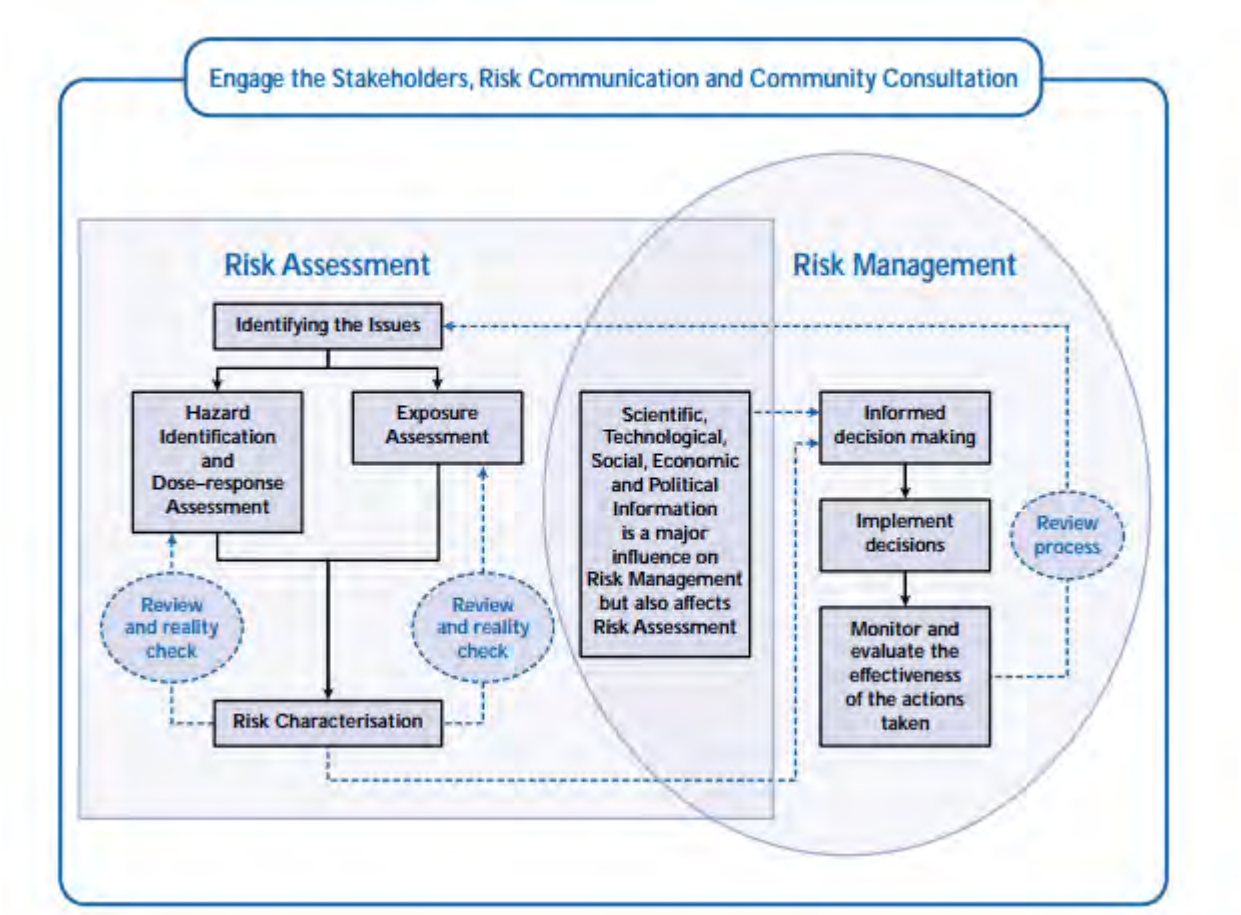
Source: Australian Government, Department of Health and Aging, Environmental Health Risk Assessment Guidelines for assessing human health risks from environmental hazards, 2002

In *infectious disease law* the health risks from infectious diseases and vaccines are determined by computer modeling and not the EHRA framework. Eduljee (2000) states that computer modeling techniques have transformed risk assessments in the last few decades but they have also conferred a false sense of overconfidence in the statistical analysis. Computer modeling has led to an elitist culture where technical experts dominate the process and other stakeholders are excluded from contributing. Bias can enter the risk assessment obtained from computer models through the choice of model, the implementation of the mathematical equations, the parameter values chosen or the interpretation of the results. These aspects of computer models involve value judgments and the underlying assumptions are not always explained to non-experts with the risk assessment that is provided.

A model of the relationship between RA and RM is provided in Figure 5. This model is comprised of four interconnected components and can be altered for adaptation to

microbiological risk assessment. This is necessary because the specific characteristics of each microorganism need to be included in the risk assessment process and described within an ecological context in a given time frame. This has been done for RA involving microbiological agents involved with food contamination in Australia but not for the control of communicable diseases.

Figure 5: The Relationship of Risk Assessment and Risk Management



Source: Adapted from P/CCRARM, 1997; Patton, 1998; NRC, 1983 as cited by the Australian Department of Health and Ageing, 2004 (AG EHRA 2012)

Many variables must be considered in assessing the health risks from vaccination policies due to genetic variability of the population, the diversity of the environment and the combination of multiple chemicals found in vaccines that are injected into the body. The risk assessment must include any issue that alters an individual's well being, quality or potential in life; it is not just about death and physical disability (Gilbert 2004). In the case

of vaccination policies the risk from the chemical exposure in vaccines must also be considered in the RA for infectious diseases. The Australian government states that current risk assessment methods cannot make 'accurate quantitative estimates of risk for low levels of exposure to environmental hazards' (AG EHRA 2012). It is noted that the uncertainties that exist in toxicological and exposure data prevent the authorities from providing feasible numerical estimates of the risk from many low level exposures. This is particularly relevant to vaccination policies because all vaccines contain low levels of toxins that are injected into the body. This method of entry allows toxins to have greater access to the organs and body systems than typical natural exposure to these toxins. See Appendix 6.

The uncertainties that can exist in risk assessment, and that can lead to bias, arise from several areas including inadequate knowledge, parameter uncertainty due to measurements, errors arising from incorrect modeling and uncertainty arising from difficulties interpreting predictions (AG EHRA 2012). Uncertainty in the risk assessment also arises when a single number is used to describe individual responses that have multiple variables. Examples include the use of a single value to represent body weight or the susceptibility to adverse effects (Gilbert 2004). Both uncertainty and variability must be discussed in risk assessment recommendations. These uncertainties exist in the number and frequency of vaccine doses given to children as well as the genetic variation in the response. Yet genetic variability is not considered in the risk assessment process for infectious diseases. The management strategy is a one-size fits all. Risks need to be weighed against the benefits of a prevention or treatment particularly when strategies are being implemented for populations. This is because the risk can be greater in sub-populations, such as ethnic groups or those that are genetically pre-disposed to diseases.

Risk assessment needs to be founded on a systematic analysis of all the hazards of a procedure. This allows an evaluation of the biological properties and an ability to identify the toxic effects that are statistically and biologically significant as well as the undone research that may exist in a particular area of the policy. The Australian government's EHRA framework recommends that the first step in any risk assessment process is consultation with the affected community. This is to ensure that the consumer's perception of risk is included in the decisions about the best management strategy to implement. Other

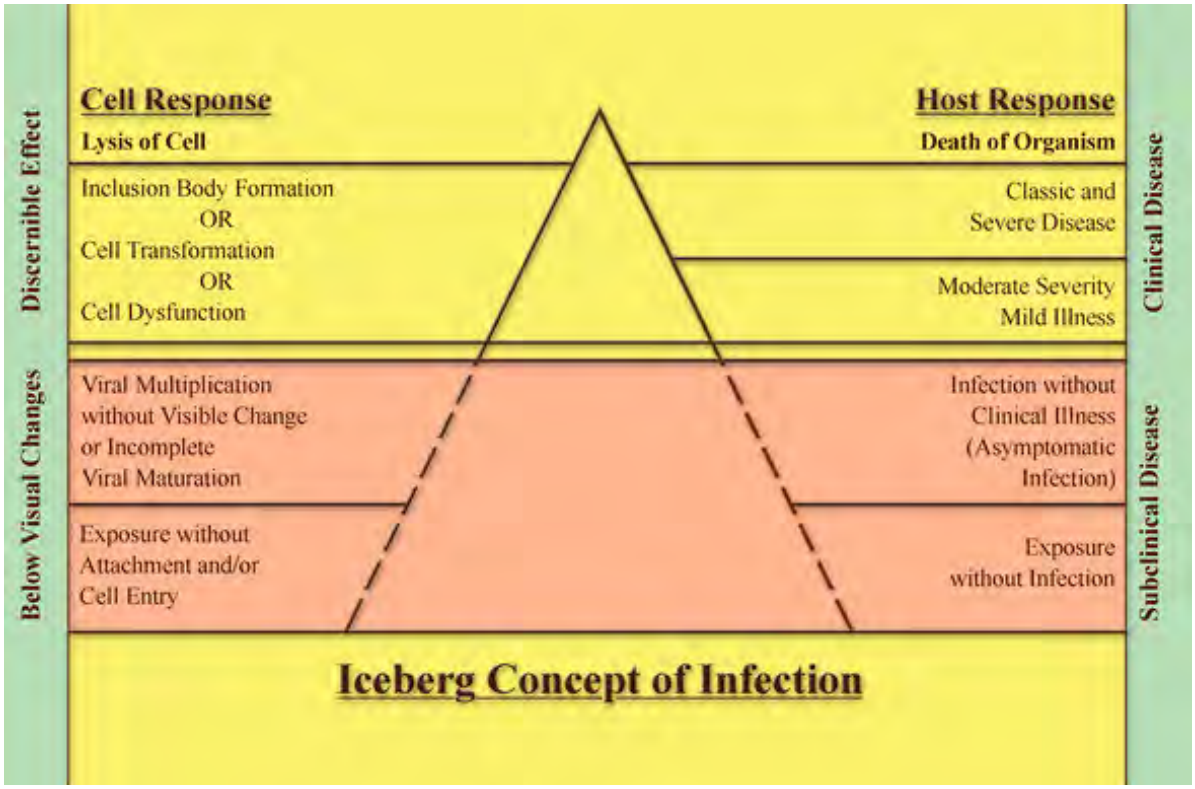
reasons for involving the public include the importance of local knowledge and concerns that may be missed by generic risk assessments and models. Ultimately a value judgment is made by policy-makers based on the tolerability of the risk to affected individuals and the cost-effectiveness of the selected strategy. Risk assessments must be a realistic analysis of the hazards and they must provide an explanation of the default positions that have been adopted based upon the evidence. In order to be realistic the framework for decisions about RA must reflect the natural variation in the environment and the population (Eduljee 2000). If these factors are not considered in the risk assessment process the estimate of risk will be unrealistic and the harm caused by the hazard will be unknown.

Currently, most RA models have an endpoint that is focused on the hypothetical individual and they do not account for the genetic variability of the population. This is a concern for Australian vaccination policies that have set a default position of using a universal medical procedure in genetically diverse populations. Universal vaccination has been adopted for many diseases in Australia even though the exposure pattern for the chemicals in the vaccines for different individuals has not been determined (FDA Thimerosal; PHAC 2002; Burton 2003). Default values that are based upon modeling on the hypothetical individual often contain assumptions and extrapolations which can be seriously flawed (AG EHRA 2012), particularly in the case of low doses of toxins and antibiotics present in vaccines that are injected into the body. This is because the effects of low doses of toxins in combination with other chemicals have not been determined in humans. This is an example of undone science. See chapter 8. Assumptions or extrapolations in default values are also dependent upon the assessor and will therefore vary according to their constructed perspective of the risk. If the default values have been determined by technical experts without a diversity of stakeholder input, they can become too rigid and the mitigation action can result in more harm than good in the community.

4.6 Clinical Disease and Subclinical Disease: The Iceberg Concept

Scientists postulate that infections resulting in active clinical disease account for a relatively small proportion of the actual infections that occur in communities. This concept is illustrated in Figure 6 and is described as the iceberg concept.

Figure 6: The Iceberg Concept of Infection



Source: US CDC, Forrester FT, The Iceberg Concept of Infection, Public Health Image Library

If the vast majority of exposure to a potential pathogen causes subclinical infections or mild disease then this can result in natural herd immunity for the community. This is because a subclinical infection produces immunogenicity through natural exposure but without signs or symptoms of the disease in the individual. The immunity achieved in this way is known to provide longer-term protection than immunity obtained from vaccines. There is a large variation in the clinical presentation of viral infections. For example, the vast majority of polio infections are subclinical as compared to infection with rabies which is largely clinical and highly virulent (Friis and Sellers 2002 pp 402-3). An important determinant of the severity of infection is the host's ability to fight off the disease. Genetics and environment play a large role in this characteristic. The improvements in nutrition and the trend back to breast feeding in the early 20th century (1920-30's) combined with other

social medicine strategies played a significant role in the ability to control infectious diseases in developed countries. See sections 2.3 and 2.4.

The shorter-term immunity produced by vaccines, using altered and genetically engineered proteins and DNA, results in the need for several booster shots throughout life (DHA IAP 2013) and the effects of vaccines in the interaction with other body systems have not been fully explored. Whilst natural immunity is not always life-long, it can reduce the severity of re-infection by the pathogen later in life (Wendelboe 2005; Behrman and Kliegman 1998). Many diseases are known to be more severe when first exposure occurs in adolescence or as an adult, rather than in childhood (Burnet 1952; Wendelboe et al 2005). Thus, natural infection in childhood can provide greater protection (and cost-effectiveness) to the community for diseases where the majority of individuals are not at risk of severe disease after exposure.

4.7 Herd Immunity

Public health authorities emphasise to communities that the control of infectious diseases depends upon the creation of 'herd immunity' by vaccination (DHA IAP 2013). This concept suggests that when a sufficient proportion of the community is immune to a disease, for example >50% (depending on the disease), this provides protection for the unimmunized individuals by interrupting the transmission of the agent. Herd immunity is known to be created by natural exposure to the infectious agent and it is theorised that vaccines can also create herd immunity (Colgrove 2006; Habakus 2011 p25). However, there are several reasons why herd immunity created by vaccination may not be achieved in practice:

I. There can be more than one strain of an organism that causes the disease which may not be included in the vaccine (Behrman and Kliegman 1998).
II. Humans may not be the only reservoir for the disease. The virus/bacteria may be found in other animals therefore transmission is not interrupted (Friss and Sellers 2004).
III. The virus/bacteria can mutate and the vaccine may not contain the mutated strain.

These problems place doubt on the ability of vaccines to provide herd immunity for some infectious diseases. The claim that a vaccine can prevent the transmission of pathogens between individuals and create herd immunity only applies to pathogens that do not have a non-human reservoir, such as dogs or other animals, and where there is only one strain of the pathogen in circulation (Basch 1994 p15). Herd immunity will not be created for a pathogen where many strains of a pathogen exist in the environment, where the life-cycle includes other animals or where spores of an agent are common in the soil (tetanus). In these circumstances the vaccine may provide some protection to the individual but cannot provide herd immunity (Basch 1994). Therefore governments should be required to provide empirical evidence that vaccine-created herd immunity is possible before recommending an increasing number of vaccines and claiming they are *necessary* for community health. Target vaccination levels of 80-90% have been accepted by the community on faith and not evidence (Colgrove 2006 p158). The duration of immunity gained from natural exposure and from vaccines should also be considered for each infectious disease when deciding whether a vaccine is the best management strategy for a disease. Diseases that produce long-term immunity from natural infection include measles (Friis and Sellers 2004) and whooping cough (Wendelboe et al 2005). These diseases are also known to be less severe when individuals are exposed as a child (over 1 year of age) than as an adolescent or adult (Burnet 1952; Behrman and Kliegman 1998; Wendelboe et al 2005). The ability of a pathogen to produce a high proportion of subclinical or mild infections and the influence of the environment and host characteristics in pathogenesis must also be considered in decisions regarding the use of vaccines to control a disease. The evidence provided by the government to the Australian community to support the theory of herd immunity and participation in vaccination programs is discussed in chapter 7.

Herd immunity for vaccines is determined using mathematical modeling (Basch 1994 pp71-72). These models use the transmission pattern of pathogens in the community and rely on parameters and assumptions chosen by the researchers/sponsors. This is a non-transparent assessment that is not inclusive of all stakeholders. Pathogens are not transmitted in a predictable manner to all individuals so it is essential that all stakeholders know what criteria are being used in mathematical models to determine the transmissibility or risk of an infectious agent to the community. This fact was emphasized by the eventual

success of smallpox eradication programs. The success of eradicating smallpox was attributed to a change in strategy from 'vaccinate every person in the world' to a strategy of surveillance and containment (Basch 1994 p72). It was realised that it was unnecessary to vaccinate every person because not everyone was at the same risk of getting smallpox, even if exposed to the virus. The new strategy depended upon tracing cases of disease and isolating the individuals who had been exposed to the virus. It is stated that only those who were contained were vaccinated (Basch 1994 p72) however it is debatable whether the vaccine would have been necessary because smallpox is only transferrable by direct skin-to-skin contact. It is not transmissible through the environment or until the symptoms appear. Therefore, isolation of the cases alone could have stopped the circulation of the virus and eradicated this disease. This is particularly that case because of the improved environmental conditions due to public health reforms in the twentieth century. A vaccine for smallpox was in use for 150 years before the disease was finally eradicated by the isolation of cases in the mid-twentieth century.

4.8 Surveillance of Communicable Diseases

This section provides information about the surveillance of infectious diseases in Australia to illustrate the variables that influence the characterisation of risk associated with infectious agents and vaccines. It also describes the practices that are utilised in the collection and analysis of the data to illustrate whether government policies are communicated to all stakeholders in a transparent and accountable manner.

When monitoring the incidence or notifications of a disease it is important that the data is presented to authorities and the public in a transparent manner (AG EHRA 2002). This is because incidence data can be manipulated to increase or decrease the reported occurrence of a disease. There are two main ways in which surveillance data can be used to demonstrate an increase or decrease in a disease. These are:

i) Changing the definition of a disease and
ii) Altering the way in which the disease is monitored.

If either of these variables changes, without informing the public or government authorities, then the statistics can be reported in the media in a way that misrepresents the risk of the

disease to the community. For example, a change in the criterion for diagnosis of a disease can achieve a reduction in cases simply by excluding some cases based on different criteria. Similarly if the surveillance of a disease is altered or the surveillance is stopped then it can appear that the incidence of the disease has changed when in fact it is a result of a change in the monitoring of the disease. Media reports of disease etiology seldom reveal the way incidence statistics are used in mathematical models. Furthermore, the media is not accountable to the health department for the information it provides to the public.

Information on surveillance is collected from the public and health professionals. The primary sources of information on surveillance are from doctors who notify authorities on suspicion *or* confirmation of a case of disease. The analysis of notifications is completed by computer models. Data from this modeling is put into context by the researchers who design the models. In other words, researchers interpret the data before they provide it to the government and the public (Cameron 2004 p205). Disease statistics are dependent upon the truthful reporting of the *classification* of the disease notification. This is because some notifications are not confirmed but are only *suspicions* and also because some are mild cases and the proportion of mild notifications is significant to the management strategy that is adopted for mitigation. Examples of the different types of notification that are reported to authorities include (Cameron 2004 p206):

i) **Definitive**: the case conforms with the surveillance case definition
ii) **Presumptive**: it is *likely* to become a confirmed case if more data becomes available
iii) **Possible**: there is little supporting data.

Disease incidence is often reported to the public through the media and it is possible to give a false or misleading impression of the risk of a disease by selectively reporting information about the cases. Some of the variables in disease statistics that are relevant to the risk of the disease include socioeconomic status (environmental context), identification of the causal pathogen (suspicion or confirmed) and vaccination status of the cases. Statistics that are reported without this contextual information are liable to misrepresent the risk of the disease to the majority of the population.

Focusing on the overall incidence of a disease in the population is not of any significance because it does not inform about the age-incidence of the disease or the socioeconomic-incidence of the mortality and morbidity from the disease (Burnet 1952; Cumptson 1989). Burnet (1952) also stated that case-fatality rates will vary greatly in different investigations because of the different criteria that can be used in diagnosing and reporting diseases. It is an inexact science. Stewart stated that notifications are incomplete indicators of prevalence and are in no way indicators of the severity of the disease to the population (Stewart 1977 pp234-237). Governments are using computer models to determine the risk however this system is dependent upon the integrity of the researchers and the assumptions they are using. This is because the variables in disease statistics are not transparent to the public or government officials and the validity of assumptions cannot be verified (Cameron 2004 p205). Hence government authorities and the public are expected to *trust* the researchers and their statistics and assume that they are making decisions in the public interest. The influence of these variables in the reporting of disease statistics to the public is illustrated in the media reporting of the 'swine flu' pandemic in Australia in 2009.

4.9 Case Study: A new strain of 'Swine' Influenza (Type A H1N1) or a change in surveillance?

In 2009 the Australian Government prioritized a vaccine for community use against a new strain of influenza. This preventative action was notable as there was little evidence that suggested this influenza strain was more virulent than previous strains that occur regularly. In fact, the World Health Organization (2009) stated the majority of people who contract this disease experience the milder form of influenza and recover without requiring treatment (WHO Swine Flu 2009). An examination of evidence provided by the Western Australian Health Department regarding deaths to swine influenza Type A H1N1 shows that it is possible that a change in the surveillance of influenza in 2009 resulted in the creation of hysteria over a new strain of influenza virus. Influenza is caused by many different strains of virus. These viruses spread easily and new strains develop regularly (Jefferson et al 2008). A vaccine against influenza is designed to protect against only one to three strains depending on the type of vaccine used (GWA CDCD 2009). For example, the 2008 seasonal influenza vaccine protected against Type A (H1N1), Type A (H3N2) and

Type B (3). Influenza Type A H1N1 is a strain that has been covered in influenza vaccines for many years and it would be expected that humans would have some immunogenicity to similar Type A strains.

The new strain of flu in 2009 was commonly called 'swine flu' by the media and it was described as being a recombination of genetic material from *human* Type A H1N1. This was stated to be a combination of one strain of bird flu and two strains of pig flu (WHO Swine Flu 2009). When this new strain was first detected in April 2009 the WHO stated 'there are no known instances of humans getting this strain of influenza from pigs or other animals'. It was also stated that this strain is not known to be endemic in pigs (WHO Swine Flu 2009). Yet this flu was promoted to the public through the media as '*swine flu'* even though it was a strain that had never been found in pigs. The official medical term for this strain of flu was '*Influenza Type A, H1N1, human strain*' (WHO Swine Flu 2009). It needs to be asked whether this strain of flu would have caused so much panic in the population and with authorities if it had been described by its medical name. The community may have been less fearful if they had been known that the virus was not transferred from pigs and that Influenza Type A H1N1 is a strain of flu that humans have been exposed to for many years - even though this strain had a different genetic make-up. The World Health Organisation stated in 2009 that influenza A (H1N1) was a new virus and one to which most people would have little or no immunity (WHO Swine Flu 2009). Yet in a study conducted by the CDC soon after the virus appeared it was shown that individuals between the ages of 18-64 had antibodies present that reacted to the swine flu virus (Schuchat in Katz et al 2009 p521-524). Whilst this does not indicate clinical protection it does suggest that some individuals may have had immunity from previous exposure to H1N1. There was no reason for public health authorities to assume in 2009 that that the population would have no immunity to this new strain when it was immunologically similar to previous H1N1 viruses (Schuchat in Katz et al 2009 p521-524).

H1N1 is a strain of influenza that has been covered for many years in the seasonal influenza vaccine. Therefore it would be expected that the Australian Health Department would have mortality data for seasonal H1N1 from previous years. After all vaccines are introduced to reduce the deaths and illness from infectious diseases and it is necessary to evaluate the

effectiveness of vaccination campaigns in the population. But this was not the case. The Western Australian Health Department stated this data was never collected in previous years (GWA CDCD 2009), even though Type A H1N1 has been one of the most virulent and prevalent strains and regularly covered in the influenza vaccine for many years. In 2009 the Australian Health Department changed the surveillance of influenza in the community (GWA CDCD 2009) to monitor the new strain of 'swine' influenza. The WA Department of Health stated the reason there is good data on the mortality associated with influenza H1N1 2009 is because of enhanced surveillance systems that were put in place specifically to monitor the incidence of this virus (GWA CDCD 2009). Prior to 2009 influenza that was notified by GP's and laboratories was not systematically followed up or linked to hospitalization/death data to determine outcomes. In addition, post-mortem victims were not routinely tested for sub-types of influenza. In previous years deaths were listed as 'influenza' and were not routinely sub-typed for the strain. The Australian Health Department also stated 'hospitals were less likely to routinely test admitted patients with respiratory viruses, including pneumonia, for influenza, so (in previous years) many cases remained undiagnosed or were assumed to be primary bacterial infections' (GWA CDCD 2009).

Yet in 2009 most cases of influenza notified by labs or GP's were followed up to see whether the cases led to hospitalization or death. The Australian Health Department was also systematically testing hospitalizations/deaths for H1N1. As a result, the health department was able to claim that 90-95% of laboratory proven influenza cases were due to 'swine' H1N1 (GWA CDCD 2009). However they could not produce the morbidity or mortality statistics for previous strains of seasonal H1N1. It has been known for many years that incidence figures for a disease can be inflated by monitoring a disease in a more systematic manner. This knowledge is not always beneficial because it can include sub-clinical or mild infections that give a false representation of the burden of the disease to the community. A more sensitive or systematic test will identify cases that would previously have gone unidentified, so a greater recorded incidence of a disease does not always indicate greater severity (or burden) to the population (Burnet 1952 p93; Cumpston 1989). This is the case with a disease such as influenza which has a high incidence in the

community but epidemics are known to be mild for the majority of people (Heikkinen et al 2006).

Members of the public could not easily assess whether this new strain of 'swine' H1N1 was more virulent than the regular seasonal H1N1 if the testing and surveillance of influenza had changed, particularly as there was no evidence of a 'pandemic' in the community. The changes in surveillance in 2009 meant that even though influenza Type A H1N1 was prevalent in previous years there was no data on the number of deaths associated with this strain in previous years because it wasn't monitored. The Health Department also stated it was unclear to what extent 'swine' H1N1 infection contributed to the deaths it was associated with because there were usually several infections present and in most cases underlying medical conditions (GWA CDCD 2009). Disease diagnosis and cause of death is an inexact science and it is up to the medical practitioner to state the primary cause of death. The Health Department did not produce statistics that demonstrated the overall death rate for influenza in 2009 was significantly worse than in previous years but the media did not report this to the public (GWA CDCD 2009). This fact was supported by the Therapeutic Goods Association in the statement 'the experience in Australia of the disease is mild in most cases' (AG TGA 2009).

The evidence presented above illustrates how using different surveillance methods can enhance the apparent incidence of disease in the community. This leaves the cause of the increase in incidence open to interpretation. For this reason the government should be required to publicize any changes to surveillance practices. This will ensure that the information the public receives can be interpreted in an open and transparent fashion and will lead to appropriate responses. The public was misinformed by reporting this strain of Influenza A (H1N1) virus as 'swine flu' and by exaggerating the risk from this new strain (AG TGA 2009). However, the health department states it is not responsible for the way in which the media reports on health issues to the public. This situation compromises public health if the media is not required to report accurately on all the variables that characterise the risk of diseases and vaccines to the public. See chapter 10 for a more detailed description of the 'swine flu' pandemic in 2009.

4.10 Communicating Risk to the Public

Risk assessment is an inexact science therefore honesty and transparency are essential qualities in the determination of risk (Langley 2004). This approach is crucial to the establishment of trust by all stakeholders and in the adoption and acceptance of an appropriate management strategy by the public. In order to promote a desired outcome in the population it is helpful for managers to understand the different ways in which humans make judgments about complex issues. There are various factors that determine an individual's perception of risk and these must be assessed before a judgment is made about the management of the risk. These include the hazard, the possible benefit/harm gained by implementing a particular management strategy, the trustworthiness of the proponents and potential responses to the management of the risk. Due to the large number of hazards the community is exposed to public members cannot assess all these factors in-depth for every hazard. Therefore, individuals use heuristics or rules of thumb to make opinions on complex information (Finucane 2004 pp148-9).

There are two heuristics in particular that are commonly used:

1. The *availability* heuristic: the more frequently a person experiences or hears of an event the more easily it will be recalled. This results in an inaccurate perception of risk if the media reports on this issue in a one-sided manner. If the focus is only on the benefits of the issue then individuals do not recall the few times that they hear about the risks. People also give more weight to concrete information as opposed to abstract information, therefore the more irrelevant detail that is added to the story, the more believable it becomes.
2. The *affect* heuristic: an intuitive feeling people get after long-time experience with particular situations. In this case, individuals, including experts make judgments from a gut or emotional level even though deliberate and logical analyses are more appropriate. Emotion blinds people to the risk.

In order for the public to make an accurate assessment of risk regarding a hazard it is recognized that the potential risks need to be emphasized and made more vivid so people will recall information other than the benefits of the activity or product. In the case of

vaccines the media continually reinforces the benefits of vaccines and the risks of the infectious diseases. The risks of vaccines are rarely reported on and when they are, they are downplayed and stated to be 'very rare' (AG IAP 2012). Another way to influence behaviour is through labeling. In the vaccination debate the terms 'anti-vax' and 'conspiracy theory' are used to suggest that the ideas are not mainstream attitudes. People have strong affective reactions to labels and it is known that statistical or factual evidence is often ineffective in changing risk perceptions if these attitudes have been stigmatized (Finucane 2004 p149). These affective associations are strong and it is difficult to change someone's perception once the association has been established.

In a similar manner the framing of information by the media is extremely important. It is known that the wording and structure of the information has a large influence over people's risk perception. This is known as the *framing* effect and it can make a big difference to the outcome of decisions. In many cases it may result in confusing the information for lay people. When this happens lay people will make decisions based on the trust that they place on proponents or institutions, rather than a true judgment of the information. In addition, humans are 'risk avoiding' so presenting the statistics as the number of lives lost as compared to the number of lives saved can strongly influence perceptions and behaviour. This can be seen in the promotion of vaccines to the public. Even though the majority of people in developed countries are not at serious risk from any infectious disease the vaccine is promoted on the small number of deaths or cases that do occur – without the context in which they occurred. For example, deaths to whooping cough or measles may be a result of the socioeconomic circumstances of the individual but these contextual factors are not reported with the number of cases that occur. Fear is a significant factor in human behaviour and disease statistics can be framed to maximize the fear of a disease and minimize the side-effects of vaccines. The framing effect is used by both experts and lay people and particularly by the media in advertising campaigns. Lay people have difficulty perceiving when the frame has been manipulated by experts and this has serious consequences in risk management when the manipulation goes undetected (Finucane 2004).

This illustrates how risk perception is a social and cultural construct. Risk perception is composed from two types of risk judgment: the technical judgment made on expert

scientific information of the frequency or magnitude of the issue and the non-technical judgment guided by qualitative information based upon the sociopolitical views, cultural norms, and environmental characteristics (AG EHRA 2012). The public also places trust in the government and medical institutions to be acting in the public interest and this information will be weighted more highly in the individual's perception of risk. There are many factors that influence a person's perception of risk and these are listed in Table 2.

Table 2: Factors Affecting Individual Perception of Risk

More Acceptable Risk	Less Acceptable Risk
Benefits understood	Benefits unclear
No alternatives	Alternatives available
Risk ahead	Risk affects few
Voluntary	Involuntary
Individual control	Uncontrollable
Familiar	Unfamiliar
Low dread	High dread
Affects everybody	Affects children
Naturally occurring	Human origin (synthetic)
Little media attention	High media attention
Understood	Not understood
High Trust	Low trust

Source: Gilbert 2004, A Small Dose of Toxicology: the health effects of common chemicals, Boca Raton Fla, CRC Press, p33.

A major factor that has been left out of this table is the influence of financial rewards. If a decision affects an individual's livelihood, status or financial arrangements it can influence their behavior and alter their perception of the risk involved in a procedure or technology (Krimsky 2003). See chapter 6. In societies that adhere to a model in which the 'expert knows best' risk assessment is very narrow and excludes the social and psychological aspects of risk assessment. In 1996 the US National Research Council supported a move to ensure risk management was addressed in its full social complexity (NRC 1996). This

means including public perceptions of risk which put value on the gaps in scientific knowledge. For example, values that can affect our perception of risk where gaps in the knowledge exist include controllability, dread, catastrophic potential and the trustworthiness of proponents. Public perceptions are based upon legitimate value laden aspects of risk and it is essential to include these risks in policy decisions to ensure the public's health is prioritized in the management decisions that are made. These aspects of risk assessment are included in the EHRA framework but they have not been made transparent in computer modeling. For the last two decades there has been a reliance on quantitative risk assessment, yet intuitive risk assessment has been fundamental to human survival for centuries (Gilbert 2004). Therefore, it is essential that social and political factors are not eliminated from the risk assessment equation by relying only on economic modeling. These qualities are important in preventing judgment decisions being made on *assumptions* rather than empirical evidence in cases where there is uncertainty or ignorance in the risk assessment.

Russell (1986) stated that the available information on the risks of diseases and their prevention rarely provides precise estimates of these risks and they are often very imprecise. It is often not clear which is riskier, the disease or the preventative measure. But he concluded that the true benefit of any preventative action was the value individuals placed on the outcomes produced by the procedure and how they valued them in comparison with alternative outcomes (Russell 1986 in Basch 1994 p81). Media campaigns play a large role in shaping the perceived risks of infectious diseases and their prevention for the public. The media emphasises the perceived benefits of vaccines and minimises the risks. An example of the minimisation of vaccine risks is the smallpox vaccine. In the 1960's compulsory smallpox vaccination in the US was stopped because it was realised that more harm was being caused by the vaccine than from smallpox disease (Basch 1994 p81). In many countries globally, both developing and developed, there is a low public understanding of the procedures for clinical trials and the processes intended to ensure their integrity in their conclusions (Basch 1994 p82). Government decision-makers and the public are expected to trust that the claims about safety and efficacy of vaccines have been produced with integrity. Clinical trials are very complex and developed nations often work with developing countries in trialing new vaccines. This can lead to claims of 'cultural

imperialism' or unethical conduct if there is an appearance that populations are being selected because they are uninformed about the risks/benefits of the procedure (Basch 1994 p83). Local communities in developing countries are often suspicious of the real motives for clinical trials because they are introduced by western nations and sponsored by pharmaceutical companies.

4.11 Conclusion

Australia's National Immunisation Program (NIP) has been developed by the Federal government as a recommendation to the states and territories under the Public Health Acts. The public health laws were reformed in 1999 and the regulation of infectious diseases was placed under infectious disease law and separated from other public health issues - sanitation and environmental control – that were traditionally associated with infectious disease control. This resulted in the use of different methodologies for determining the health risk for infectious diseases and many other environmental health hazards. Risk assessment for infectious diseases is performed by computer modeling however for many other environmental health hazards, including the microbiological risk from food pathogens, it is determined using the Environmental Health Risk Assessment (EHRA) Guidelines. See Appendix 6. This framework for risk assessment is believed by environmental health practitioners to represent the most systematic and transparent method for assessing health risks for environmental hazards in genetically diverse communities.

Risk assessment for environmental hazards must include both technical and non-technical information. This is to address the limitations and uncertainty in the science. Gaps in scientific knowledge result in incorrect value judgments about safety and this can be countered with caution and non-technical input if the gaps in the science are acknowledged. The EHRA framework also ensures that the community is consulted regarding their perceptions of the risk of a hazard. A rigorous risk assessment can stand up to scrutiny by all stakeholders and the public must be encouraged to openly debate vaccination policies to maintain population health. The public perception of risk is essential to policy development to ensure that *health* is the primary focus of the policy. There are many variables and assumptions in computer modeling that are not made transparent to the public or government ministers. In addition, the precautionary principle (PP), with the onus of proof

on the proponent and not the general public, has not been adopted in infectious disease law. When the PP is not implemented with the onus of proof of harm on the proponent instead of the general public, it is possible for governments to claim there is no evidence of harm therefore no action needs to be taken, based on a lack of scientific evidence due to appropriate studies not being funded. The public cannot be provided with definitive evidence if the studies have not been funded.

A universal management strategy that carries a risk to sub-groups in the population needs to be openly debated by the community. The dominance of scientific experts in vaccination policy is questionable because of the increasing gaps in scientific knowledge due to undone science. This can synchronise with a lack of transparency in risk assessment to compromise health management strategies. A dependency on scientific experts and elite knowledge from computer models results in the exclusion of public participation in policy debate. Yet the existence of unfunded research in the underpinning knowledge (see Chapter 6) needs to be debated and addressed with non-technical information in policy decisions. The corporate model of health that was adopted by the states and territories in the 1990's allows corporations to fund health promotion programs, such as vaccination, to the public in media campaigns. If industry funding is involved in health promotion campaigns it is possible for vaccine manufacturers to influence public behavior through the selection or framing of information. The case study of the *Swine Flu Pandemic* in 2009 illustrates how the framing of disease statistics in the media can misrepresent risk and influence public behavior regarding the use of vaccines.

Surveillance statistics can be misrepresented to the public by changing the definition of the disease or changing the surveillance of the disease without publicising the changes. This information can then be promoted to the public in health promotion campaigns in the media that are funded by corporate partnerships. The media is not accountable for the information it provides to the public and the community is expected to *trust* that the information provided is in the public's best interest. This situation can compromise public health because industry promotes industry interests which are not always compatible with the public interest. Industry became more involved in health research and promotion in the latter part of the twentieth century with the development of the medical-industrial

partnership in institutions and public-private partnerships to sponsor health programs. These have been discussed in Part 2 of the thesis: Corporate Influence and Undone Science in Public Policy.

Chapter Overview

Chapter 5 describes the scientific medical model of health and the ethical values inherent in health promotion and chapter 6 discusses the influence of corporations in the production of scientific knowledge. In chapter 7 I discuss the information the government provides to the public to support its claims about vaccines. Chapter 8 introduces the concept of undone science and the political framework that leads to its existence. Examples of undone science and industry influence in government vaccination polices are provided in case studies in chapters 9 and 10. Chapter 11 presents the conclusions drawn from this investigation.

CHAPTER 5 PUBLIC HEALTH POLICY AND HEALTH PROMOTION ETHICS

5.1 Introduction

Investigating government vaccination policies requires an analysis of the value system and beliefs underpinning the policy. This can be achieved by examining the health model that has been adopted for health promotion and the cultural environment in which it is implemented. Public health policy involves ethical issues regarding the balance between the health of individuals and community health. It is a political process that is influenced by many stakeholders who have interests other than health in these policies. Examining the main influences in the development of vaccination policies will help to assess whether the policy has been driven by the health needs of the population or economic and political interests in these policies.

This chapter examines the adoption of the scientific medical model (SMM) as the main foundation for Australia's public health policy. It provides an outline of the main features of this model with a comparison to the holistic model of healthcare. A description of the partnership between medicine and industry that developed over the 20th century is also provided. This medical-industry complex has significantly influenced society's beliefs about health and has shaped our modern beliefs about the prevention of infectious diseases. In particular this partnership has influenced the education of doctors regarding the benefits and risks of medical procedures. Moral decisions in healthcare require ethical guidelines. A discussion of the Seedhouse ethical framework is presented here with the standards that have been set by the Medical Board of Australia for the registration of medical practitioners. The *Good Medical Practice* Guidelines that are set by the Medical Board of Australia (MBA) for the registration of medical practitioners requires that practitioners support the government's NIP. Under these guidelines medical practitioners are also required to be vaccinated against infectious diseases.

In this chapter I outline the ethical guidelines that exist for the registration of doctors in Australia and the implications this has for informing the public about the risks and benefits of vaccination. I describe the ways in which mandatory vaccination policies violate human

rights and the human rights covenants that protect these freedoms. This section also provides an analysis of the political and social forces that are influencing government decisions to use a medical intervention in the prevention of disease. I have started by providing a definition of health for public health policy because this is fundamental to the expected health outcomes and evaluation of vaccination policies. In Part 2 of the thesis, Corporate Influence and Undone Science in Public Policy, I describe the influence of industry in the development of global and national vaccination policies.

5.2 A Definition of Health for Public Health Policy

Of the many definitions of health that have been used over the centuries, the one I will use for this research is derived from the Old English word for heal (*hael* meaning 'whole'). This definition states that 'health is a concern for the whole person and his or her integrity, soundness, or well-being' (Naidoo and Wills 2000 p6). This definition of health is consistent with the definition that has been adopted by the World Health Organisation (WHO) since 1948. In the WHO constitution it is stated that 'Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (WHO 1948). Traditionally, the health of the community and control of infectious diseases have been measured by the decline in the infant mortality rate (Palmer and Short 1994). However, health is more than just longevity because this measure does not reflect the morbidity in the population. Also important are the quality of life and the ability to function effectively within a given environment. (Dubos 1966 p10; McKeown 1979 p5). As environments keep changing, good health is a continual process of adapting to the multitude of microorganisms, the pollutants from our activities and the pressures of society. It can be considered that all living things are diseased and it is only the pattern of disease that changes with time and culture (Dubos 1966 p9; Burnet 1952 p106). It has been stated that the most fundamental cause of disease and health inequalities are the social conditions in which people live (WHO CSDH 2005 p4).

In contrast the meaning of health that has been utilized in the scientific medical model (SMM) adopted by most western countries is narrower and refers only to health 'as the absence of disease or illness' (Naidoo and Wills 2000 p6). Western medicine, also referred to as scientific medicine, is essentially based on a mechanistic approach to health arising

from an understanding of the structure and function of the human body and of the disease processes that occur in each separate part (McKeown 1979 p3). Whilst it is known that environmental changes play a role in the risk of disease, the scientific theory of disease prevention assumes that protection from disease can be achieved primarily through internal intervention and without knowledge of the ecological context of disease. That is, it is founded on the belief that the major determinants of health are internal mechanisms, not external environmental and lifestyle factors, and these can be targeted with medical interventions to prevent disease (McKeown 1979 p5). An illustration of the main determinants of health outcomes is provided in Figure 1. The core of the diagram represents the determinants of health that are the main focus of scientific medicine – the health dimensions within the individual – and the outer rings represent the wider determinants of health that arise from environmental, social, cultural and political factors. The WHO definition of health is inclusive of all the interacting factors in Figure 1: society structure, economic and political factors, infrastructure and the impact from physical, biological and chemical aspects of the environment (WHO 1948).

Another definition of health describes humans and the environment as a system and 'health' as a process of this ecological interaction (Friis and Sellers 2004; McKeown 1979 p45; Illich 1975 p26). This concept is inconsistent with the definition used in the scientific medical model which focuses on the health of the individual as a separate entity. A model of health that focuses on disease etiology within the individual excludes the wealth of data demonstrating that ecological factors are the primary determinants of health and disease (WHO CSDH 2005; Winkelstein 1972 p74; McKeown 1979 p78). Good health is defined differently for people living in different social and occupational environments. This is because their physical needs, food requirements and stress levels vary and they are not equally vulnerable to all diseases or infectious agents (Gilbert 2004; Dubos 1966 p10; Burnet 1952). The *Good Medical Practice* guidelines for Australian doctors also include a broad definition of health that encompasses social determinants. Doctors are required to acknowledge the social, economic, cultural and behavioral factors that influence health at both individual and population levels (MBA 2010).

5.3 The Scientific Medical Model of Health

This section describes the beliefs inherent in the model of health that has been adopted by western countries and it describes how medical education is now controlled by the industry-medical partnership which influences the belief system of medical practitioners.

The scientific medical model of health was adopted by western countries as the main belief system for modern medicine in the mid-20th century (Doyal and Doyal 1984 p90). It arose in the middle of the 18th century and was known as 'allopathy'. It is defined as 'treatment that counters illness with a treatment which opposes the illness' (Walker 1993 p3). The identification of germs in the 19th century led to the belief that illness was caused by specific biological pathogens and it became plausible to look for treatments in isolation of how a patient thought or felt (Doyal and Doyal 1984 p90; Stacey 1988 p71). If there was a problem with the body it could be treated with a chemical (such as a pharmaceutical drug) to destroy the organism or to immunize people against the effects of a harmful agent (Doyal and Doyal 1984 p90). In this model the human body is conceptualized and treated as if it were a machine (Doyal and Doyal 1984 p85; Walker 1993). The machine analogy is developed further to suggest that all the parts are interconnected but capable of being treated separately (Doyal and Doyal 1984 p.92).

Allopathy rejects the theory that the mind, the emotions and the soul are involved as causal agents in the development of illness or its treatment (Walker 1993 p3; Doyal and Doyal p85) and this places it in conflict with models in eastern countries which are founded on a holistic approach to health. Holistic medicine is founded on the belief that all parts of the body are interconnected in the cause of disease and a change in one part affects other parts (Walker 1993 p4; Stacey 1988 pp15-47). Many scientists believe that health is the interaction of the mind and body. These systems are believed to be linked so that the stress under which a person lives finds its expression in physical illness (Burnet 1952; Dubos 1966 p15: Doyal and Doyal 1984 p97). In the scientific model it is assumed that the etiology of disease is mainly biological, therefore social and economic factors are not given high significance in patterns of mortality and morbidity (Doyal and Doyal 1984 p93; Stacey 1988 pp71-77). This model objectifies human beings with its mechanistic analogy and narrow focus on etiology and bodily symptoms (Doyal and Doyal 1984 p99). It also

encourages the notion that 'passive' compliance is required to cure disease. Patients are required to 'trust' the medical experts because of the complexity of their specialized knowledge. Consequently patients become dependent and dehumanized (Illich 1975 pp31-61; Doyal and Doyal 1984 p99; Stacey 1988). Another criticism of this model is its inability to explain why there is a range of health outcomes associated with each infectious agent (Doyal and Doyal 1984 p96). For example, if an agent, such as influenza virus, is known to cause an illness it would be expected that all individuals exposed to the agent would get the illness. But this is not the case. Only a few exposed individuals show signs and symptoms of disease and these symptoms vary in severity.

An individual is more than just the sum of its parts; there is a continual interaction between the internal biology and the external environment and the organism is changed by this interaction (Birke and Silverton 1984 p3). The biology of the organism is not necessarily the primary cause of this change and in some cases the biology itself is changed by the environment (Birke and Silverton 1984 p3). The diversity of health outcomes that results from interaction with the environment and infectious agents was described in chapter 2. Since the origins of the scientific medical model there has been a continual struggle in many countries for dominance between the holistic health industry and scientific medicine (Stacey 1988 pp15-59; Walker 1993). Whilst the importance of social factors and treating the whole person has taken greater prominence since the late 20th century, the western scientific medical model has underpinned the training of doctors and health workers in most western countries for the last century (Doyal and Doyal 1984; Stacey 1988 pp47-59).

In the scientific model the terms 'disease' and 'illness' have been allocated specific meanings (Naidoo and Wills 2000 p7). 'Disease' implies an objective state of health that isn't always distinguished by visible symptoms. Instead, abnormalities in the functioning of the body can be detected by pathology or screening practices and the significance of these changes is interpreted by a medical professional (Naidoo and Wills 2000 p7). 'Illness' however is a subjective feeling of loss of health and is identified by the symptoms that are experienced. The symptoms may lead to further investigations using diagnostic tools such as blood tests and screening until the disease is diagnosed. In the scientific medical model an individual can be diagnosed with a disease without experiencing any symptoms and this

is why health can be viewed as a socially constructed entity (Naidoo and Wills 2000 p7). This has been termed 'medicalising the body' (Curry 2002 p29). Medicine is a powerful institution controlled by professional associations with vested interests (Walker 1993 p5; Naidoo and Wills 2000). It is a social enterprise that is linked to professional power (Friedson 1986 p185). Although scientific medicine is competing with a rise in self-help and holistic therapies it still remains a powerful institution because of its role in defining health and illness in society. This is also due to the elite and autonomous nature of the medical profession (Friedson 1986; Stacey 1988).

Doctors are in a powerful position due to their role in diagnosing disease and this power is controlled by professional associations who are protecting their own vested interests (Freidson 1986 p185). Bodies of scientific knowledge are considered to be a source of power over the lives of individuals. Therefore authorities who control this knowledge are able to have social control over people's lives (Friedson 1986 p1). Medicine has been described as a social activity that concentrates professional power amongst an elite group (Naidoo and Wills 2000 p15). In other words it can be described as supporting a particular type of economy: capitalism and/or patriarchy (Naidoo and Wills 2000). When biological knowledge is controlled by 'experts' with an appearance of benevolence, then individuals can become dependent upon the 'experts' for advice in all areas of family life (Friedson 1986 p1).

5.4 Culture and Medicine

Political processes that operate in policy development are moulded by the values and norms of society and by economic factors (Palmer and Short 2010 p31). The melding of medicine and industry resulted in a research focus of disease based on the internal biological structure of individuals and divorced from the environment: biomedical research (Naidoo and Wills 2000 p9). Industry believed the environment was irrelevant to the disease process (WHO CSDH 2005; Walker 1993 p8). This focus is in strict contrast to the older belief of holistic medicine that is practiced in many eastern countries and sees the health of the person within the context of their surroundings (WHO CSDH 2005; Stacey 1988; Walker 1993 p8). In recent decades practitioners and the community have become divided over the best strategies to adopt in managing health. There has always been a division between

curative medicine and preventative medicine (Stacey 1988 pp15-60; Naidoo and Wills 2000 p11). This division in society is thought to exist because doctors in western countries are being educated on the benefits of medical treatments without an equal emphasis of the risks (Rogers pp64-65; Naidoo and Wills 2000 p12). In addition, there is a lack of emphasis on the social, environmental and nutritional links to illness that would assist in the prevention of disease (WHO CSDH 2005).

A broader conception of health that includes the social and environmental determinants of health and recognition that all medications have side-effects provides strategies for reducing both infectious disease and chronic illness in the population. The prevalence of chronic illness has been increasing in western populations since infectious diseases declined in the mid–20th century (Illich 1975 p17; WHO 2013). During this time the use of medical interventions in the prevention of disease has significantly increased. Cochrane stated that most medical interventions used in 1972 had not been proven effective prior to their widespread use and he advocated for the evaluation of medical interventions in controlled clinical trials (Cochrane 1989 pp431-432). There was a significant increase in pharmaceutical drug use from 1950-77 and the negative consequences of frequent drug use were being recognised by 1984 (Rogers 1984 p65). Until the 1960's there was a lack of research on the effectiveness of western medicine. This was because research techniques to objectively evaluate interventions had not been developed. The randomized control trial was introduced in 1952 but few medical interventions had been evaluated even in the 1960's (Cochrane 1989 p432). The Chinese have continued to use medicinal herbs extensively because they are considered less toxic than pharmaceutical drugs and some are more effective (Rogers 1984 p65; Garrett 2012a). Some natural remedies are biologically successful and through years of trial and error they have been tested in many more individuals than modern drugs at the time of their release (Rogers 1984 p65). In 2012, the Council on Foreign Relations stated there is a lack of independent testing on many pharmaceutical drugs and vaccines and also many natural remedies. Many pharmaceutical drugs/vaccines have a high risk of side-effects and no proven efficacy (Garrett 2012a).

Even in 2008 the European Commission (EC) was estimating that adverse drug reactions (ADR) kill 197, 000 European Union citizens annually at a cost of €79 billion (EC 2008). It

was also estimated that ADR's represent 5% of hospital admissions and are the fifth most common cause of hospital deaths (EC 2008). Clinicians and scientists stated in 2011 that ADR's have reached epidemic proportions and are increasing at twice the rate of prescriptions. This is in part a result of a lack of adequate evaluation before drugs are approved for the market (Archibald et al 2011 p1915). Obomsawin observes that the universal childhood immunisation program (EPI) has never addressed the need for effective monitoring and proper evaluation of potential side-effects from vaccines (Obomsawin 1998). He states:

'Past estimates on the degree of adverse reactions are unreliable and optimistic since actual monitoring efforts are generally negligible.' And

'Overall, the evidence strongly suggests that the chronic underreporting of vaccine-induced morbidity, disability and mortality is in fact the norm, whether in the Developing or the Developed Worlds. The first definitive policy statement on this issue by the World Health Organisation (issued on April 1991) indicates the WHO's recognition of the significance of this problem' (Obomsawin 1998 p2).

Culture plays a significant role in the belief systems adopted by different countries as can be seen in the use of the scientific medical model in western societies. These societies use capitalist markets to encourage the maximum production and consumption of goods (Fitzgerald 2001 p73). The ideology of the market presents a dilemma when applied to health because many health outcomes are dependent upon a change in behavior, diet or the environment that operate largely outside the value of the markets. Furthermore, many of the medications that can be purchased are increasing illness in the population through adverse reactions and interactions in body systems (Archibald et al 2011).

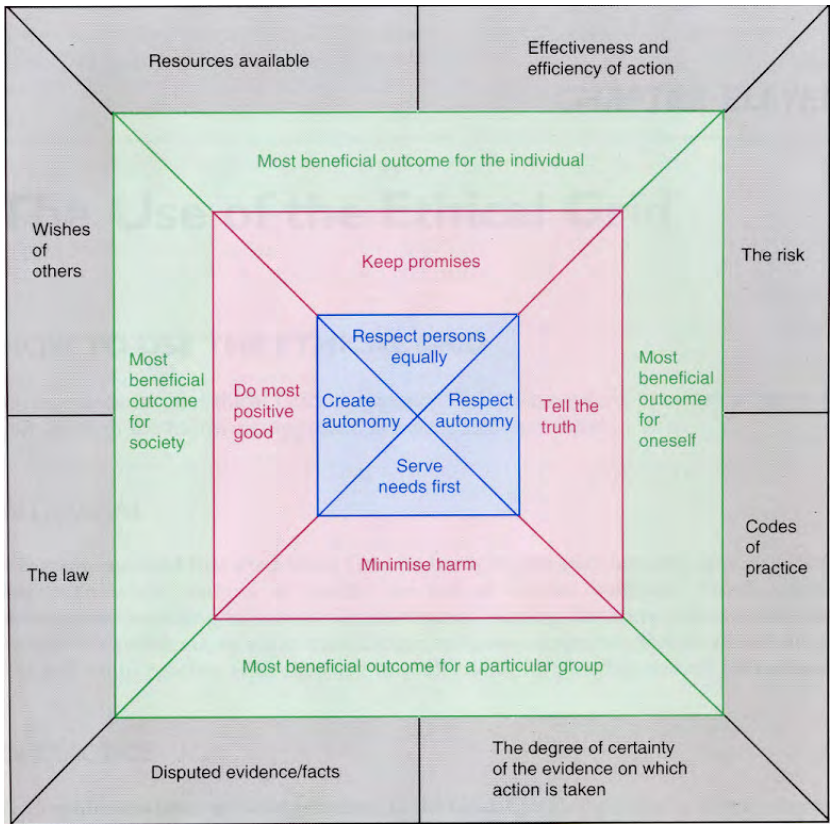
5.5 Ethical Guidelines for Health Promotion

In today's society codes of ethics provide only a general guide to moral decisions on health because people live longer and quality of life needs to be recognised in the decisions that are made. Different groups have different perspectives on the risks and benefits of different procedures. This is due to their values, and what they stand to gain or lose in the decision-making process (Palmer and Short 2010 p51). It is also a product of their education. There

are two levels at which ethics needs to be addressed: micro-level ethics between patients and doctors and macro-level ethics in policy decisions that involve the rights and responsibilities of governments, communities and individuals (Palmer and Short 2010 p51).

The ethical principles that have been utilised for decades by health practitioners to guide moral decisions have been illustrated in the grid developed by David Seedhouse (2009). This is illustrated in Figure 7.

Figure 7: The Seedhouse Ethical Grid



Source: Seedhouse 2009 p144

This grid provides a tool for making value judgments about medical procedures. It represents elements that should be part of a thorough reasoning process in the development of public health policy (Seedhouse 2009 p144). The core rationale of health ethics is found in the blue layer at the centre of the grid. These four boxes represent a simplification of the

key elements of the foundations theory of health: i) create autonomy ii) respect autonomy iii) respect all persons equally iv) serve needs before wants.

Seedhouse (2009) states 'All plausible theories of health equate work for health in some way with the creation of autonomy' (p144). He claims health work has always been driven by the goal of autonomy. In addition, the WHO's definition of health, described earlier, is only achievable by creating autonomy in individuals.

Autonomy underpins healthcare in the following ways (Seedhouse 2009 p145):

I. Under western law consent is essential in any healthcare intervention. Practitioners are required to provide clients with sufficient information about treatments to enable them to make an informed decision. In western countries it is a civil or criminal offence to provide an intervention without consent. This is also required conduct in the Good Medical Practice Guidelines for Australian doctors (MBA 2010).
II. As health problems are no different to other problems that affect people, a healthcare professional has no special training or right to force their 'judgment' of the correct procedure onto a patient. The only situation where this may be acceptable is when an individual's welfare is demonstrated to be seriously at risk or if an action will be harmful to the public interest. But the latter must be supported by a consensus from all stakeholders.
III. Health work should enhance human potential and not diminish human potential - unless the procedure is to prevent a worse harm from occurring. Autonomy is created by enhancing human potential.

Interventions that make no attempt to increase autonomy (or even remove autonomy) are not health work (Seedhouse 2009 pp144-45). There are two definitions of autonomy provided by Seedhouse (2009):

1) Being able to do
2) Being able to have one's choices

The principle of autonomy includes both respect for patient welfare *and* allowing patients to be in control of decision-making. These elements cannot be separated because autonomy is a personal quality and both aspects are necessarily connected (Seedhouse 2009 p147). It means that a person is able to 'do anything rather than nothing'. Therefore you might have a small degree of autonomy or a lot of autonomy.

All healthcare work should aim to provide patients with as much autonomy as possible (Seedhouse 2009). The foundations theory of health states that health is supposed to remove obstacles that stand in the way of human potential (Seedhouse 2009 p151). For example, practitioners need to remove ignorance by providing adequate information for clients to make an informed decision or to remove restrictions that are created by the desires of others and not the welfare of the patient. Creating autonomy by removing these obstacles can be seen as a pre-requisite for respecting autonomy (Seedhouse 2009). Health workers are limited by their training and understanding of health issues so their duty to create autonomy may be limited (Seedhouse 2009 p149). Health education can become indoctrination if practitioners do not create and respect autonomy (Seedhouse 2009 p159). The knowledge gap between healthcare workers and patients makes patients susceptible to 'trusting' their doctor hence respect of autonomy is necessary to ensure that patients are not manipulated into certain procedures without good evidence and reason. The question of whether welfare should ever take precedence over the right to choose is dependent upon the situation. In scientific medicine there is a tendency towards paternalism where doctors present their perception of what is in the patient's best interest and this can often be given a higher priority than the patient's right to choose (Seedhouse 2009 p157).

The Seedhouse Ethical Grid includes six main principles that practitioners should respect when providing healthcare advice to patients. These are:

1. Respect for autonomy: a respect for the rights of individuals and their right to determine their lives.
2. Beneficence: doing good
3. Non-malfeasance: doing no harm
4. Justice: being fair and equitable
5. Duty to care

6. Duty to be truthful

These principles form a framework to ensure there is a moral foundation in the decision-making process regarding health promotion. Healthy outcomes for individuals and the community depend upon the inclusion of these values. If a medical procedure is adopted in a public health policy, the evidence for its use must be in accordance with these ethical guidelines. This will ensure that more good than harm will be produced by this action.

5.6 Conduct for Australian Medical Professionals

The Australian Medical Association (AMA) has a code of conduct for medical practitioners that combines the 2,500 year old Hippocratic Oath with the guidelines presented by the World Medical Association (WMA) in the Declaration of Geneva (AMA 2006). The Hippocratic Oath is an oath taken by new physicians that requires them to uphold ethical standards (US NLM 2002). This oath is not required by most modern medical schools and has been re-written by many schools to suit the different cultural values and issues in the 21st century (NLM 2002). The Hippocratic Oath states that doctors will 'do no harm or injustice' to their patients (NLM 2002). Under the AMA's code of conduct new medical practitioners take a vow to abide by the principles that have been set by the WMA (AMA 2006).

Guiding principles are adopted by the AMA to ensure that the actions taken by doctors are in the best interests of the client. These principles include the following two commitments and many others (AMA 2006):

- The health of my patients will be my first consideration.
- I will not use my medical knowledge to violate human rights and civil liberties even under threat.

In Australia, the Medical Board of Australia (MBA) has set a national code of conduct for a medical practitioner that complements the *Code of Ethics* developed by the Australian Medical Association. This code is set out in a document titled *Good Medical Practice* to inform the community of the principles underpinning the ethical and professional conduct of doctors (MBA 2010). It is a framework to guide professional judgment and it states that

the principles should not be compromised. Every doctor is required to adhere by these ethical standards to maintain their medical registration (MBA 2010 p1).

The guidelines of good medical practice encourage doctors to recognise and respect the rights of patients to make their own decisions about healthcare, which is compatible with the Seedhouse ethical grid. Doctors are directed to encourage patients to take responsibility for their own health and to support them in this endeavor (MBA 2010 p3). Decisions should be a shared responsibility between the doctor and the patient. In particular, the guide emphasises the need for informed consent regarding any medical intervention. It states that an examination, investigation or treatment should not be provided without obtaining informed consent or other valid authority (MBA 2010 p6). The Australian Immunisation Handbook (ed 10) (section 2.1.3) also states that informed consent for vaccination 'must be given voluntarily in the absence of undue pressure, coercion and manipulation' and 'it can only be given after the potential risks and benefits of the relevant vaccine, risks of not having it and any alternative options have been explained to the individual'. This is compatible with the statement in the *Good Medical Practice* Guidelines. However, there are many serious risks to vaccines listed on the Product Information for each vaccine that most Australian parents are not informed about before they give their consent. Most parents are also not shown the list of vaccine ingredients in the Australian Immunisation Handbook (Appendix 3) before they give their consent. Furthermore, they are required to get a doctor's signature to *refuse* this medical intervention instead of giving their consent to *receive* it. This is contrary to the MBA guidelines and the Australian Immunisation Handbook.

The *Good Medical Practice* guidelines emphasise the right of Australian doctors to choose not to provide or participate in *treatments* if they do not support them (MBA 2010 p3). However, vaccination is not considered to be a treatment but rather it is intended to be a *preventive measure.* Another directive states that doctors must be aware of their obligations in disease prevention*,* screening and reporting of notifiable diseases (MBA 2010 p10). A doctor's 'obligation in disease prevention' is to support government vaccination policies because they are an accepted medical practice of western medicine. Doctors 'must be aware' of the guidelines set for the promotion of government vaccination policies and 'they

must immunise themselves against relevant communicable diseases' (MBA 2010 p16). The code of conduct states that doctors must adhere to these guidelines or they risk being de-registered from the medical profession. Academic freedom to speak the truth on medical issues is curtailed when the knowledge is linked to a person's livelihood. Ziman (2000) states 'science cannot be expected to speak truth to power unless power is forbidden to talk back' (p162). Hence requiring doctors to support government vaccination policies to maintain their registration has consequences for the health of society if they are unable to speak openly about the risks of vaccines without fear of de-registration.

Doctors encourage patients to use vaccines because they are educated, with influence from industry (see chapters 6 and 7), to believe that vaccines were the most important intervention in the decline of risk from infectious diseases. They are also informed that serious adverse events to vaccines are rare (AAS 2012). Current vaccination policies transgress two principles of western medicine (Obomsawin 1998):

1. Preventions and treatments should be individualized, particularly when injecting substances into the human body that carry the potential for disease, disablement and death.
2. The objectively informed patient (or parent) should always have absolute freedom to accept or reject any given measure or therapy and have reasonable opportunity to consider alternatives.

5.7 Public Health Policy and Human Rights

In this section I describe the international human rights covenants that protect the right to privacy (including bodily integrity) and non-discriminatory social welfare policies. Governments have a duty to uphold international human rights covenants in the design of public health policies. If a policy infringes upon human rights the government is required to show that the action is for a legitimate public health purpose, that it is proportionate to the risk and that it is formalised in law. The information discussed here is largely referenced from the Parliamentary Reports published by the Australian Human Rights Commission.

McGavin (2001) suggests that if the principal differences in risk estimates for an environmental hazard are value-based one has to seek consent or at least ensure that actions

do not transgress the rights of others before an intervention is adopted (Hicks 2004 p163). Government public health policies are always value-based because they are made on political decisions from the available scientific evidence. Australian vaccination policies are linked to social welfare benefits and employment. These policies coerce individuals, with financial incentives, to use a medical intervention and this infringes upon the *healthy* individual's right to choose how they maintain their own health without coercion or manipulation. The International Health Regulations (IHR's) require that health measures against persons are appropriate to the risk and no more intrusive or invasive than reasonably available alternatives that would achieve the desired level of health protection (Fidler and Gostin 2006 p87). The Australian government states that public health policy can infringe on human rights if it is demonstrated to be for a legitimate public health purpose, proportional to the risk and done by law (HRC 2013).

Human rights are covered in many international covenants. The International Covenant on Economic and Cultural and Social Rights (ICECSR) protects the individual's right to autonomy over their own body (bodily integrity) as well as the community's right to non-discriminatory social welfare policies. Article 17 of this covenant is the Right to Privacy that includes 'the right to personal autonomy and physical and psychological integrity over one's own body' (AG APb p58) and Article 9 is the Right to Social Security that includes the requirement that social security 'is accessible (providing universal coverage, without discrimination and qualifying and withdrawal conditions that are lawful, reasonable, proportionate and transparent' (AG APb pp105-6). Under the ICECSR covenant the Australian government has a duty to ensure that the right to social security is available to Australians in a non-discriminatory manner or to justify this violation of human rights.

The government's vaccination policies discriminate against some healthy children/adults on the basis of vaccination status and these have been implemented despite the government continuing to claim that vaccination in Australia is not compulsory (AG IAP 2015). This has also occurred even though there is no requirement in any Australian health act or in regulations or legislative health instruments under these acts that compel a person to accept the administration of a vaccine (AG DHA 2013). The increased use of coercive measures in vaccination policies corresponds with government recommendations to use an increasing

number of vaccines in the Australian population (AG IAP 2013). See chapter 3. These policies are not equitable because they expose some groups in society to a greater risk from vaccines than others. This applies especially to individuals who depend upon social welfare benefits and in some professional areas of employment. The government has also not informed the Australian community that government vaccination policies are guided by directives from the GAVI/WHO alliance under global public health policies that are developed with influence from pharmaceutical companies. See chapters 3, 6 and 8. These features of government vaccination policies arguably conflict with the principles of the Seedhouse Ethical Grid (respect for individual autonomy, truthfulness and justice) that are used to guide moral decisions in health promotion. Seedhouse states that all *plausible* health policies that are designed to promote health should include the creation of individual autonomy, not its removal (section 5.5).

The Australian government's Immunise Australia Program website also carries a disclaimer that states (AG DH IAP 2015):

> All the material published on the Immunise Australia site is for information purposes only. The information contained on this site is not a substitute for, and is not intended to replace, independent professional advice. Users should consider the need to obtain any appropriate professional advice relevant to their own particular circumstances.
>
> The material contained on this site may include the views or recommendations of third parties, and does not necessarily reflect the views of the Commonwealth of Australia, or indicate a commitment to a particular course of action. This site may contain references to other sites and these are provided for convenience only and should not be construed as an endorsement by the Commonwealth of Australia; conversely omissions should not be construed as non endorsement.
>
> The Commonwealth of Australia does not warrant or represent that the information contained on this site is accurate, current or complete. Users should exercise their own independent skill or judgment or seek professional advice before relying on it. The Commonwealth of Australia does not accept any legal liability or responsibility

> for any injury, loss or damage incurred by the use of, or reliance on, or interpretation of, the information contained on this site.

This disclaimer clearly states that the government does not accept responsibility for the information it provides to the public to support vaccination programs, either as being accurate or complete. In particular, the government directs members of the public to use independent advice that is specific to their own circumstances. The government states that the actions recommended on the Immunise Australia Program website may be from a third party and they do not necessarily 'indicate commitment to a particular course of action' by the Commonwealth Government of Australia. Yet the Australian government is using the recommendations on the IAP website to legislate mandatory vaccination in social welfare policies. This course of action infringes on human rights even though the Commonwealth of Australia is not stating that it supports the recommendations provided on the IAP website. In particular, mandatory vaccination in social welfare polices contradicts the government's statement above that 'Users should exercise their own independent skill or judgment or seek professional advice before relying on it.' The recommendations on the IAP website are stated to be for a legitimate public health purpose yet the government is not claiming that the information is accurate, current or complete or that it supports the course of action recommended.

5.8 Conclusion

In the mid-20th century there was a change in focus in Australia's public health policies from the social and environmental determinants of health to the use of vaccines, a medical intervention, as the main focus for disease prevention. This was in line with progress in scientific (western) medicine that considers most causes of infectious disease to be biological and initiated from within the individual. Consequently it has a narrower focus on etiology that discounts the influence of environmental, political and social causes of disease. The central aim of the scientific medical model of health is to reduce morbidity and mortality in the population by increasing the use of medical interventions. This is evidenced in the development of Australia's vaccination policies which show an increase in the number of vaccines recommended by the government, and an increase in coercive measures, as the threat from infectious diseases declined. When powerful associations

shape medical knowledge they can influence the behaviour of individuals in society through public health policies. In Australia the medical profession and the pharmaceutical industry have a major role in determining areas of health policy with limited input from other interest groups, particularly the public on whom this policy is enforced. This situation can result in the appearance of a scientific consensus on vaccination because these professional bodies can choose the research topics that will be funded. When evidence is selected to support a desired outcome in a health policy the status quo can be maintained. The political framework that enables evidence to be selected for government policies is described in chapter 8. This outcome is also achieved by the professional medical associations through the regulation of doctors' education and by the standards set through the *Good Medical Practice g*uidelines. Medical practitioners in Australia can be de-registered from the profession if they do not comply with the standards and regulations set by the Medical Board of Australia (MBA). This means doctors are not free to present their personal assessment of the risks and benefits of vaccination because their professional regulations require them to support government vaccination policies.

Vaccines were adopted as the primary preventative strategy for infectious diseases from the 1950's onwards. The sales of drugs and vaccines increased in the 1980's when the free market economic model was adopted in Australia even though the safety of many of these products had not been established in properly designed clinical trials. In this political model industry can provide financial incentives to doctors to increase the sales of their products. They can also provide sponsorship for doctors' education. When financial incentives are provided to enhance a doctor's livelihood the ethical guidelines for health promotion can be overlooked and this puts patient health at risk. Gaps may exist in the scientific knowledge that are essential to predicting health outcomes, yet these can be ignored if information is presented to doctors and patients in a selective manner or if conflicts of interest exist in decision-making boards. Doctors trust that they are getting a balanced education and in general patients trust the advice provided to them by doctors. Patients and doctors are dependent upon the information they receive to make an informed decision on a medical procedure. Consequently, maintaining patient autonomy and informed choice regarding medical interventions is fundamental to maintaining the health of populations. This is particularly important when the integrity of medical science, and sponsorship of education,

can be influenced by political and cultural factors. A policy that removes these values contravenes the guiding principles stated in the Seedhouse Ethical Grid for the promotion of health in the population.

Estimating the risk from an infectious agent depends upon the method of measuring disease burden in the community – case-fatality or incidence of the disease (see chapter 4). These methods are value-based and ethical guidelines imply that governments should seek the consent of the community before value-based interventions are implemented in public policy. When policies are presented in a benevolent manner, infringements on human rights can be overlooked if the community places unwarranted trust in the medical profession and the government. The public's interest in these policies should not be compromised by the economic or political interests of special groups. The Australian government has not provided adequate evidence for coercive measures in vaccination policies or that the recommended actions are proportionate to the risk of infectious diseases in Australia. These actions are also not included in any laws under Australian health acts. In addition, they are being implemented whilst the government states that vaccination in Australia is not compulsory. When certain political structures exist, governments can claim a procedure is safe simply because there is a *lack of evidence* for the public to prove otherwise. This is termed 'undone science' and the political structures that lead to areas of unfunded research relevant to public health policy are described in Part 2 of this thesis 'Corporate Influence and Undone Science in Public Policy'.

Part 2 Chapter Overview

The influence of corporations in the production and promotion of science is described in chapter 6 and a discussion of the government's claims about the safety and efficacy of vaccines is provided in chapter 7. In chapter 8 I describe the political framework that allows increasing areas of undone science to exist in the design of public health policy. Chapters 9 and 10 provide case studies of the HPV vaccine and the 'Swine Flu' 2009 vaccine to illustrate the influence of politics and corporations in the development of global and national vaccination policies. Chapter 11 provides the conclusions to this investigation.

CHAPTER 6

INDUSTRY INFLUENCE IN RESEARCH AND POLICY

6.1 Introduction

Cultural and political changes that have occurred since the mid-to late 20th century have resulted in government public health policies that have been increasingly influenced by corporate lobbying and sponsorship of research and education. The expansion of industry-sponsored university research during this time has led to a shift in the way knowledge is produced and published by academic institutions. There has been a decline in the autonomy over the production and transparency of academic knowledge. The commercialisation of scientific knowledge has changed the structure of academic institutions and this has been accompanied by a change in the traditional culture and values under which scientific knowledge is produced. The biggest area of commercialization in science has been in the biomedical and health sciences. In the era of globalisation research is being driven primarily for profit and not just for its contribution to knowledge.

This chapter describes the changes that have occurred to research institutions over the past fifty years and the way this has altered the culture and integrity of the scientific knowledge that is produced. I have provided specific information about the corporate influence in medical research from the US because this is where it is best documented but drugs are a global industry and these practices are occurring in (and affecting) many countries. The vaccine industry has expanded rapidly over the last two decades and regulatory processes have not kept pace with vaccine production. The effects of this rapid expansion on the regulatory processes for vaccines are described in this chapter. I have also described the conflicts of interest (COI) in medical research and policy development that can lead to a bias in the underlying science in the medical literature and in government public health policy. As there is no formal enforcement of values in medical research the public is dependent upon the honesty and integrity of the peer-review process to validate scientific knowledge. This chapter describes the influence of academic-industry partnerships on the peer-review process of scientific knowledge. Doctors are dependent upon their medical

education to make the best value judgments for their patients. To achieve healthy outcomes the information they receive should not be influenced by corporations that make a profit out of health interventions. I have described how industry sponsorship of the education of medical professionals influences the treatments that doctors provide to the community and also the direction of government public health policies.

This information is not a criticism of the involvement of industry in medical research per se or to suggest that capitalism cannot produce good science. It is to recognize that these influences can result in biased science and that transparency and patient autonomy in the use of all medical interventions are the key principles in maintaining healthy communities. The problems described in this chapter are still rife today even though it has been claimed that many of them have been addressed (Goldacre 2012 pxi).

6.2 The Academic-Industry Partnership

This section is informed especially by Marcia Angell because of her role as former chief-editor of the *New England Journal of Medicine* (NEJM) for 20 years. Her vast experience as the editor of this prestigious medical journal has led to many conclusions that are supported by other prominent authorities that are also cited in this section.

In the era of globalisation industry is providing funding for academic institutions, medical institutions and government bodies (Krimsky 2003; Angell 2005; Michaels 2008). The new image of a 'scientist' in the 21st century is the person who can make contributions to knowledge while participating in converting the new knowledge into a product for the market (Krimsky 2003 p1). This is termed *knowledge or technology transfer.* To facilitate technology transfer, university-industry partnerships have been established to direct research towards profit. In this new structure of academic institutions research ideas are patented by the industries that sponsor the research (Krimsky 2003 p30). Consequently it is possible for ambition and career success to bias the assessment of the research. This can erode the integrity of scientific institutions and eventually produces mistrust and scepticism in the general public (Krimsky 2003 p2). Partnerships with industry became common after the 1970's and 80's when universities needed to diversify their funding sources to remain

competitive. At this time there was an anti-regulatory atmosphere in the governments of many countries that facilitated the pathway to privatisation (WHO CSDH 2005). It became popular for universities to partner with the private sector and generate wealth by selling their knowledge and licensing discoveries (Krimsky 2003 pp28-9). The process of commercialising universities required changes to the laws. In the USA several congressional Acts, such as the Patent and Trademark Amendments Act (Bayh-Dole Act) and the Technology Innovation Act of 1980, were passed and tax incentives were provided by the government to encourage partnerships (Krimsky 2003 p30).

Many of the laws that were passed in the US Congress in the 1980's were designed to speed up the 'technology transfer' of government funded research into useful products. In particular, the Bayh-Dole Act granted patents to universities, small businesses and non-profit institutions from the research sponsored by the US National Institute of Health (NIH) (Angell 2005 p.202; Krimsky 2003 p30). This gave institutions title to the inventions made with federal research funds. It enabled exclusive licenses to be granted to drug companies for these patents. Prior to this Act, tax-payer funded research was in the public domain. Universities could subsequently patent and license their discoveries and also charge royalties (Angell 2005 p202). Sponsors can also own the clinical data, a practice that results in censorship of the medical literature (Goldacre 2012 p39). These political changes were a significant boost to the biotechnology and pharmaceutical industries and encouraged the establishment of many new biotechnology companies (Angell 2005 p202). It is now common for both academic researchers and their institutions to own equity in the biotechnology companies they are collaborating with. Therefore when a patent that is held by a university or a small biotechnology company is licensed to a drug company, the shareholders and employees will benefit financially from this publicly funded research. In medical schools prior to 1980 academic investigators who carried out industry-sponsored research rarely had conflicts of interest (COI) with their sponsors. However, since 1980 the medical schools themselves have a variety of deals with industry and are therefore not in a position to object to researchers behaving in the same way (Angell 2009). Conflicts of interest in industry funded research result in a systematic bias towards industry interests (Goldacre 2012 p38).

The Bayh-Dole Act transformed the ethos of medical schools and teaching hospitals to capitalize on research discoveries in medical schools. Many lucrative financial deals were established with drug companies in the 1990's and this has led to a significant 'pro-industry bias' in the medical research that is presented to governments for use in public health policies (Angell 2005 p202). This situation was demonstrated in a survey of medical schools in 2003 which showed that the majority held equity interest in companies that were sponsoring the research within the same medical institution (Angell 2009). An investigation of the department chairs also found that the majority received income from pharmaceutical companies for the department and most received personal income as well. Although medical schools were issuing guidelines in the 1980's about conflicts of interest, they were variable, permissive and loosely enforced (Angell 2009). In the 21st century, there is not 'a single sector of academic medicine or medical education in which industry relationships are not ubiquitous' (Stamatakis et al 2013 p469).

The academic–industry partnership spread globally in the late 20th century and this has meant that pharmaceutical companies do not rely on their own research for new drugs. Consequently the production of prescription drugs tripled from 1980–2000. Prior to this, sales of drugs were static but the corporatization of medicine paved the way for the pharmaceutical industry to become the most profitable industry in America (Angell 2005 p203). The global pharmaceutical industry is a $600 billion industry 'rife with corruption and greed' (Goldacre 2012 p x). In 1980, the US Patent Act was altered to remove the requirement that patentable inventions should be 'novel, useful and non-obvious'. This change opened the door to acquiring patents for many more 'inventions' (Angell 2005 p176). The monopoly rights for brand-name drugs were further extended with the 1984 Hatch-Waxman Act. This meant that copies of the drug (generics) can only be placed on the market when the rights expire (Angell 2005 pp178-179). In addition, generic drugs do not require clinical trials to test for safety and efficacy before they are licensed by the FDA if they contain the same active ingredient as the brand name drug (Angell 2005 p179). Further, half the drugs approved in the US by the FDA from 2005-2011 were approved without companies having to demonstrate a measurable benefit of the drug (Downing et al

2014). The FDA did not require proof of the benefit of drugs that had innovative chemical structures, termed New Molecular Entities (NME). The risk-benefit profiles for drugs are not properly determined because active placebos, surrogate end-points and small sample sizes are being used in many clinical trials (Downing et al 2014).

The Act extending the monopoly rights on drugs through the US Patent and Trademark Office (USPTO) ensured that creating a monopoly and extending it for as long as possible was a very profitable activity (Angell 2005 p173). Industry could also increase its profits by obtaining exclusive marketing rights from the FDA. The monopoly rights for blockbuster drugs, those that earn over a billion dollars per year, such as the HPV vaccine, are golden for the pharmaceutical companies and can now extend for more than 20 years (Angell 2005 pp174-178). Pharmaceutical companies can extend this patent by licensing the drug for other diseases. Throughout the 1980's there was a rapid growth of US university-industry relationships particularly in the area of biotechnology. This type of sponsorship was 20% higher in biotechnology than any other sector and nearly 50% of biotechnology companies were sponsoring university research at this time (US Congress OTA 1988 in Krimsky 2003 pp31-32). During this decade at least 11 multimillion-dollar contracts for research in biotechnology were issued. Sponsorship by biotechnology companies in US universities reached $120 million by 1984. This figure represented 42% of all industry-sponsored university research (Krimsky 2003 pp31-32). This is relevant to vaccination policies because nascent biotechnology is being used to produce new vaccines for many communicable and non-communicable diseases and also new combination vaccines for childhood diseases.

6.3 The Influence of Industry Sponsorship on Medical Research

In the US and many other countries, university scientists play a crucial role in providing evidence for laws and policy. In the 21st century science is being produced with industry funding and goals which mean that 'expert' opinion can now be bought with a point of view (Michaels 2008 p47; Krimsky 2003; Angell 2005). Bias has affected the outcomes of all stages of the scientific process. This has significant consequences for policies and laws that are implemented in the public interest because these should be founded on a balanced

assessment of the body of research on a topic. The commercialisation of science has led to the pharmaceutical industry selling drugs to the community without performing properly designed randomised clinical trials (Kleinman 2005 p13; Angell 2009 pp109-114; Garrett 2012; Goldacre 2012 p2; Downing et al 2014). Industry-sponsored studies downplay the side-effects of drugs, with only the benefits being emphasised to doctors and the community (Stamatakis et al 2013 p470; Goldacre 2012 p2). This situation has been made possible because of the influence of industry funded sponsorship in research grants and clinical trials, and in medical education. Industry funds, designs and controls a large portion of the most influential medical research and education (Stamatakis et al 2013 p470).

There is increasing direct evidence of the manipulation of results in industry funded trials (Stamatakis et al 2013 p470; Goldacre 2012 p21). Ioannidis (2005) concluded that nearly half of published articles in scientific journals contained findings that could not be replicated by independent researchers. In fact, he showed that most research findings are false. This problem is noted to be particularly widespread in medical journals where peer-reviewed articles can be crucial in influencing multi-million dollar spending decisions. Conflicts of interest in these journals compromise the neutrality of published research (Epstein 2011; Angell 2005; Krimsky 2003). Drug companies can select which clinical trials they will publish and the suppression of trials with negative results is producing medical literature with false positive findings (Goldacre 2012 p2). In biomedical research, COI are very common but they are rarely reported (Ioannidis 2005). The bias can be financial or just a commitment to their own findings (Ioannidis 2005; Goldacre 2012). It is observed that the peer-review process can be used by prestigious researchers to suppress the publication of findings that refute their research (Krimsky 2003 p10; Ioannidis 2005; Michaels 2008; Angell 2005). This results in the perpetuation of false claims. Ioannidis (2005) states that the more popular the scientific field, the less likely the research findings are to be true.

Medical journals are involved in COI because 50% of their income is derived from pharmaceutical advertising and reprint orders (Angell 2009). Many journals are also owned by companies who operate as medical publishers but in effect provide a marketing service

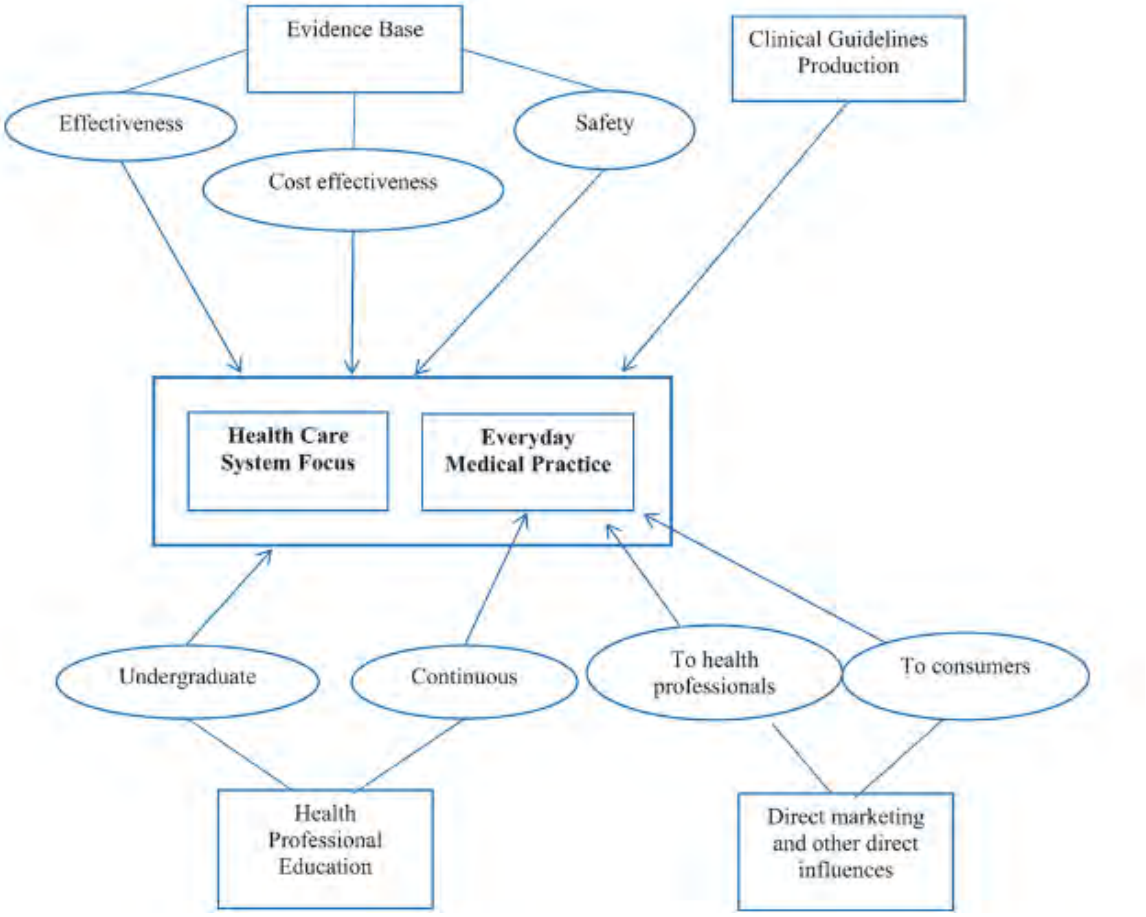
to the pharmaceutical industry (Angell 2009; Goldacre 2012 p38). Another COI in published studies is the financial ties many authors now have with the companies that sponsor their research. In the 1990's the decline in US government funding for medical research left medical scientists dependent on pharmaceutical companies to fund their work (Bosely 2002). Sponsors continue to control the data even when lead authors declare that researchers had full control over publishing decisions (Goldacre 2012 p41). Industry has gained unprecedented control over trial data and this has increased the opportunities for company employees to draft research papers and it has led to the practice of 'ghostwriting' and 'honorary authorship' (Bosely 2002).

The practice of ghostwriting is very common in the commercialised era of science (Krimsky 2003 p115; Peterson 2008; Seife 2012). This practice involves doctors being paid to put their names on a paper they haven't written. In this way credibility due to apparent independence is conferred on the findings of industry funded research. It is a deceptive practice akin to plagiarism that has become common in the marketing of scientific and medical research (Krimsky 2003 pp115-117). Many pharmaceutical companies now market drugs through a PR firm that hires a freelance writer to write an article and a doctor to put their name on it (Krimsky 2003 p116). The doctor can be paid $1,000-$10,000 for their contribution (Bosely 2002). It is then presented for publication in a peer-reviewed journal. Industry can also influence which research is published in the most influential medical journals by using ghostwriters (Stamatakis 2013 p471). The status of industry trial results can be raised by listing academically affiliated investigators as the first or second authors of the articles (Stamatakis 2013 p471). This has been done for publications regarding the HPV vaccine and is described in Chapter 10. This practice is deceptive to researchers and consumers and should be considered scientific fraud. However, much of the medical community has accepted the practice and participates in it for the financial rewards (Krimsky 2003 p115). It is also a hidden practice. In many cases, it is alleged that the authors will not have seen the raw data they are writing about – only tables of data prepared by industry employees (Bosely 2002). Originally ghostwriting was only found in medical journal supplements sponsored by industry but it is now widespread in all the major journals (Bosely 2002).

Ghostwriting or honorary authorships erode the integrity of science. Doctors are also presenting talks on ghostwritten papers at drug-company sponsored symposiums and receiving money for the talk, airfares and accommodation (Bosely 2002; Angell 2005; Peterson 2008). To combat the ghostwriting of articles, the editors of medical journals claimed they would introduce a system requiring scientists to sign a declaration that the papers they submitted to peer-reviewed journals were their own work. However, the practice of ghostwriting continued (Seife 2012). Many journals have also denounced drug companies for restricting the access of scientists to the raw data of clinical trials (Stamatakis 2013 p471; Bosely 2002). In addition, it is known that drug companies do not publish trials with negative findings. Researchers can do many trials but they are free to choose which ones they will publish (Goldacre 2012 p7). This results in 'publication bias' and it is endemic in medical and academic institutions. Regulators have failed to address this problem. Incomplete data on the safety and efficacy of drugs in the medical literature misleads doctors, patients and policy-advisors resulting in harmful decisions in patients (Goldacre 2012 p27). Dr. Richard Horton, chief editor of the *Lancet*, stated at a symposium on biomedical research at the Wellcome Trust in London that half of the scientific literature is unreliable and much is fraudulent (Engdhl 2015). He says pharmaceutical companies are manipulating the tests on the safety and efficacy of drugs/vaccines and these studies are being used to train and educate doctors: COI, lack of transparency, invalid analyses and the funding of fashionable trends, such as innovative biotechnologies, are facilitating this situation.

The integrity of health promotion organisations is threatened by the influence of industry sponsorship (Krimsky 2003 p79). Sponsors fund and influence all aspects of research, evidence synthesis, cost-effectiveness evaluation, formation of clinical guidelines, conferences, grants, healthcare professional education and healthcare professional decisions (Stamatakis 2013 p471). These pathways for influencing medical practice and healthcare are illustrated in Figure 8.

Figure 8 An outline of the main pathways through which the industry influences medical practice and the focus of the healthcare systems.



Source: Stamatikis E, Weiler R, Ioannidis J. 2013. Undue industry influences that distort healthcare research, strategy, expenditure and practice: a review. *European Journal of Clinical Investigation.* May. 43: 5: p470.

Financial involvement in these areas provides an opportunity for industry to influence every aspect of medical institutions. But the areas of most significance are the sponsorship of doctor's education and the direction of research (Krimsky 2003 p31). These directly impact on the ability of doctors and scientists to protect the public interest. Doctors and scientists now participate in the following activities that represent a conflict of interest to their professional guidelines (Angell 2005):

- consult for companies whose products they are researching
- join company and government advisory boards
- become members of speakers bureaus for drug companies
- have patent and royalty arrangements
- agree to be listed as authors of articles ghost written by interested companies
- promote drugs and devices at company-sponsored symposiums
- accept expensive gifts and trips
- have equity interest in the companies sponsoring the research

Examples of these practices are illustrated in the case study of the HPV vaccine in chapter 9. Many research institutions and medical bodies receive large amounts of money from pharmaceutical and biotechnology companies that the public is not made aware of. Exact amounts of sponsorship are unknown to the public (Krimsky 2003). Industry funding can aid the development and progression of science but it is imperative that industry partnerships are managed in a transparent process. This is necessary to maintain the integrity of the scientific/medical profession and ultimately the authority of medical doctors in the community (Stamatakis 2013 p.473; Goldacre 2012 p45). Integrity, objectivity and independence are central to the translation of evidence-based knowledge into clinical guidelines (Stamatakis 2013 p471). It is now common in the medical field for doctors to receive money or gifts from drug companies (Krimsky 2003; Angell 2005 p115; Peterson 2008). This includes funding for conference travel, accommodation, shares, consultancy fees, honoraria for speeches in drug promoting events and other products (Stamatakis 2013 p471). Between 56-87% of the authors for clinical practice guidelines have at least one conflict of interest (Norris et al 2011). Research in social psychology suggests that large gifts to doctors can influence behaviour and small gifts can influence attitudes towards the company and its products (Krimsky 2003 p33).

Research on the influence of gifts to doctors was used by a subcommittee in Congress in the 1990's to recommend against COI in drug evaluations. The committee requested that the Department of Health and Human Services (DHHS) 'immediately promulgate Public Health Service regulations that clearly restrict financial ties for researchers who conduct

evaluations of a product or treatment, in which they may have a vested interest' (Krimsky 2003 p33). However, this request was never acted upon (Krimsky 2003 p33). The boundary between industry and academia has become blurred and clinical guidelines are now founded on costly interventions instead of the available evidence (Stamatakis 2013 p472). The bias in clinical research is enhanced when financial incentives are provided to doctors or policy advisors (Krimsky 2003 p7). Drug companies subsidise the majority of meetings of professional organizations thereby influencing the content of these meetings. In addition, they fund the continuing education of doctors to maintain their licenses (Angell 2005 p135). This enables the drug companies to influence doctors' views about drugs. Side-effects can be down played and benefits enhanced when the drugs/vaccines are promoted at industry funded conferences (Stamatakis 2013 p472; Angell 2009; Goldacre 2012). Consequently, in an unregulated environment, the health advice provided to consumers is strongly biased towards industry priorities (Stamatakis 2013; Goldacre 2012). Angell (2009) estimates that drug companies pay US physicians tens of billions of dollars a year which gives them enormous control over the way in which doctors practice. In particular, they have control over the way doctors evaluate and use pharmaceuticals. Drug companies have significant influence over the results of research, the way medicine is practiced and the definition of what constitutes a disease (Angell 2009; Stamatakis 2013). This is all possible because of the financial ties they have to doctors and in particular, senior academics at prestigious medical schools (Angell 2005 pp142-147). It has also been demonstrated beyond doubt that studies funded by industry produce positive results more often than independently funded studies (Goldacre 2012 p1). This is called the funding effect.

In order to carry out clinical trials, drug companies need access to human subjects therefore many of these trials occur in medical schools to provide access to hospitals. Alternatively they are done through private research companies. By utilizing the medical schools for clinical trials the drug companies can work with highly influential academic physicians (Angell 2005 p142). These doctors are referred to as 'thought-leaders' or 'key opinion leaders' (Angell 2005 pp142-147; Peterson 2008). Many of these doctors write text books, medical journal papers, issue practice guidelines (treatment recommendations), sit on the

FDA and government advisory committees, head professorial societies and speak at many conferences for clinicians about prescription drugs. Access and gifts to these physicians benefit pharmaceutical companies and provide many opportunities to influence medical practices (Krimsky 2003). The growing number of scandals in which the dangers of prescribed drugs have been discovered too late led a group of scientists and clinicians to write an open letter to the UK Prime Minister (Archibald et al 2011). The letter stated that adverse drug reactions have reached epidemic proportions and are increasing at twice the rate of prescriptions. This leads to the question of whether drugs/vaccines are being adequately trialed and tested for adverse reactions before being approved by boards dominated by individuals affiliated with industry (Stamatakis 2013 p471). Data from a litigation trial against a pharmaceutical company suggested the manufacturer intentionally altered the presentation of trial safety data and trained sales representatives to avoid questions from doctors about safety (Stamatakis 2013 p471). Goldacre (2012) states that manufacturers test drugs in poorly designed trials that use analytic techniques that exaggerate the benefits and downplay the risks and they do not publish trials that represent the body of scientific data on a topic (p21).

The harmful effects of drugs are being minimised by choosing incorrect parameters and selective criteria in the design of clinical trials. Primary data that is not independently assessed by the scientific community can be massaged to produce the desired result through the choice of methodology and criteria (Michaels 2008 p53; Goldacre 2012 p2). The sponsor of the trial can then claim ‘there is no evidence of harm’ simply because the study did not use the parameters that might have revealed harm from the drug/vaccine. This is biased or misleading science and it is being used in public health policies. In the new structure of university funding and governance the available evidence can be influenced at all stages by the sponsor to prevent vital evidence from being collected.

6.4 Australian Examples of Academic-Industry Partnerships

An example of the academic-industry partnership in Australia is found at Murdoch University, which has recently collaborated with many corporate partners to form the

Institute for Immunology and Infectious Diseases. This is an international medical centre with over 30 collaborations and significant international funding, including $12 million from the Bill and Melinda Gates Foundation. Other partners include the Royal Perth Hospital, Fiona Stanley Hospital, biotechnology industries, Microsoft Corporation, GlaxoSmithKline, Merck, Roche and other pharmaceutical industries. The research program at the new medical institute is titled 'The Genesiis Campaign'. This is in reference to a new era in the fight against infectious diseases based upon recent research in the understanding of human genetics and differences in individual gene patterns. The institute aims to open the door to new treatments and vaccines for infectious diseases. Its goal is to be a top international multidisciplinary research centre focusing on contemporary issues such as AIDS research and clinical and diagnostic care. In achieving this goal, intellectual property and commercial benefits will be secured to Western Australia. In 2011 there were two patents being developed in the international phase (Murdoch University 2011).

Another Australian example of academic-industry collaboration is the University of Queensland (UQ) and CSL Ltd (Uniquest). UQ collaborates with Uniquest Pty Ltd, a company that manages the university's commercial interests such as the sale of products that are based upon UQ technology. According to Uniquest, innovations that it has licensed have sales of $3 billion per year, putting it in the top 10% of universities worldwide for technology transfer (Uniquest). This partnership is described further in chapter 9.

6.5 The Global Regulation of Vaccines

In the era of globalisation many pharmaceutical products such as medicines and vaccines are no longer being produced and regulated in the countries in which they are used. As a result there is now a vast international network of production and distribution. However, the industry has expanded rapidly and the distribution problems are resulting in sub-standard vaccines. The increased demand has resulted in criminal, false products in some cases (Garrett 2012b). There is concern that the regulatory processes are not keeping up with changes in the industry and it is alleged that organised crime is increasingly involved in the production of medicines. Regulators are over-whelmed or non-existent in many

countries. The WHO does not have the legal framework to effectively address these problems so the Council on Foreign Relations (CFR) is looking to the G8 and G20 countries for solutions (Garrett CFR 2012).

Government regulators of drugs/vaccines for many countries are funded by the industry whose products they approve (Goldacre 2012 p128). This includes the European Medicines Agency (EMA), the Medicines and Healthcare products Regulatory Agency (MHRA) (UK regulatory board), the US Food and Drug Administration (FDA) and the Australian Therapeutic Goods Administration (TGA). The situation where government regulators promote the interests of the industries they monitor instead of the public interest is described by sociologists as 'regulatory capture'. This is now a global practice even when regulatory boards state 'members of the Management Board shall not have financial or other interests in the pharmaceutical industry which could affect their impartiality' (Goldacre 2012 p126). Despite this requirement many of the representatives on EMA boards come from pharmaceutically funded companies, including on their management board. It is observed that regulatory decisions in the US FDA have been influenced by political pressure because of this practice. The FDA has even been described as an 'agent of industry' to the US Senate Committee on Finance (Goldacre 2012 pp127-8). Dr. Lucija Tomljenovic, at the University of British Columbia's Neural Dynamics Research Group in the Department of Ophthalmology and Visual Sciences, has been quoted as saying 'vaccine manufacturers, pharmaceutical companies and health authorities have known about multiple dangers associated with vaccines but chose to withhold them from the public. This is scientific fraud and their complicity suggests that this practice continues to this day' (Enghahl 2015).

6.6 Conflicts of Interest in the Regulation of Vaccines in Australia

The information provided in this section regarding the Australian Therapeutic Goods Administration (TGA) has been largely sourced from the Australian government's website and a WHO review of the functioning of advisory boards for vaccines funded by the Bill and Melinda Gates Foundation.

The Therapeutic Goods Administration (TGA) was established in 1989 and it is the Australian government regulator of therapeutic goods such as medicines, vaccines and blood products. This board, like the vaccine regulatory bodies in governments globally, is conflicted by being 100% funded by the industry whose products it monitors (AG RWAR 2010 p10). This funding system is known as Cost Recovery (or User-Pay) and it means that the TGA recovers the full cost of its regulatory activities by charging the sponsors and manufacturers of the products that are regulated. The pharmaceutical and manufacturing industry funds the TGA even though this government board has the dual role of approving drugs for its sponsor and monitoring the safety of these same drugs in the Australian population (AG TGA 2012). In order to effectively regulate in the public interest the TGA would need to be independent from industry funding. Regulations that provide incentives for producing *profit* and not *health* in government policies, compromise all participants in health promotion – doctors, researchers and policy advisors. These regulations encourage individuals – even those with integrity - to participate in decisions that cause significant harm to patients and the community (Goldacre 2012 pxi).

The activities of the TGA in the cost-recovery program include:

- Registration and approval of drugs/vaccines
- Issuing exclusive rights, licenses and privileges
- Monitoring ongoing compliance with regulations
- Monitoring ongoing safety of the products
- Investigation and enforcement of regulations

At present the processes of the TGA are not transparent to the public and funding arrangements for this government body illustrates that pharmaceutical companies are influencing the approval and monitoring of drugs/vaccines in the population. In addition, consumers whose health is invested in these policies are not properly represented in the decision-making processes of the TGA or on vaccine advisory boards for public health policy. The fact that the TGA is funded by the pharmaceutical companies and manufacturers of medical devices creates an incentive for bias towards industry interests. Funding arrangements and COI for committees that control the health of the population

should be transparent to the public. The TGA justifies the COI in funding arrangements and policy decisions by suggesting that 'it requires commercial companies that apply for marketing approval to pay for the cost of the review of the application on a cost recovery basis' (AG RWAR p10). But this arrangement does not explain why the TGA has the responsibility for monitoring the safety of these products in the population when their procedures can be influenced by the industry that manufactures the product and sponsors the TGA. A regulatory body, to protect the public interest, needs to be independent of commercial interests (Gessner et al 2010 A4). The current funding situation for the TGA does not provide incentive to implement an effective monitoring system for vaccines because the TGA is monitoring the very drugs it has approved for its sponsors for commercial gain. Whilst the TGA states that it rigorously enforces conflict of interest requirements there is no evidence of this and up to 2015 the conflicts of interest of members of vaccine advisory boards have not been disclosed to the Australian public. The clinical trials used by government regulators to approve drugs are being funded by industry and performed by researchers who are voting members on vaccine advisory boards for the Australian government (Nolan et al 2010).

The Influenza Specialist Group (ISG) that provides advice on influenza policy in Australia is also fully funded by industry (Sweet 2011). The ISG justifies this situation by claiming that 'they (the ISG) are helping promote public health messages, not pushing specific brands of vaccine' (Finch and Burson-Marsteller in Sweet 2011). However, this does not justify the position of the ISG because the committee makes decisions affecting the financial interests of industry, specifically whether a vaccine is used as a preventative strategy against influenza: a multi-million dollar decision. The consequences of this decision make a significant difference to the profits of vaccine manufacturers. Therefore, it is essential that this public health decision is determined independently of the manufacturers. Whilst the existence of a conflict of interest does not automatically lead to bias it is important they are made transparent to the public if they are allowed to exist in the decision-making process. This allows consumers to judge the value of the information they are receiving, particularly when decisions are made that are contrary to the evidence. If boards are not truly independent of commercial interests the health information can potentially be influenced by these interests and COI need to be transparent to the public.

Value judgments made in political decisions can have serious implications for public health. In 2008 at least two members of the ISG believed that the advice given by the ISG regarding influenza policy was questionable. Associate Professor Michael Whitby, an infectious disease physician, decided not to be actively involved on the ISG committee because:

'He was concerned about the organization promoting influenza vaccination for indications not supported by national guidelines, especially the promotion of vaccination of children' (Sweet 2011).

Professor Peter Collignon and colleagues expressed similar sentiments in an article that was published in the *British Medical Journal* (Collignon et al 2010). Collignon has also been quoted saying 'The TGA made that decision (about risk-benefit to children) without any evidence to back it up' (Corduroy 2010). At this time there were members of the ISG that had financial COI that had not been disclosed to the public. One member of the Influenza Specialist Group (ISG) had been the previous Research and Development Manager at Commonwealth Serum Laboratories (CSL), Australia's only flu vaccine manufacturer (Dean 2009). Another member had shares in CSL and was in charge of the WHO influenza laboratory in Melbourne at the time the 'Swine Flu' pandemic unfolded (Bita 2011). The Australian government states that committee members are required to declare any conflict of interest and this is 'taken into consideration at meetings' (Bita 2010). If these conflicts of interest are unavoidable then it is important that they are made transparent to the public because it is known that financial connections can affect policy decisions. This information is needed by the public to make informed decisions about their health otherwise they are left to *trust* that government decisions are in the public's best interest. Some public health experts have called for an independent body to monitor drug safety because it is clear that self-regulation of the industry is not in the public interest (Stokes 2010; Baxter 2010; Moore in Corderoy 2010).

6.7 Conflicts of Interest in Government Vaccine Advisory Groups (ATAGI)

A sustainable vaccination program recommending many new vaccines, most of them free, cannot be provided to Australians without an effective funding mechanism. The cost of Australia's vaccination program by 2008-2009 was well above $AU400 million (Nolan 2010 A76). During 1990-1997 the recommendations for the funding of vaccines in Australia were made by a sub-committee of the NHMRC. This committee was also responsible for developing the *Australian Immunisation Handbook*: a government document outlining national clinical guidelines for all health professionals. The governance of this sub-committee was brought under government control in 1997 when it was moved into the Department of Health and Ageing (DHA). At this time the board was re-named the Australian Technical Advisory Group on Immunisation (ATAGI) and its main roles were to provide confidential advice to the Health Minister and to develop guidelines for health professionals in the *Australian Immunisation Handbook* (Nolan 2010 A76-77). In producing the guidelines for health professionals in Australia, ATAGI is required to adhere to the NHMRC's guidelines for the levels of evidence and ethical behaviour in healthcare and medical research.

ATAGI is an example of the many National Immunisation Technical Advisory Groups (NITAG) that have been set up with the assistance of WHO, in member countries, to develop government vaccination programs founded on WHO recommendations (Bryson et al 2010 A13). See chapter 3. These boards provide information for the government to make decisions regarding recommendations on vaccination schedules and the implementation of new vaccines. They also provide advice on research priorities, vaccine formulations, high-risk groups and the implications of adverse events (Gessner et al 2010 A2). Representatives on ATAGI include medical and public health practitioners, technical experts, ex-officio members (government bodies e.g. NCIRS, OHP, TGA, NIC, CDNA) and one consumer representative (AG IAP 2012). In fact, WHO has stated that the inclusion of a civil/public representative is optional and only 'if needed' (WHO ITAG 2008 p5). This contradicts the statement that these boards are 'independent' and representative of all stakeholder interests. Australian government vaccination policies are developed on the advice provided by these

expert technical advisors who are selected to ATAGI by the Health Minister through an informal nomination process (Nolan 2010 A79). Given that vaccine advisory boards include experts associated with industry, the boards should also include representatives of the public. This is because the public is the stated beneficiary of public health policies: the major stakeholder. If a major stakeholder is not properly represented in policy development then their perspective of risk can be minimised in policy decisions. In this way, a one-sided consensus can be achieved when there is insufficient dissent to oppose the dominant interests on the advisory board. A stakeholder's perspective can be further side-lined if they are not properly represented in the media, in the political domain or involved in public debates on the topic. A lack of balance in the media removes the stakeholder's voice from the debate and synchronises with a lack of political power. When there is only one representative of a stakeholder on the advisory panel I believe it is also possible to choose a representative who is in agreement with the desired perspective and/or influence their opinion by ensuring they gain financially from their participation. It is possible for policy decisions to be founded on biased or 'selected' information when specific political structures such as COI exist. See chapter 8.

In Australia members of ATAGI hold their positions for many years. The term is set for 4 years but can be extended at the Minister's discretion (Nolan 2010 A79). For example, Terry Nolan was the chair of ATAGI for 9 years from 2005-2014, Peter McIntyre (2004-2015) and Robert Booy (2005-2015), co-directors of the National Centre for Immunisation Research and Surveillance (NCIRS), have been members/ex officio members of ATAGI during this time (AG NCIRSn). Conflicts of interest are a concern on the ATAGI board because the decisions made have significant implications for vaccine sales for pharmaceutical companies. It is stipulated that committee members of ATAGI must be independent of pharmaceutical industry influence (Gessner et al 2010 A3) and the Australian regulations state that a detailed agenda is sent to each representative before each meeting to update relevant COI (Nolan 2010 A79). However, declaring a COI does not remove it and it is the public that needs to be informed of these relationships to protect their interests in these policies. COI on the ATAGI board were not publicised prior to 2015. The COI policy for ATAGI members has variable consequences that are determined by the chair of ATAGI in consultation with the chair of the PBAC and other government members

(Nolan 2010 A79). Depending on the level of COI, members can participate and vote, participate and not vote, attend meetings but not contribute or be prevented from attending meetings altogether (Gessner et al 2010 A3). The chair's own COI and decisions about the consequences of COI are not transparent to the public. It is stated that in general 'personal remuneration of other forms of direct or indirect financial or other benefits for marketing or promotional activities are inconsistent with ATAGI membership' (Nolan 2010 A79). Over the last decade, 2005-20014 many ATAGI representatives had COI with vaccine manufacturers that were not revealed to the public. During this time many new vaccines were added to the recommended schedule of vaccines that are paid for by the government and provided free to the community.

The chair of ATAGI from 2005-2014 was also the deputy chair of the research committee of the National Health and Medical Research Council (NHMRC): the committee that allocates funding for research projects (DHA 2012). Nolan states that involvement in industry-sponsored vaccine research is generally not considered a conflict of interest that requires exclusion if the payment is made to the institution and not the individual (2010 A79). However, industry grants for vaccine trials are not provided to institutions to allocate to projects of their choice. They are usually provided to specific researchers for specific vaccine trials. Over the last decade many members of ATAGI, including the chair and co-directors of NCIRS, have been chief investigators on vaccine trials that are funded by GlaxoSmithKline, Merck, Pfizor, Novartis, Sanofi, BioCSL, Baxter, Wyeth, Merck, Janssen &Janssen (Crucell) (AG ATAGI 2015; Nolan et al 2010). Many members have also been representatives of vaccine advisory boards at some time and received individual payments (honoraria) from vaccine manufacturers for their attendance at conferences (Nolan et al 2010). In addition, there is no funding provided by the NHMRC for vaccine clinical trials or research that is independent of vaccine manufacturers.

NITAG's, such as ATAGI, are described as consisting of independent experts with the technical capacity to evaluate new and existing immunisation interventions. The premise of these groups is to provide a systematic, transparent process for developing immunisation policies by making 'evidence-based technical recommendations' to the national government (WHO ITAG 2008). Their role is described as being 'technical' and 'advisory'

and it is intended to bring 'increased scientific rigour and credibility to the complex process of making immunisation policies, free of political or personal interests' (Bryson et al 2010 A13). Yet it is clear from the governance of Australia's vaccination policy that vaccine advisory boards such as ATAGI are not using a systematic framework of assessment or evidence from the local community and they are not independent from vaccine manufacturers, government influence or transparent in their processes and assumptions. See chapter 4. Bryson et al state that the credibility of NITAG's relies on 'true independence from the government' (2010 A16) yet ATAGI is heavily influenced by government representatives from NCIRS, NIC, PBAC, OHP.

There is global concern about the significant influence of government in NITAG committees and the lack of independence from political interference (Gessner et al 2010 A4). Gessner et al (2010 A4) state that scientific information from pharmaceutical companies should be presented through documents or via telephone and not through industry representation and participation in NITAG meetings. This is particularly the case as the public is not invited to attend these meetings or to present information to the committee. The US Government justifies the use of expert panels by claiming it cannot assemble, from its own staff, the expert knowledge necessary to address the diversity of technical issues under the government's responsibility (Krimsky 2003 p92). Hence the government suggests that it is broadening the knowledge base that is used in the decision-making process by using external expert advice. A government report even stated 'Advisory committees continue to represent part of federal efforts to increase public participation' (US Government Report in Krimsky 2003 p92). For decades university staff and academics have been encouraged to work with industry in equity arrangements. Therefore regulations prohibiting experts with COI from participating in policy decisions would remove many well qualified people from the assessment process and it would also be hard to find experts without COI. Hence this regulation is difficult to enforce (Goldacre 2012 p128). This indicates that the solution lies in having a decision-making board that has transparent COI and has proper public representation and scrutiny, without financial ties to industry or government influence.

6.8 The Approval Process and Funding for Vaccines

ATAGI consults with other government advisory boards and it provides advice to the government's pharmaceutical benefits scheme (PBS) on the strength of evidence for the funding of new vaccines. One member of ATAGI doubles as a member of the pharmaceutical benefits advisory committee (PBAC) (Nolan 2010 A79). The government funded National Centre for Immunisation Research and Surveillance (NCIRS) also plays a significant role in the advice provided by ATAGI and in setting up working parties. (Nolan 2010 A79). See Appendix 4. Recommendations for the funding of vaccines made by the PBAC to the health minister are based on the manufacturer's submission and ATAGI/ NCIRS advice. Whilst pharmaceutical companies do not have formal representation or voting rights on the NITAG committees, industry representatives are allowed to attend meetings and provide information yet in Australia these meetings are not open to the public to attend or to present information (Gessner et al 2010). There is no transparency in who has been allowed to provide 'factual' information or to participate in decisions at ATAGI meetings.

ATAGI does not use a systematic process for collating and assessing data for the decision-making process. Some criteria used in making recommendations include the mortality and disability data attributed to the disease but not always local mortality or disability data. Other data that is used is disability-adjusted life years lost (DALY), hospitalizations, epidemic potential and the potential for disease eradication. Local data is relevant for all infectious diseases and also for the outcomes for vaccines in different populations but this is not always used in the economic modeling for new vaccines in many countries (Gessner et al 2010 A3). Decisions regarding the inclusion of a new vaccine on the Australian NIP are determined by an ATAGI sub-committee ahead of the licensure of the vaccine. Nolan states that considerations for the suitability of a new vaccine include the implications for herd immunity but this (herd immunity) is 'neither necessary nor sufficient for a positive recommendation for NIP suitability' (Nolan 2010 A79). This is of note because the government is using claims about vaccine-created herd immunity to justify its use of coercion to promote vaccination.

Data that is used to develop recommendations is sourced from WHO documents, journals, other NITAC's and regional/ local sources. The final decisions made by NITAG committee's for national programs are often influenced by WHO recommendations. Most committees adopt all of the WHO recommendations and some adopt them with modifications to local priorities. Whilst the recommendations made by the committee are only advisory and not legally binding, Australian health ministers depend upon ATAGI advice. Nolan (2010 A81) stated that the assumptions and economic principles underpinning the recommendation process were still being debated but that they were widely accepted by industry and healthcare professionals. There is no mention that they have been examined or accepted by consumers. All ATAGI working parties are chaired by an ATAGI member and supported by one or more scientific officers from the NCIRS who are responsible for writing the report (Nolan 2010 A82). Nolan states that the policy branch of the NCIRS is critical to the quality of the advice provided to the government and health professionals.

Since 2005 funding applications for new vaccines have been addressed by a sub-committee of the PBAC, not by ATAGI (Nolan 2010 A79). The methodology for determining the cost-effectiveness and funding for vaccines is based on price per disability-adjusted life year (DALY) saved (Nolan 2010 A78). The cost-effectiveness of vaccines is determined by examining the evidence of the benefit of the vaccine from large clinical trials. This can then be used to estimate the cost of saving one quality-adjusted life year (QALY) which translates to the number of doses that need to be given at the vaccine cost to gain one extra year of full quality life (McIntyre 2012). This economic modeling, which relies on many non-transparent assumptions about the effectiveness and safety of vaccines, has resulted in the recommendation of many new vaccines into the Australian population since the 1990's. Unlike the UK there are no specific cost-effectiveness cut-offs for making recommendations for vaccines in the Australian NIP (Gessner et al 2010 A3). It is also of note that the price of vaccines funded by the Australian government is not made available to the public even on request (AG DHA 2013).

The recommendations for vaccine funding are included in the PBAC framework for all drugs marketed in Australia. The PBAC receives submissions mostly from pharmaceutical companies on the cost-effectiveness of new vaccines/drugs. Vaccine sponsors may request that a vaccine be recommended on the NIP, and subsidized by the government, or listed on the PBS where a co-payment is required from consumers (Nolan 2010 A82). The general criteria for vaccines to be recommended on the NIP are defined in the *Vaccine Appendix* of the PBAC submission framework which has been developed with significant influence from the Medicines Australia Vaccine Industry Group (MAVIG), a sub-committee of Medicines Australia that represents the pharmaceutical companies. Whilst the ATAGI recommendations are founded on input received from many different professional, industry and government groups, the general public does not actively participate in ATAGI discussions and ATAGI does not conduct open forums for debate (Nolan 2010 A82). In addition, the unabridged ATAGI working party reports on vaccine recommendations are not made public. This is stated to be because they contain unpublished clinical trials that have restrictions on releasing the data. If this is the case it also means that the material has not been peer-reviewed by independent scientists and its integrity is questionable. Public health is at risk if the scientific data cannot be viewed and debated by all stakeholders before new vaccines/drugs are approved in government public health policies. The existence of COI on decision-making boards and the use of non-transparent science facilitate policies that can be developed on selective science of questionable integrity chosen by the dominant network of scientists. See chapter 8.

6.9 Conclusion

In the 21st century universities and research institutions are operating in partnerships with industry and directing research into profitable technology. Universities receive large amounts of money from industry that are not transparent to the public. COI are ubiquitous in financial relationships involving researchers in university faculties. Consequently industry has unprecedented influence over the type of research that is performed and the outcomes achieved. COI also exist in relationships involving the medical profession, media and government. These relationships play a significant role in the way drugs/vaccines are promoted to the community. When industry funds the research it leads to less public

interest science being investigated because it might not serve industry interests. This is termed ‘undone science’ and the political framework for this practice is described in chapter 8. Vaccines/drugs are being approved for the market without properly designed clinical trials. The side-effects of drugs are being down-played to doctors and consumers and the benefits are over-emphasised. Many peer-review journals now depend upon industry funding for their profits and this increases the publication bias towards positive trial results and the suppression of negative results. Pharmaceutical companies are also sponsoring lobby groups that appear to be advocating for consumer interests but in fact are fronts for drug companies. This influence synchronises with pharmaceutical marketing to doctors which is presented as ‘education’ and the media promotion of vaccines influenced by corporations. Consequently there is a systematic bias towards industry interests in medical research and public health policy and promotion.

A lack of acknowledgment by governments of an important area of research is easier to maintain if the stakeholder whose interests are affected is removed from the political decision-making process. This is observed in the development of Australia’s vaccination policies as the community is not consulted or encouraged to participate in public debate on vaccination and there is only one consumer representative on the government vaccine advisory committee (ATAGI). In addition, pharmaceutical representatives can be invited to ATAGI committee meetings to provide information but these meetings are not open to the public and the information is not available for public scrutiny before vaccines are approved. A lack of political power and financial support also has the effect of reducing the consumer voice in the mainstream media. These factors are synchronising to remove an independent consumer perspective from the risk assessment process of policy development. They are also resulting in non-transparent policy decisions being made by ATAGI/NCIRS members in an unsystematic assessment of the risks.

The lack of independent regulation of the global vaccine market is resulting in sub-standard vaccines. Vaccines are a global production and they can be automatically approved in many countries based on clinical trials that were performed in another country. Manufacturers in the US have less incentive to develop safe and effective vaccines because they are exempt from liability when harm is caused. This legislation ensures that there is a stable vaccine

market but it does not provide incentives to protect the health of the population. Government regulators in most countries are 100% funded by industry under a Cost-Recovery (User-Pay) system. This means they approve their sponsor's vaccines/drugs for the market and monitor these same products for safety and efficacy. In effect they are indirectly monitoring their own products. Large political donations from pharmaceutical companies are also being allowed to influence government policy. Funded lobby groups are targeting policy decision-makers, medical practitioners, educational boards and mainstream media with selective information. Vaccine advisory boards are rife with conflicts of interest, enabling industry to influence the direction of government funding in health policy research and policy decision-making. National vaccine advisory committees such as ATAGI have been established in many WHO member countries and they receive advice and financial support from the WHO in the development of national vaccination programs. Recommendations for new vaccines are not always founded on local data and cost-effectiveness is being determined using economic models that rely on non-transparent assumptions about the safety and efficacy of vaccines. Although the importance of vaccine-created herd immunity is used to promote vaccines to the community, the chairman of ATAGI for the last decade states that the implications for herd immunity for new vaccines are 'neither necessary nor sufficient for a positive recommendation for NIP suitability' (Nolan 2010 A79). This indicates that vaccines are being promoted to the community on a false premise that has serious implications for population health. Further, the cost-effectiveness of vaccines is being determined on evidence produced in clinical trials that are funded by pharmaceutical companies and carried out by researchers/chief investigators who are representatives on government vaccine advisory boards such as ATAGI and the NCIRS.

This arrangement is very profitable for universities, governments, researchers and representatives on vaccine advisory boards but it is extremely costly to public taxpayers and to population health. In 2008-2009 the cost of providing vaccines 'free' to Australians was well above $AU400 million (Nolan 2010 A76). However, the actual cost of these programs is unknown because the figures are not released to the public (even when requested) and they do not include the cost to the community of the deaths and disability that are a known side-effect of vaccines. This cost to the community is unknown because

the TGA has not established an active surveillance system that can make causal relationships to vaccines. A regulator that is 100% funded by industry has no incentive to accurately monitor the adverse events from its own products. This demonstrates the need for vaccination policies to be independent from commercial and political interference in order to protect public health. In Australia policy decisions for vaccination programs are based on research (often unpublished) that is performed by government representatives on vaccine advisory boards who receive honoraria and funding for their clinical trials from pharmaceutical companies. The findings from such research are being used in policy decisions for vaccination programs without public scrutiny or assessment by independent researchers.

In chapter 7 I discuss the evidence the Australian government is providing to the public to support the claims about vaccine safety and efficacy. Chapter 8 presents a description of undone science and the political framework that leads to a lack of integrity and rigour in medical science. Chapters 9 and 10 are case studies of the HPV vaccine and 'Swine Flu' 2009 vaccine, showing the influence of corporations in the development of global vaccination policies. Chapter 11 presents the conclusions for this investigation.

CHAPTER 7

THE EVIDENCE UNDERPINNING CLAIMS ABOUT VACCINES

7.1 Introduction

The aim of this thesis is to assess the rigour of the claims supporting the efficacy, safety and necessity for the use of an expanding number of vaccines in the Australian Government's National Immunisation Program (NIP). I have provided here an examination of the key claims that the Australian government has presented to the public to support current vaccination policies. The information provided to the public discusses vaccines in a general non-specific way yet it is necessary to examine the scientific evidence for *each* vaccine separately to determine its safety and effectiveness in protecting community health. This is because there are many variables that influence pathogenesis that are specific to each disease agent. The risk/benefit equation for each vaccine varies according to the ecological context of the infectious agent and the interaction of multiple variables in pathogenesis. This has been described in chapter 2. This chapter investigates whether the government promotes vaccines to the public in an ecological context recognizing the variables that contribute to the 'risk' of disease to different individuals (due to environment and genetic differences) or in a general way implying that all vaccines are safe, effective and necessary in the prevention of infectious diseases.

In particular, this chapter provides an assessment of key information that is provided to the public to support vaccination policies. I have assessed the Australian government's claims made in the Frequently Asked Questions (FAQ) on the Immunise Australia Program (IAP) website (See Appendix 6) and in the Australian Academy of Science's 2012 document *The Science of Immunisation: Questions and Answers*.

My critical analysis of the claims made by the government includes:

1. Exposing misleading statements (such as equating vaccination and immunisation) and /or
2. Illustrating where the government has not provided (here or elsewhere) evidence to back up its statements, or where there is contrary evidence and/or

3. Illustrating where research has not been done to support the conclusions and/or
4. Illustrating undeclared or unsupported value judgments embedded in or associated with statements.

7.2 Terminology: Vaccination, Immunisation and Vaccine-Preventable Diseases:

On the IAP website the government has used the word *immunisation* to answer public concerns although the correct term is *vaccination.* I have explained the meaning of these terms here and I will use the correct term 'vaccination' for this discussion. This is significant to the vaccination debate because receiving a vaccine does not always provide immunity and using the word 'immunisation' implies that immunity has been achieved. Similarly I have explained why the term *vaccine-preventable disease* is also a misleading term.

Vaccination is a medical intervention that injects weakened pathogens (antigens) and chemical substances into the tissues of healthy individuals to stimulate the production of antibodies (Stern and Markel, 2005). This is different from *immunisation* which is the process of obtaining immunity from the artificial stimulation of antibodies against an antigen (Martin 2002). These two words are often used interchangeably by members of the public and on the government Immunise Australia Program (IAP) website although they have very different meanings and it is misleading to use them interchangeably. Individuals can obtain immunity to a disease by either natural exposure to the pathogen or by receiving a vaccine. Sometimes individuals are vaccinated but do not obtain immunity to the disease (AG IAP 2012). This can be a result of the vaccine not working or because an individual is exposed to a strain of the disease that is not covered by the vaccine. Conversely individuals can have immunity to a disease without being vaccinated. This is because exposure to the infectious agent can result in natural immunity which is usually of longer duration (often life-long) than that gained from a vaccine, as in the cases of whooping cough, hepatitis B and measles (AG IAP 2012).

The government defines vaccination and immunization on the *Immunise Australia Program* (IAP) website. It states:

- ***Vaccination means having a vaccine - that is actually getting the injection.***

- ***Immunisation means both receiving a vaccine and becoming immune to a disease, as a result of being vaccinated.***

Most people use the terms 'vaccination' and 'immunisation' interchangeably but their meanings are not exactly the same. The term 'immunisation' is used in this website, as it is most commonly used in the community (AG IAP FAQ 2012).

The government is misusing the word immunisation and misleading the public in the benefits gained from using vaccines. The information discussed on the government website refers only to the physical act of receiving a vaccine therefore the correct word for the government to use is vaccination. The government's language incorrectly implies that all individuals who get vaccinated have gained immunity. This is known to be a false assumption; some vaccinated individuals do not gain immunity so the correct term to use for the act of receiving a vaccine is *vaccination.* In addition, the US Centers for Disease Control and Prevention (CDC) and governments globally are now referring to common infectious diseases as *vaccine-preventable diseases* (CDC 2012). Again this terminology suggests that vaccines create immunity in all individuals and that vaccines can *prevent* infectious diseases. Infectious diseases can only be described as 'vaccine-preventable' if it is demonstrated that protection from disease is a direct response to the use of the vaccine. Epidemics of some diseases are still occurring in areas where vaccines have been used for many years (WHO CSDH 2005 p19) and it is known that a percentage of recipients *do not* gain immunity after vaccination. Therefore it is necessary to establish that any protection from disease is a direct result of the use of vaccines before these diseases are labeled as 'vaccine-preventable diseases'. This empirical scientific evidence can only be provided from *correctly designed* randomized controlled clinical trials of vaccinated and unvaccinated participants. These trials control the variables involved in disease prevention and therefore offer definitive conclusions about the best method of prevention.

The Swedish government regulator for medicinal products, the Medical Products Agency (MPA), states that many conventional vaccines that have a long history of use have never been tested in formal controlled clinical trials to demonstrate their efficacy in preventing

disease (MPA 2007 p5). The Agency states that whilst there are no formal controlled clinical trials demonstrating efficacy in preventing disease 'there is a well demonstrated relationship between human serum antibody titre and protection against infection' (MPA 2007 p4). In other words, it is common practice to trial vaccines for efficacy using the surrogate of seroconversion. This end-point is the level of antibody titre in the blood that is believed to be necessary to protect the individual from disease (AG IAP 2012). Whilst antibody titre is used as a surrogate for disease protection, proof that 'vaccine induced' seroconversion protects against disease still requires evidence from randomized controlled clinical trials to demonstrate that the artificially induced level of antibody titre is protective against disease and that it was produced by the vaccine. Antibody seroconversion is also achieved by natural infection – with or without clinical symptoms. That is, asymptomatic infections (or sub-clinical infections) also produce seroconversion and immunity to disease. See Chapter 4. Proof that 'vaccine-induced' seroconversion results in immunity to disease has not been demonstrated in controlled clinical trials presented by the Australian government on the IAP website, the Australian Academy of Science in the *Science of Immunisation* document or the MPA in the discussion of vaccine efficacy in the Public Assessment Report for Afluria (MPA 2007).

The public is expected to accept that vaccine-induced seroconversion is responsible (and necessary) for disease protection. Yet it is known that whilst there is a general correlation between antibody titre and disease protection, a high antibody titre does not always protect against disease and vice versa: individuals with a low antibody titre do not always get the disease (Ryan et al 1998; Granoff and Rappuoli 1997; Smith A 1999; CDC MMWR 2009). This fact is observed with respect to the whooping cough vaccine and it indicates that other factors play a role in immunity to disease. Therefore, without a controlled clinical trial between vaccinated and unvaccinated participants demonstrating protection against the disease, it is only an *assumption* that the person who doesn't get sick was protected by the antibody titre induced by the vaccine. There is no empirical proof that the vaccine provided protection against the disease because there are other vaccinated children who still get the disease. It may have been the strength of the child's immune system, natural exposure with a sub-clinical infection or lack of exposure to the wild virus that resulted in the absence of disease.

When epidemics of a disease do not occur there are many factors that could play a role, including the vaccine, but without the qualifications noted above, the term 'vaccine-preventable disease' is misleading. This term implies that vaccines can prevent infectious diseases but the fact that formal controlled clinical trials demonstrating that vaccines prevent infectious disease have not been done represents 'undone science' in this policy. Hospitalization statistics are another method that could be used to evaluate the effectiveness of vaccines in the population. Recording the vaccination status of individuals hospitalized with infectious diseases indicates whether the most serious cases of disease are vaccinated or unvaccinated. This data, collected in a transparent manner by an independent authority, could be used to promote vaccines to the public, yet it is not presented by the government on the IAP website or in the AAS supportive document.

In the discussion below I have used the terms *vaccination* and *immunisation* according to their correct definitions. I have also used the term *infectious disease* instead of the government's terminology of *vaccine-preventable disease* to provide clarity to the discussion.

7.3 The Government's Answers to FAQ on the IAP Website

In the presentation of this discussion I will provide government statements in bold italics followed by a discussion of the claims. A complete list of the FAQ's on the government website can be found in Appendix 6**.**

Statement 1

All forms of immunisation work in the same way. When a person is vaccinated, their body produces an immune response in the same way their body would after exposure to a disease, but without the person suffering symptoms of the disease. When a person comes in contact with that disease in the future, their immune system will respond fast enough to prevent the person developing the disease.

Discussion: The scientific literature does not support the claim that all forms of immunisation work the same way. For example, artificial immunity produced by vaccination with inactivated agents is of shorter duration than that produced from natural infection (AAS 2012; AG IAP 2013; NCIRS Fact Sheet VC 2009). This shows that all

forms of immunization – artificial and natural - do not work in the same way. The attenuated, inactivated or genetically engineered pathogen in a vaccine is injected directly into the tissues of the body – as opposed to ingestion or respiration - along with many excipients in the vaccine carrier: preservatives, antibiotics, and adjuvant. Many of these excipients are not inert substances and this means they will have an unpredictable effect in the human body (Pifferi and Restani 2003; Shoenfeld and Agmon-Levin 2011; FDA). The body's defense mechanisms are stimulated in a different way due to the fact that the vaccine is injected into the tissues as opposed to entering the body naturally via the respiratory or digestive systems. Absorption of substances is increased when they are injected into the blood vessels or the tissues as opposed to inhaled or digested (Gilbert 2004 p26). There are also many other factors that come into play in the prevention of disease - host, environmental and agent characteristics – and this interaction of factors must be taken into account when predicting health outcomes (Burnet 1952 p107). Immunity is not just the production of antibodies stimulated by an infectious agent it is a reaction in the body that is produced by a number of integrated systems (Behrman et al 1998).

The human body has many first-line defense mechanisms (non-specific defense) to prevent micro-organisms from entering the body (Friis and Sellers 2004 p403; AAS 2012). Whilst it is true to say that a newborn infant is regularly exposed to multiple pathogens in the first year of life they rarely pass the infant's non-specific defense system. The route of entry plays a fundamental role to the health outcomes that result from exposure to toxins (Gilbert 2004 p25). Outcomes are also affected by the duration and frequency of the exposure. If there is little absorption of the substance/agent then there will be little response. Metabolism and excretion can also have a modifying effect on the absorption of some substances (Gilbert 2004 p26). Other influential factors include gender, age and genetics which determine the rate at which a person metabolises substances. Some individuals are unable to metabolise substances at all due to their genetics or age. These factors apply to the expression of disease after exposure to an infectious agent and also to exposure to foreign antigens from the injection of vaccines. Mercury, an ingredient that was used in some vaccines for many years, is a good example of the differences between the effects from ingestion and injection of substances and this has been described in Appendix 4. When the body is exposed to a pathogen naturally the first line of defense is the skin and

the lining of the lungs (AAS 2012 p4; Friis and Sellers 2004 p403). Mucous, cilia, stomach acid, phagocytes and other white blood cells are the first line of defense against foreign particles (antigens). These tissues are referred to as the innate immune system; the white blood cells in these regions (guardian cells) have sensors that detect the antigens (AAS 2012 p4). The guardian cells then activate lymphocytes to produce B-cells and T-cells. It is the B-cells that produce the antibodies that target specific antigens in a lock and key fashion to prevent infection (AAS 2012).

In contrast, a vaccine is injected into the subcutaneous or intramuscular tissues with the excipients of the vaccine, including the foreign proteins and DNA of the altered pathogen and contaminants of the manufacturing process (Eldred 2006; NCIRS VC 2009). The animal-derived protein in the manufacturing process can be calf serum, monkey kidney tissue, chick or human diploid cells, all of which are similar in structure to human proteins (La Rosa 2002; Eldred 2006). Hence the antibodies that are produced in the vaccinated animal can cross-react with its own tissue proteins in a process similar to autoimmunity (Greville 1966; La Rosa 2002; Shoenfeld and Agmon-Levin 2011; Tomljenovic and Shaw 2011). This demonstrates that all forms of immunisation do not 'work in the same way' as stated in the FAQ. Vaccination induces auto-antibodies in animal models (including lupus-associated ones) and these are a known cause of autoimmune diseases (La Rosa 2002; Molina and Shoenfeld 2005; Shoenfeld and Agmon-Levin 2011; Tomljenovic and Shaw 2011). The link between vaccines and the autoimmune response has been known for decades (Greville 1966). It has also been known that this response can occur weeks, months or years after exposure (Shoenfeld and Agmon-Levin 2011; Gilbert 2004 p.27; FDA Thimerosal). The immune system functions together with other body systems and interfering with one system can have unpredictable health outcomes. There is evidence that artificial immunity caused by vaccination causes accelerated autoimmunity and inflammation and many scientists consider that individuals with a family history of these diseases are genetically pre-disposed to these conditions after vaccination (NHMRC 1954–1986; Obomsawin 1998; NCIRS VC 2009; Shoenfeld and Agmon-Levin 2011 p6).

Statement 2:

The two main reasons provided by the government for vaccinating every child in Australia are:

i. ***Immunisation is the safest and most effective way of giving protection against the disease. After immunisation, your child is far less likely to catch the disease if there are cases in the community. The benefit of protection against the disease far outweighs the very small risks of immunisation.***
ii. ***If enough people in the community are immunised, the infection can no longer be spread from person to person and the disease dies out altogether. This is how smallpox was eliminated from the world and polio has disappeared from many countries.***

Discussion: To conclusively support these claims further research needs to be done.

I. The government states that after *immunisation* your child is far less likely to catch the disease. This statement is not correct because not all vaccinated individuals gain immunity. The correct word to use in this statement is *vaccination* and not *immunization*. Some individuals still get the diseases they are vaccinated against and the observation that artificial immunity is different to natural immunity (see statement 1 above) means that the claim cannot be sustained. Formal controlled clinical trials using an inert placebo to demonstrate efficacy in preventing disease have never been performed for most conventional vaccines (MPA 2007) to conclusively support the claim that 'the benefits of immunity gained from vaccines far outweighs the very small risks of immunisation (vaccination)'.

   There are many factors and body functions that interact in health outcomes and a public health policy should not be justified using incorrect statements such as all types of immunisation (artificial and natural) work in the same way. In addition, vaccines have side-effects in some individuals and whilst the FAQ has described these risks as 'very small' the fact remains that the frequency and nature of side-effects from vaccines are not fully known because government monitoring systems

are not designed to make causal links regarding the types and frequency of adverse events that occur after vaccination. The statement that the risks are 'very small' is a value judgment that is not supported with adequate scientific studies. In other words, this is an area of undone science.

II. The statement that smallpox and polio were controlled by 'immunisation' (meaning 'vaccination') is a simplistic description of the control of infectious diseases. Pathogenesis results from a complex interaction of many factors (see chapters 2 and 4) that relate to the host, the agent and the environment. The eradication of smallpox was significantly influenced by the specific nature of the smallpox virus and public health reforms that occurred in the early 20th century (Wallace 1989; Curry 2002; Kleinman et al 2005; Disease Warriors 2005). A vaccine against smallpox was available for 150 years prior to its eradication in the mid-twentieth century. Kleinman et al (2005) ask why the disease took so long to be eradicated if the vaccine was effective (p312). One strategy that has been credited with assisting in the eradication is *case tracing epidemiology* (or the 'ring strategy) (Disease Warriors 2005). This strategy involved identifying and isolating cases of the disease and it was successful because the smallpox virus is only communicable once the symptoms have appeared (Curry 2002; Kleinman et al 2005). This isolation of cases prevented transmission of the disease. Consequently only 50% of the global population was vaccinated. The fact that the disease is only transmissible after the symptoms appear was fundamental to the interruption of the life cycle of the virus and this factor combined with improvements in sanitation and hygiene enabled the disease to be eradicated 150 years after the vaccine was first used. Since smallpox has been eradicated scientists have raised serious questions about the safety and efficacy of smallpox vaccine which was never tested in randomized controlled clinical trials prior to its use in the 19th and 20th centuries (Wallace 1889 p217; Kleinman et al 2005). In 1889 Wallace commented on the numerous deaths and injuries caused by smallpox vaccine and described its use as 'one of the scandals of the 19th century' (p219). After a trial in US healthcare workers in 2003 it was established that the smallpox vaccine can cause neurological adverse events that

included meningitis, encephalitis, Bell palsy, seizures, Guillain-Barre syndrome and death. The documentation of these events in the smallpox vaccine trial on healthcare workers in 2003 resulted in an early end the trial (Schwenk 2006).

There are many contextual issues surrounding the decline of infectious diseases that are significant to their ability to be eradicated. The variables that are involved in the incidence of an infectious disease include characteristics of the pathogen and host, environmental factors and any changes to case definitions or surveillance methods that occur at the same time as the incidence of disease declines. The government has not discussed any of these factors. Herd immunity was a concept that was first observed after communities were exposed naturally to infectious agents. For many infectious agents this can offer better community protection because exposures can be sub-clinical (asymptomatic) or mild and provide longer-lasting immunity than artificial immunity produced by vaccination. The theory of herd immunity is discussed in chapter 4.

Statement 3

Immunisation protects people against harmful infections before they come into contact with them in the community. Immunisation uses the body's natural defense mechanism - the immune response - to build resistance to specific infections. Immunisation helps people stay healthy by preventing serious infections.

Discussion: This statement is misleading because it is not true if the correct word, *vaccination*, is used. Vaccination does not always produce artificial immunity and it sometimes causes illness and disability (AG IAP 2013). Hence the use of the word 'immunisation' in this statement is misleading. The statement *assumes* that immunity (without any harmful effects) will always be produced by vaccination. Statements about the lack of evidence for vaccine efficacy and safety are often listed on the package inserts or product information (PI) for vaccines. For example, the Commonwealth Serum Laboratory's (CSL) package insert for influenza vaccine (Fluvax/Afluria), a vaccine that has been produced in Australia since the 1960's, states:

‘There have been no controlled clinical studies demonstrating a decrease in influenza disease after vaccination with Fluvax/Afluria’ and ‘Vaccination with Fluvax/Afluria may not protect all individuals’ (CSL Fluvax PI 2007).

Efficacy is defined by the US Congress Office of Technology Assessment (OTA) as ‘the probability of benefit to individuals in a defined population from a medical technology applied for a given medical problem under ideal conditions of use.’ Vaccine efficacy trials use the measure of seroconversion as a surrogate for vaccine efficacy in preventing disease in the population (Basch 1994 p69). In addition, the government does not publish independently assessed data of vaccinated and unvaccinated individuals (including socioeconomic status) who are hospitalized due to infectious diseases to promote vaccines to the public. Cases that are hospitalised are the more serious cases of disease and transparent data on vaccination status is needed to evaluate the influence of a vaccine in reducing the disease. This has not been presented by the Australian government on the IAP website to support current vaccination policies (AG IAP 2013).

Statement 4

Vaccines contain either:

- ***a very small dose of a live, but weakened form of a virus;***
- ***a very small dose of killed bacteria or virus or small parts of bacteria; or***
- ***a small dose of a modified toxin produced by bacteria.***

Vaccines may also contain either a small amount of preservative or a small amount of an antibiotic to preserve the vaccine. Some vaccines may also contain a small amount of an aluminium salt which helps produce a better immune response.

Discussion: This statement is misleading because it uses the word ‘small’ to imply that it would not cause significant harm and it does not list all the possible ingredients of the combined schedule of vaccines. The government has used qualitative descriptions of the amount of each ingredient and not actual ‘quantities’ with the known effects of these substances in humans. Yet it is known that ‘very small’ amounts of many toxic substances,

including antibiotics and preservatives, can have severe health effects in humans, particularly in children and infants (Gilbert 2004 p21). The Australian government even states in its framework for risk assessment for environmental health hazards that the health effects of low doses of many toxic substances have not yet been established (AG EHRA 2013; Gilbert 2004 Preface). These effects are often synergized when injected into the body in combination with other chemical compounds (Gilbert 2004 p32). Yet this knowledge about the risks of vaccines is not provided in the government's discussion about the ingredients of vaccines. The exact ingredients of vaccines are not provided to consumers on the IAP website. The government has listed 'components of vaccines' in Appendix 3 of its Immunisation Handbook (10th Ed) (DHA IH 2013). Most community members would not access this handbook for information and doctors are not required to provide it to patients.

Statement 4 also omits to mention the serious adverse events that are known to be caused in some recipients by vaccines. These include allergies, hypersensitivity, anaphylaxis and autoimmune diseases that are discussed in the medical literature and in the product information sheets for vaccines (NCIRS VC 2009; NHMRC 1954-86; Obomsawin 1998; Tomljenovic and Shaw 2011; CSL PI Afluria /Fluvax 2007). These possible adverse events are often not discussed with doctors before vaccination and this is particularly the case now that vaccines are being administered in schools. A family history of these conditions was traditionally a contraindication to some vaccines (NCIRS VC 2009; NHMRC 1954-86; Obomsawin 1998) but these conditions were removed as a barrier to universal vaccination in school programs in the 1990's (AG NHMRC 1991; Obomsawin 1998). The possible serious adverse events that are listed on the CSL package insert for the influenza vaccine, Fluvax (2007), include allergic reactions (including anaphylactic shock), neuralgia, thrombocytopenia, paresthesia, encephalopathy, neuritis (neuropathy), transverse mylitis and Guillain-Barre Syndrome (GBS), vasculitis, pruritus, urticaria, influenza-like illness, partial facial paralysis and brachial plexus neuropathy (CSL PI Afluria/Fluvax 2007). Yet neither these, nor adverse events from other vaccines are mentioned in the FAQ's on the government's website.

Statement 5

Thimerosal (or thimerosal) is a compound used in small amounts to prevent bacterial and fungal contamination of vaccines. Thimerosal is partly composed of mercury in the form of ethyl mercury. Mercury causes a toxic effect after it reaches a certain level in the body. Whether or not it reaches a toxic level depends on the amount of mercury consumed and the person's body weight. As a result of these concerns, in particular for newborn babies and very young children, thimerosal was removed or reduced from vaccines.
Currently, all vaccines on the National Immunisation Program for children under 5 years of age are now either thimerosal free or have only trace amounts of Thimerosal. It is not possible to completely remove thimerosal from all vaccines; some vaccines like Energix-B are still most effectively manufactured using a trace amount of thimerosal as a preservative.

Discussion: This information is selective and it justifies the use of a toxic substance in infant vaccines whilst confirming that thimerosal is not demonstrated to be safe in infants.

1. The statement does not provide evidence that any level of thimerosal in vaccines is *safe*; indeed it specifically states that mercury has toxic effects. It also downplays the significance of mercury in vaccines. Parents have a right to be fully informed about the ingredients of vaccines and thimerosal should be correctly defined to parents as a compound that is made up of 49% ethyl mercury which is a known neurotoxin (FDA Thimerosal).
   In the 60 years that vaccines have been used this knowledge has never been provided to parents before they gave consent for their children to be vaccinated. The government states that the toxicity of thimerosal 'depends on the amount of mercury consumed and the person's body weight'. It does not say *what amount* of mercury is safe. The safety of this ingredient will vary for each infant/child according to body weight and with the number of vaccines that are used. A safe level in humans has never been determined because establishing a safe level of a known neurotoxin in humans would be unethical (FDA Thimerosal). However the

government does not consider it unethical to use mercury compounds in infant vaccines without knowledge of its safety, and without the consent of parents.

The Public Health Agency of Canada (2002) states 'High dose, acute or chronic mercury exposure of children and adults can cause neuro- and nephrotoxicity…..there are limited data examining the effects of low-dose, intermittent mercury exposure in infants immunised with thimerosal-containing vaccines'.

This statement was made after many thimerosal-containing vaccines had been used in infants for 60 years and particularly in the 1990's when the number of thimerosal-containing vaccines increased significantly (AG IAP 2012; PHAC 2002). There were over 20 vaccines that had been licensed that contained thimerosal in quantities ranging from 0.005%-0.01% (Varughese and Calver 1999 in PHAC 2002). The amount of mercury is cumulative with each vaccine that is given.

2. The US Food and Drug Administration (FDA Thimerosal) revealed in 1999 that the cumulative exposure of American infants (6 months of age) to ethylmercury from vaccines exceeded the recommended US Environmental Protection Agency (EPA) guidelines that were established for the closely related organic mercury compound methylmercury (AAP 1999 in PHAC 2002). It is also documented that exposing the feotus or infant in the first 6 months of life to organic mercury compounds poses a risk of neurological damage due to mercury toxicity (PHAC 2002). The symptoms of neurological damage due to mercury toxicity are similar to those of autism (Kirby 2005; PHAC 2002). A case study on mercurial toxicity and its links to autism has been discussed in Appendix 2.

3. Energix-B is the hepatitis B vaccine given to babies at birth (day 1 – 7) (DHA IAP 2013). It is a vaccine manufactured by GlaxoSmithKline (GSK) and the prescribing information states that the 'pediatric formulation contains a trace amount of thimerosal (< 0.5 mcg mercury) from the manufacturing process' (GSK 2005). This

trace amount of mercury is combined with aluminium hydroxide, sodium chloride and phosphate buffers in the Hepatitis B (Energix-B) vaccine and given to infants before their excretory systems and the blood brain barrier have developed. The government does not address these issues in the FAQ even though the scientific literature does not provide a consensus that it is safe to combine these substances in developing infants and adults.

A study to investigate the health effects of using Hepatitis B vaccine in neonates (infants under 4 weeks of age) was carried out in 2010 on children born before 1999. This was *before* thimerosal-free vaccines were available. The study reported that male neonates had a 3-fold increased risk for autism diagnosis than males never vaccinated or vaccinated after the first month of life. Non-white boys bore a greater risk than white neonates (Gallagher and Goodman 2010 p1671). Universal vaccination with hepatitis B vaccine was recommended to all neonates in the US in 1991 and findings from studies regarding the safety of this vaccine have been mixed. Until 2000 this vaccine contained thimerosal and some studies have shown links between hepatitis B vaccine and autism, neurodevelopmental disorders, central nervous system inflammatory demyelination in childhood, liver problems, chronic arthritis and receipt of early education intervention services (Gallagher and Goodman 2010 pp1665-6). Yet the Institute of Medicine (IOM) stated in 2004 that there was no link between thimerosal-containing vaccines (TCV) and autism based on a selection of studies from countries ***that did not have recommendations for universal vaccination with hepatitis B vaccine for neonates*** (EUVAC.net, 2010 in Gallagher and Goodman 2010 pp1671). Some of the risk factors that have been identified for autism diagnosis include a family history of an autoimmune disorder, aberrant metabolic dysfunction, impaired methylation, early antibiotic use, genetic variants among subjects of European ancestors, porphyrin biomarkers of metal inhibition of the heme synthesis pathway and jaundice (Gallagher and Goodman 2010 pp1672).

Statement 6

Another reason why children get many immunisations is that new vaccines against

serious infections continue to be developed. The number of injections is reduced by the use of combination vaccines, where several vaccines are combined into one shot.

Discussion: The government does not mention that since 1950 the introduction of vaccines in the Australian population has been for diseases that represent a small risk to the majority of children (Com Yearbook 1953; Stanley 2001). The introduction of most vaccines in Australia was not to control epidemics of disease but to see if these diseases could be eliminated. See Chapters 2 and 3. This claim by the government implies that it is worthwhile to combine an unlimited number of vaccines in the infant body and that this can be done without producing significant side-effects or chronic illness. Yet the risks are not mentioned in the FAQ's and the long-term safety of using multiple vaccines has not been established. The chronic illnesses that have increased in the Australian population as the use of vaccines has increased include autism, asthma, allergies, anaphylaxis, neurological damage (learning and behavioural difficulties), speech delay and autoimmune diseases, e.g. arthritis and type 1 diabetes mellitus.

Statement 7

Many children experience minor side effects following immunisation. Most side effects last a short time and the child recovers without any problems. Common side-effects of immunisation are redness, soreness and swelling at the site of an injection, mild fever and being grizzly or unsettled. You should give extra fluids to drink, not overdress the baby if hot and may consider using paracetamol to help ease the fever and soreness.

Serious reactions to immunisation are very rare, however if they do occur consult your doctor immediately. It is important to remember that vaccines are many times safer than the diseases they prevent.

Discussion: This information is misleading because it does not describe the serious side-effects that are listed on the PI inserts for all vaccines (WAVE). For a significant but unknown number of children, vaccines will not be safer than the disease they are designed to prevent. This is because of genetics but also because the majority of children in

developed countries, like Australia, are not at risk of getting the disease. Some of the serious side-effects that are not listed by the government include neurological disorders such as encephalopathy, convulsions, seizures, Guillain-Barre syndrome, autoimmune diseases, allergies and anaphylaxis are possible adverse events to vaccines (Coulter 1995; Shoenfeld and Agmon-Levin 2011; CSL PI Fluvax/Afluria, PI MMR). These conditions are listed in the PI for vaccines yet not mentioned in the government's FAQ. Furthermore doctors are not required to provide this information to parents.

The claim that 'serious reactions to immunisation are very rare' does not provide the frequency or probability of a child being harmed by individual vaccines. The government is unable to provide accurate statistics of the risk of adverse reactions because the clinical trials for vaccines that are funded by the vaccine manufacturers do not compare vaccinated children with unvaccinated children using an inert placebo (Downing 2011; Future II 2007; CSL Fluvax PI 2007) and they do not establish the long-term health effects (5-20 years) of using vaccines in humans (AG TGA 2013). The passive post-vaccination surveillance systems used by government regulators globally are unable to determine the frequency and types of causally related adverse events linked to vaccines – in the short-term or the long-term – because they are dependent upon 'voluntary' reporting of health outcomes and not the mandatory reporting of all health outcomes for vaccinated individuals (AG TGA 2013; US CDC VAERS 2013).

Whilst the government FAQ states 'it is important to remember that vaccines are many times safer than the diseases they prevent' this cannot be sustained because the appropriate studies and surveillance systems have not been funded. Information on the government website downplays the side-effects of vaccines and over-emphasizes the benefits without definitive evidence. Vaccines and drugs can cause serious damage, or even death and it is known that phase III clinical trials are not large enough to characterize the risk from the vaccine/drug (Basch 1994 p93). The monitoring of vaccines/drugs and acceptance of adverse events linked to these products is influenced by the pharmaceutical companies that sponsor the trials, employ many of the researchers and fund the government regulators to monitor the safety of these drugs in the population after they are approved. See chapters 6, 9 and 10. This illustrates that public safety is dependent upon government regulators

establishing an *active* post-approval surveillance system that can make causal links between vaccines and adverse events.

Statement 8

Natural immunity and vaccine-induced immunity are both natural responses of the body's immune system. The body's immune response in both circumstances is the same. In some cases, vaccine-induced immunity may diminish with time; natural immunity, acquired by catching the disease is usually life-long. The problem is that the wild or natural disease has a high risk of serious illness and occasionally death. Children or adults can be re-immunised (required with some vaccines but not all) if their immunity falls to a low level. It is important to remember that vaccines are many times safer than the diseases they prevent.

Discussion: This information does not address all the differences between natural and artificial immunity, it is selective (See Statement 1 above). There is no risk/benefit analysis of immunity gained naturally and immunity gained artificially with the probability of risk for each disease. There is a risk on both sides of this equation – from the disease and the vaccine - and it will vary for each disease. The government has not provided quantitative evidence of the risk presented to the majority of individuals from both the infectious agent and the vaccine. In developed countries like Australia, the majority of children are not at serious risk from infectious diseases even when they are exposed to the infectious agent. The reasons for this are discussed in chapters 2 and 4.

The placebos used in safety trials always contain *all the adjuvants and often neomycin (an antibiotic and known neurotoxin and allergen)* that are also in the vaccine (Virtanen et al 2000). This means that comparing the safety of the vaccinated group to the unvaccinated group does not provide complete information about the safety of the vaccines in the human body. It assesses the safety of the vaccine when compared to the adjuvant (and/or antibiotic) in the human body and these substances are known to be *non-inert* meaning they are known to cause adverse events, immediate and delayed, in the human body (Shoenfeld

and Agmon-Levin 2011; Tomljenovic and Shaw 2011). Therefore it cannot be sustained that 'vaccines are many times safer than the diseases they prevent'.

Statement 9

The FAQ about 'Overloading the Immune System':

No. Children and adults come into contact with many antigens (substances that provoke a reaction from the immune system) each day, and the immune system responds to each antigen in specific ways to protect the body. Without a vaccine, a child can only become immune to a disease by being exposed to infection, with the risk of severe illness. If illness occurs after vaccination, it is usually insignificant.

Discussion: This statement is inaccurate because it fails to address the different ways that children/adults come into contact with multiple antigens naturally and artificially by vaccination. As described in **statement 1** above, the route of entry for pathogens has a major influence on the health outcome of the individual. The risk of severe illness due to natural exposure to infectious agents in developed countries is very low. Again the claim that 'if illness occurs after vaccination, it is usually insignificant' is questionable if it is not supported by evidence. Vaccination stimulates a different chain of events than natural exposure due to the injection of substances into the body where components have access to the organs and body systems. The final sentence of the FAQ answer could be re-written in the following way: 'Without a vaccine a child can become immune to a disease by being exposed to infection with little risk of severe illness in Australia. However, in genetically-diverse populations there is real risk that many children will suffer severe adverse events after vaccination'.

Statement 10

The government's statement for 'why vaccines are still necessary':

Many diseases prevented by immunisation are spread directly from person to person, so good food, water and hygiene do not stop infection. Despite excellent hospital care,

significant illness, disability and death can still be caused by diseases which can be prevented by immunisation.

Discussion: This statement is misleading because it generalizes the risks of all infectious diseases. Whilst it is true that illness and disability can still be caused by infectious diseases in developed countries, vaccines are being introduced for diseases that are not a risk for the *majority* of people in these countries. If the government is implementing a management strategy to prevent death and disability and the adopted management strategy *also causes death and serious disability*, then it is deceptive not to address the risks of the management strategy as well as the risks of the disease. Public health policy should be beneficial to the majority of individuals in that community.

The government's statement also ignores the fact that vaccinated children can still get the diseases they are vaccinated against. Therefore if the appropriate studies have not been funded to provide empirical evidence of the influence of vaccines in preventing disease, then the weight of evidence for the benefits of vaccines has not established.

7.4 A Discussion of the Australian Academy of Science Document *The Science of Immunisation*

The Australian Academy of Science (AAS) produced a supportive document for the Australian government's vaccination policies in 2012. At this time many parents were questioning the number of vaccines being recommended by the government and this document was developed to address parental concerns (AAS 2012). I am addressing the AAS claims in this chapter because this document represents another example of the type of information used to promote vaccines to the public.

In the following discussion AAS statements are in bold italics followed by discussions of the claims. The terms 'vaccination' and 'immunisation' have been conflated by the AAS; I will use the correct terms in my discussion.

1. ***Immunisation has transformed human health by preventing the deaths of hundreds of millions of people.***

2. ***The widespread use of vaccines has been highly effective globally in reducing the incidence of infectious diseases and their associated complications, including death.***
3. ***As a result of vaccination several infectious diseases have been controlled or eliminated in Australia which would never have occurred just due to improvements in healthcare, sanitation or nutrition.***
4. ***Vaccines are the most successful form of disease prevention available and will continue to be an essential tool in controlling infections and complications.***

Discussion:

These four claims from the foreword and summary (pp2-3) are about the achievements of vaccination programs. The claims have been made by ignoring the historical evidence that infectious diseases declined prior to the use of the majority of vaccines in all developed countries (Commonwealth Yearbook of Australia 1945–1986; Stanley 2001). This historical decline has been described in chapter 2. The claims have been made without providing historical data to support the statements and without definitive evidence to demonstrate the influence of vaccines in reducing infectious diseases. This is because definitive studies of the efficacy and safety of vaccines have not been funded.

Statements 1 and 2 claim hundreds of millions of deaths have been prevented by vaccines but the claims do not address the many deaths and cases of illness that have been caused by vaccines (Wallace 1889; Allen A 2007; Habakus and Holland 2011; US VICP). Value judgments about the benefits of vaccines must be founded on the weight of evidence not selective evidence for the use of the procedure. This was discussed in FAQ 9 above.

In statement 3 the AAS claims *'*As a result of vaccination several infectious diseases have been controlled or eliminated in Australia'. This is a general statement and it does not list any disease that has been controlled or eliminated by a vaccine. Similarly, the claim in statement 4 that 'vaccines are the most successful form of disease prevention available' is not sustained by evidence. The AAS has not provided empirical evidence

of the influence of vaccines in controlling specific diseases. This could be done by providing independent data on the number of vaccinated and unvaccinated individuals in the Australian population, with their socioeconomic status, that are hospitalized in outbreaks of a disease.

The Commonwealth Yearbook of Australia (1953) and prominent public health authorities clearly illustrate that the infant mortality rates declined significantly *before* the introduction and widespread use of all vaccines except diphtheria. Voluntary mass vaccination programs in Australia were not strongly promoted in Australia until after 1954 (NHMRC 1954). This evidence has not been discussed or countered by the AAS to make the general claim above. Although diphtheria vaccine was used prior to 1950 prominent public health officials such as Lancaster and Cumpston noted that the rate of the decline for diphtheria was no greater than the decline for all the other infectious diseases for which there was no vaccine (chapter 1). Proof of the influence of diphtheria vaccine in the control of this disease would also require data on the percentage of the susceptible population that had been vaccinated. This has not been provided.

5. ***Immunisation is based on scientific knowledge.***

Discussion:

This claim implies that the information presented as *scientific knowledge* to support this claim is proof that vaccines are safe, effective and necessary. This ignores the processes by which science is produced and assumes that all *scientific knowledge* is produced with integrity and rigor. This is not the case and the cultural and political influences on the production of scientific knowledge have been described in chapters 6 and 7. Much scientific knowledge is distorted by vested interests and the knowledge base is incomplete due to undone science. Furthermore, there is scientific knowledge that does not support vaccination and this has not been provided in this AAS document.

6. ***We know there are a very small number within a vaccinated population who can have adverse reactions as a consequence of vaccination. No medical intervention is completely without risk.***

7. ***Immunisation with each vaccine protects an individual from a serious infectious disease and from associated long-term complications***.

Discussion:

These statements fail to mention that many people are not at risk from the infectious diseases they are being vaccinated against in Australia, even if they are exposed to the infectious agent. The claims also do not address the fact that accurate knowledge about the health risks of vaccines is unknown because the appropriate studies and monitoring systems have not been funded. The statements are based on selective information and are therefore misleading the public on the risks and benefits of using multiple vaccines to protect the community.

8. ***Before release for use in the population a vaccine must undergo a series of rigorous clinical trials each of which involves a greater number of participants.***

Discussion:

There are no formal controlled clinical trials of vaccines that compare the safety and efficacy of vaccines against the disease or against an inert placebo. In addition, the recent introductions of HPV vaccines and the 'Swine Flu' 2009 vaccine have demonstrated that comprehensive testing was not carried out before the vaccines were used in the population. See chapters 9 and 10. HPV vaccines were fast-tracked for approval by the FDA before the clinical trials for efficacy and safety against cervical cancer were completed. Similarly, the influenza vaccine was recommended to Australian children under 5 years of age in Western Australia in 2008 without being tested for long-term safety and efficacy in children prior to its recommendation (Jefferson et al 2008; AG TGA 2010). When companies can make significant profit from the research they sponsor it is known that they can influence the design and hence the outcome of the clinical trials. See chapter 6. This throws into question the claim that vaccine trials are rigorous. An independent assessment of the clinical trials is necessary before the claims stated by vaccine manufacturers are accepted.

9. ***Vaccines undergo stringent monitoring once they are in widespread use in the community to ensure their ongoing safety and effectiveness.***

Discussion:

This claim is incorrect. There is no stringent monitoring of adverse events or evaluation of the effectiveness of vaccines in the population that would provide meaningful data on their effects in the population. This is because all countries use a 'passive' or voluntary post-vaccination surveillance system that is unable to provide data on causal relationships between vaccines and the frequency of adverse events that are observed in the population (US FDA; AG TGA).

10. ***There is no credible evidence to suggest that any vaccine in current use can cause these particular diseases (multiple sclerosis and diabetes 1)*** (AAS Box 9 p.12).

Discussion:

Whilst the AAS claims there is no credible evidence of a link between vaccines and autoimmune diseases, they have made this statement by ignoring the studies that are showing this link – not by addressing why the studies are not credible. They have also made this claim without providing evidence from a properly controlled long-term clinical trial (5 or more years) of the health effects of using the combined schedule of vaccines (against 16 diseases) in infant animals or infant humans. A link between vaccines and autoimmune diseases has been postulated in the medical literature for over fifty years and the combined schedule of vaccines is a plausible cause of these diseases. The *Medical Journal of Australia* reported the link between vaccines and autoimmune diseases in 1966 (Greville 1966) and Burnet discussed the association between hypersensitivity and vaccines in 1952 (Burnet 1952). There are also many recent studies that have demonstrated this link (La Rosa 2002; Shoenfeld and Agon 2011; Tomljenovic and Shaw 2012) and in particular the link with multiple schlerosis (Fourrier et al 1999; Marshall 1998, Confavreux et al 2001; Geier et al 2005) and diabetes mellitus (Blumberg et al 1993; Feery 1982; Stewart 1977). The AAS has made the claim that 'there is no credible evidence' without stating *why* these studies are not 'credible'. In fact there is clear evidence from animal studies from

1965 that foreign protein and adjuvants produce auto-antibodies which are a known cause of autoimmune diseases. Burnet and Mackay stated in 1965 ‘There is no doubt that conditions basically resembling certain human autoimmune diseases can be produced in originally healthy experimental animals by injections of normally inaccessible autologous antigens’ (in Grigor 1965 p83). Whilst there are studies in the medical literature that discount a causal link between vaccines and autoimmune diseases, there are no studies that have discounted this link using empirical evidence from properly designed RCT’s in animals or humans. In addition, a public hearing into the adverse events associated with HPV vaccines held in Paris in 2014 included this statement:

‘Current scientific knowledge and progress has revealed that aluminium is responsible for what can be called vaccine-induced illness or illnesses that did not naturally exist pre-vaccination and which the individual therefore contracted through aluminium toxicity.’ (Vanlangendonck P. 2014). Aluminium adjuvants are also found in most childhood vaccines.

Here is a description by Basch of the knowledge scientists had of adjuvants and their effects in 1994 when the use of vaccines was expanding. This information gives an insight into the potential effects of adjuvants and is relevant today in light of recent knowledge about the effects of aluminium adjuvants in the functioning of the human body. Adjuvants enhance the immune response of the body. That is, they operate to increase the production of antibodies in vaccine recipients (Basch 1994 pp227-8). Vaccines that are not made with the complete organism (bacteria/virus) are known to be less immunogenic. These vaccines require more adjuvant to raise the antibody titre to the protective level. Many of the vaccines produced with new biotechnology are made without using the whole organism as the antigen. These vaccines use acellular components, chemical synthesis or recombinant DNA as the antigen and therefore they require more adjuvant to raise the antibody level of the vaccine recipient. Adjuvants also influence the class of immunoglobulin antibodies that are produced in the body (Basch 1994 p227). One class of antibody produced is immunoglobulin E which plays a major role in allergic diseases; asthma, hayfever, dermatitis, gastroenteritis and anaphylaxis (Martin 2002). These conditions have increased 5-fold in Australian children over the last decade (ASCIA 2015). See section 1.1.

Examples of novel vaccines include hepatitis B, acellular pertussis (DTap) and HPV. The HPV vaccine has three times as much aluminium adjuvant as any other vaccine and three times as many adverse events (chapter 9). The most common adjuvants used in vaccines are aluminium hydroxide and aluminium phosphate. In 1984 it was stated that the complexity of vaccine adjuvants means that they produce a variety of responses in the host some of which are irrelevant to the immunogenic effect. The immune response is a multistep process and can occur through a variety of pathways therefore they can theoretically act in unknown ways on many cells in multiple pathways. These processes are not fully known and understanding of the immune response is unclear (Bomford 1984 in Basch 1994 p228). It is also known that there are significant differences in the effect of adjuvants from species to species and between individuals within a species. Basch (1994) stated that the extent of genetic variability with respect to adjuvant function is unknown but believed it may be significant to health outcomes in human populations (p228).

11. ***The vast majority of people (mainly adults) who develop autoimmune diseases have no recent history of being vaccinated*** (AAS p12).

Discussion:

This statement is misleading for two reasons. Scientists know that the autoimmune diseases show a delayed response (Eldred 2006; Shoenfeld 2011; Gilbert 2004; FDA). Autoimmune diseases and hypersensitivity (allergies) can develop months or years after exposure so even if patients do not have a 'recent history' of vaccination, vaccination could still be responsible. The statement also ignores the fact that autoimmune diseases such as diabetes 1 and autism are rapidly increasing in children - not just adults. This increase has occurred at the same time as the number of vaccines has increased (AIHW 2005). Two diseases that the AAS admits have increased due to vaccines are Guillain-Barre syndrome and idiopathic thrombocytopenic purpura (ITP). The suggestion that they are less of a risk than the infectious diseases is a value judgment that is not sustained with specific evidence of the risks and benefits of different vaccines and infectious agents.

7.5 Political Decisions in Government Policy

The discussion in this chapter illustrates that there is credible evidence for a causal link between vaccines and many serious and debilitating diseases that are increasing in the population. Yet political decisions are being made in government policies that do not acknowledge the medical literature supporting these links. This allows those with vested interests in vaccination programs to downplay the risks of vaccination. This is possible because governments have reversed the precautionary principle to place the onus of proof of harmfulness on the general public *and not the proponent*. It is difficult for the public to prove with 'hard evidence' that vaccines are causing many diseases in the population because governments have not funded the studies that might establish causal links with the vaccines. This allows political decisions to be made that ignore the evidence from small scale studies that harm is being caused by using multiple vaccines. Decision-makers use political and scientific criteria in deciding whether a procedure should be implemented and these decisions can include transient and subjective (value-based) reasons regarding the evidence. Not all evidence is of equal value or produced with equal integrity and rigour (Basch 1994 p79). The evidence that is used in policy decisions is provided by the dominant network of scientists that gains power through the cultural and institutional structures that exist in the prevailing political ideology. See chapter 8.

After the considerable public concern about the safety and efficacy of hepatitis B vaccine in the 1990's, due to its association with multiple-sclerosis, the Virus Hepatitis Prevention Board reviewed these safety issues. Several members authored a paper to downplay the risks and to promote the vaccine in neonatal and adolescent vaccination programs in many countries. This was done by promoting the studies, mostly funded by industry, that do not show a link between vaccines and chronic illness. The other studies showing links to diseases were ignored. This allowed the authors to claim 'no scientific data currently allow the conclusion that hepatitis B vaccine or other childhood vaccines represent a significant risk……' (Guido et al 2005 p958). This is the type of value judgment that is being made to develop vaccination policies and it is not the same as stating 'vaccines do not cause significant harm in the population'. The claim can be re-framed 'it has not been proven that hepatitis B vaccine is not the cause of autoimmune and other diseases in the population'.

Scientists are succeeding in hiding the possibility of causal links because the relevant research is not carried out. Governments have not funded the studies that might provide the evidence showing vaccines are causing many chronic diseases in the population. See chapter 8.

The article concludes that the media should be seen as 'reliable key partners in countering vaccination scares and the anti-vaccination movement' (Guido et al 2005 p958). The authors claim that 'cultivating optimal professional working relations with them is imperative'. They continue 'Open debate about vaccine safety issues and the performance of sound scientific studies are powerful instruments to be used against vaccine scares and should be encouraged' (Guido et al 2005 p958). However in Australia the public is not encouraged to participate in debates on vaccination. Powerful pro-vaccination lobby groups such as the Australian Skeptics and Stop the Australian Vaccination Network (SAVN) influence politicians and the media. They also use social blogs to ridicule and abuse individuals, including academics and professionals, who are questioning the safety and efficacy of vaccines (Martin 2015). There is evidence that lobby groups in many countries are being funded by industry to promote industry interests (Michaels 2008). These groups discredit people's reputations and promote disinformation to suppress scientific debate.

7.6 The Evidence not Provided by the Government and AAS

Evidence for the Necessity of each Vaccine Recommended in Australia

- The diseases for which vaccines are recommended have not been demonstrated to be a serious risk to the majority of children in Australia.
- Quantified data of the risks of vaccines and the risks of each infectious disease to the majority of children have not been provided to demonstrate the weight of evidence for the necessity and safety of each vaccine.

Evidence for the Efficacy of each Vaccine Recommended in Australia

- There is no definitive evidence from formal controlled clinical trials comparing vaccinated participants to unvaccinated participants and demonstrating the efficacy of each vaccine against the infectious disease they are designed to prevent.
- The surrogate of seroconversion has been used for proof of efficacy of each vaccine but the models of seroconversion demonstrating a protective level of antibody titre against the disease have not been provided.
- Many vaccinated individuals still get the diseases they are vaccinated against and the government has not provided complete evidence, including SES, of the percentage of vaccinated individuals who are still getting the diseases.

Evidence for the Safety of each Vaccine Recommended in Australia

- There is no definitive evidence from formal controlled clinical trials comparing vaccinated participants to unvaccinated participants, using an inert placebo that demonstrates the safety of each vaccine or the combined schedule of vaccines.
- Definitive evidence of vaccine related causal adverse events and their frequency in the population has not been provided.
- A post-vaccination surveillance system that can establish the short and long-term causal events and their frequency in the population is not used by government regulators.
- The known link between a family history of autoimmune diseases and allergies/anaphylaxis is not discussed and is no longer presented as a contraindication for vaccination programs implemented in school settings.
- The correlation between mercury poisoning and autistic symptoms has not been acknowledged by governments even though the US Government regulator, the FDA, admitted that the cumulative level of mercury in infants under 6 months of age had exceeded the EPA's guidelines in the 1990's. This correlation needs to be acknowledged and investigated to demonstrate that vaccines are not causing autism.

- Adverse events that are listed on the Prescribing Information (PI) for each vaccine are not mentioned to parents. E.g. encephalopathy, convulsions, seizures, Guillane-Barre Syndrome, autoimmune diseases, allergies and anaphylaxis.
- The risk of each disease and vaccine in genetically diverse communities has not been provided.

7.7 Conclusion

The evidence provided by the Australian government and the AAS for vaccinating with multiple vaccines does not include an assessment of the ecological complexity of the cause of infectious diseases or account for the genetic diversity of the population. It also does not provide direct evidence of the influence of vaccines in controlling any infectious diseases. In addition, the adverse events from using multiple vaccines in infants/adults should be considered in the adoption of a management strategy that is implemented in public health policy. The government information analysed here does not provide estimates of the frequency and type of risk associated with each vaccine - or with the combination of vaccines. It also does not provide evidence that policy-decisions about infectious diseases are being made for the benefit of the majority of the community. The value judgments made by policy advisors in Australia are emphasising the *assumed* benefits of vaccines and downplaying the risks. This is illustrated in the selective evidence and misleading statements that are used to promote vaccines to the public in the FAQ and by the AAS. Conflated terminology has been used to mislead the public about the efficacy of vaccines. The government has not provided evidence that the 'best judgments' for public policy are being made on comprehensive and independent evidence. Australia's vaccination policies include undone research and a lack of transparency in the rigour of scientific trials and the assumptions used in the evaluation of vaccines. This is a consequence of a culture that promotes scientific research for 'profit' as opposed to its contribution to progressing knowledge. In the 21st century industry is sponsoring vaccine clinical trials without evaluation from independent experts. This is not disinterested science and it is being promoted in public policy by experts with vested interests.

The culture in which research and policy development is occurring in Australia is described in chapters 6 and 8. An example of the influence of corporations in global vaccination policies is provided with the HPV vaccine in chapter 9 and the 'Swine Flu' 2009 vaccine in chapter 10. These case studies demonstrate how vaccines can be implemented into global vaccination polices even though the underpinning science is incomplete. Chapter 11 presents the conclusions to this investigation.

CHAPTER 8 POLITICS AND UNDONE SCIENCE IN PUBLIC POLICY

8.1 Introduction

This chapter introduces the concept of undone science and the increase in undone science that occurs when policies are designed pre-dominantly on the advice provided by technical or 'expert' advisors with specific agendas. I have provided here a description of undone science, a case study, a summary of the political framework that fosters undone science and the undone science relevant to government vaccination policies. Many of the sources I have used refer to practices in the US and I have described here the relevance of these practices to the Australian situation.

8.2 Undone Science

Undone science is the research that is not conducted because institutional barriers are constructed in the political process to prevent it from being done (Hess 2007 p22). These are the areas of science that are left unfunded, incomplete or ignored although many scientists consider them to be worthy of further research (Frickel et al 2010 p445). The relevance of undone science to government policy is that gaps exist in the scientific knowledge that underpins the value judgments made by policy-makers. Nearly all new scientific research depends upon funding therefore if the research is not prioritized by academic institutions, governments, industry or civil society organisations it can be left unfunded. This situation affects the on-going contribution of knowledge which is fundamental to the decisions made by politicians in public health policy. The political sociology of science describes the power play involved in the prioritising of research agendas and the institutional barriers that can be constructed in governments and research institutions to produce areas of ignorance in particular fields. This lack of knowledge can prevent social movements from challenging public policies that are not seen to be beneficial to the public interest (Frickel et al 2010 p446). Hess (2007) describes this situation in the following way: 'The prioritization of research tends to create huge pockets of undone science that result in the systematic nonexistence of selected fields of research' (p22).

Scientific leaders play an important role in allocating the funding for research agendas and they are also in a position to be influenced by economic and political leaders. These scientists can also be influenced by social movements and public opinion but this occurs to a lesser extent if the area of science is unfunded. It is also less likely to occur if the advocates for the science do not have political power (Hess 2007; Gross 2007). Even when the undone science is completed it is observed that the scientists and their research can be discredited if they are not part of the dominant network of scientists (Hess 2007). These political barriers to the production of knowledge arise when the interests of political, economic and industrial leaders synergise to control the direction of funding for scientific research. In many governments political decisions are determined by the dominant network of scientists who advise the government through representation on policy-advisory boards. These 'technical advisors' are influential in validating the assumptions and extrapolations that are inherent in the accepted scientific practices and innovations that are promoted (Frickel et al 2010). Whilst science is a social institution that forms the foundation of many political outcomes it is noted that most politicians do not have an in-depth understanding of scientific issues (Hess 2007 p21). The legitimacy of political outcomes therefore depends upon the values inherent in the production of science and in the use of science that has been accepted by all stakeholders.

When the production of science and the 'selection' of science for government policy is influenced by industry sponsors, the resulting policies may serve the interests of industry but not necessarily the public interest. The research agendas of industrial sponsors are determined by motives to improve industry profits (Krimsky 2003; Angell 2005). In these situations the production of knowledge can rest on the material interests and cultural assumptions of privileged groups in society (Frickel et al 2010). In situations where universities partner with industry it is observed that the research environments reflect industry needs rather than the interests of society. The dominant research areas that are selected for funding are technology and the production of goods for profit. When academic institutions, governments and industry are aligned it is noted that sponsors (with vested interests) have control over the design of studies and the areas of study that are selected for funding (Hess 2007; Michaels 2008; Angell 2005; Krimsky 2003). This occurs at the expense of public interest science. The existence of undone science illustrates how cultural

factors and societal beliefs can mould the science that is produced in scientific institutions. In a capitalist economic model of health the science is shaped by profit and not public interest because this is a fundamental cultural value inherent in this system. See Chapter 5.

In the era of globalisation political outcomes can be achieved because industrial sponsorship has converged in university partnerships and government funding agendas have aligned with corporations (Krimsky 2003 ch5; Hess 2009 p311). Political outcomes from epidemiological studies can be achieved by sponsors selecting the study criteria and the mathematical models that will be used to analyse the data (Michaels 2008 pp60-78). Whilst it is possible for social movements and the public to influence government research agendas, this influence is reduced by institutional bias constructed by powerful coalitions (Frickel et al 2010). This structural bias can result from the following practices (Michaels 2008; Angell 2005; Smith 2005; Krimsky 2003):

I. Conflicts of interest (COI) in government and academic institutions
II. A lack of community representation on government advisory boards
III. Financial control of the peer-review system of validating scientific knowledge

These structures within the political and academic system can act as a barrier in preventing some important areas of science from being acknowledged and funded. This type of bias is hidden from the public. In the globalisation era it is observed that the peer-review process and production of validated scientific knowledge is being influenced by vested interests that control the financial channels of the peer-review process (Angell 2005; Hess 2007; Michaels 2008; Krimsky 2003). When global market mechanisms are uncontrolled they nurture the COI that generate bias and unreliability into research and medicine. According to an Italian editor of an international medical journal: ‘Members of corporate driven special interest groups, in virtue of their financial power and close ties with other members of the group often get leading roles in editing medical journals and in advising non-profit research organizations*’* (cited in Krimsky 2003 p10).

In this culture corporate members are acting as reviewers and consultants of scientific research and they systematically prevent the dissemination of scientific research that may be in conflict with their vested interests (Krimsky 2003 p10). This statement is supported by the previous editor of the *New England Journal of Medicine*, Marcia Angell. She states:

'It is simply no longer possible to believe much of the clinical research that is published, or to rely on the judgment of trusted physicians or authoritative medical guidelines. I take no pleasure in this conclusion, which I reached slowly and reluctantly over my two decades as an editor of the *New England Journal of Medicine'* (Angell 2009 p2).

The COI that the public hear about are only the tip of the iceberg (Krimsky 2003 p9). The validity of scientific knowledge that is used in the risk assessment framework for a public health policy should be formed from a consensus of all the stakeholders and not just technical experts. See Chapter 4. But this is not possible if journals are selecting against some areas of science and if important stakeholders are removed from the academic and political process. Each stakeholder in a scientific issue will be affected by policy decisions in a different way therefore decisions must be made on a consensus of all the stakeholders in the issue. A consensus that does not include all the stakeholders allows selective science (which excludes undone science) to be used as the foundation for public health policy.

The structure and hierarchy of academic institutions have changed with the commercialisation of academic research and development. In the US, university research is considered a source of economic and technological innovation and new professional groups, including technology-licensing officers, exist on university campuses to link research to industry. Whilst there have been formal university/industry relationships in the past, the new model is a merger of two cultures and has resulted in extensive structural change in university processes (Kleinman and Vallas 2006 p40). These changes have been described as 'revolutionary' and the rapid acceleration of innovative research to technology-transfer is referred to as 'the golden goose that is responsible for the nation's economic resurgence' (Owen-Smith 2006 pp63-4). The change in norms around public and commercial science is re-positioning the relevance of universities with respect to other

institutions – the government, the market, the citizenry and other constituencies. The 'enterprising' university represents the merging of two institutions, industry and academia, built on different values. In the US, in many fields with commercial relevance, the changes in norms and practices within the university are resulting in new structures for the production of knowledge (Kleinman and Vallas 2006 pp35-38). This has been described as 'asymmetrical convergence' because the driving force for the production of knowledge is profit and not public knowledge. In this system, some sectors of industry are adopting characteristics of academic culture to enhance their credibility, and the codes and practices of universities are changing to those of the commercial sector. This has resulted in tension due to the contradictory nature of the co-existing cultures.

Whereas universities were once seen as having collegial and open workplaces, with a high degree of researcher autonomy, they are now viewed as offering less autonomy over research direction. Research is increasingly driven by commercial agendas and data secrecy. University-industry relationships (UIR) are hindering the sharing of data and stronger competitiveness for professional recognition is a barrier to the free flow of knowledge. There is a commitment to the hoarding of information instead of the traditional commitment of knowledge to 'scientific communalism' (Kleinman and Vallas 2006 pp45-6). Further, in many technical fields the conditions and resources needed for traditional research are now mostly found in corporate laboratories. This has resulted in a blurring of the lines between 'academic' and 'industrial' science in the US (Kleinman and Vallas 2006 pp35-38), a change in culture that significantly impacts on the structure and integrity of knowledge production. It has resulted in a hybrid knowledge structure. Intellectual property is now a factor in the production of knowledge in addition to publishing in the most prestigious journals (Kleinman and Vallas 2006 p40). In this system universities have retained their image of being committed to the education of students and producing curiosity-driven, public interest science, whilst at the same time becoming enterprising businesses driven by profit. The over-riding goals of the commercial university are capital and economic competitiveness. Industries are the main sponsors of UIR's and they drive the research agenda. There is less curiosity-driven research to find the answers to questions of interest; the drive for knowledge is subordinated to the drive for profit. US universities

are justifying this structural change in the knowledge base on the potential benefits of technology-transfer to the public (Kleinman and Vallas 2006 p43).

8.3 Examples of Undone Science

Undone science is a lack of knowledge that arises when a specified area of science is not researched or when uncertainty exists in the science due to the assumptions and extrapolations that have been used (Gross 2007 pp747-8; Frickel et al 2010 pp444-473). The existence of undone science can be a result of a lack of funding or it may be a result of difficulties in publishing findings or a lack of career opportunities in this area of science. Particular research areas can remain unfunded because the likely answer would not support the political objectives of the sponsor. It may be detrimental to profits or it may be an embarrassment to the sponsor (Hess 2009 pp306-327). An example of undone science is a situation where a new technology or procedure is not tested for long-term safety and efficacy in a specific population. Examples include the long-term effects of genetic engineering, vaccines or nanotechnology in products that are marketed to the public. This information is valuable to the community and essential for safeguarding population health in the development of public health policy. When these technologies/procedures are implemented into the population before the long-term health effects are known it represents an experiment on the population: one that requires adequate monitoring to safeguard population health. The question of whether the long-term health effects are established *prior* to the introduction of a new technology or *after* the introduction of the technology or *never*, revolves around whose interests the government is protecting. This also reflects how governments interpret and use the precautionary principle in policy development.

Undone science also includes science that is founded on assumptions and extrapolations as opposed to direct empirical observations. An example of this type of undone science is the development of safety standards for the use of chemicals in humans and the environment. The majority of data that is used to establish safety standards for toxic chemicals is collected from observations in animal studies or naturally occurring accidents rather than controlled clinical trials on humans. This is because it is unethical to perform dose-response experiments on humans (Michaels 2008 pp60-78). This data includes assumptions and

estimations in the extrapolation process that represents undone science. Extrapolation produces uncertainty from both 'known' and 'unknown knowledge'. This uncertainty is illustrated in extrapolations of data from substances or animals that are similar in structure but not *the same* as the substance/animal in question. Unknown processes can influence the results in these cases. In some cases this uncertainty arises because the sponsor has chosen to ignore researching this area for political reasons. An example of this type of undone science is the extrapolation in humans of risk data for *ethylmercury* from observations of *methylmercury* in humans. These substances are related in structure but not exactly the same therefore value judgments about the safety of ethylmercury are being founded on the assumption that the biological reactions are similar. However, these assumptions might be demonstrated to be false if an empirical study was performed in years to come. For example, many chemicals have been found to have harmful effects in lower doses than was originally assumed. An example of an assumption concerning undone science was the long-held belief that the only serious consequence of lead exposure to children was death from high exposure. Further research determined that even small concentrations of lead can cause permanent brain damage to children (Gilbert 2004 p19).

8.4 The Consequences of Undone Science

When government funding is directed towards research fields that enhance national competitiveness or shift towards applied science and technology then there is a trend of increasing undone science (Hess 2007 p40). In particular, it is observed that when there is a switch to patenting and licensing in a research field then funding will shift from public sources, (federal government grants) to industrial sources. This reduces the opportunities for alignment with research projects in the public interest as they are generally not in line with industrial goals. This will occur even when there isn't an increase in direct support from industry if the government has aligned its research goals with those of industry innovation (Hess 2007). Scientists who research the environmental and health risks of new technologies are often acting against the interests of industry and its government allies and therefore find themselves with limited budgets and opportunities for career development. These scientists become marginalized and rather than dedicating their resources towards

prestige within the field they find themselves dedicating their resources towards investigating the undone science: a career path of anonymity (Hess 2007 p40).

Undone science has resulted in uneven development of different disciplines throughout history with greater investments in military and industrial interests than into public interest research (Hess 2007). By de-funding particular areas of research and engaging in political suppression of information, industry and governments can prevent causal links from being established. An example of a government being directly involved in the suppression of research was the US government under George W Bush (2001-2009) when global warming science was opposed and suppressed (Kleinman et al 2005). Research investment during this era and today focuses on research topics within fields that are of special interest to corporations, such as information technology (IT), biotechnology (BT) and nanotechnology (NT) (Hess 2007 p46). The aggressive commercialization of universities has resulted in effects on communities that have only become obvious with time (Krimsky 2003 pp73-87). These problems generally result from the stifling of academic freedom to pursue public interest research activities. That is, the integrity of the academic process to be able to speak the truth in the interests of society is curtailed. Essentially when universities and government supported non-profit research institutions become commercially orientated they lose their status as impartial and balanced centres of learning. An example of the dilemma that is created by commercialised research is when an academic publishes a study that is critical of a product in which the university has an investment. The question is - will the university punish the academic and suppress the research or will they support them? (Krimsky 2003).

The main areas of focus in the current scientific era are the creation of profitable new products that enhance economic and military interests (Hess 2007 p24). Among the pockets of undone science that are created in this research agenda are those essential to protecting public health. Government policies that are being developed despite a lack of full scientific evidence prevent civil society organisations from confronting the policies that are not in the public interest (Frickel et al 2010). This is a result of industrial and political leaders requesting that the public provides ‘proof of a causal link of harm’ before action is taken and at the same time they ensure that the area of science that might provide the proof does

not receive funding for investigation (Michaels 2008). Industry representatives on advisory panels are emphasizing the uncertainty in the science to ensure that no regulatory action is taken. See chapter 6. This was a strategy devised by the tobacco industry for many years and now it has been adopted by many other manufacturers (Michaels 2008).

Whilst some scientists have attempted to enforce the precautionary principle in a form that states 'The absence of certainty is not an excuse to do nothing' the industry representatives are reversing this principle to state 'there is no evidence of harm' therefore no action is required (Michaels 2008 pp60-78). However, the absence of evidence of harm may be due to absence of investigation as opposed to evidence that harm is not being caused. Gaps in the science can be achieved by a lack of funding in a particular field. This is occurring within government regulatory boards for medicines/vaccines because the majority of the funding is being directed towards marketing and fast tracking drugs for approval, as opposed to adequate safety testing, monitoring and regulation. Other strategies to hide causal links involve corporations funding studies that will create confusion and public controversy. This scientific literature is referred to as 'the social production of ignorance' (Frickel et al 2010 p447; Michaels 2008) and it increases public confusion: the public has to *trust* that the government and medical/academic institutions are acting to protect the public interest. Another strategy that government and industry have adopted in the current era is to ensure that particular knowledge is invisible by producing classified knowledge and trade secrets (Krimsky 2003; Frickel et al 2010; Angell 2005). In addition, the evidence regarding chemically exposed groups is also obscured to prevent causal relationships from being established (Frickel et al 2010 p447). As science has merged with the wider society the boundaries between 'producing knowledge' and 'applying knowledge' have become blurred and this has led to the implementation of new technologies with a high degree of uncertainty or risk (Gross 2007). Policy-makers, scientists and the public are increasingly acknowledging that harmful consequences of new procedures and technologies cannot be reliably determined through the usual risk assessment framework. This is because the areas of ignorance that result from undone science are increasing (Gross 2007; Hess 2007; Frickel et al 2010).

8.5 A Case Study of Undone Science: Corby Children Win Landmark Toxic Waste Case

A case study of the rehabilitation of the Corby Steelworks in the town of Corby, Midlands, UK, illustrates the political nature of risk assessments and the conclusions that can be made about causal links when environmental hazards have not been monitored (Dyer 2009; Collins Solicitors). This case was the result of a class action taken by 18 claimants who believed their deformities were caused by the rehabilitation of the steel works site in the town of Corby (1984–1999). The rehabilitation involved transporting toxic waste in open trucks through heavily populated areas. The environmental report stated that the badly polluted area had never been effectively assessed, properly permitted, regulated, monitored or adequate records maintained.

The mothers of 18 children claimed that during their pregnancies the exposure to high levels of toxins in the atmosphere during the rehabilitation of the Corby steel works site led to birth defects in their children. It was submitted by the counsel for the claimants that whether Corby Borough Council knew or should have known that the substances being transported were potentially hazardous to human health 'was hardly rocket science'. Despite the council's claim prior to the ruling that there was no causal link between the reclamation work and the children's birth defects because the levels of pollutants had not been monitored, the Court ruled that there was a statistically significant cluster of birth defects and that the types of contaminants that were being moved could plausibly cause the defects that were observed. On this basis, the Court made a ruling in favour of the claimants. The council appealed this decision on the basis that 'a causal link had not been proven with scientific evidence' however this appeal was dropped in April 2010 in favour of an out of court settlement and an apology by the council for its negligent activities in not monitoring the levels of contaminant exposure.

8.6 Implications of the Corby Case for Public Health Policy

Proof of causality of harm to individuals cannot be determined if the possible causal agents have not been monitored systematically. A lack of monitoring of harmful agents enhances the interests of industry as opposed to the interests of the general public. This commonly

occurs in the environmental and health sciences where inadequate monitoring prevents industries from concluding that a chemical or procedure is the causal link for an increase in a public health problem of significant concern to the community. This situation can prevent corporations from being liable for harm and can save companies or government bodies from financial loss.

This case study demonstrates that undone science is an important factor in public health policy and that a lack of science sometimes is not a satisfactory defense for a lack of action. In addition, a policy that ignores the role of undone science should not be called an 'evidence-based policy'. It can be argued that governments are breaching their duty of care to the public if they are implementing policies based on a 'lack of evidence' of safety and efficacy when there is a plausible biological link between the procedure/activity and harmful health effects in the population. The implications for this ruling extend to any situation where there is the potential for disease to be caused from toxic substances. The risk assessment for hazards is a key process and it illustrates how undone science must be accounted for in a systematic assessment of the risk. It also demonstrates the necessity for including both technical and non-technical information into the framework for risk assessment. When there is a lack of evidence resulting from undone science healthy outcomes can only be achieved if non-technical values are incorporated into the development of public health policy. In other words, in situations where there is a plausible causal link between a procedure and harmful effects on the population, the proponent, not the general public, must be responsible for taking action to protect public health when there is uncertainty in the science.

The initial court ruling reached in the Corby Toxic Waste Case rejected 'experimentation' on the human population. Population health is at risk when an absence of evidence can be used as a defence for a lack of accountability, that is, authorities stating 'there is no evidence of long-term health effects because we haven't looked for these effects' – even though there is a plausible link. Undone science can be addressed by adopting the use of the precautionary principle that was agreed upon by the Scientific and Environmental Health Network (SEHN) in 1998 which states that 'the onus of proof of harm is on the proponent and not the general public'. Public health policies that do not address undone science may

be experimenting on humans, which is contrary to the Nuremberg Code of Conduct (Holland 2011). This is a result of the uncertainty in the outcomes of these policies caused by a lack of relevant research. The traditional method for implementing new technologies/procedures into the human population is to perform safety studies in animal populations before they are introduced into the human population (Michaels 2008 pp60-78; Archibald et al 2011). It is also a requirement that innovative technology is systematically monitored and assessed to ensure the outcomes are beneficial to the population after they have been implemented (Michaels 2008; AG EHRA 2013). Whilst there is some fallibility in testing new technologies in animal populations it is currently the best guide scientists have for predicting health outcomes from new technologies or medical procedures (Archibald et al 2011).

The decision in the Corby Toxic Waste Case did not accept the Corby Council's defence of 'the science has not been done', that is, a lack of hard evidence because the levels of toxins were not monitored. Instead the decision was based on the knowledge of the plausibility of the causal link and the negligence of the Council in not ensuring that the levels of these *known toxic substances* were monitored. This ruling has relevance for all government health policies. Policies that do not incorporate the precautionary principle in a manner that protects the public interest are clearly protecting the interests of industry. Duty of care to the public can only be maintained when governments take responsibility for their actions. The defence of an absence of evidence demonstrates a lack of accountability and a disregard for public health. Governments that place the onus of proof of harmfulness on the public and not the proponent *after* the technology/procedure has been introduced are allowing experimentation on human populations. Health outcomes in these policies are unknown and in many cases will never be known because governments have not established adequate monitoring systems to determine a causal link. This was demonstrated in the Corby Toxic Waste Case which in my view should be used as a guiding principle for all public health policies.

8.7 Addressing Undone Science

Science depends upon the moral integrity of the scientists themselves but it also depends on the culture - the accepted norms and values - of each historical period. It is possible for the

desire for profit and recognition to become more important and acceptable in cultures that do not value integrity and accountability. For example, in societies where there is no accountability for the fabrication of data, plagiarism and selective reporting of experimental results these practices will flourish and everyone will participate in them to improve their status and livelihood. Influence from external agencies on academic institutions can bring about this change in values and place public health at risk. In order to redress this situation it is necessary for the public to become involved in the decision-making process for public health policy (Eduljee 2001; Hess 2009 pp306-327). This is because the public is the stakeholder whose primary interest in the policy is the health of the population. Other stakeholders, for example, industry, governments and the medical profession, have profit, livelihood and status interests tied up in the outcomes of policy-decisions. See Chapter 5. This can represent a bias in the value judgments that are made about risk assessment based on advice from technical advisory boards. If stakeholders can profit from the decisions that are made in public health policy then the only stakeholder whose sole interest is making the government accountable for improving health outcomes in the population will be the public. In this situation it becomes necessary for the public to have influence in the decision-making process to ensure all the science is assessed in policy decisions.

In the 2000's civil society movements increasingly countered the foreign domination and exploitation of WHO global policies. The People's Health Movement (PHM) started with a People's Health Assembly as an alternative to the WHO's World Health Assembly (Baum 2008 p127). WHO is perceived to be out of touch with global communities and it is controlled by the interests of corporations and the World Bank. PHM established a People's Health Charter that reflects the way political economy is directly linked to the health status of communities. This movement promotes democracy and hope to global communities whose social welfare and human rights are affected by corporate interests in global public health policies. The World Social Forum (WSF) was also established with a focus on human rights. This was conceived as an alternative to the World Economic Forum (WEF) to discuss concerns and action regarding the direction of global economic policy (Baum 2008 p129). The slogan was 'Another World is Possible'. This illustrates the competing value systems and political ideologies that are influencing the social and cultural systems of global communities. An 'ethical seachange' is needed; controls are needed on

the activities of transnational companies and international capital, to distribute resources more equitably to global communities so that we do not threaten our own existence (Baum 2008 pp132-3).

Krimsky (2003) summarizes the problems associated with the new values in academic-industry partnerships:

> Policies and legal decisions have created new incentives for research institutions with the establishment of academic-industrial complexes. This has led to changes in the values of scientific and medical researchers that include secrecy instead of openness, the privatization of knowledge and the marketing of discoveries. Consequently the idea that university-generated knowledge is a free good no longer applies (p79).

This alters the concept of 'consensus knowledge' and explains the gaps that have arisen in scientific knowledge regarding the scientific practices and policies that are currently being implemented into communities for the 'public good'. A summary of the political structures that result in undone science in government public health policies is provided below.

8.8 A Summary of the Political Context for Undone Science

I have provided here the key features of research systems where important areas of research are likely to remain undone. This information has been based on analyses by Hess (2007), Krimsky (2003) and others:

- Government advisory boards are dominated by technical experts who ignore and de-fund research that would prove a causal link of harm to a profitable technology.
- An alignment is formed between the dominant scientific network and political leaders of governments and research/academic institutions.
- Political and economic leaders support innovative research into applied science and technology. Scientific areas that reduce profits in this field are de-funded by governments.
- The funding for different fields in science is chosen by the dominant scientific network through control of research agendas and the rewards in science.

- Financial control of departmental budgets ensures that the goals of the dominant scientific network are enforced in research institutions and in peer-reviewed journals. The commercial university ensures that industry can intervene to influence research priorities in these institutions.
- Non-tenured positions reduce the freedom of scientists to speak the truth: behaviour of researchers and medical practitioners can be controlled through employment opportunities.
- Science that reduces the profit of innovative technologies is suppressed by governments and media or poorly publicised and the scientists are marginalised.
- Government supported non-profit research institutions that are commercialised lose their status as impartial institutions. They can no longer be described as providing balanced or consensus knowledge.
- Government authorities are requiring proof of harm from the public for a technology/procedure before action will be taken to protect public safety. When specific areas of science are de-funded this proof cannot be obtained.
- Industry participates in producing studies that confuse the public about the science. This practice is called the 'social production of ignorance'. See Appendix 5 for an example regarding the debate on the universal use of HPV vaccines.
- Classified knowledge and trade secrets are used to hide causal links. Other tactics include obfuscation of data and a lack of transparency in publications.
- Mainstream media is used to inform the public on scientific issues. Stakeholders do not have equal access to voicing their perspectives in the media.
- Funded lobby groups are used to present 'disinformation' campaigns in the media and discredit individuals that present findings that reduce industry profit.

8.9 Undone Science in Australian Vaccination Policies

The following areas of the Australian Government's vaccination policies have not been supported by evidence from appropriately designed scientific studies. The government has not provided this evidence either on the government website, in the Immunisation Handbook or in the Australian Academy of Science's document published in 2012 titled *The Science of Immunisation: Questions and Answers.* See Chapter 9. This evidence is

critical to the government's claim that 'vaccination is an evidence-based policy' and that 'the benefits of vaccines far outweigh the risks'.

- The medical literature links the ingredients of vaccines as a plausible causal factor in the significant chronic illness that is increasing in Australian children (Greville 1966; NCIRS Vaccine Components; FDA Thimerosal; Eldred 2006; Shoenfeld and Agmon-Levin 2011; Habakus and Holland 2011; Tomljenovic and Shaw 2012). Yet the Australian government is not acknowledging or investigating the strong correlation between the increased use of vaccines in the 1990's and the significant increase in allergies, asthma, anaphylaxis, autism and other chronic illness that also occurred at this time (AIHW 2005).
- Evidence from formal randomized controlled clinical trials demonstrating
    i) Effectiveness of the vaccines in preventing *the disease*: only the surrogate of seroconversion has been used or
    ii) The safety of the vaccines using an inert placebo

  Efficacy: Seroconversion (the level of antibody titre in the blood) is used as a surrogate in clinical trials to determine the effectiveness of vaccines in preventing disease in the population. This surrogate requires a model of seroconversion from controlled clinical trials to demonstrate the level of antibody titre that is needed to protect against each disease. The Australian government has not provided empirical evidence demonstrating that the stated level of antibody titre *induced by the vaccine* (seroconversion) is protective against the disease. Vaccination policies are based on the *assumption* that the induction of a particular level of antibody by a vaccine protects the individual against disease. This reductionist thinking about the control of infectious diseases was discussed in chapter 2.

  Safety: Clinical trials for vaccines do not compare vaccinated participants with unvaccinated participants using an inert placebo. See Chapter 9. In addition, the health effects of vaccines are not actively followed up in all participants of clinical trials to determine the *long-term* (4-5 years) health effects of the vaccine. Actively following all vaccinated participants would take into account the delayed reactions that are known to occur months or years after exposure to the many ingredients of vaccines.

- The safety of vaccines is based only on evidence from phase 1, 2 and 3 human clinical trials (with chosen criteria and parameters) and the evidence does not include animal models that demonstrate the safety of vaccines. Long-term health outcomes of single vaccines and the combined schedule of vaccines have never been done in large-scale animal studies or controlled human clinical trials - comparing vaccinated and unvaccinated groups using an inert placebo. This is significant because small–scale animal studies and clinical evidence show there is a plausible link between vaccines and adverse events.
- A demonstrated safe level of the 'trace' amounts of excipients (alone or in the recommended combination) has not been established in animal studies or human studies.
- The safety of ethylmercury has been extrapolated from the knowledge of the neurotoxin methymercury. See Appendix 4**.** These two neurotoxins are not the same and the health effects of ethylmercury in low doses combined with other excipients in the vaccine have not been established in studies of the human feotus, infants or adults. Many toxins in the past have been found to be more toxic in lower doses than originally believed. See Chapter 8.
- The lack of an active post-vaccination surveillance system to systematically monitor the health outcomes of *all* vaccinated individuals means that definitive evidence of vaccine related adverse events and their frequency in the population are unknown.
- Many vaccinated individuals still get the diseases they are vaccinated against but the government does not provide transparent data on the number of vaccinated individuals that are still getting the diseases and/or that are hospitalized with these diseases. This information is essential for determining the benefits of vaccination programs in different populations.

Government regulators state that studies of diseases in human subjects present logistical and ethical problems (Warfel et al 2013 p1). These include the potential for severe disease, the lack of effective treatments for cases of disease and the highly contagious nature of many diseases. It is also difficult to get a consensus on the efficacy and safety of vaccines due to the differences in study designs (Zeigler et al 1991 p16). These problems result from

differences in the methodology that is used in studies and the large number of potential biases regarding the definitions of disease, socioeconomic conditions and vaccination status, that result in different interpretations being drawn by different researchers.

Vaccines contain active components and excipients (other components) and many of these ingredients are known toxins that are not inert. These excipients are stated to be in 'trace' amounts and it is *assumed* that these low doses do not cause significant harm in the population. The Australian government states that current risk assessment methods cannot make accurate quantitative estimates of risk for low levels of exposure to environmental hazards (AG EHRA 2013). It is noted that the uncertainties that exist in toxicological and exposure data prevent the authorities from providing feasible numerical estimates of the risk from many low level exposures.

The US FDA states that it would be unethical to determine the health effects of different doses of ethylmercury (and other toxins) in children because these substances cause neurological reactions in humans (FDA Thimerosal). See Appendix 4**.** This is the stated reason why the studies of the health effects of the excipients of vaccines have never been tested in children/adults. However, government regulators do not consider it unethical to use ethylmercury and other non-inert excipients in the recommended childhood schedule of vaccines – without knowing if and how much neurological damage is being caused in the population. This has been done for many years without informing doctors or parents of the ingredients of vaccines. In some countries it is also done with the use of financial incentives to encourage the uptake of vaccines.

8.10 Case Study: Efficacy and Safety of Whooping Cough Vaccine

The FDA funded a study in 2013 of infant baboons to test the efficacy of whooping cough vaccine in preventing whooping cough disease. This study concluded that the acellular (aP) whooping cough vaccine does not prevent infection (colonization) and transmission of the whooping cough bacteria in the population (Warfel et al 2013). The authors also concluded that 'the differences in colonization (infection) between the protocol groups [acellular vaccine (aP), whole cell vaccine (wP), and naïve (no vaccine)] did not correlate with levels of circulating anti-pertussis antibodies' (p3). In other words, there was no correlation

between the antibody titres (seroconversion) and protection from disease. This has been known for many years (CDC MMWR 2009). Smith stated in 1999 that the vaccine trials for acellular pertussis vaccine show no correlation between antibody responses and vaccine efficacy (Ryan et al 1998; Granoff and Rappuoli 1997; Smith A 1999). This is evidence that seroconversion (the surrogate for vaccine efficacy) does not equate to immunity in individuals against whooping cough infection.

Yet this is the surrogate for efficacy that governments are using to promote vaccines as effective in preventing infectious diseases. This baboon study demonstrated that the antibody levels were high even when the vaccinated animals were challenged with the WC bacteria and they were still infected (colonised) and were able to transmit the disease to unvaccinated baboons (Warfel et al 2013 p3). In contrast the naturally infected baboons were not colonised after being re-challenged with the bacteria and they were protected from disease. This protection is known to be long-term in contrast to the short-term duration of whooping cough vaccine (Zeigler et al 1991; Wendleboe et al 2005). The Australian College of Pediatricians (ACP) stated in 1991 that the theory that whooping cough disease could be eradicated by achieving a vaccine uptake of 95% was probably wrong (Zeigler et al 1998 p16). Two authors of this paper were the founding and current directors of the National Centre for Immunisation Research and Surveillance (NCIRS), Margaret Burgess and Peter McIntyre, the government body that plays a key role in the development of Australia's vaccination policy through the ATAGI. See section 6.7.

Whilst Warfel et al (2013) conclude that the vaccine 'protects against severe disease but not colonization and transmission' this claim is based on a blood count of *leukocytosis* – as an indicator (surrogate) for severe disease in baboons. This surrogate (leukocytosis) is considered 'a significant marker of morbidity in pertussis-infected infants' (Rowlands et al 2010 in Warfel et al 2013 p2). However, this conclusion that 'the whooping cough vaccine protects against severe disease' is again an *assumption* based on the surrogate of leukocytosis as a biomarker for 'severe disease'. It is not empirical evidence demonstrating that the vaccine prevents against 'severe disease'. In contrast, the historical evidence demonstrates that whooping cough was generally not a concern in adolescents and adults because most were exposed to natural whooping cough infection in childhood and this

confers long-term immunity (Wendleboe et al 2005; NHMRC 1991). It is known that re-infection at a later age is less severe in individuals who are naturally exposed to pertussis bacteria and this maintains a high level of immunity in adolescents and adults (NHMRC 1991; Wendleboe et al 2005).

In addition, Warfel et al incorrectly state that whooping cough has only re-emerged as a threat in highly vaccinated communities since the whole-cell WC vaccine was replaced with the acellular vaccine in the 1990's (2013 p1). This statement is not supported by historical data. Highly vaccinated populations experienced epidemics of whooping cough throughout the 1980's and 1990's - prior to the introduction of aP vaccine. Whooping cough epidemics were recorded regularly in many countries as the push to increase vaccination rates continued (Stewart GT 1977; Feery 1981 p174; Behrman et al 1998 p363; Zeigler et al 1991; Burgess M et al 1998; Tinnion ON and Hanlon M 1998; Wendleboe 2005). The acellular vaccine was only introduced in the Australian population from 1997-1999 (NHMRC IH 2003). The NHMRC states that the whole-cell WC vaccine was never tested for efficacy prior to its use in the Australian population (Andrews et al 1997). Small studies that have been done since its introduction in 1953 show that efficacy is between 40-90%. This range of efficacy is due to the differences in the methodology and design of the various studies (Zeigler et al 1991 p1).

The increased use of vaccines in the 1990's and the emphasis on higher participation rates in vaccination programs was an attempt to *eliminate* infectious diseases through 'vaccine-created herd immunity'. See Chapter 2. This evidence of the lack of efficacy of both the whole-cell and acellular WC vaccines does not support a theory that vaccines can create herd immunity and eliminate infectious diseases. In addition, the Warfel et al (2013) primate study, which was funded by the FDA, did not record the health outcomes of the vaccinated and unvaccinated infant baboons that were studied in each group. Why not? It would be feasible for the FDA to continue this study for 2 or 3 years to record the health outcomes of the vaccinated and unvaccinated baboons. But the FDA is not ensuring that this safety data is collected. The FDA and governments should provide evidence about safety and efficacy using empirical evidence and properly designed scientific studies.

8.11 Conclusion

Undone science is the research that is not carried out because the likely results would be unwelcome to powerful groups. When areas of science are not funded, policies can be designed on incomplete knowledge and result in unpredictable health outcomes in the population. This is because there are gaps in the scientific knowledge that underpins the value judgments that are made in policy decisions. Government policies that are designed on incomplete scientific knowledge may not protect the public interest. Areas of undone science have expanded in the era of globalization because industry is influencing the research agendas of both governments and research institutions. This is a consequence of industry being in partnership with universities and being the main sponsor for many private research institutions. In addition, government funding agendas have aligned with industry goals because the dominant network of scientists is influential on government advisory boards. A shift to industrial sources of funding for scientific research is also achieved when there is increased scope for the patenting and licensing of scientific discoveries. These developments lead to increased conflicts of interest in the production of scientific knowledge and in the design of public health policy, along with a lack of transparency. They also have the effect of reducing government emphasis on public interest research and increasing the pockets of undone science in different fields of science.

In Australia the federal health minister receives advice on vaccination policies from technical experts without consultation with the community. The institutional barriers that exist in the Australian political system and in academic and media organizations have resulted in the marginalisation of the public's contribution to vaccination policy, even though the public is a main stakeholder in these policies. The Australian government justifies current vaccination policies by claiming, in effect, there is no evidence of harm so therefore no action is required. However, this claim ignores the lack of evidence due to research that has not been funded. The undone science in Australia's vaccination policies includes comprehensive RCT's for the efficacy and safety of vaccines, either singly or in the combined schedule of vaccines in animals and humans. In this situation it becomes necessary for the public to have influence in the decision-making process to ensure that all relevant research is undertaken and accounted for in policy decisions.

The lack of integrity and rigour in the clinical trials and scientific research that is being sponsored by industry for global health policies was discussed in chapters 6 and 7. In chapters 9 and 10, I have provided case studies illustrating the undone science and industry influence in the promotion of global HPV vaccination programs and the pandemic 'Swine Flu' 2009 vaccine. These case studies illustrate how vaccines can be developed and policies implemented on incomplete science due to the political framework that results in undone science.

CHAPTER 9

HUMAN PAPILLOMAVIRUS (HPV) VACCINE

PART 1 HPV AND CERVICAL CANCER PATHOGENESIS

9.1 Introduction

HPV vaccines are an example of the technology transfer that is occurring in research institutions with industry sponsors. This transfer is facilitated in the 21st century by governments that are playing a major role in the marketing of innovative products. Public health policies are being designed by technical experts with financial links to industry on policy advisory boards. The development of HPV vaccines was based largely on research at the US National Institutes of Health (NIH). This government body is part of the US Department of Health and Human Services (HHS) which profited from the licensing and marketing of this vaccine in 2006. See Section 9.19. HPV vaccines have been promoted to the Australian community since 2007 as a vaccine to prevent cervical cancer and genital warts in women. However, in 2012, the US FDA extended its use to the prevention of anal cancers and genital warts in men. The vaccine is now being recommended to all adolescent boys and girls in many countries, including Australia. A time-line of events regarding the development and marketing of HPV vaccines is presented in Appendix 7.

This case study will examine the evidence Merck & Co have used to suggest an HPV vaccine will protect against cervical cancer. The sequence of events that led to the marketing of this vaccine as 'a prevention' for cervical cancer will be presented to assess the validity of the claims about its safety and efficacy. This will provide the context for the discovery that led to a vaccine being marketed for a non-infectious disease – cervical cancer – instead of an infectious disease. Traditionally vaccines have been developed to prevent infectious diseases because these diseases can spread through communities so governments recommend vaccines for 'community protection'. However, this argument does not apply to non-infectious diseases and the involvement of HPV infection in the etiology of cervical cancer needs to be examined. Whilst it has been established that the human papillomavirus is a necessary transmissible factor in most cases of cervical cancer, this research will demonstrate why a vaccine against

cervical cancer – a non-communicable disease – is not beneficial as a universal preventative strategy for this disease.

The HPV vaccine has been demonstrated to prevent the transmission of 2 of 15 high-risk strains of Human Papillomaviruses that are associated with causing cervical cancer but it has not been demonstrated to prevent cervical cancer. Consequently, the Australian Health Department only refers to this vaccine as an 'HPV vaccine' and not a 'cervical cancer vaccine'. Yet the Australian Government has allowed this vaccine to be promoted to the public as 'a prevention for cervical cancer'. A causal theory for an infectious disease requires that the incidence of the causal agent varies with the incidence of the disease. This chapter examines the global incidence of HPV 16/18 and the global risk of developing cervical cancer to determine if a correlation exists. It also analyses the assumptions that have been made to claim that a quadrivalent HPV vaccine will protect against most cervical cancer and that it is cost-effective in countries that already have Pap screening programs. The cost-effectiveness of HPV vaccines in many countries has been determined using mathematical models that are limited by the assumptions they are founded on. These assumptions are described in this chapter. An independent and transparent assessment of these assumptions is essential to population health and the effective distribution of health resources to the community. This case study provides an example of the influence of academic-industry partnerships on the production of scientific knowledge. It illustrates the type of evidence that scientists are using to claim vaccines are safe and effective and it provides an illustration of the communication of risks and benefits of diseases/vaccines to the general public. In western countries, such as Australia, health promotion occurs within the capitalist free market model of health which is driven by profits. Whilst this can result in good health outcomes in many cases it needs to be acknowledged that when doctors promote profit-making technologies it can conflict with their pledge to prioritise the health and well-being of their patients. See chapter 5.

This chapter examines the promotion of this vaccine by medical associations to determine how doctors have been educated on the etiology of cervical cancer and whether they are promoting it because it is in the best interests of the community. It also investigates the design of clinical trials, the rigour of the evidence that conclusions are founded on and the communication of risks and benefits to the public. In addition, it will observe whether all types of evidence have been used to draw conclusions about

the benefits and risks of HPV vaccines. Scientists can obtain valuable scientific knowledge from clinical, animal, biological and epidemiological studies and it is important that *all* types of evidence are used to draw conclusions about the risks and benefits of vaccines. The manufacturers of the HPV vaccine claimed in 2006 'the vaccine has the potential to eradicate cervical cancer within a generation' (NADC). Such a claim needs to be supported by evidence. This case study will examine whether the conclusions about the benefits of this vaccine have been founded upon comprehensive scientific knowledge or whether there are significant areas of undone science that throw these conclusions into question. It also provides an example of the way in which scientific knowledge and health promotion are being altered by the industry-academic partnership that is driving the production of medical knowledge in the 21st century.

This chapter begins with background information regarding the sequence of events that led to the identification of HPV DNA in the majority of cervical cancer tumours. I have then described the global risk of developing cervical cancer to see whether the risk is similar in all countries. This is compared to an overview of the global incidence of HPV sub-types to determine whether the risk of cervical cancer correlates with a higher incidence of HPV sub-types 16 and 18: the sub-types stated to be the determining and independent cause of cervical cancer. Historically scientists believed that cervical cancer had a multifactorial etiology involving environmental and lifestyle factors. Several factors have been implicated in the cause of this disease for decades and these are discussed in this chapter. I have also outlined the strategies that have been used to market HPV vaccines to the public. Communication of the risks and benefits of vaccines is an important part of public health policies and providing balanced scientific information to the public is essential to improving health outcomes. I have provided information on the ingredients of HPV vaccines and the adverse events that have been associated with these vaccines. This information is compared to the government's claims about the safety and efficacy of HPV vaccines to see whether all the available evidence is being included in the government's assessment of the benefits and risks. The methodology for determining the cost-effectiveness of HPV vaccination programs in different countries is discussed along with an assessment of the assumptions that these models are founded on. Finally I have discussed the conflicts of interest in the

production and promotion of HPV vaccines to evaluate their possible influence in the decision to use a vaccine in global national vaccination programs.

Chapter 9 Part 2 outlines the undone science in HPV vaccination programs which results in unpredictable health outcomes in the population.

9.2 Historical Knowledge of the Etiology of Cervical Cancer

The theory that HPV DNA is the cause of cervical cancer is founded on nascent technology that is being used to identify different sub-types of cervical HPV. In this section I have discussed the development of this biotechnology to provide background information on its sensitivity and specificity in determining the global distribution of HPV sub-types from 1995-2003. I have only referenced studies that were available at the time the vaccine was developed because my aim is to evaluate the information that led to the decision that a vaccine was a suitable management strategy for this disease.

The information presented in this chapter includes an examination of the correlation between the incidence of HPV16/18 and the incidence of cervical cancer to determine whether the risk of this disease varies in different populations and regions. This is essential to the assessment of whether HPV is *an independent* cause of cervical cancer and whether an HPV vaccine will be effective in preventing this non-communicable disease. I have started this section from 1989 because at this time it was unknown whether HPV infections were the determining causal factor in the development of cervical cancer and I have described the other factors that were believed to be central to the etiology this disease. In 1989 the IARC stated there was no clear cut evidence that HPV infection is causally related to cancer of the cervix (Munoz et al 1989). This was supported by Pfister (1990) who stated 'the etiology of cervical cancer is still unknown.' He continued 'vaccination is not yet justified as there is no formal proof for HPV causing cancer ...' (Pfister 1990 p248). At this time the IARC had not excluded the possibility that Herpes Simplex Virus-Type 2 (HSV-2) and HPV played a role in the causation of cervical cancer (Munoz et al 1989; Bosch et al 2002).

It was unclear whether HPV was a passenger virus in carcinoma development or whether it played a causal role in the progression to ICC (Villa and Franco 1989). HPV's are a group of viruses with strong epitheliotrophic properties (Villa and Franco 1989). That is, epithelial cells normally harbor the virus and 80% of women are infected

with HPV during their lifetime (IARC 1995; Henderson 1989). Therefore you would expect that the vast majority of abnormal cervical proliferation was associated with HPV infection. The overall evidence in 1988 pointed to a multifactorial cause of cervical cancer as other determinants consistently emerged as independent risk factors in epidemiological investigations (Villa and Franco 1989). The evidence suggesting an etiological role for certain sub-types of HPV in the development of cervical cancer stemmed from the following observations (Villa and Franco 1989):

1. Most genital cancers contain HPV DNA sequences
2. The viral DNA differs in its physical state
3. Cervical tumors frequently contain transcriptionally active viral genomes and their cell lines are maintained in culture
4. Malignant transformation can be obtained when viral DNA is introduced into mammalian cells in culture (p339)

In 1989 this evidence was not always consistent (Villa and Franco 1989). Some studies demonstrated that the distribution of viral DNA within the specimen and its transcriptional activity in cervical tumours showed an inconsistent pattern of occurrence. The differences in the physical state and expression of advanced and pre-cursor lesions could also be a consequence of long-lasting viral infections (Villa and Franco 1989). It has also been observed that HPV is present in high frequency in women with normal cervices in different populations (Villa and Franco 1989; IARC 1995) and that cervical cancer is a rare outcome from all HPV infections (NHMRC 2005; WHO 2008). In other words, HPV infection of any sub-type is not predictive of cancer, particularly as ninety percent of HPV infections have no clinical consequences at all (IARC 1995; Pfister 1990). That is, there is no development of genital warts or progression to cervical cancer. Pfister also stated in 1990 that 'no papillomavirus is able to induce cancer right away and fully on its own which indicates that additional events are mandatory to trigger malignant conversion' (p6). It was observed that carcinomas usually develop only after primary lesions are present for several months or even years and this indicates other factors are necessary to trigger cancerous tumours.

New methods for distinguishing different strains of HPV infection became available in the 1990's. Type specific exposure to HPV became available around 1989 due to cloning techniques of HPV DNA in bacteria and the development of various

hybridization methods but there was uncertainty about the sensitivity and specificity of the various analytic methods in detecting HPV DNA in the different tissue types (Munoz et al 1989). For example, the detection of HPV sub-types in different tissues, such as carcinoma, cervical intraepithelial neoplasia (CIN) and normal tissue, was not considered reliable. Pfister (1990) stated that the prevalence of HPV types varies considerably in biopsies of cervical lesions depending upon the hybridization detection method used. New analytic hybridization techniques for identifying HPV DNA became available in the 1990's and these were believed to be highly sensitive and specific (Franco 1995 p779) providing more reliable estimates for the relationship between HPV infection and pathogenesis.

HPV was found to be predictive of cervical intraepithelial lesions (CIN) and associated with invasive carcinoma in case-control studies (Franco 1995 p779). Epidemiologists claimed there was a highly statistically significant association between HPV and the development of cervical intraepithelial neoplasia (CIN) grade 2 or 3, with persistent CIN 2/3 and with the development of cervical cancer (Bennett et al 2010). Carcinogenicity of HPV16/18 is supported by experimental evidence that proteins of these viruses interfere with the functions of cellular regulatory pathways (IARC 1995). At this time Bosch et al claimed 'the association of genital human papillomavirus (HPV) with cervical cancer is strong, independent of other risk factors and consistent in several countries' (Bosch et al 1995 p796). In 1995, Bosch et al set out to characterise the global distribution of HPV genotypes because they knew this was 'essential to the development of vaccination strategies to curb the burden of cervical cancer' (Bosch et al 1995 p797). In this study of 1000 cervical cancer tumours it was found that 93% contained HPV DNA (Bosch et al 1995). This international study used new polymerase chain reaction-based (PCR) assays to detect more than 25 HPV types in 1000 specimens. In 1999, the 7% of tumours that were originally found to be HPV negative in the Bosch et al study of 1,000 tumours were re-analysed using different techniques and assumptions (Walboomers et al 1999).

Whilst PCR methods are more sensitive and specific than liquid hybridization techniques and enable the identification of different genotypes, the specificity of this technique depends upon the type of primer used: type-specific or broad-spectrum (van Doorn et al 2006). The Bosch et al 1995 study used the broad-spectrum MY11/09 method to genotype HPV-DNA. The re-analysis by Walboomers et al using different

primers and assumptions led to the conclusion that 'a virtual absence of HPV-negative carcinomas implies that effective prophylactic vaccination might eliminate cervical cancer worldwide' (Walboomers et al 1999 p18). The nascent technology used in this study was only available from the mid-1990's so the evidence for the causality of different HPV genotypes in cervical cancer was based on a small number of studies between 1995 and 2002. The limitations of the Bosch et al (1995) study and the Walboomers et al (1999) re-analysis have been presented in Appendix 8.

By 2002 scientists were declaring human papillomavirus (HPV) Type 16 and 18 to be the 'first ever identified necessary cause of human cancer' (Bosch et al 2002 p244). Yet in 1989 CSL had provided funding to Professor Ian Frazer and Dr. Jian Zhou to develop a drug that would prevent carcinogenic changes believed to result from HPV infections (Uniquest). Frazer and Zou's research on an HPV vaccine was initiated in the early 1990's based on the belief that the illness from genital warts and the association of HPV with pre-cursor lesions in the cervix, vulva and penis were sufficient reason to develop a vaccine (Pfister 1990). However, it wasn't known until 1995 that HPV was found in most cervical cancer tumours and until 2002 that HPV 16/18 were the most prevalent strains in all countries. Uniquest had patented Frazer and Zhou's HPV vaccine technology in 1991 (Uniquest). In 2002 scientists declared human papillomavirus (HPV) was associated with *virtually* all cervical cancer globally and claimed 'The causal role of HPV infections in cervical cancer has been documented beyond reasonable doubt' (Bosch et al 2002 p244). The statement that HPV infection is a necessary cause does not say whether it was a *sufficient* cause of cervical cancer. It had been known for decades that persistent infection of the cervix with high-risk HPV was not *sufficient* to cause cervical cancer (Pfistor 1990; IARC 1995; Cogliano 2005; Munoz et al 2006 pS3/1). In other words, other factors are also necessary to initiate cancer development. This indicates it is not an independent cause of cervical cancer.

Whilst Bosch (1995) and Walboomers et al (1999) claimed that epidemiological studies have shown a strong association of genital HPV with cervical cancer in several countries that is independent of other risk factors, they did not demonstrate that HPV 16/18 are the necessary and determining cause of most cervical cancer by providing evidence of a higher incidence of these strains in the countries with the highest risk for cervical cancer. The statement of causality was based on the development of new biotechnology. Whilst phase 1 and 2 clinical trials had begun for an HPV vaccine in

1999, the phase 3 clinical trials to test the efficacy of HPV vaccines against high-grade cervical cancer lesions were not begun until 2003 (Future II 2007).

The plausibility of a causal theory, such as that put forward by Bosch et al, requires evidence that the risk of the disease varies with the factors implicated in the cause of the disease (Friis and Sellers 2004). It also requires evidence that the disease develops only in cases where the virus is present. Prior to 1995 scientists stated that the detection of HPV DNA in different tissues had been unreliable but with the development of new molecular technology many scientists now claimed that the detection of HPV DNA was reliable because the new technology was truly 'sensitive and specific' (Franco 1995 p779).

Bosch et al (2002) defined a 'necessary' cause as the circumstance where the disease 'does not and will not develop in the absence of the persistent presence of HPV DNA' (p244) yet they also confirmed in 2002 that HPV DNA had not been detected in approximately 10% of specimens of cervical cancer cases (p244). Despite this knowledge these scientists claimed that 'this is the first necessary cause of a human cancer ever identified' (Bosch et al 2002 p244). Although Bosch et al (2002) stated that '*proof* of cause was elusive' they believed that scientists had a duty to make causal judgements based on the available scientific evidence on the premise that all scientific work is incomplete (p260). Hence this network of scientists concluded it was their duty to trial an HPV vaccine even though their evidence that HPV 16/18 were the determining cause of most cervical cancer was incomplete. It is noteworthy that the claims supporting the hypothesis that a vaccine would be effective against cervical cancer were made by a dominant group of scientists with financial links to the vaccine industry (Bosch et al 1995; Walboomers et al 1999; Munoz et al 2006; Franco 1995).

9.3 Biotechnology for the Detection of HPV Genotypes

A causal theory based only on the presence of HPV genotypes is strongly dependent upon the accuracy and precision of the biotechnology used for detection. Identification of HPV genotypes in the anogenital tract is also complicated by the fact that 40 or more different HPV types may be present making it difficult to distinguish the causal agent (van Doorn et al 2006). Several methods are used to identify HPV DNA and it is essential to know that these methods are unbiased in the amplification of different

genotypes (Mori et al 2011). Klug et al (2008) state that genotyping assays that have been used in the past decade are known to differ in their ability to amplify and detect specific genotypes. A comparison between different studies has been difficult because there was no global standardisation of assay performance or methodology for quality assurance prior to 2005 (Klug et al 2008).

The World Health Organisation (WHO) did not establish the global HPV laboratory network (LabNet) to standardise assay tests and laboratory procedures until 2005 (Eklund et al 2012). This is necessary to ensure that assay performances and laboratory practices globally can be evaluated against a known and universal standard, with the same criteria for accurately determining the incidence of HPV genotypes found in different countries. Standardised assays and laboratory practices were established after the clinical trials for HPV16/18 vaccines were started.

9.4 The Global Distribution of HPV Genotypes in Invasive Cervical Cancer (ICC)

The strongest evidence for proving that HPV16/18 are the central etiological factors in the majority of cervical cancer would be a correlation between the incidence of HPV16/18 worldwide and the incidence of cervical cancer worldwide. This section investigates the distribution of HPV genotypes to see whether this correlation exists. An important factor in this discussion is the definition of 'cervical cancer'. This question is significant because the incidence rates for cervical cancer include cervical intraepithelial neoplasia (CIN) grade 3. These lesions are asymptomatic but they are described as 'disease' and included in the incidence figures for cervical cancer. CIN 3 can only be detected by screening and the majority of these lesions do not progress to cancer. This section discusses the burden of cervical cancer in different populations and how this is affected by Pap screening programs. I have used references that provide evidence of the knowledge that was available to scientists at the time the HPV vaccine was developed and not the most recent references, to evaluate the strength of evidence on which decisions at the time were founded.

There are over 100 HPV genotypes that have been identified and 40 of these are known to more frequently infect the genital tract through sexual contact when a condom or diaphragm is not used (Munoz et al 2006; Smith et al 2002). This indicates that the risk

of infection with HPV can be reduced by using condoms or a diaphragm even if these methods are not 100% effective. Studies of young women who have not had sex show that HPV DNA and antibodies to genital types of HPV are not usually detected (IARC 1995). Although some HPV antibodies are obtained by skin to skin contact during birth or childhood these studies provide evidence that HPV infection in childhood is rare and that a higher number of sexual partners is an increased risk for HPV infection and cervical cancer (IARC 1995). Most strains of HPV are common and harmless, however there are at least 20 types associated with cervical cancer: 14 of these are considered carcinogenic and these include HPV 16, 18, 31, 33, 35, 39, 45, 51, 56, 58, 52, 26, 53, 66 (Bosch et al 1995). These types are frequently found in cervical cancer and are classified as 'high-risk' HPV's (Bosch et al 1995). Other types such as HPV 6, 11, 42, 43 and 44 are rarely or never associated with cervical tumours and they are classified as low risk HPV types (Bosch et al 1995).

Study results indicate that high rates of genital HPV infection are sustained in all communities throughout the world even in groups that do not have a high partner exchange (IARC 1995). As there is not a similar rate of cervical cancer in all these communities throughout the world, it has been postulated that the more 'high-risk' HPV types may be associated with higher grades of CIN and carcinoma (IARC 1995). Whilst some scientists are claiming that the variation in the incidence rate between countries is due entirely to the implementation of screening practices this does not explain all the evidence regarding the incidence and mortality of this disease. Screening has significantly reduced the mortality of cervical cancer in many countries through early detection and surgery, but prior to Pap screening the mortality from cervical cancer was significantly reduced through environmental and lifestyle changes. These co-factors are known to influence the variation in cervical cancer incidence rates that are observed between countries. Whilst persistent HPV infection is known to be a necessary cause of cervical cancer, co-factors (risk factors) *are also necessary* for pathogenesis to occur (IARC 1995).

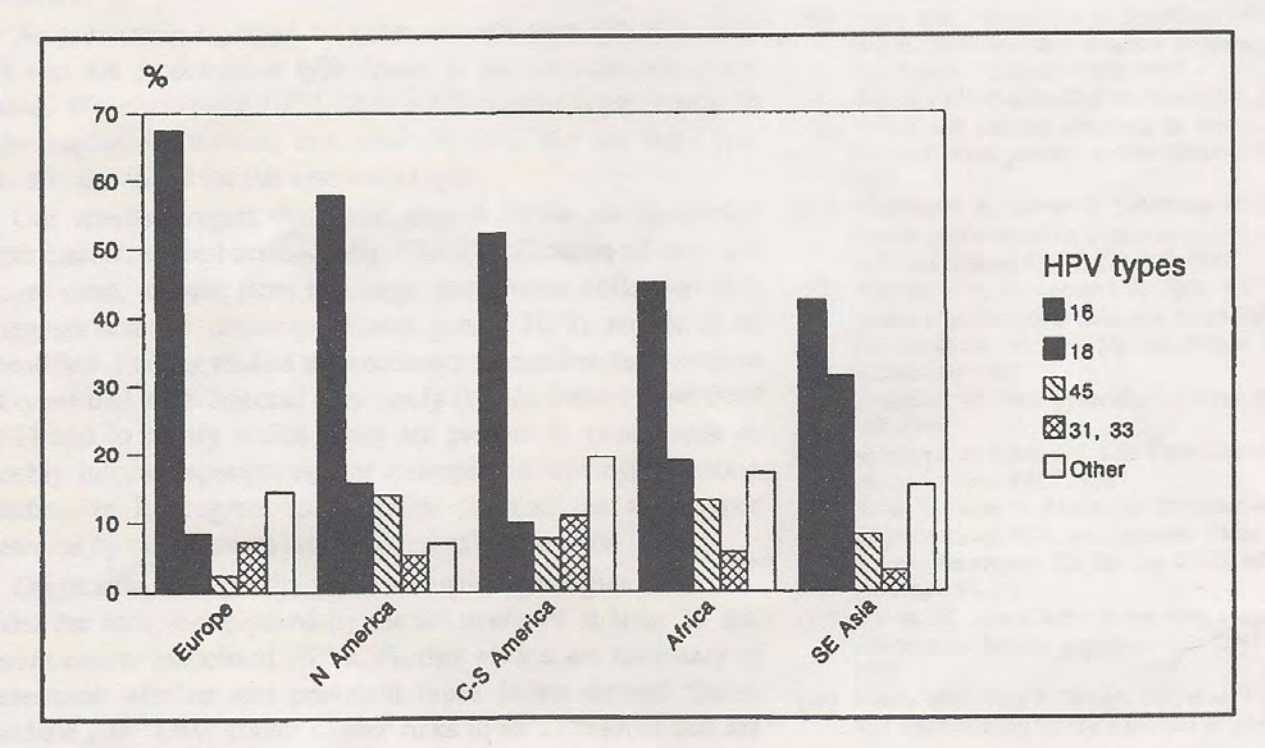
An example of the influence of environmental co-factors in the etiology of cervical cancer is provided by the cervical cancer statistics for sex workers. The incidence of cervical cancer is found to be four times greater in sex workers than in other women (Gitsch et al 1991). Yet the study by Gitsch et al did not find any statistically significant difference between the distribution of HPV subtypes in the lesions of sex workers and

other women. That is, there was no correlation between the incidence of high risk HPV subtypes and the incidence of cervical cancer in sex workers. This indicates that environmental factors must also play a role in the progression to disease.

The role of HPV 16 and 18 as the *main and determining* causal factor in the majority of cervical cancer would be confirmed if the countries with the highest incidence of cervical cancer (mainly developing countries) also had a higher incidence of HPV 16/18. If these sub-types are not more prevalent in the general population in these countries then there should be no greater incidence of cervical cancer from HPV infection in developing countries than in developed countries. Pap screening has reduced the mortality and incidence associated with cervical cancer in many countries through early detection and intervention but a reduction in the disease burden also occurred as a result of environmental changes prior to screening programs.

Studies have shown that the incidence of the most common HPV subtypes in different geographical regions is similar. There are a variety of subtypes in all populations even though HPV 16 appears to be the most prevalent in all countries (Bosch et al 1995; Clifford et al 2003). Yet cervical cancer incidence is highest in developing countries: 83% of cervical cancer cases occur in developing countries (IARC 1995). Some similarities in the distribution of HPV sub-types have been found in invasive cervical carcinomas across regions (Clifford et al 2003). HPV 16 was found to be the dominant strain in all countries (51% of cases) and HPV 18 found consistently in 10-14% of cases (Clifford et al 2003). This led Clifford et al (2003) to claim that HPV 16 and 18 are found in approximately 70% of all ICC cases. Patterns in the prevalence of other HPV genotypes in different countries were also observed (Bosch et al 1995; Clifford et al 2003). These are illustrated in Figure 9.

Figure 9: HPV Subtype Prevalence in Carcinomas Globally



Source: Bosch FX, Manos M, Munoz N, Sherman M, Jansen A, Peto J, Schiffman M, Moreno V, Kurman R, Shah K, International Biological Study on Cervical Cancer (IBSCC), 1995, Prevalence of Human Papillomavirus in Cervical Cancer: a Worldwide Perspective, *Journal of the National Cancer Institute,* Vol.87, No. 11

Clifford et al claimed two thirds of ICC was associated with HPV 16 and 18, yet these two strains are slightly less common in developing countries where the incidence of cervical cancer is the highest (Clifford et al 2003). The prevalence of HPV 16 was slightly higher in America, Australia and Europe: *the developed countries* where the risk of cervical cancer is low (Parkin et al 2005). More than 15 high-risk HPV sub-types are prevalent in all countries both in regions where the rates of cervical cancer are considered high and where they are considered low (Clifford et al 2003). This indicates that HPV infection on its own is not pathogenic. These sub-types include 45, 31, 33, 58, 39, 59 and 52 (Bosch et al 1995; Clifford et al 2003). This can be observed in Figure 12.

Whilst the incidence of HPV 16 was only slightly higher in developed countries it needs to be acknowledged that the evidence does not support the conclusion that HPV 16 is an independent cause of this disease, even if HPV infection is a necessary cause.

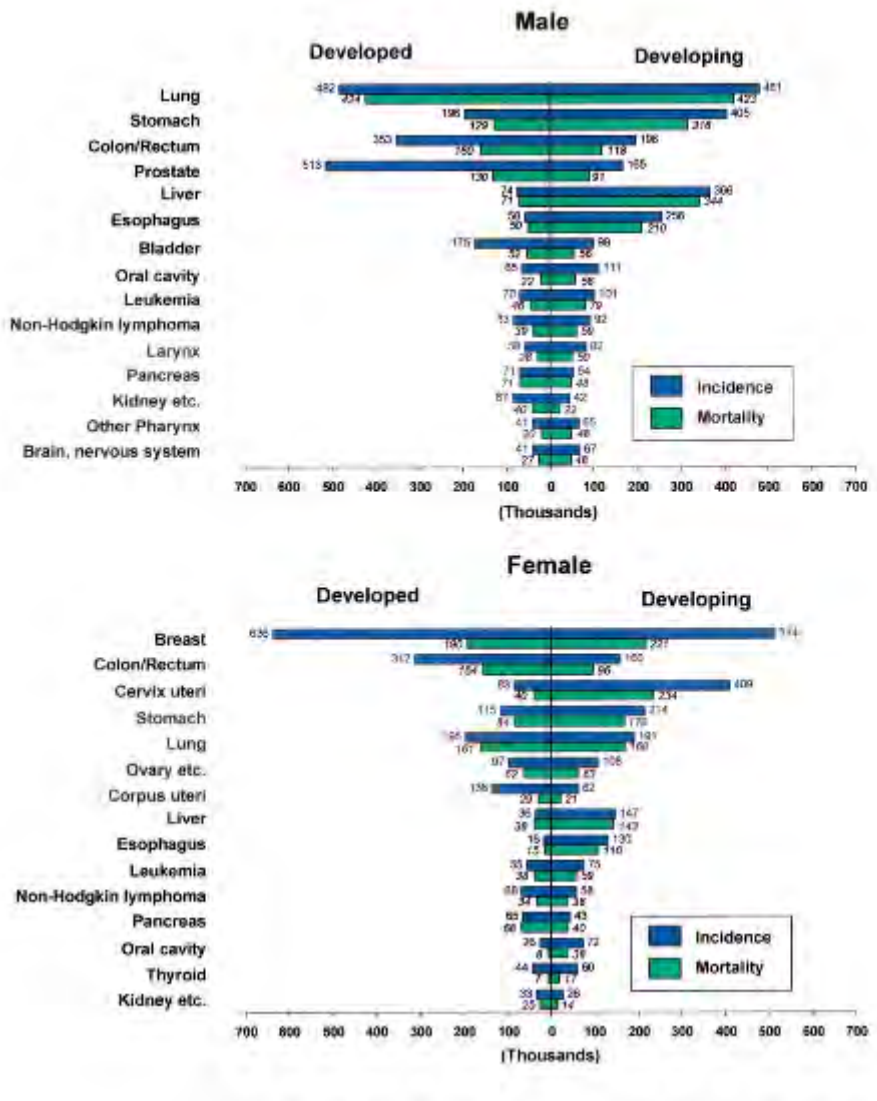
The Australian developer of HPV vaccines, Ian Frazer, stated in 2005, prior to the introduction of the vaccine, that 90% of cervical cancer occurs in the developing countries not the developed countries (Williamson 2005). The fact that cervical cancer is a rare outcome of HPV infection from any strain (Bosch et al 2002) is supported by the difference in the prevalence of HPV infection and cervical cancer worldwide. It is estimated that the worldwide prevalence of genital HPV infection amongst adult women is 326 million and the annual incidence of new cases of cervical cancer worldwide is approximately 450,000 (Parkin et al 2005). Approximately eighty percent of all women will be infected with HPV yet ninety percent of HPV infections do not lead to cervical cancer or warts (IARC 1995). Screening for high-risk HPV infection would identify a very large number of women but only a few of these are at risk of cervical cancer (NHMRC 2005). This is the same when HPV vaccines are used in universal vaccination programs; a large number of women would be using the vaccine but only a few are at risk of developing cervical cancer, even when they have a high-risk HPV infection.

9.5 Overview of the Global Risk of Cervical Cancer

This section examines the global risk of dying from cervical cancer to investigate the severity of the disease in different populations and to determine the most important factors in reducing the risk from this disease.

The two measures of the burden of cancer worldwide are incidence and mortality rates. Incidence rates measure the number of new cancer cases each year and can be expressed as a rate per 100,000 persons per year (Parkin et al 2005). Figure 9 illustrates the incidence and mortality rates for different cancers worldwide. This graph shows that cervical cancer (combined with uteri cancer) is placed seventh in importance in women in *developed countries* after breast, colon/rectum, lung, stomach, ovary, and corpus uteri cancer. But in *developing countries* it is placed second in importance in women after breast cancer. The graph shows there is a significant difference between the risk of cervical cancer in developed and developing countries (Parkin et al 2005).

Figure 10: Estimated Numbers of New Cancer Cases (Incidence) and Deaths (Mortality) in Developed and Developing Countries in 2002



Data shown in thousands for developing and developed countries by cancer site and sex

Source: Parkin DM, Bray F, Ferlay J, Pisani P, **Global Cancer Statistics 2002, *CA: A Cancer Journal for Clinicians*, 2005; 55; 74-108**

In developed countries cervical cancer accounts for 3.6% of new cancers and in the developing world it accounts for 15% of new cancers (Parkin et al 2005). This is an important distinction to make when educating women about the risks of cervical cancer.

Cervical cancer is a disease that has a much lower mortality than incidence rate. It is therefore considered to have a good prognosis because the case-fatality rate is low. The prognosis is good even in developing countries where many cases present at a relatively advanced stage (Parkin et al 2005). This is because cervical cancer can be treated by removing the abnormal cells. The high incidence of cervical cancer arises because early diagnosis through screening programs enables sub-clinical cases to be detected (Parkin et al 2005). CIN 3 is considered a sub-clinical case of 'disease'. This is because the majority of CIN 3 is asymptomatic (Schiffman M et al 2008; McCredie MRE et al 2008) but it is included in the incidence data because a percentage of CIN 3 will progress to cervical cancer. This represents a grey area of diagnosis because not all CIN 3 is predictive of cancer.

The low case-fatality ratio for cervical cancer is a result of two factors:

i) the inclusion of sub-clinical cases (CIN 3) in the incidence figures that would normally go unnoticed in an individual's lifetime and
ii) the fact that cancerous cells can be successfully treated with surgery.

The variation in the incidence rates for cervical cancer between developed and developing countries is illustrated in Table 4.

Table 3: Incidence Rates of Cervical Cancer Worldwide

Developed Countries per 100,000 women	Developing Countries per 100,000 women
0 – 14.5	14.5- 44

Source: Parkin DM, Bray F, Ferlay J, Pisani P, 2005, Global Cancer Statistics 2002, *CA: A Cancer Journal for Clinicians*, 2005; 55; 74-108

The risk of dying from cervical cancer in developed countries is considered very low (Parkin et al 2005). For example, the incidence of cervical cancer in Australia is 6.9 /100,000 women and the mortality rate is 1.9/100,000 women per year (AG NCIRS 2009). Australia has one of the lowest rates of incidence and mortality for cervical cancer in the world and the vast majority of women in Australia (99%) will not be

affected by cervical cancer in their lifetime (AG NCIRS 2009). In Australia early detection by Pap screening reduced the incidence of cervical cancer by almost 50% in the decade from 1991 – 2002 (AIHW 2006).

The incidence rate has been decreasing in developed nations since the 1950's (Parkin et al 2005). In contrast, the developing countries are considered to have a high risk of cervical cancer. The cervical cancer incidence rates in developed countries during the 1960's and 1970's were similar to the rates of cervical cancer in developing countries today (Gustafsson et al 1997). This is evidence that environment and lifestyle factors play a role in cervical cancer pathogenesis. Table 5 illustrates the mortality rates for cervical cancer worldwide. The table shows that mortality rates are much lower than incidence rates illustrated in Table 4 and again there is a significant difference between the developed and developing countries.

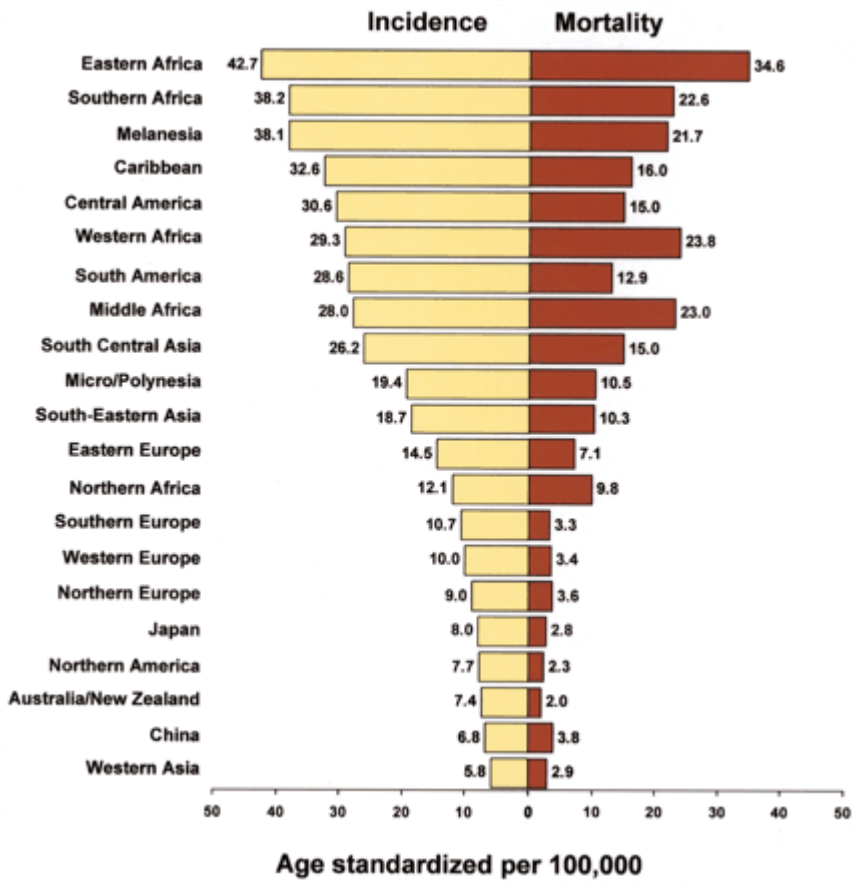
Table 4: Mortality Rates for Cervical Cancer Worldwide

Developed Countries per 100,000 women	Developing Countries per 100,000 women
0 - 10	10 - 34

Source: Parkin DM, Bray F, Ferlay J, Pisani P, 2005, Global Cancer Statistics 2002, *CA: A Cancer Journal for Clinicians*, 2005; 55; 74-108

The cumulative risk of cervical cancer to women before age 64 in the developed world is 0.8% and in the developing world is 1.5% (Parkin et al 2005). This difference in incidence rates is observed within Australia when comparing indigenous and non-indigenous women. In Australia, indigenous women have twice the risk of developing cervical cancer and the mortality rate is four to five times that of non-indigenous women (AG NCIRS 2009). This is a result of lower socioeconomic conditions which are more conducive to the spread of infectious agents. This is evidence of the role of environmental and lifestyle factors in the etiology of cervical cancer. The variation of risk of cervical cancer between countries can be observed in Figure 11.

Figure 11: Age-standardized Incidence and Mortality Rates for Cervix Uteri Cancer Worldwide.



Source: Parkin DM, Bray F, Ferlay J, Pisani P, 2005, Global Cancer Statistics 2002, *CA: A Cancer Journal for Clinicians*, 2005; 55; 74-108

The developed countries are listed at the bottom of this graph and show that the burden cervical cancer in these countries is very low: they have a low case-fatality ratio. Whilst the risk of cervical cancer is shown to *vary* significantly between countries the risk of infection with HPV 16/18 is the *same* in all countries. In addition, there have been substantial declines in cervical cancer incidence and mortality rates in many countries over the past decades, particularly in the Western world (Parkin et al 2005). Parkin et al state co-factors such as high-parity (a high number of births), tobacco smoking and use of oral contraceptives are factors that are shown to increase the risk of cervical cancer in women who have an HPV infection. Groner et al (2014) state that one of the most important risk factors for cervical cancer is the number of lifetime partners. The risk of cervical cancer increases four-fold amongst sexually active 14-19 year olds with 3 or more partners.

9.6 Environmental and Lifestyle Co-factors in Cervical Cancer Etiology

A lack of correlation between HPV 16/18 infection and a higher risk for cervical cancer incidence indicates that co-factors are necessary in conjunction with HPV infection for pathogenesis to occur. The evidence supporting this conclusion is described here.

It has been observed that cervical cancer declined in developed countries between 1955 and 1992 (Parkin et al 2005). Pap screening was not implemented in Australia and many other developed countries in a comprehensive way until after 1990 (AIHW 2006). The death rate dropped by 74% in the US during this time. Evidence for an association between cervical cancer and sexual activity has been available for more than a century (Munoz et al 1989). Since 1842 it has been noted that women who do not have sex do not get cervical cancer. This has led to the belief that a sexually transmitted virus was implicated in the etiology of cervical cancer. For many years the focus was on Herpes Simplex Virus Type 2 (HSV–2) as the cause of cervical cancer but as this virus is not found in all cervical cancer tumours the focus changed to HPV infection (Munoz et al 1989). Harald zur Hausen found HPV-DNA in cervical cancers in the 1980's and was awarded the Nobel prize for this discovery in 2008. He was the first to isolate HPV 16 and 18 from cervical cancer tissue (zur Hausen 2008). The reduction in cervical cancer in developed countries from 1955 onwards coincided with improvements in social conditions and lifestyle changes (Pfister 1990). There was greater access to healthcare facilities, health education and condoms in developed nations. Since 1990 the decline in mortality to cervical cancer in Australia has been aided by early detection of neoplasia through cervical screening (AIHW 2006). Cervical cancer is nearly always curable (9 out of 10 cancers) if detected early by Pap screening (NHMRC 2005).

Studies have shown that early sexual activity, high promiscuity and low socioeconomic status are risk factors for the development of cervical cancer (Munoz et al 1989; Gitsch et al 1991). Many developing nations have cultures that allow polygamy and the social conditions and infrastructure in these countries are poor which increases the transmission of infectious agents (Howett and Kuhl 2005). The incidence and mortality rate of cervical cancer increases with poverty and varies with socioeconomic status (Vetter and Gellor 2007). Educational attainment and access to healthcare significantly reduce the incidence of this disease (Vetter and Gellor 2007). Sexually transmitted

diseases (STD) are common and increasing in developing countries where there is frequent contact with commercial sex workers or where the onset of intercourse occurs at an earlier age with increased numbers of partners and sexual acts (Howett and Kuhl 2005).

A study by the IARC concluded that women infected with HPV combined with Herpes simplex virus – type 2 (HSV-2) are two or three times more likely to get cervical cancer than when they are only infected with HPV. Yet women who are infected with HSV-2 are not at increased risk of cancer if they are not also infected with HPV (Smith et al 2002). STD organisms represent prolonged and life-long infections in low SES regions because antivirals do not represent a cure for STD's (Howett and Kuhl 2005). Therefore, the higher incidence of invasive cervical cancer (ICC) in these regions is partly because women are more likely to be infected with a combination of two or more STD's at once and less likely to be regularly screened. Immunosupression is another risk factor for cervical cancer and this can be induced by HPV infections that are combined with HIV (Bosch et al 2013). Sexual behaviour that is conducive to acquiring sexually transmitted diseases represents an increased risk for developing cervical cancer and other genital diseases (Munoz et al 1989; Smith et al 2002). Infection rates with Herpes Simplex Virus-type 2 (HSV-2) are one in four in the USA and they are the cause of acute and recurrent genital herpes (Howett and Kuhl 2005).

There is a large body of evidence that also implicates sexual practices for males in the etiology of cervical cancer (Thomas et al 1996). It has been found that women whose husbands were in their twenties or younger when they first visited sex workers were found to be at higher risk of cervical cancer than women whose husbands did not visit sex workers (Thomas et al 1996). A major predictor of risk among women whose husbands visited sex workers was whether they used condoms during their visits. Not using a condom is a high risk factor for cervical cancer because it increases the risk of exposure to multiple infectious agents. It is believed that the risk of cervical cancer in Thailand could be reduced four-fold if men who regularly visit sex workers wore condoms (Thomas et al 1996). Contraceptive foams, creams and jellies are also found to reduce the risk of cervical cancer (Thomas et al 1996; Howett and Kuhl 2005). Studies in Thailand conclude that sex work plays an important role in the development of cervical cancer and it is thought that the most likely infectious carcinogenic agent is a

combination of some strains of HPV, HSV-2 and HIV (Thomas et al 1996; Smith et al 2002; Bosch et al 2013).

It is known that high-risk HPV infections have high resolution rates in young women and infections can persist for a lifetime without giving rise to cervical cancer (NHMRC 2005). This is evidence that environmental and lifestyle factors act in conjunction with HPV in the etiology of cervical cancer. In summary the environmental and lifestyle factors which are known to increase a person's risk of persistent infection and the progression of high-grade lesions to related cancers include (IARC 1995; Walboomers et al 1999; Haverkos 2005):

a) Multiple partners for the male and female

b) Presence of HPV plus other sexually transmitted viruses

c) Sex work (Gitsch et al 1991)

d) Sex without a condom/microbicides (WHO 2008 p.9)

e) High parity > 3 children

f) Cervical tar exposures (Bennett et al 2010)

g) Low socioeconomic status: poor hygiene/sanitation/nutrition conducive to sexually transmitted diseases

h) Immunosuppression

i) Smoking

j) Long-term oral contraceptive use and

k) Older age (WHO Biotext 2008 p2).

When the HPV vaccines were implemented in global populations in 2006/7 it was known that most individuals do not develop clinical signs or symptoms of any disease after infection from *any type* of HPV infection. Cervical cancer was known to be a rare outcome of HPV infections (IARC 1995; Bosch et al 2002; NHMRC 2005; WHO 2008). Bennett et al (2010) state '..most women who become infected with HPV will not develop cervical cancer' (p331). Yet promotional campaigns for the HPV vaccine

create fear about HPV infections by stating that most women will be infected with HPV in their lifetime and these infections are the *cause* of cervical cancer (AG IAP HPV 2012). HPV vaccines have also been promoted on the information that 'cervical cancer is the second most life threatening cancer world-wide' (Bennett et al 2010) even though this is a misleading statement that ignores the variation in environmental and lifestyle factors that significantly affect the risk of this disease in different countries.

9.7 Summary of the Evidence for Environmental/ Lifestyle Co-factors in Pathogenesis

The evidence described above demonstrates that the claim by scientists that HPV 16/18 infections are an *independent* cause of cervical cancer are false. HPV 16/18 infections are a necessary factor in most cases but not sufficient to cause disease. That is, they do not cause disease without the presence of environmental co-factors. In addition, it is known that cancer can have genetic causes. Evidence for this conclusion is summarised below:

1. HPV infection with any strain is not sufficient to cause cervical cancer (Walboomers et al 1999).

2. Approximately eighty percent of women are infected with HPV yet ninety percent of HPV infections do not lead to cancer or warts (IARC 1995; AG NHMRC 2005).

3. HPV 16 is identified as the pre-dominant sub-type in all countries yet cervical cancer rates vary significantly between countries (Parkin et al 2005). This was the case prior to the implementation of Pap screening in many countries so screening programs do not fully explain the variation in risk between countries.

4. Developed countries had the same high rates of cervical cancer in the 1960's and 1970's as the developing countries today but this was reduced by changes in environmental and lifestyle factors and with the introduction of Pap screening programs in the 1990's (Parkin et al 2005).

5. There is an increased risk of cervical cancer with an increased number of sexual partners (IARC 1995).

6. Sex workers have a four times greater chance of getting cervical cancer even though the detection of HPV subtypes is similar to controls (Gitsch et al 1991).

7. Condoms can reduce the risk of cervical cancer four-fold by preventing many infections from HPV (Thomas et al 1996).

8. Bosch et al (1996) highlight the fact that the sensitivity of new molecular biology techniques confirms the plausibility of HPV infection as the pre-cursor event leading to cervical cancer (Bosch et al 1995). However, a pre-cursor event is not a useful predictor of cancer if the *majority* of cases do not progress to cancer. Environmental factors play a role in the progression of some pre-cursor events to cancer.

9. Some scientists still claim 5-10% of tumors are not associated with any HPV DNA (Bosch et al 2002; Schiffman in Kircheimer 2002; Haverkos 2005).

10. It is stated that HPV 16/18 are present in approximately 70% of tumours but improved technology could prove this figure wrong. The 70% figure is dependent upon the detection methods used and it is not supported by evidence of a global correlation between these subtypes and cervical cancer pathogenesis. This vaccine has been founded on evidence of a causal factor for cervical cancer that is dependent upon the specificity and sensitivity of the analytical biotechnology that is used.

9.8 The Efficacy of HPV Vaccines in the Prevention of Cervical Cancer

This section describes the science that underpins the claim that HPV vaccines will be effective in preventing cervical cancer. HPV vaccines were not tested against cervical cancer outcomes in the clinical trials and this section describes the surrogate that was used in the clinical trials and the assumptions that underpin the conclusion that HPV vaccines would be effective in preventing cervical cancer.

HPV DNA is associated with the development of squamous cell cervical cancer and cervical adenocarcinoma (FDA Merck Ltd 2006). In 2003 when the WHO consultation group was investigating the possibility of developing a prophylactic vaccine to prevent these cancers it was decided that a suitable surrogate end-point for the efficacy of the vaccine would be the histologic pre-cursor lesions for these cancers (Pagliusi 2004).

The histologic pre-cursor lesions are defined as cervical intra-epithelial neoplasia (CIN) grade 2/3 lesions and adenocarcinoma in situ (AIS) (FDA Merck Ltd 2006 p2). Cervical cancer has a latent period of between 10 and 30 years between HPV exposure and the development of cervical cancer and this time period for accruing cases was considered unfeasible (Pagliusi 2004). The WHO consultation group decided the virological end-point of pre-cancerous lesions in women 15-26 years of age was a useful surrogate for vaccine efficacy studies (WHO 2008; Pagliusi 2004). This was decided even though pre-cursor lesions are common but rarely progress to cancer (WHO 2008 p8) therefore they are not a suitable definitive end-point for determining the efficacy of the vaccine in preventing cervical cancer.

The natural history of HPV infections shows that 90% are not detectable after 2 years. In addition, only 5% of HPV infections progress to either CIN 2 or 3 lesions within 3 years (Schiffman M et al 2008; McCredie MRE et al 2008). Many CIN 3 lesions do not lead to invasive cancer later in life. Of the CIN 3 lesions that do progress, only 20% will progress to invasive carcinoma within 5 years and only 40% progress to invasive carcinoma within 30 years (Schiffman M et al 2008; McCredie MRE et al 2008).This suggests that the majority of CIN 2 and 3 pre-cursor lesions in young women do not lead to cancer later in life and hence they are not accurately predict how much cervical cancer an HPV vaccine can prevent. The decision to use this end-point was based on four key features (WHO 2008; FDA 2006; NCIRS 2009):

1. They are obligate precursors of cervical cancer
2. They are closely associated in temporal sequence to the development of invasive cervical cancer
3. They are associated with a high risk of development of invasive cervical cancer (WHO Biotext 2008 p1).
4. Treatment or reductions in incidence are shown to result in a reduction in risk of invasive cervical cancer.

The first feature needs qualification. Whilst it is true that lesions grade CIN 3 are obligate precursors of cancer, the majority of lesions do not progress to cancer. Most high-grade pre-cursor lesions (CIN 2) in young women (~90%) regress quickly and without treatment in 2 years and the majority of CIN 3 lesions do not progress to ICC (Schiffman M et al 2008; McCredie MRE et al 2008; WHO 2008). The incidence of

high-grade squamous intraepithelial lesions (HSIL) is highest in this age-group and declines with age (NHMRC 2005; Heitman and Harper 2012). It is stated that cancer is an uncommon outcome of these lesions even in the absence of screening. Raffle et al (2003) observed that at least 80% of HSIL regresses without intervention or is asymptomatic in this age-group (NHMRC 2005 p15).

Similarly, features two and three are only true when the environmental and lifestyle co-factors (listed in 10.7 above) are also present (NHMRC 2005). This is demonstrated by the variation in the incidence and mortality rates for cervical cancer between developed and developing countries and between Australia's indigenous and non-indigenous populations. The fourth feature also needs to be qualified. In countries where the environmental risk factors for pathogenesis have been reduced the majority of HPV infections are not a risk for cervical cancer. Cervical cancer is a rare outcome of all HPV infections with the majority being self-limiting and asymptomatic (IARC 1995; NHMRC 2005; WHO 2008). Screening for high-risk HPV infection would identify a very large number of women but only a few of them would be at risk of cervical cancer (NHMRC 2005 p9). This would be the same if all young women are vaccinated – the majority of these women would not be affected by cervical cancer in their lifetime. In addition, there are 15 high-risk HPV subtypes that are implicated in causing cervical cancer; protecting against just 2 does not prevent infection from the other 13 (AG NHMRC 2005). This is why Merck is now producing a vaccine that will include 5 more HPV genotypes. Resolved infection from high-risk HPV 16/18 does not protect against other high-risk HPV genotypes (Tomljenovic and Shaw 2012). In addition, Gardasil® does not prevent cervical cancer from HPV infection 16 and 18 which was already present at the time of vaccination (FDA Merck Ltd 2006).

In 2006 when HPV vaccine was licensed and approved for use in the population there was no standard serological assay for detecting HPV antibodies and it was not known what level of antibody titre would be protective against HPV infection (WHO 2008; NCIRS 2010). An antibody titre against 2 of many oncogenic HPV genotypes (even if a protective level is established) is unable to provide accurate information about the efficacy of HPV vaccines against the burden of cervical cancer. This is because antibody titre is an indication of exposure to the infectious agent which in this case is not an *independent* cause of the disease. In this case the majority of people exposed to HPV do not get cervical cancer. There is 'overwhelming evidence that infection with

HPV is necessary, though not sufficient, for development of cancer of the cervix' (NHMRC 2005 p9). The expression of disease from an HPV infection depends upon environmental and lifestyle co-factors and most HPV infections are harmless if these co-factors are not also present (IARC 1995; WHO 2008; NHMRC 2005). Currently there is no technology to predict which CIN 3 lesions will progress to cancer and which ones will persist for a lifetime without causing disease (Heitmann and Harper 2012) but it is known that the vast majority of CIN 3 lesions do not progress to cancer.

9.9 The Design of Phase 3 Trials for the Quadrivalent Vaccine: Gardasil

This section describes the evidence that was collected from the clinical trials and the assumptions that have been used to market HPV vaccines as a safe and effective prevention for cervical cancer.

The trials investigating the efficacy of an HPV vaccine in preventing cervical cancer observed that women (15-26 years old) who were given the vaccine had fewer pre-cursor lesions than women who were not given the vaccine (FDA Merck Ltd 2006). However, this result was dependent upon the protocol of the study group. A significant reduction in pre-cursor lesions was only observed in the study group that had not been infected with HPV 16/18 at baseline (FDA Merck Ltd 2006). The Australian Health Department states that the HPV vaccine does not prevent HPV infection (16 and 18) which was already present at the time of vaccination (NHMRC 2005) and the efficacy of the vaccine was only 44% in the study group that was infected with HPV 16/18 at baseline (Future II 2007). Previous sexual activity is the main reason for infection with HPV (NHMRC 2005). In other words, you are still susceptible to cervical cancer if you were infected with HPV 16/18 prior to vaccination. This would be a large percentage of the population as these are claimed to be the dominant sub-types in all populations.

Since the vaccine was marketed in 2006 there has been no screening for HPV sub-types prior to vaccination so there is no conclusive data on the effectiveness of HPV vaccine in preventing pre-cursor lesions due to HPV 16/18. Merck pharmaceutical company, the sponsor of the clinical trials, stated the vaccine prevents '100% of high-grade disease and 'non-invasive' cervical cancers associated with HPV infection' based on its ability to prevent pre-cursor lesions (grade 2/3) in women 15-26 years of age (FDA Merck Ltd

2006). If CIN 3 does change into invasive cancer the time frame for this to happen averages between 8.1 to 12.6 years (ACOG 2005). Yet the longest follow up study for the phase 3 clinical trials that examined efficacy against pre-cursor lesions was only 4 years (FDA Merck Ltd 2006). In addition, 'the vast majority of women (15-26 years of age) clear or suppress HPV to levels not associated with CIN 2 or 3 (high-grade disease) and for most women this occurs promptly' (ACOG 2005). Raffle et al state that modelling data from the United Kingdom suggests that eighty percent of high-grade intraepithelial abnormalities will regress without intervention (NHMRC 2005). Therefore, the correct assumption is that pre-cursor lesions in this age-group are not an indication that cervical cancer will develop from high-risk HPV infections. The clinical trials do not provide evidence that a reduced number of pre-cursor lesions in women 15-26 years of age (even if not previously infected with HPV16/18) will reduce the incidence of cervical cancer in older women. Therefore there is no evidence of how much cervical cancer this vaccine may prevent. The only definitive evidence obtained from the clinical trials in this age group was that the drug prevents infection from 2 of 15 high-risk strains of HPV identified in cervical cancer cases. However the duration of this prevention is unknown (WHO 2008).

It was *assumed* that fewer HPV associated pre-cursor lesions in the vaccinated group indicated a reduction in cervical cancer cases in older women later in life. However, as the majority of pre-cursor lesions in this demographic regress naturally and do not lead to cancer later in life then it is not predictive of cervical cancer cases in older women. A drug to reduce infection from 2 of 15 HPV sub-types may not protect against cervical cancer because other HPV sub-types (13+) can infect. Further, the vaccine is not beneficial to the majority of women in developed countries because the co-factors for pathogenesis are not prevalent and most women are not at risk of cervical cancer.

9.10 Marketing the HPV Vaccine

In 2006 when the HPV vaccine was licensed and marketed to females the phase 3 clinical trials had not been completed (Future II 2007). In other words, the benefit and safety of this vaccine against cervical cancer had not been established. Questions that still needed answering were (Vettor and Gellor 2007):

i) Effectiveness of the vaccine as a prevention for cervical cancer

ii) Duration of vaccine efficacy
iii) Efficacy of the vaccine in males and females older than 26 years of age and
iv) The long-term safety of the vaccine.

However, the vaccine was already being promoted to the public as a preventative for cervical cancer. It was recommended for all women aged 9-26 years old, even though it had not been tested for the prevention of pre-cursor lesions in females younger than 15 years of age (Slade et al 2009). Phase 4 clinical trials of HPV vaccine continued in India *even* after the vaccine was implemented into the NIP's of many countries in 2007; after it was fast tracked for approval outside the guidelines for this process (Sarojini et al 2010 p29). The phase 4 trials in India were halted after one year when 6 girls died post-vaccination and many suffered serious adverse reactions that were not being recorded. PATH (Program of Appropriate Technology in Health), the organisation responsible for the trials and largely funded by the Gates Foundation, was accused of breaches of ethical guidelines and the exploitation of children. This organisation had started a two year trial called a 'Demonstration Project' in paediatric populations/marginalised groups, without proper informed consent and without an active adverse event reporting system to monitor the health effects in the population. The reporting of adverse events by medical practitioners was voluntary (Sarojini et al 2010 pp27-8). This does not allow causal relationships or frequency of adverse events to be determined. The vaccine was promoted to these participants as giving 'lifelong protection' to cervical cancer and no side effects were mentioned. They were also not informed that the vaccine only covered 2 of the 15 plus strains of HPV that are associated with carcinogenesis and therefore Pap screening would still be required. The purpose of the study in India was to determine the vaccines public health value yet it was already being promoted as beneficial in national immunisation programs. The implications of these practices and the influence of private-public partnerships on public health priorities are discussed further in Part 2 section 9.19.

By promoting the vaccine as a preventative for cervical cancer, instead of a sexually transmitted virus, the HPV vaccine was placed in the non-communicable disease category thus enabling the manufacturer to avoid public health officials who would have scrutinized a high-risk vaccination campaign (Rothman and Rothman 2009). In addition, the US 1986 National Childhood Vaccine Injury Act removes liability from

vaccine manufacturers in the US for all design defects including those based on negligence (Holland and Krakow 2012 pp39-44). It states that vaccine manufacturers do not bear any liability for failing to give accurate or complete information to those vaccinated. Manufacturers only have to provide relevant information to doctors who must give patients CDC Vaccine Information Statements. In other words, even doctors are not required to make judgments about the risks and benefits of vaccines because the CDC provides the assessment for them in prepared information sheets. The 1986 Childhood Vaccine Injury Act created a no-fault compensation program that was designed to ensure the stability of the vaccine supply as opposed to the safety of the vaccines recommended in government schedules (Holland and Krakow 2012 pp39-44).

The quadrivalent HPV vaccine was approved by the US Food and Drug Administration (FDA) on June 8 2006 and 3 weeks later it was recommended by the US CDC Advisory Committee on Immunisation Practices (ACIP) for universal HPV vaccination for women 9 – 26 years of age (Blaxhill and Olmsted 2012 p186). The time period from clinical trial observing pre-cursor lesions to recommendation against cervical cancer was only 4 years. When recommending this drug the committee recognized they would need to create a demand for the drug (Vettor and Gellor 2007). In other words, cervical cancer was not prominent enough in developed nations for women to request a drug for its prevention. Most western women had not thought much about cervical cancer when the vaccine was introduced because it was not in the highest 10 most serious cancers in many developed countries (AIHW 2006; Rosenthal 2008). The public was also largely unaware of the connection between HPV infection and cervical cancer (Vettor and Gellor 2007). This causal link was only established in the early 2000's (Munoz et al 2006). The ACIP observed that education programs were needed to promote this drug and the programs would need to be from a trusted source (Vettor and Gellor 2007).

This vaccine was fast tracked for approval by the FDA due to industry lobbying (Rosenthal 2008) and Merck ensured that Gardasil was approved for universal use in all women, not just for high-risk groups. The time frame from application to approval of the drug by the FDA was only 6 months and the CDC recommended it for universal use only weeks later (FDA News Release 2006). Harper, the principal investigator on the clinical trials of both HPV vaccines, Gardasil and Cervarix, states 'Most vaccines take

three years to develop and then 5 to 10 more for universal acceptance' (Rosenthal 2008 p3). This is necessary to establish the safety and duration of efficacy of the vaccine. Many side effects only become apparent after they have been tested on a larger number of participants over longer time-periods (Slade et al 2009). The medical director at Merck, Richard Haupt, was questioned about the speed with which the HPV vaccine had been marketed and he replied 'Our hope and belief is that this is a remarkable vaccine that will have a huge impact on women' (Rosenthal 2008 p3). 'Hope' and 'belief' are not the same as scientific evidence.

Politicians were lobbied and invited to receptions urging them to legislate against a 'global killer' (Rosenthal 2008 p2). Abramson, the chairman of the committee of the CDC that recommended the vaccine for all girls aged 11 or 12, stated 'there was incredible pressure from industry and politics' to approve this vaccine (Rosenthal 2008 p2). Harper agrees 'Merck lobbied every opinion leader, women's group, medical society, politicians and went directly to the people – it created a sense of panic that says you have to have this vaccine now' (Rosenthal 2008 p3). In the US pharmaceutical companies are allowed to advertise directly to the public and the campaigns for HPV vaccines have been very aggressive.

The marketing of drugs is a very important issue. In the following paragraphs I have relied largely on Rothman and Rothman (2009) for this information because they have provided an in-depth analysis of the health promotion campaigns for HPV vaccines.

In order to promote HPV vaccines through a trusted source the industry obtained government reimbursement and mandates to promote the vaccine to all women, not just to high-risk populations. This enabled Merck, the manufacturer of Gardasil, to fund the professional medical associations (PMA's) to promote the vaccine. The pharmaceutical companies supplied the medical associations with a Speaker Lecture Kit. This included ready-made presentations and letters to promote Gardasil as a preventative for cervical cancer, even though the data was incomplete. Much of the promotional material did not address the complexity of the issues surrounding the vaccine and did not provide balanced advice regarding the risks and benefits of the vaccine. It was also presented in a way that obscured the involvement of pharmaceutical companies in the marketing campaign. Doctors and nurses were recruited for an 'Educate the Educators' program created by the pharmaceutical

companies to train health professionals to promote the vaccine. The PMA's maintained a registry of educators and participants lectured to thousands of healthcare professionals. Hundreds of doctors were paid $4,500 per 50 minute lecture to present the information supplied by the pharmaceutical companies at Merck sponsored conferences. Health professionals were also paid by the manufacturers to attend vaccine advisory board meetings and to educate the public in awareness campaigns. The financial support is often indirect so patients are unaware that 'expert' advice has been paid for by the vaccine makers (Rosenthal 2008).

The Speaker Lecture Kit enabled the speaker to customize the talk to specific groups, for example, pediatricians, gynecologists, patients or parents. One of the medical slides stated 'Cervical cancer screening is described as secondary prevention identifying a precursor lesion; the HPV vaccine is primary prevention that would eliminate the cause of cervical cancer' (Speaker Lecture Kit slide 13 in Rothman and Rothman 2009). This information is deceptive because it does not inform women that there are more than 15 other cancer causing strains of HPV, so the vaccine will not eliminate the cause of cervical cancer. Whilst the slides acknowledged the uneven distribution of cervical cancer rates globally they did not draw attention to the risk factors that make cervical cancer a higher risk for women in developing countries. This knowledge is critical to women in determining the necessity for the vaccine. When questioned about the cost-effectiveness of this vaccine the standard company reply was 'other vaccines exist for relatively unusual diseases (for example, rotovirus and meningococcal disease) and many newer vaccines are not inexpensive either' (Speaker Lecture Kit slide 119 in Rothman and Rothman 2009). The pharmaceutical company did not attempt to justify this vaccine on benefits or the necessity for its use. The HPV vaccine is the most expensive vaccine costing $Au 450 per person, with three doses needed for protection (Cancer Council Victoria). These vaccines are among the first approved for universal use *in any age group* and Rosenthal (2008) says they will cost the health system more money than it will save.

Education campaigns emphasized the worldwide incidence of this disease whilst omitting risk factors for the disease in different countries and cautionary qualifications about efficacy and safety of the vaccine. At no time has the public been informed that the information they received on this vaccine was designed by pharmaceutical companies (Rothman and Rothman 2009; Tomljenovic and Shaw 2013 p190). The

pharmaceutically funded promotional campaigns for HPV vaccines have maximized the threat of HPV infections and minimised the environmental and lifestyle co-factors that are necessary in cervical cancer pathogenesis. The public places its trust in medical associations to provide accurate information to health professionals for the promotion of medical products to the community. Clearly this trust has been breached. At a minimum the public is entitled to be informed openly about relationships with industry and precise funding arrangements in order that they can weigh up the credibility of the information. This was an intentional deception as the pharmaceutical companies sought to present their information through trusted sources and the PMA's condoned it.

9.11 Adverse Events associated with HPV Vaccination

Many adverse events to HPV vaccines were reported during the two and a half years following the licensure of the vaccine (Slade et al 2009). The Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA) operate the US Adverse Events Reporting System (VAERS). This is a voluntary, national, passive surveillance system set up to monitor adverse events from vaccines. Manufacturers, health professionals and patients can report reactions to this database. There have been three times the rate of reported adverse reactions after HPV vaccine than to all other vaccines combined (Slade et al 2009; Tomljenovic and Shaw 2013). However, passive pharmacovigilance systems are not designed to determine causal relationships to adverse reactions or their frequency in the population (.Tomljenovic and Shaw 2013 p186). Although an analysis of the postlicensure safety surveillance data for the HPV vaccine has been performed, the analysis only included adverse event data from the US (Slade et al 2009). This is despite Gardasil® being licensed in many foreign countries. The decision to use only US data was justified on the grounds that it offers more complete information and is more feasible for follow up studies for medical review. Slade et al indicate that 68% of the adverse reports for the HPV vaccine, in their analysis, came from the manufacturer. Of these reports, almost 89% *did not* provide sufficient identifying information to allow medical review of the individual cases. As a result of this failure in the system, VAERS data cannot be used to infer causal associations between vaccines and adverse events (Slade et al 2009). That the majority of the data did not permit follow up for medical review nullifies the stated reason for excluding adverse event data from foreign countries.

Reporting systems for adverse events also allow the pharmaceutical companies that manufacture the vaccine to influence the reporting of adverse events to government regulators. The package inserts for HPV vaccines state that suspected adverse events should be reported to the manufacturer of the vaccine or to VAERS (Merck & Co Inc 2006). The manufacturers of the HPV vaccines are pharmaceutical companies that benefit financially from the vaccines. It is not in the interest of company profits to be vigilant about adverse events. Pharmaceutical companies also fund the clinical trials and employ many of the researchers who design the trials and safety studies (Future II 2007). The only supervision of the clinical trials was performed by the FDA's Center for Biologics Evaluation and Research (CBER) who also granted Merck the first Biologics License Application (BLA) for an HPV vaccine (Blaxill and Olmsted 2012 p186).

The need for a rigorous long-term surveillance system for vaccines is clear when a comparison is made between the pre- and post- licensure adverse events. Slade et al comment that rare adverse events following vaccination (AEFV) were observed more often in the post licensure data than the pre-licensure data. There are two reasons for this:

I. The longer time period over which the data was collected and
II. The larger number of people that were included in the trial.

In the pre-licensure trials adverse events were only actively reported for 15 days after immunization (Future II 2007). However, in the post-licensure passive surveillance system events were reported that occurred weeks or months after immunization. For example, venous thromboembolic events were diagnosed between 0-306 days after vaccination and motor neurone disease was reported some months after vaccination (Slade et al 2009). This indicates the inadequacy of the phase 2 and 3 safety data that only included events within 15 days of vaccination. It is well established that the effects of the chemicals in vaccines may not appear until weeks, months or years after the vaccine has been administered (Shoenfeld and Agmon-Levin 2011). The lack of adequate surveillance data after vaccination allows the manufacturers to claim there was no evidence that the deaths or serious side-effects were caused by the vaccine (Slade et al 2009). In other words, if you don't monitor the events in an appropriate and systematic manner then there is no evidence to disprove this statement. Researchers are

then able to conclude from the post surveillance data that 'Gardasil continues to be safe and effective and its benefits continue to outweigh the risks' (Rosenthal 2008 p9). This statement is made on the basis of a surveillance system that the researchers themselves say is severely limited. The limitations of the system include (Slade et al 2009):

I. It is a passive system that results in the underreporting of events
II. Reported events are not always systematically validated.
III. Inconsistency in the quality and completeness of reported data
IV. Reporting biases

The adverse events that have been reported to VAERS from this voluntary reporting system include hypersensitivity, anaphylaxis, Guillane-Barre syndrome, transverse myelitis, pancreatitis and venous thromboembolic events, deaths and pregnancy abnormalities (Slade et al 2009; Tomljenovic and Shaw 2013 p186). An accurate comparison of adverse events, including congenital abnormalities and spontaneous abortion after vaccination, cannot be made with the unvaccinated group in the clinical trials because the placebo was not inert (Slade et al 2009; Tomljenovic and Shaw 2013). The manufacturer funded clinical trials used a vaccine adjuvant - aluminium hydroxyphosphate sulphate - as the placebo in the unvaccinated group (Future II 2007). This is a chemical known to be linked to serious adverse events including hypersensitivity and autoimmune diseases (Shoenfeld and Agmon-Levin 2011).

There cannot be an accurate measure of the degree of harm caused by the vaccine if all known active ingredients are not removed from the placebo. In one of the clinical trials it is stated that the two HPV vaccines being trialled contained 225 micrograms and 395 micrograms of adjuvant respectively and the two placebos contained 225 micrograms and 450 micrograms respectively (Villa et al 2005). The higher amount in the second placebo was stated to be for 'appropriate safety comparisons' but no explanation was provided to explain how it would prove safety. Health authorities often report on the number of adverse events for a particular vaccine with respect to the background rate in individuals who have never had the vaccine. It is hard to make a true comparison in the 21st century because children are given multiple vaccines from the first day of life. Slade et al (2009) indicate that the FDA and the vaccine manufacturer (Merck & Co) agreed to carry out a phase 4 study to determine the safety of simultaneous use of HPV vaccine with other recommended vaccines, as well as autoimmune and other serious

AE's. This scientific knowledge is essential because 5 newly licensed adolescent vaccines have been introduced at age 12 and 13: meningococcal, tetanus, diphtheria, and acellular pertussis vaccine (Slade et al 2009). When these vaccines were introduced in the US, there was an increase in the number of females 11-18 fainting (syncope) after vaccination. The scientific literature reports seizure-like activity in children during syncope (Slade et al 2009) so it is important to have an accurate assessment of reactions before parents are informed this practice is safe. Between 2006 and November 2013 there have been approximately 155 deaths and 32,995 adverse events reported to VAERS (CDC). Of these events 6,549 have resulted in permanent damage. The VAERS statistics are believed to represent only one-tenth of the population damaged by the vaccine because this is a passive reporting system (Slade et al 2009). There has been no systematic, active, long-term surveillance of the adverse events resulting from this vaccine since it was marketed six years ago. Whilst the WHO states the vaccine is 'generally safe and well-tolerated' (WHO 2008 p17) this claim does not include a true comparison of vaccinated and unvaccinated (non-adjuvanated) females and there has been no *active* follow up of vaccinated individuals.

This illustrates that the risks and benefits of HPV vaccines have not been founded on sufficient evidence. It also demonstrates that the manufacturer was not required to prove the vaccine was effective or safe before it was approved by the FDA and marketed to all women in 2006.

9.12 The Ingredients of HPV Vaccines

This is a genetically engineered, recombinant vaccine produced in yeast cells (Villa et al 2005). HPV itself is a non-enveloped, encapsulated, double-stranded DNA virus. In yeast cells the L1 protein generates virus-like-particles (VLP) that resemble HPV virons but are non-infectious. These are the particles included in the HPV vaccine (Villa et al 2005). There are 2 HPV vaccines on the market - Cerverix and Gardasil - and they contain different ingredients (CDC Vaccine Excipients):

I. **'Cerverix:** 3-0-desacyl-4'-monophosphorl lipid A (MPL), 225 micrograms aluminium hydroxide, amino acids, insect cell protein, mineral salts, sodium dihydrogen phosphate dehydrate, vitamins, 20 micrograms HPV -16 L1 protein, 20 micrograms HPV 18 L1 protein (recombinant VLP's)

II. **Gardasil**: Contains 4 recombinant VLP's: HPV types – 40 micrograms VLP 16, 20 micrograms VLP 18, 40 micrograms VLP 11 and 20 micrograms VLP 6. Other ingredients include amino acids, 225 micrograms amorphous aluminium hydroxyphosphate sulphate, carbohydrates, L-histidine hydrochloride, mineral salts, polysorbate 80, sodium borate, vitamins'.

Polysorbate 80 and sodium borate found in the Gardasil vaccine are known to be linked to infertility (WAVE). The World Association for Vaccine Education (WAVE) states sodium borate is linked to infertility, seizures (twitching), convulsions and paralysis. This chemical is a dangerous poison which the National Library of Medicine states 'is no longer commonly used in medical preparations' (WAVE). This statement was made in 2005 and the vaccine was licenced in 2006. Polysorbate 80 is an emulsifier that can sometimes have fatal effects when given through a needle (WAVE). Changes in heart function can be immediate. The blood-brain-barrier can be penetrated followed by seizures and death. Anaphylaxis is known to be caused by this chemical. It demonstrates synergistic toxicity with a range of other chemicals that can be found in vaccines. It needs to be asked why it is necessary to put this chemical into many children's/adolescent vaccines, given that other stabilizers can be used. Cerverix does not contain this chemical.

Aluminium hydroxyphosphate sulphate is the adjuvant used in HPV vaccines to stimulate the immune system. Aluminium is a heavy metal that is known to have neurotoxic effects in humans and animals (Klish and Baker 1996). In 1996 the American Academy of Pediatrics stated aluminium is implicated in the interference of a variety of cellular and metabolic processes in the nervous system and other human tissues (Klish and Baker 1996). Scientists have known for many years that this chemical is associated with autoimmune diseases and hypersensitivity (Shoenfeld and Agmon-Levin 2011; Greville 1966). In addition, aluminium adjuvants may lead to macrophagic myofascitis which is a syndrome where aluminium macrophages infiltrate muscle tissue and may be accompanied by myalgia, arthralgia and fatigue (Eldred et al 2006). In the clinical trials 0.1% of women did not complete the trials due to adverse events and 3.6% of pregnant women from both the vaccinated and the placebo groups experienced a serious adverse event (WHO 2008 p17). There were 15 to 16 congenital anomalies born in each group (WHO 2008). The common factor in these trial groups was aluminium adjuvant and it is an indication that many adverse events may not have been causally

related to the vaccine in the trials because the trials did not compare vaccinated participants to an inert placebo group.

The WHO states that background information about the health status of adolescents including acute, chronic and autoimmune diseases should be collected before broad HPV vaccination programs are established (WHO 2008 p6). This would ensure that the risks of the vaccine can be properly evaluated. Broad vaccination programs have been rapidly implemented into many countries and the true health effects of this vaccine may never be known if this information has not been collected and if government regulators are using passive post-vaccination surveillance systems.

9.13 Evaluating the Cost-Effectiveness of HPV Vaccination Programs

Government policy-makers in many countries are using epidemiological and economic models to determine the cost-effectiveness of HPV vaccines (Brisson et al 2009). There are over 20 different models with considerable variations between them (WHO 2008; Brisson et al 2009). This is due to the significant gaps in the scientific literature regarding many aspects of HPV natural history and also due to the subjectivity of individual scientists in deciding the level of detail to include in the mathematical models (WHO 2008; Brisson et al 2009). The HPV vaccine is being utilised in many countries even though it is known that there are many uncertainties in the health outcomes predicted by the models because of the use of simplified assumptions (WHO 2008; Choi et al 2012). Mathematical models depend upon the equations used and the parameter values chosen. Modelling involves many assumptions so good judgment and disciplined integrity by the investigative scientists are vital (Michaels 2008 p61). Results can be manipulated intentionally or inadvertently so it is important that there is an independent assessment of the models and data used (Michaels 2008). Almost all HPV models assume that infection, clearance, progression and regression for each HPV type are independent of infection from other types (Choi et al 2012). Although some scientists are now claiming infection from one type influences the chance of infection by another type, more sophisticated multi-type individual based models are needed to properly analyse this possibility (Choi et al 2012). HPV vaccines have been deemed cost-effective for many countries, using mathematical models, even though scientists are claiming that the effects of the vaccine on high-grade lesions and invasive cancer will not be clear for many years (WHO 2008 p5; Choi et al 2012).

In 2008, Brisson et al stated that the HPV vaccine trials were showing 'promising' results. The cost-effectiveness models of HPV prevention in developed countries prior to 2008 concluded that vaccinating girls is 'likely' to be cost-effective *if* the duration of vaccine protection is greater than 30 years *or* if booster doses are given when the duration of efficacy is short-term (Brisson et al 2008). Other scientists claim that the duration needs to be at least 15 years with 90% efficacy against *at least HPV 16* to be cost-effective (Heitmann and Harper 2012). Yet the duration of the vaccine was unknown when the vaccine was marketed to women in 2007 (NCIRS 2010) as an effective prevention for cancer (NADC 2006). Mathematical models present cost-effectiveness as a ratio (CER) defined as the incremental cost of obtaining a unit of health effect from an intervention when compared to an alternative (Brisson et al 2009). Models for HPV vaccine can only produce speculative health outcomes because of the assumptions made about HPV pathogenesis. In the developed countries the majority of HPV infections (90%) are not a high risk for cervical cancer (WHO 2008). Empirical evidence of the benefits of the vaccine will not be determined for decades due to the long latent period (10-30 years) between HPV infection and cervical cancer incidence (WHO 2008 p5).

The assumptions that have been used in the CER models for HPV vaccines include:

1. HPV DNA on its own is a cause of cervical cancer.
2. HPV 16 and 18 infections are a high risk for developing cervical cancer.
3. High-grade pre-cursor lesions (CIN 2/3) in 15-26 year old women are a surrogate for cervical cancer.
4. The other 13 + strains of HPV will not infect and progress to cervical cancer.
5. The duration of the vaccine is longer than 10 years.
6. There are few serious side-effects produced by the vaccine

HPV vaccine is not proven safer or more effective than Pap screening combined with loop electrosurgical excision procedure (Heitmann and Harper 2012; Tomljenovic and Shaw 2012) therefore it is important to assess the validity of each assumption regarding pathogenesis and vaccine safety that has been used in the CE models. This knowledge plus the fact that vaccinated women will still need Pap screening must be factored into

the CE assessment. The HPV vaccine costs $Au450 per vaccinated individual (3 doses of vaccine) (Cancer Council Victoria) and this must also be compared to the cost of a Pap test every 2 or 3 years, as HPV vaccine does not protect against all oncogenic HPV infections. Pap screening is believed to detect 9 out of 10 cervical cancer cases (Cancer Council Victoria) and it is virtually risk free. As vaccinated women will still need this program HPV vaccination programs cannot be cost-effective.

9.14 Assumptions in HPV Vaccination Programs

The introduction of the HPV vaccine was based on a number of questionable assumptions that are summarised here:

HPV DNA is an independent cause of cervical cancer

When scientist's trialled this vaccine against pre-cursor lesions in 2003 it was known that HPV 16 and 18 could persist for a lifetime without causing cervical cancer. It was also observed that 5–10 % of tumours did not contain HPV DNA. Genetic and environmental factors were known to be a cause of all types of cancer and many co-factors were identified in the etiology of cervical cancer prior to the development of HPV vaccines. There were significant gaps in the scientific knowledge regarding the interaction of these co-factors with numerous oncogenic HPV genotypes in pathogenesis.

HPV 16/18 infections do not lead to cancer without co-factors being present. The majority of HPV 16/18 infections (90%) are harmless, self-limiting and asymptomatic and are not a high risk of cervical cancer or warts. Environmental and lifestyle factors are known to influence the global incidence and mortality of cervical cancer and this is demonstrated by the lack of correlation between the presence of HPV 16 and 18 and the incidence of cervical cancer. Current biotechnology has identified that HPV 16 and 18 infections are a necessary causal factor in approximately 70% of cervical cancer, but these infections are not sufficient to cause disease and future developments in biotechnology may prove this percentage wrong.

Pre-cursor lesions in young women as a cervical cancer surrogate.

The natural history of HPV 16/18 infection in the 15–26 year demographic does not support the conclusion that HPV precancerous lesions are a precursor for cervical

cancer: the opposite is true. The majority of pre-cancerous lesions in this demographic regress naturally and do not lead to cancer later in life. This indicates that a measure of efficacy against pre-cancerous lesions (CIN 2 and 3) in young women is an inadequate surrogate for determining *how much* cervical cancer can be prevented with a quadrivalent HPV vaccine.

HPV genotypes and progression to cervical cancer

It is believed that this vaccine will protect against ~70% of cervical cancer. The assumption is that vaccinated women will not be infected with the 13 other HPV subtypes that are associated with carcinogenesis. Approximately 30% of cervical cancer is linked to HPV genotypes that are not covered in the vaccine. Therefore it is recommended that all vaccinated women should still have regular Pap screening to ensure they are protected. Preventing infection from HPV 16 and 18 assumes that it will prevent *some* cervical cancer but there is no empirical evidence to indicate *how much* cancer it can prevent in developed countries where cervical cancer is already a low risk due to Pap screening programs and where 13+ other genotypes can also infect.

Duration of the vaccine

The duration of this vaccine was unknown when it was approved by the FDA in 2006 and it is still unknown years later. Duration of the vaccine is believed to be at least 5 years as predicted by mathematical modelling performed by the manufacturer. In addition, duration of the vaccine is not an indication of the protection against cervical cancer – only against infection from 2 subtypes of 15+ high-risk HPV infections.

Adverse Events

Safety was not adequately investigated in the clinical trials for this vaccine. The trials for this vaccine did not use an inert placebo in the unvaccinated group and they did not study the latent effects of the vaccine components for a year or more after exposure. In addition, there is a lack of knowledge about the harm this vaccine will cause in the population because there is no *active* surveillance system to monitor adverse events. This allows scientists to claim there is no indication that the adverse events reported after HPV vaccination are caused by the vaccine. It is often claimed that these events are a ‘coincidence’, enabling government regulators to state the vaccine is safe and

effective based on insufficient evidence. Models for the cost-effectiveness of HPV vaccines do not include an estimate of serious side-effects due to the vaccine.

Vaccination programs are targeting 11-12 year olds at an age when the risk of cervical cancer death is zero and for which a trial for a vaccine for efficacy against cervical cancer would be unethical. In comparison, the risk of vaccine injury or death for this demographic is very real. This risk may be small or large but it is necessary to have an accurate estimate before broad vaccination programs are implemented for healthy adolescents who have a low lifetime risk of developing cervical cancer.

Costs

Vaccination programs are very expensive compared to the cost of screening programs. Pap screening is effective in preventing 9 out of 10 cervical cancer cases and virtually risk free. In contrast, the HPV vaccine is very expensive and it cannot prevent at least 30 % of cervical cancer. In addition, Pap screening will still be required by all vaccinated women. Vaccinating all women in developed countries results in the majority of women using a vaccine for a disease they are not at risk of getting but they are now at risk from the vaccine.

9.15 Conclusion to Part 1

The promotional campaigns for HPV vaccine misrepresented the risk of HPV infections and cervical cancer to women in different countries. This was done in order to create a market for the vaccine. Currently the benefit of HPV vaccines against the burden of cervical cancer is unknown and the risk of injury or death associated with the vaccines has not been accurately determined in different populations. Universal HPV vaccination programs that target infection from HPV 16 and 18 are not beneficial to the majority of women in developed countries because these infections will not progress to cancer without specific environmental and genetic factors (risk factors) also being present. HPV infections do not progress to carcinoma in the majority of cases and there are currently 13+ oncogenic strains of HPV that the vaccine does not protect against.

HPV vaccines are not demonstrated to be safer or more effective than Pap screening combined with surgical procedures. Hence it follows that implementing broad HPV vaccination programs is not necessary or cost-effective because Pap screening programs

combined with surgery are the most effective prevention and are still required by vaccinated women. HPV vaccines are offering uncertain benefits in reducing the burden of cervical cancer and may cause more harm than good due to the lack of investigation of their long-term safety.

PART 2 UNDONE SCIENCE IN HPV VACCINATION PROGRAMS

9.16 Introduction

The global policy of using HPV vaccines to prevent cervical cancer has been formed on incomplete evidence resulting from undone science. In the following sections I will present the undone science in HPV vaccination programs and explain why this science is important and why funding has not been provided to carry out this research. The *Political Framework for Undone Science* that is summarised in chapter 8 illustrates the cultural values found in governments and research institutions that result in conclusions being formed on a lack of evidence. This allows public health priorities to be determined on political decisions. The political decisions made in the development of HPV vaccines reveal the role that industry now plays in developing vaccines for the market and approving them for national immunisation programs. This has been facilitated by the private-public partnerships in the GAVI alliance that determines global public health priorities through the WHO.

This chapter illustrates how conflicts of interest within research institutions, doctor's education and government advisory boards are institutional barriers that allow biased and incomplete knowledge to be used in government policy. These structural barriers are hidden from the public but they are accepted practice by governments. In the next section I will present seven areas of undone science that represent incomplete knowledge relevant to global HPV vaccination programs. In each area I describe the significance of the undone research to knowledge about the safety and efficacy of the HPV vaccine. A consequence of industry influence in research and academic institutions is that the production of knowledge is no longer impartial therefore it is necessary to ensure that policies founded on industry-funded science include value judgments that are made on all the health risks involved. See chapters 4, 6 and 8. Government policies can be founded on selective evidence to serve the interests of industry when the public is not involved in decisions about policy development. In many health and environment issues, industry interests do not synergise with the best interests of the public. This case study also indicates the ways in which the Australian government's NIP may include other vaccines about which there is incomplete evidence. The discussion and references for the evidence presented in this section are provided in Part 1 of this chapter.

9.17 Undone Research on the Efficacy of HPV Vaccines

UHPVR#1 **Research has not been carried out to demonstrate that the quadrivalent HPV vaccine can prevent cervical cancer. There are 15+ high risk strains of HPV that are associated with causing cervical cancer when influenced by environmental and lifestyle factors. The clinical trials for the efficacy of this vaccine used a surrogate for cervical cancer: high-grade CIN lesions (CIN 2/3) in women 15-26 years of age. This end-point was an inadequate indicator of cervical cancer.**

Why is this Undone Research Important?

This undone science is important because it is necessary to have complete knowledge about the efficacy of the drug before it is recommended for universal use. The fact that there are 15+ strains of HPV that are associated with cervical cancer and only 2 oncogenic strains are covered by the HPV vaccine places doubt on the premise that the vaccine can prevent the burden of cervical cancer, particularly as co-factors are also required. The vaccine is not proven to be safer or more effective than Pap screening and surgery in preventing cervical cancer therefore it is essential to know that the drug can achieve the desired outcome before it is implemented into the population. An accurate risk/benefit assessment of the drug cannot be performed if it is not demonstrated to prevent any cervical cancer.

If conclusions about efficacy are based on a surrogate for cervical cancer it must be demonstrated that the surrogate is predictive of cervical cancer development. The surrogate used in the clinical trials for HPV vaccine was not predictive of cancer in the demographic that was studied (See Section 9.8). Therefore the trials could not provide evidence of ‘how much’ cervical cancer the drug could prevent.

UHPVR#2 **HPV 16/18 is a common infection in all populations but cervical cancer is a low risk in many populations. Research has not been done to correlate a causal factor with a high risk of developing cervical cancer.**

Why is this Undone Research Important?

Scientists have not found a correlation between the stated causal agent of most cervical cancer - HPV16/18 - and a high risk of cervical cancer. Therefore it is unknown whether this vaccine will target the majority of cervical cancer. Lifestyle changes such as regular Pap screening have been observed to significantly reduce the risk of this disease and environmental co-factors also play a role in the progression of HPV infections to cancer. Research needs to be done to demonstrate a correlation between the main causal factors with a high risk of cervical cancer *before* it is decided that a vaccine will be effective in preventing this disease.

What would it involve to carry out undone research #1, and #2?

A trial of a vaccine with cervical cancer as the end-point would take 20-30 years because of the latent period for cancer development. This is the only method for proving that an HPV vaccine against 2 oncogenic HPV strains will be effective in preventing the majority of cervical cancer when there is no correlation between the stated cause of the disease and the risk of the disease. The fact that HPV infections rarely progress to cancer indicates that an HPV vaccine is not the solution for preventing cervical cancer. This is because the majority of women would be put at risk from the vaccine when they are not at risk from the disease. Research that focuses on the environmental factors that correlate with the high risk of cervical cancer in developing countries could be easily carried out, as many co-factors have been identified, and would be effective in reducing the burden of this disease.

9.18 Undone Research on the Safety of HPV Vaccines

UHPVR#3 **Research has not been carried out to determine the safety of the HPV vaccine using a saline inert placebo in an unvaccinated group.**

Why is this Undone Research Important?

This research is necessary to determine the effects of the vaccine in healthy individuals. An inert placebo means that the placebo will not react in the human body to cause adverse events. Definitive conclusions about the types and frequency of adverse events that will result from the vaccine can only be made if the placebo that is used does not react in the human body. The clinical trials for Gardasil, the quadrivalent HPV vaccine, used the aluminium adjuvant contained in the vaccine however this comparison will not provide conclusive safety data about the vaccine because this adjuvant itself is linked to causing autoimmune and other neurological reactions (See section 9.9).

UHPVR#4 Research has not been carried out to establish the long-term adverse events caused by the vaccine.

Why is this Undone Research Important?

The clinical trials for the efficacy of quadrivalent HPV vaccine in preventing pre-cursor lesions were carried out for 4 years from 2003-2007. However, safety data on the outcomes for each participant in these trials was not followed for this time period. This data would have provided significant evidence for the long-term safety of using this vaccine in women because the health of vaccinated and unvaccinated women could have been compared for at least 4 years in the clinical trials. Yet this data was not collected during this trial. Ideally the long-term health effects should be actively followed for decades to determine the long-term health risks and benefits of using this vaccine to prevent cervical cancer.

UHPVR#5 Research was not carried out to observe the health effects of HPV vaccine in animal studies. There are no animal models demonstrating the safety of HPV vaccines in animals.

Why is this Undone Research Important?

A study of the quadrivalent HPV vaccine in animals for 4 years or longer could provide significant data on the possible long-term harm from the vaccine. This could be done by comparing vaccinated and unvaccinated animals. Whilst animal studies do not provide conclusive evidence for adverse events in humans they are considered to be good indicators of the possible harm a drug might cause in the population.

What would it involve to carry out the undone safety research #3, #4 and #5?

This undone research provides knowledge about the types and frequency of adverse events that have been observed after HPV vaccination. This research could have been done easily by using an appropriate inert placebo in the 4 year clinical trial for quadrivalent HPV vaccine. If the health outcomes of *all* the participants of the trial had been followed actively for 4 years, instead of 15 days, this would have provided valuable information on the long-term safety of the vaccine compared to an unvaccinated control group. Similar data could have been collected in a 4 year (or ideally longer) animal study of vaccinated and unvaccinated animals using an inert placebo to provide a rigorous safety profile of the vaccine before it was implemented in the population.

UHPVR#6 The Australian government did not carry out research to determine the baseline health of adolescent girls prior to the introduction of the vaccine with an emphasis on the adverse events (AE's) observed in the clinical trials for HPV vaccines.

Why is this Undone Research Important?

This research would provide valuable information for evaluating the long-term safety of the vaccine in the population. Baseline data of health outcomes in the population (prior to implementing the vaccine) specifically focusing on the adverse events observed in the clinical trials is essential for determining the harm the vaccine will cause after universal HPV vaccination programs have been implemented.

What would it involve to carry out the undone safety research #6?

Performing this research would involve collecting information on the frequency of certain conditions and illnesses in the population prior to HPV vaccination programs. The type of baseline data that should be available prior to vaccination includes events such as encephalopathy, seizures, allergies, anaphylaxis, autoimmune diseases and death that were observed in the clinical trials for the vaccine from 2003-2007. The trial researchers concluded these were rare events even though it is known that clinical trials are not representative of the frequency of the events in the population. This is because of the greater genetic diversity of populations compared to trial groups. In order to accurately evaluate the benefits and risks of vaccines it is necessary to compare the

incidence of these diseases/conditions in the general population *before* and *after* the vaccination program has been implemented.

UHPVR#7 Research has not been conducted to establish the type and frequency of AE's causally linked to the vaccine post-vaccination.

Why is this Undone Research Important?

Although many AE's were observed in the clinical trials researchers were not able to provide accurate information on the frequency of these events in the larger population. This is due to the size and genetic diversity of populations. Yet government regulators have implemented HPV vaccination programs into populations without providing post-vaccination surveillance systems that can causally relate the types and frequency of adverse events that are associated with this vaccine. This is because regulators are using *passive* surveillance systems that depend upon voluntary reporting of adverse events. These systems do not follow the health outcomes of all vaccinated individuals and therefore cannot be used to make causal links to the vaccine. Passive surveillance systems also depend upon the authorities acknowledging that an event is associated with the vaccine. In the current passive system it is known that many adverse events (~90%) are not reported by doctors and patients and it is also possible for government regulators to claim that an event is not associated with the vaccine. The assessment of adverse events is a subjective process that is being performed by government regulatory bodies that are 100% funded by industry. See chapter 6.

Since 2007, when HPV vaccines were introduced globally, parents whose children have been injured or have died after vaccination have set up a database and website to record the adverse events (AE's) that are occurring after vaccination. The types and frequency of these AE's that are being recorded by parents on this website are linked to the CDC's Vaccine Adverse Event Reporting System (VAERS) (SaneVax website). Although these reactions are being associated with the vaccine government regulators have dismissed these reactions as being 'psychosomatic' and unrelated to the vaccine (Erikson 2014). In this way many reactions are not being acknowledged and this signal of possible harm to many recipients is being ignored.

What would it involve to carry out undone research #7?

This data can be easily collected and recorded using the government ACIR database. Mandatory bi-annual or annual follow-up of the health outcomes of all vaccinated individuals can be recorded on the ACIR database. The ACIR is set up to monitor the timely vaccination of children and it can also be used to record the health outcomes of vaccinated children/adults. This would ensure that safety signals associated with the vaccine can be detected and evaluated early. It is necessary to *actively* follow the health outcomes of all vaccinated individuals to make causal links between adverse health outcomes and the vaccine.

Assessment

This undone research is essential to a rigorous assessment of the safety and efficacy of the HPV vaccine yet governments have not ensured this research is done prior to implementing a policy that is claimed to be *for the health of the community*. A public health policy that is not implemented on complete scientific knowledge of the effects of the policy on the *majority* of individuals may produce more harm than good in the population.

9.19 Why is this Undone Research Unwelcome?

The undone research summarised above would be unwelcome to academic institutions, scientists, industry and governments that are profiting from the patenting and marketing of this vaccine. The way in which governments are profiting from this arrangement is discussed below. Merck is the pharmaceutical company that made the quadrivalent HPV vaccine and funded the only clinical trials for safety and efficacy that were performed before its approval in the US in 2006 (FDA Merck Ltd 2006). The clinical trials were designed by Merck employees with clinical-site investigators and employees of Merck who were responsible for collecting and analysing the data (Villa et al 2005). The main researchers in the phase 2 and 3 clinical trials for the quadrivalent HPV vaccine were paid current or former employees of Merck (Villa et al 2005 p278; Future II 2007 p1925). Many had an equity interest or held stock in the company or they received consulting fees for serving on advisory boards for Merck and other pharmaceutical companies such as GlaxoSmithKline (GSK). This arrangement was similar for many of the main researchers in all the clinical trials for this vaccine. The

academic institutions, governments and pharmaceutical companies involved with developing HPV vaccines received large royalty payments for their contribution to its development. In 1995, when HPV subtypes 16 and 18 were identified as being the pre-dominant types in all countries, based on a study of 1000 tumours (See Appendix 8), the Gardasil HPV vaccine was licensed to CSL, the Australian developer of the HPV vaccine, and sub-licensed to Merck & Co (Uniquest; CSL Ltd). CSL received royalties and milestone payments and retained the right to market the vaccine in Australia and New Zealand in return for providing Merck with exclusive worldwide rights to market the vaccine (Williamson 2005). A time-line of these events is provided in Appendix 7.

The US government FDA supervised the phase 3 clinical trials for this vaccine from 2003-2007 and approved the license for the two pharmaceutical companies – Merck and GlaxoSmithKline – to manufacture the vaccines. The US government's Advisory Committee on Immunization Practices (ACIP), an advisory board for the CDC, recommended the HPV vaccine for inclusion in the US national vaccination program shortly after it was approved by the FDA in 2006. In the US the CDC purchased $51 million of Gardasil (HPV4) for the strategic national stockpile (Merck & Co 2011) and they continue to purchase $10 million doses of HP4 annually (CDC 2008). In 2007-8, the first year of promoting Gardasil in Australia, CSL received $227 million from its inclusion in the national immunisation program (NIP) and it received royalty payments of $167 million from international sales of the vaccine (CSL 2008). The vaccine has made > $6 million for Merck since it was marketed in 2006 (Blaxill and Olmsted 2012 p188).

There are mechanisms in the Australian and US political process that allow industry to influence policy development (Levinson HHS 2009; Baxter 2010). It is noted that the inclusion of HPV vaccines in the Australian NIP has been influenced by political advisors with COI with industry and a government regulator, the Therapeutic Goods Association (TGA), that is 100% funded by industry. This vaccine was fast tracked for market approval by the industry funded US FDA in 2006 (See section 9.10). At the time HPV vaccines were approved for the national immunisation programs in Australia and the US, there were COI within the vaccine advisory committees in both countries: ATAGI and the US CDC. It is noted that senior officials in the US government health department move from government employment to lucrative corporate consulting jobs for the companies whose products they have approved while employed by the

government, a practice called the revolving door. (Blaxill and Olmsted 2012 p202; Angell 2005; Haberkus and Holland 2011).

The US government Department of Health and Human Services (HHS) shared directly in the profits that are made from approving HPV vaccines for the market (Blaxill and Olmsted 2012 pp188-196). This is a clear conflict of interest in the role of the US Food and Drug Administration (FDA), the government regulator of medicines and biological products. The FDA was responsible for supervising the clinical trials for the HPV vaccine and approving the application to market the drug. It is also worth noting that the industry funded regulators, both the Australian TGA and US FDA, can decide which AE's and deaths they will acknowledge as being associated with the vaccine and which AE's they will not associate with the vaccine: the process is subjective and is similar to the documentation of AE's in the Merck funded clinical trials (Blaxill and Olmsted 2012 pp188-196).

Conflicts of interest within the CDC for policy decisions regarding HPV vaccines were reported in a CDC report (Levinson HHS 2009). The report states that of special government employees hired by the CDC in 2007 for service on panels to evaluate flu and cervical cancer vaccines, 97% had potential conflicts of interest that were not fully declared and resolved (Levinson CDC 2009). Conflicts of interest of representatives on government advisory boards raise the question of whose interests these individuals are representing – industry or the public. A cultural ethos accepting of COI has become prevalent in most research institutions globally and within the governing bodies of many countries and organisations. The governing body of the World Health Organisation (WHO) that directs public health policy for 194 United Nations member countries also has consultation boards that are dominated by industry representatives (European Parliamentary Council 2010). See chapters 3 and 10.

Financial ties to industry provide an explanation for why important research has not been completed to assess the claims that HPV vaccines will be safe and effective in preventing cervical cancer. Research that might provide evidence that the vaccine is not effective against cervical cancer or research that enables causal links to be made between the vaccine and adverse events would harm the profits of industry, and this is research that remains undone in HPV vaccination policies. This also explains why the PATH run phase 4 clinical trials in India from 2009-2010 were not designed to conform

with the declaration of Helsinki with respect to ethical standards in medical research (Sarojini et al 2010 p28). There is a lack of transparency in the promotion of drugs in national and global health policies and in many cases the uncritical acceptance by medical practitioners of these practices is a consequence of the registration requirements for doctors. Even when independent bodies request the evidence for the design of clinical trials for drugs/licensing under the Right to Information Act 2005, they are being refused on the grounds that the data is a trade secret and exempted from disclosure under this Act (Sarojini et al 2010 p32). Private-public partnerships providing funding for public health research have been introduced without any mechanisms to enforce transparency and accountability. In the phase 4 clinical trials in India ('Demonstration Projects') medical practitioners were given certificates of safety and worthiness for HPV vaccines from the Indian Academy of Paediatrics even while the safety and benefits of the vaccines were still being determined. These unethical practices are the responsibility of all health authorities – government, private and non-government (Sarojini et al 2010 p32).

Some of the national and international trials for HPV programs violated ethical guidelines and were of questionable scientific value. Regulatory authorities in many countries are 100% funded by industry (see chapter 6) and are approving trials that are performed with sponsorship from pharmaceutical and biomedical companies without requiring ethical protocols to be followed. National regulations need to be revised to enforce ethical standards and transparency in medical research (Sarojini et al 2010 p33). National interests should be addressed before market interests and this was clearly not the case with the rapid introduction of HPV vaccines into national vaccination programs. The hidden influence of corporations and their aggressive marketing strategies in public health policies were discussed in detail in chapter 6.

9.20 Conclusion to Part 2

It is important that comprehensive research on the safety and efficacy of drugs is completed prior to their implementation. When crucial research is left unfunded, policy decisions are founded on incomplete evidence (selective science). In addition, it is essential that any research that is performed and funded by industry is open to assessment by independent scientists before the conclusions are accepted in public health policies. Research that is performed by scientists with ties to industry may result

in biased results and this has significant implications for population health when the findings are recommended to policy advisors by representatives who also have financial ties to industry.

Hidden COI in all areas of research and policy development are institutional barriers that prevent the government from being accountable to the public. This is because industry agendas influence the research and industry employees double as representatives on government and professional decision-making bodies. Ultimately, the price that is paid for adopting private-public sponsorship of global health policies and the academic-industry model for research institutions is an increased risk to the health of populations because the profit motive contaminates the search for knowledge. This health model is a faith-based system and not an evidence-based system because it is dependent upon trade secrets and political decisions that are based on biases that are not transparent to the public.

CHAPTER 10 CASE STUDY: 'SWINE FLU' 2009 PANDEMIC

10.1 Introduction

This case study illustrates the influence of industry in the design of public health policies that are promoted to global populations by the WHO. In chapter 3 I described how public-private partnerships have influenced global and national health policies since the 1990's and how the influence of the GAVI alliance dominated these policies from 2000 onwards. The partners in the GAVI alliance have influence in the design of WHO directives for global policies and GAVI assists in advocating and implementing these policies into WHO member countries. The partners of the alliance include pharmaceutical companies, the biomedical industry, the World Bank, International Monetary Fund, the Rockefeller Foundation and the BM Gates Foundation in a partnership with WHO/UNICEF. All partners in this alliance have an influence in global policy decisions and they provide financial assistance to governments to implement the recommendations in national public health programs. The involvement of industry in the development of public health policies breaches the WHO charter and it puts public health at risk. Industry influence in WHO policy decisions is a deceptive practice that is not transparent to the global population. In 2000 industry generated statistics from the Global Outbreak Alert and Response Network (GOARN) were already being used by GAVI/WHO to monitor outbreaks of disease and promote vaccines to the public. This chapter describes how the influence of the GAVI alliance changed the governance of the WHO and altered the International Health Regulations to orchestrate a global influenza pandemic in 2009 using a sophisticated media campaign.

10.2 Influenza Disease

This section provides background information on the case history of influenza disease and its pathogenicity and case-fatality rates in the population.

Influenza is a widespread viral disease that has been present almost continually somewhere in the world for the last few centuries (Hays 2000). It shares symptoms with the common cold and these can vary in severity. However, even in epidemic and pandemic times most people recover from influenza within a few days and without complications (AG DHAi; Hays 2000; Jefferson et

al 2007). The disease is characterized by frequent high illness rates and relatively low mortality. Seasonal flu and human swine flu are known to cause mild illness in most people (GWAc 2009). In the tropics, influenza can occur all year around but in temperate climates most activity occurs in autumn and winter (AG DHAi). The main symptoms of influenza include fever/chills, myalgia (muscle aches), headache, malaise (tiredness), upper respiratory tract infection with a non-productive cough, sore throat and rhinitis (runny nose). In typical cases, the illness resolves for within several days to a week. In a minority of cases, generally those with underlying medical conditions, influenza can result in secondary bacterial pneumonia or viral infections (AG DHAi). Influenza-associated illness can also be present in children. This includes lower respiratory tract infection with symptoms such as croup and bronchiolitis (AG DHAi). Complications such as primary viral or secondary bacterial pneumonia, otitis media, diarrheal illness and febrile seizures are rare but may occur in children with underlying medical conditions (Heikkinen et al 2006).

The great majority of deaths to influenza occur in the 65 years and older age group (AG DHAi). Other symptoms in this age group can include loss of appetite, confusion, shortness of breath and increasing Chronic Obstructive Airway Disease symptoms. Influenza is highly contagious and passed from person to person in droplets in the air by sneezing and coughing. Individuals are contagious 1-2 days before symptoms appear and 3-4 days after infection (AG DHAi). Although there are many influenza viruses that cause this respiratory disease there are two main types that are responsible for causing epidemics in humans. These are influenza Type A and Type B viruses (AG DHAi). Type B viruses are found in humans only but Type A viruses are found in several species. Water birds are the natural host of influenza Type A viruses (AG DHAi). Influenza A viruses have been known to jump the species barrier and become established in other animals. Hence, Type A viruses are the most likely cause of new epidemics. These viruses are further sub-typed on the basis of two surface antigens: hemagglutinin (H) and neuraminidase (N). Influenza B is not sub-typed even though it contains the same surface antigens that change regularly. The most common influenza Type A strains circulating since 1977 are A (H1N1) and A (H3N2). Only H1, H2 and H3 have been transmitted easily between humans (AG DHAi).

The influenza virus is extremely contagious and unstable. This means it changes its structure frequently through antigenic drift. New strains of influenza A and B continually emerge because of changes to the neuraminidase and hemagglutinin antigens (AG DHAi). As a result of these changes influenza viruses present a constant challenge to our immune systems and also to the production of a vaccine. This is the basis for seasonal epidemics and the reason why it is necessary to reassess the recommended strains each year. Infection with influenza one year may not ensure immunity the next year.

It is believed that immunity to hemagglutinin and other surface antigens reduces the chances of infection. Therefore the influenza vaccine is an inoculation of antigen prepared from inactivated influenza virus which will stimulate the antibody response (AG DHAi). The measure of the antibody response is referred to as the hemagglutination inhibition (HI) antibody titre. It is known that soreness, fever, fatigue, muscle soreness (symptoms that mimic the flu) and allergies including hives, asthma, breathlessness and collapsing are side-effects of the vaccine (AG DHAi). Allergies are known to occur due to the egg protein, antibiotics, thimerosal and other ingredients of the vaccines. Therefore a contraindication to being vaccinated with influenza vaccine is a family history of hypersensitivity to any of the ingredients or high fever due to another illness (AG DHAi). People with specific chronic diseases and older people often develop lower post-vaccination antibody titres than healthy young adults, hence they can remain susceptible to infection after vaccination (AG DHAi).

10.3 Discovery of the Influenza Virus

I describe here the progress in science and technology that led to the development of a vaccine as a strategy for the prevention of influenza disease.

The discovery of the influenza virus in 1933 led to the possibility of a preventative vaccine (Hays 2000). In 1918 the mortality rates to influenza were higher than we would expect today because there were no remedies for a viral illness or a bacterial infection once it took hold of the body. Biomedicine was still a developing field at this time. Although different strains of viruses could be identified in the 1940's preventative therapies remained elusive due to the changing nature of the virus. Serum therapies were not highly successful and many failed or resulted in

persistent problems (Hays 2000). In predicting a pandemic today, authorities remind the public of the pandemic of 1918 to illustrate the dangers of new strains of influenza viruses. This was the case for the false prediction of a swine flu pandemic in 1976 in America. Scientists wrongly identified the new strain of influenza in 1976 as being similar to the 1918 strain. It was identified as 'swine flu' (H1N1) which scientists claimed 'had not circulated for 50 years' (HSA). In fact, it is thought by the US Centers for Disease Control (CDC) that the 1918 strain was derived from an avian species of the flu virus and not a 'swine' virus at all (HSA). On the basis of this false identification the CDC claimed 'This new flu strain might conceivably become as big a killer as the flu of 1918, the worst ever' (HSA).

The fallacy of this way of thinking is that the conditions of 1918 were unique to the social, economic and political influences of the time. The poor social conditions, vaccination for small pox and typhoid (with poorly tested vaccines), mass movement of troops, the stress of war, lack of medicines and shortages of food are not present in developed countries today. The strong correlation between these conditions and a greater mortality to influenza is well known. See chapter 2. Public health officials use the epidemiological triangle to assist in determining the causality of disease (Friis et al 2004). This model recognizes three major factors as being important in pathogenesis – host, pathogen and environment. Environmental conditions and host characteristics, due to better nutrition, in many countries today are not as conducive to influenza pandemics as they were in 1918. In Australia and other developed nations sanitation, hygiene, nutrition and living standards had all improved by 1950 (CoA 1953). At this time the NHMRC altered the list of notifiable diseases and removed influenza, as well as whooping cough and measles, because mortality and morbidity from these diseases had been significantly reduced. This was prior to the use of any vaccines for these diseases (CoA 1953). Antibiotics were discovered in the 1940's and this assisted in the reduction of mortality from these diseases by 1950 (O'Connor 1989).

10.4 The Global Influenza Surveillance Network (GISN)

The World Health Organization (WHO) set up the Global Influenza Surveillance Network (GISN) in 1952 to monitor the global circulation of influenza viruses and to serve as a global alert mechanism for the emergence of influenza viruses with pandemic potential (WHO GISN).

The GISN advises members on the best control measures for influenza through a network of international laboratories. Samples are collected from national influenza centres and sent to one of five WHO Collaborating Centres, where antigenic and genetic analyses of isolates are done and repositories of different strains of virus maintained. Improvements in biotechnology over past decades have enabled scientists to identify influenza viruses through new techniques in sub-typing (HSA). This has changed the surveillance of influenza and has given governments the opportunity to predict pandemics based on the surveillance of different sub-types (strains) of influenza. The 'pandemics' that have been predicted on this technology are:

I. 1957 Asian Flu

II. 1968 Hong Kong Flu

III. 1976 Swine Flu America

IV. 2009 Swine Flu

The predictions for the pandemics listed above were based upon the identification of a new strain of influenza virus and the assumption that the public would have little or no immunity to the virus (HSA). The death rates predicted for these pandemics did not occur but in all cases a vaccine was rushed onto the market within 3 months of the virus being identified (HSA). The appearance of a 'pandemic' can be created by increased global surveillance and sub-typing of influenza viruses which results in an 'incidence' of the new strain of flu that is identified. If the definition of a pandemic refers only to the spread of this new strain and not the severity then it is a 'pandemic' of influenza that will be no more serious than the many other strains of influenza that circulate each year. The only difference is that new technology has enabled scientists to identify sub-types of the influenza virus.

In the case of the Asian Flu 1957, the H2N2 virus was identified in February 1957 and a vaccine was produced by August 1957 (HSA). The vaccine was produced rapidly on the assumption that the community would have little immunity to this new strain. Interestingly, there were no community outbreaks of this strain of influenza (H2N2) in America until August 1957 when the vaccine was first used (HSA). The first wave of illness peaked in October 1957. The H2N2 virus sub-type stopped circulating in 1968. This prediction of a pandemic in 1957 was similar to the

1976 and 2009 influenza ‘pandemics’; both were predicted on the basis of a new strain of flu that was claimed to be spreading rapidly and authorities feared a repeat of the 1918 pandemic (AG OHP; HSA). The vaccine was made available rapidly after the new strain was identified based on the assumption that the community would have little or no immunity to the new strain.

10.5 Pandemic Influenza

Pandemics of influenza have occurred since the eighteenth century and they are believed to have certain characteristics (Hays 2000).

1. Pandemics can occur when a new sub-type of the virus appears which meets little or no resistance from human antibodies.
2. Crowded conditions are conducive to pandemics particularly in poverty stricken areas.
3. Domestic animals can play a role in transmission.
4. Illness is very high in outbreaks but most cases are not severe. The young and the very old are most at risk.
5. Death is usually a result of a combination of influenza and some bacteria – most often pneumonia.

The Australian Health Department also emphasises that the influenza virus is spread easily and rapidly between humans infecting large numbers of people around the world and causing many deaths. However, it is known that influenza disease is characterized by an extremely high incidence of infection and relatively small mortality.

The occurrence of influenza pandemics coincides with improvements in global mass transportation systems. One of the most serious pandemics occurred in 1889–90 when steam transportation by sea resulted in large numbers of people being transported around the world (Hays 2000). The combination of crowded areas and poor living standards is known to correlate with infectious disease in general. Poor living conditions facilitated serious outbreaks of cholera, plague, measles and influenza in 1889. Poor nutrition, poor housing and less supportive care are associated with secondary bacterial infections that worsen the

effects of influenza. Although influenza affected millions of people in 1889 most individuals had little reason to fear death. Influenza quietly kills thousands of vulnerable elderly people during a pandemic but this figure is small relative to the millions that get infected (Hays 2000).

10.6 Influenza Pandemic 1918-1919 (Spanish Flu)

This section provides a comparison of the patterns of influenza pandemics that have occurred during the 20th century. The information is drawn largely from Hays' 2000 book *The Burden of Disease: Epidemics and Human Response in Western History* which provides a comprehensive description of the historical context of infectious diseases. I describe the similarities in the way these pandemics have been declared at different times in history and the government responses to these situations.

It is believed that the pandemic of 1918-19 was caused by a more virulent sub-type of influenza that was particularly dangerous for young adults. This virus seriously compromised people's lungs which resulted in many deaths from respiratory complications. Crowded troopships were believed to be responsible for transporting the virus around the world. This virus was observed to diminish during the summer months and was followed by a more virulent second wave during the winter months. It is known that the social, economic and political circumstances of World War I contributed to the severity of influenza in the pandemic of 1918-19. Young men were brought together in crowded camps, ships and during rallies. In many areas there was social chaos in addition to poor nutrition, sanitation and stress which leads to a greater chance of contracting a bacterial infection combined with influenza. It is also observed that many areas unaffected by war were also hit by the influenza pandemic. This is the case in India where poverty played a much greater role in influenza's mortality. Whilst war has helped spread influenza through communities, poverty or poor social conditions plays a much greater role in the deaths associated with influenza. These characteristics of influenza disease were reflected in the definition of a pandemic that existed prior to May 2009. See section 10.9.

In 1918-19 physicians tried many remedies including antitoxins and vaccines but none had a noticeable effect. Approximately thirty percent of the US population was affected by influenza in 1918-19 but despite this, its impact passed quickly in the US and other developed countries. In comparison, mortality rates in the developing countries were much higher. These are illustrated in Table 3.

Table 5: Mortality Rates to Influenza in Different Regions (1918)

Region	Mortality Rate per infected cases
Europe	5 / 1,000
USA	5 / 1,000
Latin America	10 / 1,000
Africa	15 / 1,000
Asia	Approx. 25 / 1,000
India	Approx. 60 / 1,000
Tahiti	100 / 1,000

Reference: Hays JN, 2000, The Burdens of Disease: Epidemics and Human Response in Western History, Rutgers University Press, New Jersey/London p.273.

This indicates that social conditions are a major factor in the mortality associated with influenza and this is because poor living standards are conducive to secondary bacterial infections. The most severe effects of the influenza pandemic occurred in developing regions in Latin America, Africa and Asia. Many of these regions were densely populated or had poor social conditions in 1918. Whilst millions of people are affected during pandemics of influenza the majority of people recover without permanent scarring or chronic illness. Poverty increases the opportunity for individuals who are weakened by influenza to be infected with pneumonia and other bacterial infections. Correlations have also been observed between high mortality rates for influenza and

damage to crops. Poor nutrition results in decreased immunity and greater susceptibility to infections. The effects of war in some regions also resulted in increased mortality to influenza due to a shortage of medical staff, provisions and poorer social conditions.

The question remains as to why young adults were so susceptible to this virus in 1918 and some suggestions are that military generations were subject to more stress. They were required to move around a lot during troop movements and often in unsanitary or crowded conditions. Stress may also have been enhanced in 1918 by the vaccinations provided to the troops before departing or as a result of the trauma of the military situation (Hays 2000; Allen 2007). The vaccines for smallpox and typhoid may have caused stress on the constitution of soldiers and in combination with the stressful conditions, poor nutrition and hygiene this could have resulted in the higher number of deaths due to a greater susceptibility to secondary infections (Allen 2007). In 1914 the manufacturing and testing of vaccines was in the early stages of development (Allen 2007). In America during the early nineteen hundreds, a report commissioned by the Royal Army College established that the unsanitary conditions of the camps led to the easy spread of typhoid. It was known at this time that the biggest decrease in typhoid fever in both the military and civilian life had come from better hygiene. Despite this fact, it was recommended that all soldiers be vaccinated against typhoid in case the hygienic reforms failed (Allen 2007). A new typhoid vaccine produced by Almroth Wright was being made available at this time and the argument for adopting this preventative strategy was that men in active service often experience unsanitary conditions and this made the vaccine worthwhile.

Wright happened to be the professor of pathology at the Royal Army College at the time. In 1912 typhoid vaccine was made mandatory even though the vaccine was known to have serious side-effects (Allen 2007). During World War I the vaccinated United States force suffered 1,500 cases of typhoid, 227 deaths to typhoid and more than 35,000 soldiers were made ill from the vaccine (Allen 2007). It is possible that vaccinating the troops in 1918 reduced their vitality and made them more susceptible to the pandemic flu. American soldiers who were *vaccinated* against typhoid and small pox were significantly affected by influenza in September 1918 when 43,000 men died (Allen 2007). The Navy reported that 40 percent of its members were flu-

stricken and the Army had 36 percent flu stricken. These soldiers were vaccinated with a reactive typhoid vaccine which was never put into widespread civilian use in America (Allen 2007).

10.7 Swine Flu Pandemic 1976

Whilst influenza vaccines are commonly used it is difficult to make them effective because the virus continually changes its structure. New influenza antigens appear and major shifts in two of the viruses' key proteins occur every few decades (HSA). There were major antigen shifts in 1957 and 1968. This complicates the production of the vaccine which has to be produced a season in advance on guesswork. The flu vaccine is promoted annually to elderly people because they have the highest mortality rate yet their immune systems do not respond well to the influenza vaccine (GWA 2009c).

In 1976 CDC scientists identified a strain of influenza in a soldier that appeared to be similar to the deadly flu virus of 1918-19 (HSA). The outbreak resulted in 4 cases of flu with pneumonia and one death. The strain was identified as 'swine' influenza H1N1 that the CDC claimed had not circulated for 50 years (HSA). On this basis, on 24 March 1976, the CDC sent a memo to the secretary of Health and Human Services predicting a pandemic. A news conference was held by Sabin and Salk, creators of the polio vaccines. The support of these high profile scientists provided additional credibility to the public health campaign promoting the influenza vaccine. At this time President Ford asked Congress to spend $135 million to produce enough vaccine for every 'man, women and child' in the United States (HSA). The four main vaccine manufacturers were asked to rush out 200 million doses (10 times the usual number) of the new vaccine. However, the insurance companies became concerned because they assumed that a massive campaign using rapidly produced vaccine would result in side-effects and lawsuits. The pharmaceutical companies stopped production of the vaccine and demanded that Congress assume the risk (HSA). A swine flu bill was rushed through Congress making the government liable for the program. By mid-August there had not been a single extra case of swine flu in America and none of the known cases had been seriously ill from this strain. In fact, there was not a single case of swine flu around the world in June 1976. The vaccine was made available only after the new legislation was implemented on 1 October 1976 (HSA).

In October 1976, three people died after receiving the flu vaccine and by late November the first reports of Guillane-Barre syndrome were received (HSA). Guillane-Barre syndrome is a rare inflammation of the nerves that usually follows viral infection, injury, surgery, vaccination or a period of stress (Carter and Bowen 1991). The muscles that the nerves supply become paralysed and sensation is lost. Twenty percent of people are left with a permanent disability (Carter and Bowen 1991). The government set up a special branch of the Federal Court of Appeals to deal with 4,000 injury claims and 1,384 lawsuits (HSA). The government ultimately paid out $100 million in compensation and the risk of developing Guillane-Barre syndrome appeared to be 11 times greater in the vaccinated than the unvaccinated. The program was suspended on 16 December 1976 and the influenza pandemic never eventuated (HSA). This incident opened the public health authorities to criticism and ridicule. One skeptical journalist stated 'something had gone out of American life – our unbridled faith in science ……for too long we believed uncritically in science, swallowing whole what we've been told. Any program conceived by politicians and administered by scientists comes to us doubly plagued' (Allen 2007 p261). This scenario was repeated globally in 2009.

10.8 Pandemic Influenza 2009: A New Strain of Influenza H1N1

This section describes the steps that led to the declaration of a global influenza pandemic in 2009. Infectious disease pandemics are considered an issue of international concern and the GAVI alliance was instrumental in developing the new IHR's that came into force in 2007. These included pandemic preparedness plans (PPP) that required governments to enact a set of policies if a pandemic was declared. See chapter 3.5. It is noted that there were also two milestones WHO member countries were required to achieve under the PPP that came into force in 2007:

i) the assessment of their surveillance and response capacities by June 2009 (*the global pandemic was declared on June 11 2009*)

ii) the development and implementation of plans of action to ensure that these core capacities are functioning by 2012 (WHO IHR 2008).

The information provided below is a description of the unfolding of the 2009 pandemic and should be considered within the context of the IHR's and the PPP's.

In April 2009, a new strain of influenza A was first detected in North America (CDC 2009a). Two cases of febrile respiratory illness in children were identified in Southern California on April 17, 2009 and although these 2 cases resolved uneventfully within a week, the swabs were sent to reference laboratories for extra testing and identification. This would seem unnecessary if the cases were uneventful. Further testing identified a new strain of flu with a unique combination of gene segments (CDC 2009a). This combination of genes in a flu strain had not been identified in either pigs or humans prior to these cases and neither child had been in contact with pigs. The CDC stated that 'this is not a new subtype of influenza A in humans' but they were concerned that this new strain of influenza A (H1N1) was substantially different to the A (H1N1) from previous years. Scientists postulated that the community may have less immunity to this strain because of the lack of exposure (CDC 2009a). The reason this new strain was detected was because two sick children presented at outpatient clinics that were participating in a clinical study actively obtaining influenza surveillance. If these children had presented to a GP and no test for the sub-type of the virus made, there would have been no concerns as both cases were uneventful. Despite the fact that influenza activity in California and Texas was declining at the time, it was still decided that surveillance for this new strain of virus should be enhanced.

The new influenza strain was identified as being a recombination of genetic material from human influenza Type A H1N1, and swine and bird gene segments. The majority of genes were from swine influenza viruses that have circulated in pigs in America since 1999 but swine influenza genes from the Eurasian lineage were also identified (CDC 2009a; WHO 2009a). The WHO stated that this strain is not known to be endemic in pigs. Despite this fact the new flu strain was promoted to the public as 'swine flu' (WHO 2009a). The very few cases of swine flu that have been found in pigs since the outbreak are believed to have been transferred from humans (CFIA 2009). In the past there has been no national surveillance of pigs for influenza in America but a pilot swine surveillance program was recently established to determine the efficiency of transmission of new viruses in swine and in humans (CDC 2009a).

Influenza is a disease that is caused by many strains of virus. These viruses spread easily and new strains develop regularly. The CDC reports that there are approximately 1-2 new human swine influenza viruses appearing every couple of years (CDC 2009a). These novel influenza A viruses became nationally notifiable in America in 2007 and this explains the increase in the number of reported cases that have occurred in recent times. Prior to 2007 sub-types of influenza A were not monitored systematically (WHO GISN; GWA IFS 2009). Cases were recorded as influenza A or B or Influenza-like-illness (ILI) (GWA IFS 2009). The CDC stated on the 24 April 2009 'there is no information currently available regarding the efficiency of transmission (of this virus) in swine or in humans' (CDC 2009a). At the same time the World Organisation for Animal Health stated 'no link between an animal and the first cases (of this virus) has been established' (Vallet 2009). Although the two Californian cases of swine influenza observed in children were uneventful and were not transmitted from pigs, the public health authorities requested that clinicians consider notifying any observed cases of animal or seasonal influenza infection (CDC 2009a). Clinicians were particularly asked to monitor those individuals who had been in contact with pigs even though there was no evidence of a connection with pigs. They were asked to send any suspected cases of swine influenza to the laboratory for confirmation and the CDC was to receive any influenza A specimens that could not be sub-typed.

Diagnosing 'Swine' 2009 Influenza

Mexico also experienced outbreaks of influenza-like-illness (ILI) in several regions in early April 2009 (CDC 2009b). On 17 April an atypical case of pneumonia prompted the authorities to increase surveillance of influenza viruses in Mexico. Laboratory testing of several cases of respiratory illness confirmed infection with 'swine-origin' influenza A. Analysis revealed they were the same as the two cases in California and this led the General Directorate of Epidemiology (GDE) in Mexico to issue a national alert to all influenza-monitoring units and hospitals. Hospitals were required to collect specimens from all infected cases within 72 hours (CDC 2009b).

There were three definitions for cases of 'swine-flu':

I. A suspected case: severe respiratory illness with fever, cough and difficulty breathing.

II. A probable case: a suspected case in a patient from whom a specimen tested positive for influenza A.

III. A confirmed case: a probable case that tested positive for swine origin influenza virus (S-OIV) by real-time reverse-transcription polymerase chain reaction (RT-PCR).

In accordance with these criteria health care providers were contacted to provide retrospective data to 1 March, as well as ongoing data for persons with the above descriptions. Surveillance was concentrated on hospitals and 1,918 suspected cases were reported. It is stated that these suspected cases included 286 probable cases and 97 confirmed cases (CDC 2009b). In other words, only 97 cases were confirmed as the new strain of influenza – the others were only suspected. Other data was mainly collected from sites conducting routine surveillance of patients with influenza-like-illness (ILI) (CDC 2009a). This data was collected from clinical studies investigating the transmission of influenza in the community. Suspected or probable cases were reported from all 31 states of Mexico (CDC 2009b). Again these were suspected cases, not confirmed 'swine flu' and there was no evidence at this time that animals were playing any part in the transmission of this virus (Vallet 2009). If there had been no monitoring for subtype A influenza then the incidence of this strain would have remained unknown – as it was in previous years. This type of surveillance can be seen as a method of creating an incidence of disease. It was reported that 97 patients were confirmed with swine origin influenza virus (S-OIV) and 7 had died by 30 April (CDC 2009b). Of this number there were only 24 cases (out of 97), for which there was demographic and clinical information. They ranged in age from 1-59 years with 79% aged 5 to 59. Only 16 of the cases had full clinical records and they reported symptoms of fever, coughing, tachypnea (rapid breathing), dyspnea (labored breathing), vomiting and diarrhea (CDC 2009b). Of the 16 cases with records 12 had confirmed pneumonia from radiography records and 3 of the 16 had underlying health problems. 7 of the 24 cases died.

On April 24, the president of Mexico was advised to close all schools in the Federal District and metropolitan area of Mexico City. Warnings were issued to travelers to seek medical advice if they experienced symptoms of ILI. Educational messages, masks and sanitizers were distributed to the public which raised the anxiety of the population (CDC 2009b). Authorities announced a national decree for house-isolation for any person with a suspected case – even if the case wasn't confirmed at this early stage of surveillance. By April 27 school closures were mandated throughout the country. At this time the CDC stated 'The clinical spectrum of S-OIV illness is not yet well characterized in Mexico ……evidence suggests that S-OIV transmission is widespread and that less severe (uncomplicated) illness is common' (CDC 2009b). If less severe cases of influenza were most common it would have been appropriate to monitor the virus without undue concern to the community until virulence was established. This involves a comparison of hospitalization and mortality data due to influenza in previous years. At this time it was stated that 'patients with confirmed cases had been identified in several states and suspected cases have been identified in all states'. The CDC concludes that 'this suggests that S-OIV transmission is widespread' (CDC 2009b). Considering that 'suspected' cases refer to influenza A and not S-OIV then the only evidence was *some* confirmed cases in several states. Influenza A has been covered in the influenza vaccine for many years because it is a predominant strain (GWA 2009c). If the technology to subtype this strain had not been available there would have been no evidence of this new H1N1 infection only an incidence of influenza A. This incidence and mortality should have been compared to previous years to establish virulence *prior* to creating a vaccine and promoting anxiety in the population.

Is it a 'Swine' Flu?

It was stated by the WHO in June 2009 that 'swine' influenza A (H1N1) was a new virus and one to which most people have no or little immunity (WHO 2009b). Influenza Type A (H1N1) is a strain of flu that has been covered in the flu vaccine for many years yet the WHO stated 'this virus is not related to previous or current human seasonal influenza viruses' (WHO 2009b). This statement was contradicted by the CDC which claimed 'this is not a new subtype of influenza A in humans' (CDC 2009a). The CDC was concerned the population might have less immunity to this strain because it was substantially different to previous strains but it stated the genetic

makeup does contain human, avian and swine virus components (CDC 2009b). Therefore, it was not completely unrelated to previous human Type A (H1N1) as the WHO stated. The seasonal influenza vaccine from previous years covered three strains of influenza - A (H1N1), A (H3N2) and Type B (GWA 2009c). Despite the fact that in April 2009 there were no known cases of this strain in pigs (Vallet 2009), the WHO and CDC labeled this influenza strain as 'swine flu' (CDC 2009a). A 'swine flu' is defined as a highly contagious pathogen endemic in pigs (Kothalawala et al 2006). Human infection with swine influenza viruses is uncommon and usually associated with close contact with live pigs (Vallet 2009). To refer to swine flu in humans normally implies an ongoing role of pigs in the transmission of the virus and yet there were no cases of this influenza strain being transferred from contact with pigs (Vallet 2009). The first case of this influenza strain being identified in a pig was in May 2009 in Canada (CFIA 2009). It was believed that the pig was infected from contact with a human.

If this strain of influenza had been promoted to the public in the media as 'human influenza Type A, H1N1 2009'- the official name – it would not have created as much fear in the community. This is because humans have been exposed to a related strain for many years. Influenza pandemics are traditionally named after the region where they are first identified (Vallet 2009). Authorities disagreed over the naming of this virus. The WHO suggested the virus should be called 'North American influenza' and others suggested 'Mexican influenza' because this is where the epicentre appeared to be (CDC 2009b). These names were disputed because the genetic material in the virus included elements from a swine influenza virus of Eurasian origin (CDC 2009a). The majority of the swine genes in the virus appeared to be related to an American pig virus but the virus itself was unknown in pigs. Therefore, it was scientifically and factually inaccurate to name this human disease 'swine influenza' as it was predominantly a human disease (Vallet 2009). The virus was labelled 'A/California/7/2009-v like H1N1' in the vaccines that were developed for use against this 2009 virus and marketed to populations in 2010/11 (Nolan et al 2009).

10.9 Surveillance of Influenza in 2009

There was little evidence of this strain being more virulent when it first emerged in April but in June 2009 the WHO was speculating that this virus *could* cause more infections than are seen

with seasonal flu (WHO 2009a). This was stated two months after identifying the new strain. At this time the WHO stated 'large outbreaks of disease have not yet been reported in many countries and the full clinical spectrum of disease is not yet known' (WHO 2009a). Despite this fact and the fact that this strain had not yet shown itself to be more virulent than other new strains, the WHO stated it was already working closely with pharmaceutical companies to develop a vaccine to protect against this virus.

In other words, the WHO admitted that this strain of flu was mild in the majority of cases and new strains appear regularly but they had already initiated plans to develop a vaccine *before* its virulence was established. At this time the WHO claimed that this strain of influenza was spreading fast among young people aged 10 to 45 (WHO 2009b). The WHO admitted that the majority of hospitalized cases in this age group had underlying health problems or weak immune systems. The WHO's decision to develop a vaccine was based on the *assumption* that most people would have no immunity to this new strain. The WHO stated that this H1N1 strain was unrelated to the human seasonal H1N1 viruses that had been in circulation since 1977 (WHO 2009b). This is contradicted by the fact that the new virus contained human strain A H1N1 and a study conducted by the CDC found that individuals between the ages of 18-64 had antibodies present that reacted to the 'swine' H1N1 virus (CDC 2009c). Whilst this evidence doesn't indicate clinical protection it does suggest that some individuals may have had immunity from previous exposure to H1N1 (CDC 2009c). The WHO was very quick to assume that the population would have no immunity to this new strain even though it was immunologically similar to previous H1N1 viruses. Further studies have shown that a significant proportion of people over the age of 65 also had some immunity against this new strain (AG OHP 2009).

In August 2009 the Australian government prioritized the implementation of a vaccine against this new strain of influenza H1N1 (AG OHP 2009). This preventative action was notable because there was little evidence in the community that this new influenza strain was more virulent than other new strains of flu which occur regularly. In fact, prior to a vaccine being produced, the WHO stated the majority of people who contract this disease experience the milder form of influenza and recover without requiring treatment (WHO 2009b). The Therapeutic Goods Association stated 'the experience in Australia of the disease is mild in most cases' (AG

TGA 2009). In addition, the Australian Health Department did not produce statistics showing that the overall death rate for influenza in 2009 was significantly worse than in previous years *before* it considered buying a vaccine (AG OHP 2009). Analysis of the case-fatality data at the end of the pandemic (2010) in Australia and other countries showed the excess mortality from influenza and pneumonia to be lower than in recent influenza seasons (NSW PHN 2009; Laurell 2010). In 2009 many cases of the new strain - Type A H1N1 2009 - were identified in comparison to sub-types for previous years because national and international surveillance centres were actively and systematically sub-typing cases of influenza A (GWA 2009c). In previous years many of these cases would have gone unnoticed and been recorded as 'Influenza Type A' or 'respiratory infection'. This is because few national or international surveillance systems distinguish between influenza and influenza-like-illness (ILI) (Jefferson et al 2009). ILI refers to other respiratory viruses that are not laboratory confirmed or sub-typed. Prior to 2009 surveillance systems in most countries were not distinguishing between these viruses because it was not considered important and systems were not geared up for it.

10.10 Declaring a Pandemic

In 2005, the newly established International Health Regulations (IHR) board stipulated that the WHO Director-General (DG) was to appoint an Emergency Committee (EC) for advice on matters relating to global pandemics of disease. It was stated in the IHR that membership of this committee was not to be made public and therefore conflicts of interest would not be declared or publicised (Flynn 2010). Further, the composition of the board with respect to stakeholder representation would also be unknown to the public. This secret committee was given the power to make decisions about vaccination policies in global pandemics without consultation with the Strategic Advisory Group of Experts (SAGE), the principal advisory group within the WHO for the development of policies related to vaccines and immunization strategy (WHO 2009i). The SAGE board comprises 15 members who have to sign a declaration of interests they have with professional activities that might conflict with their advisory function for the WHO. This is done with the purpose of excluding representatives with conflicts from the decision making process. The establishment of the secret EC did not require any declaration of COI or stakeholder representation in decisions to declare a global pandemic.

Some experts noted from an early stage that the new sub-type of influenza virus was causing less harm than other strains of the virus in previous years (Flynn 2010; Rosella et al 2013). In this regard the definition of a pandemic is of great significance. In 2009, some scientists became concerned when WHO raised the pandemic to level 6 when the influenza virus was causing mild symptoms in most cases of the disease. It was noted that the WHO Emergency Committee changed the definition of a pandemic just prior to calling the level 6 pandemic (Flynn 2010). It would not have been possible to call a pandemic if the definition of the pandemic had not been changed. Whilst the WHO claims that the definition was finalized in February 2009 as part of the current pandemic preparedness plans, the fact remains that after 10 years of PPP the change in definition made it possible to call a pandemic (O'Dowd 2010). There was a lot of time and money invested in planning for a pandemic.

The important change to the definition that occurred in May 2009 was the removal of the need to show how severe the impact of the virus would be on the population. For many years prior to 2009 the WHO defined pandemics as causing 'enormous numbers of deaths and illness' but this phrase was removed in 2009 (Cohen and Carter 2010). Both definitions of a pandemic are listed below (Flynn 2010):

1. Before 4th May 2009:

   "An influenza pandemic may occur when a new influenza virus appears against which the human population has no immunity, resulting in epidemics worldwide with enormous numbers of deaths and illness. With the increase in global transport, as well as urbanization and overcrowded conditions, epidemics due to the new influenza virus are likely to quickly take hold around the world".

2. After 4th may 2009:

   "A disease epidemic occurs when there are more cases of that disease than normal. A pandemic is a worldwide epidemic of a disease. An influenza pandemic may occur when a new influenza virus appears against which the human population has no immunity ….Pandemics can be either mild or severe in the illness and death they cause and the severity of a pandemic can change over the course of the pandemic".

It is clear that pandemic planning requires that all stakeholders agree on a common definition of what an influenza pandemic actually represents (Flynn 2010). The Parliamentary Assembly of the European Council (PA) believes that the changes made to the pandemic definition were highly inappropriate at a time when a major influenza infection was occurring. These changes affected disease descriptions and indicators and they were made in a non-transparent manner. It also meant that because of the PPP's that locked governments into prescribed actions when a pandemic was called, authorities were constrained in their actions – even when the evidence didn't match the actions they were required to implement (Rosella et al 2013). Once the pandemic was declared governments had no choice but to buy up the required vaccines according to quantities and prices set in the PPP's.

10.11 Conflicts of Interest in the WHO

In 1993 the World Health Assembly encouraged the participation of public-private partnerships in health development in the governance system of the WHO. The intention was to improve funding and resources for public health whilst improving the corporate image and thereby attracting new investors and establishing new markets (Buse and Waxman 2001). This means that many of the members of WHO advisory boards now have financial and professional links to pharmaceutical and biotechnology companies that are involved in identifying and monitoring viruses *and* manufacturing vaccines. Whilst the WHO states that safeguards were put in place to protect the public interest there are many scientists who believe the safeguards lack substance and process (Buse and Waxman 2001). The safeguards were also not evidenced in the establishment of a secret Emergency Committee (EC) in 2009 to advise the WHO when to call a pandemic. The Parliamentary Assembly has expressed concern that this lack of transparency and unregulated or secret lobbying, as occurred with the PPP's, has undermined the democratic principles and good governance provided by the WHO. In particular there is concern about the systematic recruitment of key opinion leaders by specific image and communication agencies in the pharmaceutical industry (Flynn 2010; Krimsky 2003; Angell 2005). See chapter 6.

In order to counter the effects of individuals with a conflict of interest, the WHO describes some routine safeguards that are in place. WHO believes transparency regarding conflicts of interest is ensured by requiring external experts to declare any relevant commercial interests or activities,

including funding, that they have received from pharmaceutical companies or consultancies (Flynn 2010). WHO officials state that experts with perceived conflicts of interest are excluded from making recommendations and they believe this removes bias from the decision-making process. This did not occur in the 2009 decision to declare a pandemic as was evidenced when the composition of the secret emergency committee (EC) was eventually revealed. WHO claims that when individuals with COI participate in discussions their views are weighted according to their declared conflict of interest (Flynn 2010). This is a very subjective method of dealing with conflicts of interest and it is not transparent to consumers. Individuals have their own interpretations of a 'perceived' or 'real' conflict of interest and how much it will affect their advice. For example, many experts insist their ties to pharmaceutical companies have no influence on their recommendations (Bita 2010). This system remains non-transparent to consumers due to the subjective nature of a perceived conflict of interest. In addition, the public has no evidence of how effectively safeguards are enforced. The public is expected to trust the WHO to enforce the safeguards but the WHO itself has admitted that there are some inconsistencies regarding its policies on conflicts of interests (Kmietowicz 2010). It admitted that safeguards surrounding engagements with industry need to be tightened. It can be argued that consumers without COI must be properly represented on vaccine advisory boards to ensure the discussions include a diversity of arguments and are not dominated by 'groupthink'. This is the situation where members of an advisory board present the same perspective and other perspectives are not discussed.

Margaret Chan defends the non-transparency of the EC as a desire to protect the experts from commercial or other influences (Chan 2010). Yet the primary objective of the WHO is its mandate to protect public health and this policy is not consistent with COI policies in all other areas of government decision-making. Scientists and decision-makers are always at risk of being pressured by lobby groups and they are expected to make professional decisions under these conditions. The lack of transparency in the EC board protects industry interests in decisions made about global health policies: transparency can protect the public interest. Even when the PA attempted to find out if the members of the EC had COI with industry the WHO refused to publish this information (Flynn 2010). WHO only agreed to release the names of the members of this committee after the pandemic was over, in August 2010. It was then revealed that 5 of the 15

members, including the chief advisor, had direct professional connections to pharmaceutical companies (WHO 2009iii). The chief advisor had received payment for previous work with Roche and GlaxoSmithKline – the two companies that were due to profit from the advice they provided to the WHO (Cohen and Carter 2010). Indirect links to industry in this board were not publicised. It is of note that a key milestone of the PPP that was pre-established in the IHR was the assessment of the surveillance and response capacity of the member countries by June 2009. This is of note because the EC declared a global pandemic on *June 11 2009*. The EC held its first meeting on 25 April 2009 to provide advice to the Director-General and a pandemic was declared on 11 June 2009. A level 6 pandemic could not have been declared if the EC had not been given the power under the IHR to change the definition of a pandemic (Flynn 2010). This power given to a secret committee enabled the pharmaceutical companies to secure substantial profits that led to an investigation into the governance of the WHO.

The vaccine manufacturers had a vested interest in the declaration of a pandemic because of the billion dollar 'silent' contractual agreements with member countries regarding vaccination campaigns that were put in place in 2006/7 (Flynn 2010). Viewed in this light the change in definition of a pandemic that occurred a month before the declaration is significant. Pharmaceutical companies could make huge profits because of this change. Estimations from the international investment bank JP Morgan indicate that sales of H1N1 vaccines in 2009 were expected to result in profits of approximately 7-10 billion dollars to pharmaceutical laboratories (Flynn 2010). Figures from Sanofi-Aventis at the beginning of 2010 show a record year of anti-flu sales that produced a net profit of 7.8 billion Euros (+11%) (Flynn 2010). It was observed that H1N1 vaccines were being sold to national governments at significantly inflated prices compared to the usual influenza vaccines. This is because they were using new patented technology to speed up the production of vaccines (Flynn 2010). Countries were even informed that double doses of vaccine were necessary leading to many countries overstocking and wasting large amounts of public money. The Parliamentary Assembly questioned whether this was justified particularly as some experts have wondered whether the new strain could have been treated with normal seasonal flu vaccine which has contained a human strain A of H1N1 since 2007 (Flynn 2010).

10.12 Summary of the Evidence for an Orchestrated Pandemic in 2009

- Key scientists advising the WHO on planning for a flu pandemic had done paid work for drug firms that would benefit from the advice they were giving.
- The establishment of a secret emergency committee (EC) to advise the DG was implemented by a board fully funded by pharmaceutical companies (ESWI) (Cohen and Carter 2010).
- The EC was given the power under the IHR to change the definition of a pandemic and many of the members of this board, including the chief-advisor had COI with pharmaceutical companies.
- The advice from the non-transparent EC to the WHO led to governments around the world stockpiling billions of dollars worth of antiviral drugs and vaccines. This advice was given without the WHO declaring conflicts of interest of the representatives on the secret committee at the time.
- The assessment of the severity of the influenza virus was removed from the definition of a pandemic by the EC but the 'sleeping contracts' that governments had with pharmaceutical companies, adopted in their PPP's for a severe pandemic, remained tied to the declaration of a pandemic.
- Pressure was put on governments to buy more expensive vaccines that were evaluated through accelerated authorization procedures.
- The communication of risk to the public did not include the changes to surveillance of influenza viruses that enhanced the incidence of this 'new' sub-type or the mild nature of the pandemic that was unfolding (Cohen and Carter 2010). It has been stated that there was no scientific basis for the claim that there would be 2 billion cases of H1N1 and also that scientists knew little about the benefits and harm of the vaccines (section 8.13). Yet this uncertainty in the science was not communicated to the public in the media campaigns.

10.13 Conclusion

The 'Swine Flu' pandemic of 2009 was declared by a secret WHO committee that had ties to pharmaceutical companies that stood to make excessive profits from the pandemic. This situation was facilitated by the lack of effective regulations and transparency regarding COI, within the WHO and national governments, to prevent pharmaceutical companies from exploiting global health policies to their advantage. The pattern of this pandemic was similar to that of the 'swine' flu pandemic of 1976 which also did not eventuate. Scientists are using industry funded research to predict the occurrence of influenza pandemics and these are based upon questionable premises and assumptions linked to the profits that can be made if a pandemic is declared. Under the influence of GAVI significant changes were made to the governance of global health policies through the implementation of the International Health Regulations (IHR) in 2005. These changes required all WHO member countries to increase surveillance systems for *all* infectious diseases to create extensive national surveillance systems: not just at the entry and exit points for countries. GAVI/WHO also spent 10 years developing Pandemic Preparedness Plans (PPP) with all member countries to ensure that if a global pandemic was declared all countries would be required to buy vaccines at prices that were set in 'silent contracts'. By 2005 nascent technologies had enhanced the surveillance of diseases by enabling greater sub-typing of infectious agents. Whilst increased surveillance of a disease can give the *appearance* of a greater risk due to more cases, this is not always the case. For many diseases, such as influenza, the majority of cases are mild and without complications, and would otherwise have gone unnoticed. This risk assessment of disease incidence and severity needs to be characterised for each disease because it is the *severity* of a disease and not the *incidence* that presents a risk to population health (Burnet 1956; Cumpston 1989). This characteristic of risk assessment for infectious diseases was discussed in chapter 4.

Influenza is a common respiratory virus that mutates regularly. Whilst a new strain of virus *ma*y be more virulent it is important to establish the risk prior to introducing a new vaccine because vaccines themselves produce a risk to individuals and the efficacy and safety of influenza vaccines are still being debated. The interpretation of the PP used in government policies is a political decision that is linked to the desired outcomes of the policy. An interpretation that does

not put the onus of proof on the proponent does not protect the public interest in health policies. The information about the risks of vaccines is significant to public health but it is not communicated to the public by governments or the mass media. In the case of the 2009 ‘Swine Flu’ pandemic, a level 6 pandemic could not have been declared if the WHO secret Emergency Committee had not been given the power to change the definition of a pandemic. This power was given to the EC by the European Scientific Working Group on Influenza that was 100% funded by industry. Public health is at risk if authorities and the media are not accurately informing the public about the risks of both diseases and vaccines. For many diseases increased surveillance results in a large number of identified cases that do not present a greater threat to public health. This was the case for the increased surveillance of ‘Swine Flu’ in 2009 and it resulted in an excessive waste of government funds and endangered public health.

CHAPTER 11

CONCLUSION

11.1 Introduction

In Australia vaccination is not compulsory however the financial and workplace requirements that are linked to using vaccines make it difficult for Australian consumers to refuse vaccines in practice. The aim of this thesis was to assess the Australian government's rationale for its vaccination policies and to determine whether the government's policies have been implemented in response to the needs of the Australian community. It was useful to examine the historical decline of infectious diseases in Australia and to investigate the cultural and political influences that have led to the introduction of mass vaccination campaigns for many infectious diseases in the last two decades. An investigation of the methodology that is used for determining health risk assessment was also important. These risks need to be assessed in the Australian context – a genetically diverse population in a developed country.

The data collected was used to assess the following claims by the Australian government (section 7.3):

I. Vaccines are *proven* to be a safe, effective and necessary management strategy for infectious diseases and
II. The benefits of vaccines to the community far *outweigh* the risks of vaccines to individuals.

11.2 The Development of the Australian Government's Vaccination Policy

The historical evidence of the decline of infectious diseases in the 20th century shows that most of the reduction in deaths and illnesses due to infectious diseases occurred *before* the introduction of the majority of mass vaccination campaigns. The reduction in disease by 1950 was due to the natural adaption of humans to the environment, including naturally acquired herd immunity, and to the effects of social medicine (environmental and lifestyle changes) that were promoted to the public through mass media campaigns. Prominent public health officials of the 20th century stated that the most important factors in the reduction of deaths and illness from infectious diseases were adaptation to the environment, nutrition, sanitation, hygiene, smaller family sizes (exposure to the infectious agent at an older age), less

crowding, maternal education and improved infrastructure and healthcare facilities. This was discussed in sections 2.3 and 2.4.

Genetics, gender, age, socio-economic status and maternal education all interact in the expression of disease outcomes from infectious agents. Hence there is a diverse range of health outcomes that occur after exposure to any infectious agent. These vary from sub-clinical (asymptomatic) or mild infection to serious disease and death, and severity is determined by the specific characteristics of each environment, host and agent interaction: the ecological context. See sections 4.1 and 4.6. This has been described for decades in the Epidemiological Triad (section 2.3). Infectious agents on their own are not a sufficient cause of disease, that is, they do not produce disease in all individuals because of a diverse range of environmental and host characteristics. Hence it cannot be assumed that all individuals in a community (or all communities) are at the same risk of disease from any infectious agent, just as we cannot assume that all individuals are at the same risk from a vaccine. Vaccines are used in genetically and environmentally diverse populations; therefore implementation on a 'one size fits all' basis is questionable. A risk/benefit assessment for vaccines and diseases needs to consider the specific ecological context of each geographical community due to the diversity of many factors. See chapter 2.

The key measures of health that the Australian government has used to evaluate community health over the last century have been i) the reduction of infant mortality rates and ii) vaccination coverage in the population (section 2.8). However, these provide an incomplete picture of the health and wellbeing of communities. Quality of life and chronic illness cannot be accurately determined from the infant mortality rates of populations or from vaccination coverage when evidence for the safety and efficacy of vaccines is incomplete. Public health authorities who evaluate the success of health policies using only these outcomes are limited in their ability to recognise other safety signals regarding the health of populations. If a specific adverse event or chronic illness is not acknowledged as being plausibly linked to vaccines and investigated, it will not be identified as a causal link for those outcomes. For example, the correlation between the significant increase in chronic illness in Australian children and the increasing use of vaccines in the NIP (section 1.1) has not been acknowledged as a plausible causal link by the Australian government and therefore it has not been investigated. The Australian government is claiming the NIP is safe without investigating the long-term health outcomes, 5 years or more, of using the combined schedule of 16 vaccines in infant animals or humans (sections 7.4 and 7.5). In Australia, infants are

recommended to have vaccines to protect against 7 diseases by 2 months of age and 12 vaccines by 12 months of age. A government that is assessing 'health' by measuring vaccination coverage and infant mortality rates will not be looking for, or detect, a link between an increase in chronic illness in children and the continually expanding childhood vaccination schedule.

In the mid 20th century, Western countries adopted the scientific medical model of health as the foundation for government public health policies (chapter 2, 3 and 5). This model of health focuses on causes of infectious disease that arise from biological processes within the individual and is based on the germ theory of disease: a single external cause. This allows for a biomedical solution to disease prevention - vaccines - but it downplays the significance of environmental and lifestyle factors in the expression of infectious diseases and it downplays the risks of vaccines (section 5.3). Scientists in the 1950's and 1960's believed it was possible to prevent deaths and illness to infectious diseases by artificially raising the antibody level of the blood to fight the antigen without experiencing a serious case of the disease. At this time vaccines were only being used in voluntary mass vaccination programs for a few diseases. The belief in using vaccines as a method of prevention for many infectious diseases became most entrenched *after* the threat from infectious diseases significantly declined in developed countries.

The theory of vaccine-induced immunity is based on the assumption that immunity is gained solely from the presence of antibodies to combat the pathogen and not on the interaction of complex body systems. It also assumes that adverse events and deaths due to each vaccine, and the combination of childhood vaccines are rare, something that has never been demonstrated with systematically collected data over many years. The ecological evidence of the significant increase in chronic illness in Australian children is a signal that this might not be the case (chapter 7). Since 1960 many new vaccines have been introduced into national vaccination programs in developed countries for infectious diseases that were not a serious risk to the majority of children. Most vaccines have not been implemented because of epidemics of disease in Australia or because of a serious threat of death or disability to the majority of the community, but to see if the diseases could be eliminated. Many vaccines have been introduced on this rationale even though some public health authorities stated that this theory was flawed (sections 3.2 and 3.10). The expansion of Australia's vaccination program was not in response to a serious risk from infectious diseases in Australia, but in

response to directives from the WHO/GAVI alliance under global public health policies (section 3.2 to 3.5).

The Australian Government adopted a free market model of healthcare in the 1980's: a model that is underpinned by neoliberalism, the current capitalist economic model. This model is driven by profit, hence it encourages the production and consumption of health products and drugs in the community. A free market model of health is not necessarily a negative for public health, however the influence of financial rewards for all healthcare professionals and medical researchers must be recognised and appropriate measures must be taken to protect the public interest if policies are being promoted to the public for the good of the community (sections 5.4 and 6.2). Australia's adoption of this model of health was in line with the WHO's international program to vaccinate all the children of the world. The program, known as the Expanded Program on Immunisation (EPI), was launched in 1974. In 1983 all WHO member countries committed to achieving vaccination rates of 80% by 1990. This was to be achieved for all vaccines in use at this time even though the majority of the populations in developed countries were not at risk from these diseases. After 1990 the WHO re-set the standard to achieving 90% vaccination coverage by 2000 with many new vaccines being added to the schedule. This included both developed and developing countries irrespective of the ecological context of the disease in each country. In 1990, even though infectious diseases were not of significant concern in Australia and expenditure on infectious diseases was low (section 2.6), the Australian government complied with the WHO directive to raise the vaccination rate of the population by introducing financial incentives to doctors and parents to encourage the use of *all* the recommended vaccines (sections 3.10 and 3.11). This included a push for high vaccination rates for the many new vaccines that were introduced at this time without a transparent risk/benefit assessment for each vaccine. Infant mortality rates to infectious diseases were low (8.2/1000 live births) before the new vaccines and strategies for increased participation rates were implemented in the 1990's.

The Australian Government claimed at the time that the need to increase the vaccination rate of the population was to see if these diseases could be *eliminated* and not because the diseases posed a serious risk of death and illness to the majority of children (section 3.10). Infectious diseases were re-named *vaccine-preventable diseases* at this time implying that the diseases could be prevented with vaccines. The rationale for the government's requirement for high participation rates in vaccination programs was the need to create herd immunity with vaccines and the claim that high vaccination rates (90% and above) would lead to the

elimination of these diseases. It is well established that infectious diseases declined in part because of the effect of *natural* herd immunity created after exposure to the infectious agents when children are at the right age (section 2.5). This produces long-term immunity in individuals *and* communities but this is not addressed by the government in the promotion of vaccination policies to the public (section 4.7 and chapter 7).

Australia's vaccination policy was formalized in 1997 as the Immunise Australia Program (IAP) and the expanded schedule of vaccines was linked to welfare benefits and school entry to encourage (pressure) parents to vaccinate (section 3.11). At this time children could not be prevented from attending school but the emphasis on vaccination suggested it was the responsible thing to do and financial incentives for doctors and patients were used to encourage vaccination. Many parents depend on welfare and childcare benefits and this policy limits their choices regarding employment and health. Although parents could choose not to vaccinate based on philosophical or religious exemption, this required a doctor's signature; a requirement that coerces parents to participate in this medical practice. This is a reversal of the guidelines for informed consent set by the Medical Board of Australia (MBA) and stated in section 2.1.3 of the Australian Immunisation Handbook (Ed.10 2015). This guideline states informed consent 'must be given voluntarily *in the absence of undue pressure, coercion and manipulation*' (section 5.6). The Australian government's adoption of strategies in public health policy that pressure the community to vaccinate represents a paternalistic attitude to health that promotes the recommendation of a medical intervention on the basis that it is in the community/individual's best interest. This system effectively removes the autonomy of individuals over their own health, that is, the individual's right to choose how they care for their own bodies. Australians are expected to accept vaccination, and the government's public health policies, without question or debate, because doctors are the 'experts' who know best. See chapter 5.

The ethical code of conduct for Australian practitioners is controlled by the Australian Medical Association (AMA) under the *Good Medical Practice* guidelines designed by the Medical Board of Australia (section 5.6). This system allows the AMA, a powerful institution, to influence doctors' education and behaviour through the registration procedures for practitioners. This ethical code was adopted from the guidelines set by the World Medical Association in the Declaration of Geneva and they replace the Hippocratic Oath. Medical practitioners in Australia vow to abide by these ethical guidelines that include the following commitments:

- The health of my patients will be my first consideration.
- I will not use my medical knowledge to violate human rights and civil liberties even under threat.

Informed consent to medical interventions is protected in the *Good Medical Practice* guidelines. Doctors are required to get signed consent from consumers/patients *before* a medical intervention is accepted. This guideline also requires that doctors present all the risks and benefits of a medical intervention before consent is given. Yet this is not the case for vaccination in Australia: a medical intervention for *healthy* people. Doctors are not required to provide Australian parents with a list of the ingredients of vaccines and the government does not publish this data on the IAP website where parents are directed to obtain information about Australia's vaccination program. Few parents are informed, either by doctors or the Australian government, of the *serious* adverse events that are listed on the Product Information for each vaccine. In addition, they are required to get a doctor's signature to *refuse* this medical intervention. Australian vaccination policies are violating human rights by linking this medical procedure to social welfare benefits (section 5.7). The International Covenant on Economic and Cultural and Social Rights (ICECSR) protects an individual's right to individual autonomy over their own bodies (bodily integrity) with respect to medical interventions. This covenant also protects the community's right to non-discriminatory social welfare policies. The removal of these rights in a government public health policy must be justified as being 'appropriate to the risk and no more intrusive or invasive than reasonably available alternatives that would achieve the desired level of health protection' (Fidler and Gostin 2006 p87). The Australian Human Rights Commission states that governments can infringe on human rights if the infringement is done for a legitimate purpose (including public health), is proportionate to the risk and is done by law. However, the Australian government has not provided adequate evidence that the use of multiple vaccines in infants is *appropriate to the risk* from these infectious agents, and there is no legislation or regulations in any Health Acts that compel Australians to accept a vaccine (section 5.7). In the disclaimer on the government's IAP website the government states that members of the public should seek independent advice from an appropriate professional relevant to their own particular circumstances. The Commonwealth of Australia does not warrant that the information contained on the IAP website is accurate, current or complete.

In 2012, the Australian government decided to increase the incentives to vaccinate by increasing the welfare and childcare benefits that are linked to vaccines (section 3.13). At the

same time the government increased the number of vaccines listed on the recommended NIP: three new vaccines were added to the schedule even though there was no increased risk from these diseases. The government emphasized the need for *all* children to receive the new vaccines by providing childcare and welfare benefits only to children who were 'fully' vaccinated. This change meant that parents would not receive the benefit if they selectively vaccinated or did not have a valid exemption form signed by a doctor. Hence the default position in Australia is to vaccinate and pressure is placed on parents to be responsible for the good of the community. In 2015 the Australian government proposed removing religious and philosophical exemption to vaccination and only allowing medical exemptions. These coercive policies using financial incentives effectively mandate vaccines for all parents who rely on childcare and welfare benefits. In 2006 the NSW Health Department issued a Policy Directive mandating the use of the recommended vaccines for some clinical positions and for tertiary health students. This was expanded to other states by 2008. Many Australian institutions, such as hospitals and general practices, now require employees to be fully vaccinated even though there is no regulation or legislation under Australian health acts to compel individuals to use vaccines (AG IAP 2013). This policy was introduced without the government providing evidence for its necessity and whilst still claiming that vaccination in Australia is not compulsory. Employees in some institutions are threatened with losing their jobs if they choose not to update with the recommended vaccines (section 3.15).

In this paternalistic system, the public is expected to place their trust in the directives provided by the government and the medical profession regarding this medical intervention. Governments implement public health policies on the premise that they are in the public's best interest and they will promote health in the community. Yet government vaccination policies are not underpinned by the ethical principles used to guide decisions in health promotion. These principles are described in the Seedhouse Ethical Grid (section 5.5). The underlying ethical principle of health promotion in the Seedhouse Ethical Grid is to create individual autonomy. This is stated in the code of conduct for health professionals as the right for a patient to be *fully* informed of the risks and benefits of a medical intervention *without coercion* before giving their consent to the procedure. Australian vaccination policies restrict individual autonomy in the use of vaccines. Seedhouse (2009) states 'All plausible theories of health equate work for health in some way with the creation of autonomy' (p144). In other words, when autonomy is not promoted in the use of a medical intervention, health is not assured. Individual 'autonomy' in vaccination policies refers to the right to *informed consent*

without coercion', as stated in the Australian Immunisation Handbook (ed.10). If this guideline is violated a medical intervention can be promoted through indoctrination and this puts public health at risk. Linking the professional registration of doctors to supporting government vaccination policies also puts public health at risk because it prevents doctors speaking freely about the risks and benefits of the procedure to their patients.

The generally accepted ethical principles for health promotion include (Seedhouse 2009):

1. Respect for autonomy: a respect for the rights of individuals and their right to determine their lives.
2. Beneficence: doing good
3. Non-malfeasance: doing no harm
4. Justice: being fair and equitable
5. Duty to care
6. Duty to be truthful

Government public health policies are founded on political decisions and value judgments concerning the scientific evidence available. Scientific evidence is not static; it evolves over time and can be produced under different cultural practices that alter its integrity and rigour. If the ethical guidelines for health promotion are not adopted in the design of government health policies it is possible for these policies to do more harm than good in the population. This is particularly the case if policies are designed on non-transparent decisions/evidence and if the government is not accountable for the decisions it makes. Australians, who depend on government welfare benefits and some employment situations, are pressured to vaccinate to receive financial benefits. This discriminatory policy exposes these individuals to a greater risk from vaccines without a compensation scheme for those who suffer adverse events. The requirements for implementing Australian vaccination policies are contrary to the ethical guidelines for promoting health in communities and they are being implemented without community involvement in debate or decision-making.

11.3 Industry Influence and Undone Science in Public Policy

In the current political climate of neoliberalism, global health policies are being formed by partnerships with corporations. The WHO/GAVI alliance is a partnership that includes pharmaceutical and biotechnology companies, the Rockefeller and Gates Foundations, the World Bank and the International Monetary Fund, etc, and all these players are influential in

determining global health policy directives for all WHO member countries. These public-private partnerships are designing global public health policies that are promoted by the WHO as being in the interests of community health (sections 3.2 and 3.3). The WHO/GAVI alliance is also involved in advocacy for these directives with national governments and providing financial incentives to countries that cannot afford to implement vaccination programs (section 3.4). Sponsorship of programs allows GAVI to influence the agendas that are promoted in national public health policies of many countries. WHO/GAVI policy directives are being justified on evidence-based policy-making (EBPM), however the type of evidence used in the assessment of risks and benefits is not transparent to the global community (chapter 6). Many national governments are relying on international donations that require them to prioritise global health initiatives (influenced by industry) over local health issues and requirements. Financial incentives are being used to induce governments to pursue global goals for an increasing number of vaccination programs, even when these policies do not match the needs of the country. This trend is observed in the development of the Australian government's NIP. See chapter 3 and the case studies in chapters 9 and 10.

Public health policies for infectious diseases in Australia are determined on the advice provided to the health minister by the Australian Technical Advisory Group on Immunisation (ATAGI) (sections 3.4 and 6.7). This body relies on technical advice provided by the WHO/ industry and the medical profession, with only one public representative. There are many interests other than health that can be protected in government health policies, even though the stated goal of these policies is to protect public health. This is why all stakeholders should be properly represented in the decision-making process, particularly the public upon whom the policy is enforced. The Environmental Health Risk Assessment (EHRA) framework emphasises the need for a transparent and systematic assessment of the risks of health hazards and the importance of public involvement in debates/decisions on public health policy but the Australian government has not adopted the EHRA framework for the foundation of vaccination policies (sections 4.4 and 4.5). Vaccination policies are being designed using generic computer modeling of diseases by the GAVI/WHO alliance for broad communities without accounting for the specific environmental and lifestyle factors of different communities. Generic modeling for the implementation of vaccines is modified with local factors for some countries but many countries adopt the recommendations made by WHO/GAVI. The cost-effectiveness of these programs is determined using industry

generated statistics with underlying assumptions that are not transparent to the public. See chapters 3, 9 and 10.

When technical experts dominate political systems, their values and beliefs can play a role in framing government health agendas. The value judgments made by the representatives of the ATAGI advisory board help determine which information should be prioritised in government policy. In the Australian political system health ministers are dependent upon the recommendations of this board. If the minister is not informed about the significance of a gap in the scientific knowledge it is possible for government policy to be formed despite relevant studies not being undertaken (section 8.2). The status quo can be maintained in this system because authorities can claim 'there is no evidence of harm therefore no action needs to be taken.' When the public is not consulted about their perspectives on the risk of a procedure and when the science used in policy decisions is not transparent, it is possible for the dominant network of scientists to shape policy priorities in ways that may not be in the public's best interest. See chapter 8.

In section 6.7 I described the representation of stakeholders on the Australian government's vaccination advisory board (ATAGI). There are many representatives on this board who have financial ties to industry, including the chairman of the committee from 2005-2014, and there is only one consumer representative. Biased or selective science can be used in government policy when industry interests dominate the decision-making process. COI in the political system assists industry to dominate the design of public policy and this can synchronise with a powerful voice in the media. This underscores the need for governments to maintain individual autonomy in public health policies as special interest groups can promote their agendas in these policies. In the era of globalization and neoliberalism, decisions regarding research agendas and public health policy are being influenced by industry via industry sponsorship of medical research and representatives on government and institutional advisory boards. This reinforces a dominant network of scientists in academic institutions that controls the finances and resources in the field as well as the allocation of rewards (section 8.8). The funding arrangements in academic/industry institutions can appear fair but they can be designed to enhance some areas and neglect others due to the drive for industry profits. Scientists who wish to pursue public interest science that is not aligned with industry outcomes can experience a lack of funding, less prestige and suppression of their research. Academic institutions can no longer be considered independent and impartial educational facilities because of industry sponsorship and because of the equity that researchers and

departments hold in the research they perform. This influences Australian public policy because industry has influence in ATAGI decisions and the scientific evidence that underpins these decisions is performed at academic/industry research institutions. See chapter 8.

Industry sponsorship in academic institutions can influence the direction and outcomes of the scientific research that is produced. Industry can influence which areas of science will remain unfunded and therefore 'undone', resulting in a lack of evidence in policy development. This often occurs in areas that would reduce company profits. Examples of this have been provided in chapters 6, 7 and 8. It is also important that science remains open for all stakeholders to debate because this ensures that it is produced with the values that result in scientific rigor and integrity. When scientific data is not shared and openly assessed by the scientific community it is more susceptible to fraudulent practices and manipulation while the community is expected to trust that the scientific knowledge has been produced with integrity. In the capitalist model of health where doctors and scientists are financially dependent on their research/work for their livelihood, it is important that they are free to speak the truth. Loyalty to the health of society should take precedence over jobs, careers, research grants and professional memberships. The public interest is not protected if scientists can lose their jobs if they do not produce results that support their sponsor/employer's interests. Job security is needed for scientists who present findings that are contrary to the interests of their employer.

Governments that place the onus of proof of harmfulness on the public and not the proponent *after* a technology/procedure is introduced into the population are allowing experimentation on human populations. This is contrary to the precautionary principle that is intended to protect human and environmental health when there are significant gaps or uncertainty in the science. Health outcomes in these policies are unknown and in many cases will never be known, because governments are not establishing adequate monitoring systems to determine causal links. This is the case with government vaccination policies and it has been illustrated with the examples of the HPV vaccine and the 'Swine Flu' 2009 vaccine in chapters 9 and 10. Undone science can be addressed in public health policies to protect the public interest by adopting the form of the precautionary principle that was agreed upon by the Scientific and Environmental Health Network (SEHN) in 1998. This principle is stated as:

'The burden of proof of harmlessness of any procedure/technology is on the proponent and not the general public'.

Public health policies that do not address significant undone science violate the Nuremberg Code of Conduct and the Geneva Declaration (Physicians Oath) adopted by the General Assembly for the World Medical Association in 1948 and by the Australian Medical Association (AMA) in the *Code of Ethics* and *Good Medical Practice* guidelines for health practitioners (section 5.6).

The Undone Science in Australian Vaccination Polices

Here is some of the research that has not been funded but is needed to justify the Australian government's vaccination policies (chapters 6, 7 and 8):

- Evidence from formal randomized controlled clinical trials is needed to demonstrate
    i) Effectiveness of the vaccines in preventing *the disease* (and not just the surrogate end-point of seroconversion)
    ii) The safety of the vaccines using an inert placebo
- The safety of vaccines is based on evidence from phase 1, 2 and 3 human clinical trials (with chosen criteria and parameters) and the evidence does not include animal models that demonstrate the safety of vaccines. Long-term health outcomes of single vaccines and the combined schedule of vaccines have never been investigated in large-scale animal studies or controlled human clinical trials, comparing vaccinated and unvaccinated groups using an inert placebo. This is significant because small–scale animal studies and clinical evidence show there is a plausible link between vaccines and the chronic illness that is increasing in Australian children (section 7.4).
- A demonstrated safe level of the 'trace' amounts of excipients (alone or in the recommended combination) has not been established in animal studies or human studies (AG EHRA 2012) (section 4.5).
- The safety of ethylmercury has been extrapolated from the knowledge of the neurotoxin methylmercury. These two neurotoxins are not the same and the health effects of ethylmercury in low doses combined with other excipients in the vaccine have not been established in studies of the human feotus, infants or adults. Many toxins in the past have been found to be more toxic in lower doses than originally believed.
- The lack of an active post-vaccination surveillance system to systematically monitor *all* the health outcomes of vaccinated individuals means that definitive evidence of vaccine related adverse events and their frequency in the population is not available.

- Many vaccinated individuals still get the diseases they are vaccinated against but the government does not provide transparent data on the number of vaccinated individuals that are still getting the diseases and/or that are hospitalized with these diseases. This information needs to be presented with the socioeconomic status of the case to evaluate the benefits of vaccination programs in different populations.

11.4 CONCLUSION

In chapter 1 I stated that the aim of this thesis is to examine the following claims made by the Australian government (section 1.3):

1. Vaccines are *proven* to be a safe, effective and necessary management strategy for infectious diseases and
2. The benefits of vaccines to the community far *outweigh* the risks of vaccines to individuals and population health.

This thesis has demonstrated that there is inadequate evidence from independent studies to support these claims about vaccines.

Claim 1: Most mass vaccination campaigns were introduced into developed countries after 1950 in an attempt to *eliminate* infectious diseases, not because infectious diseases were a serious risk to the majority of Australian children. In addition, many vaccines were introduced after 1980 on a directive from the WHO at a time when infant mortality rates and the risk of infectious diseases in Australia were very low. There is a lack of evidence to support the claim that vaccine-induced herd immunity can eliminate infectious diseases. The Australian government has not provided evidence from formal controlled clinical trials that demonstrate the efficacy of vaccines in preventing disease nor has it provided transparent, independent data on the vaccination status, socioeconomic status, and severity of reported cases of disease that would demonstrate the influence of vaccines in preventing disease.

There is a lack of evidence to claim that vaccines are a safe and effective management strategy in diverse genetic populations because the appropriate scientific studies have not been funded to determine the types and frequency of adverse events that are occurring in different communities.

Claim 2: The government's claim that the benefits of vaccines to the community far outweigh the risks of vaccines to individuals cannot be sustained because the government has

not established an active surveillance system that can provide data on the long-term health effects of single or multiple vaccines in the Australian population. The correlation between the increased use of vaccines in the NIP and the significant increase in chronic illness in children has not been acknowledged or investigated by the Australian government. Furthermore, the Australian government claims that the benefit of using vaccines is to create herd immunity to protect the community. Yet the criterion for recommending a vaccine for approval in the NIP does not include the necessity to demonstrate that the vaccine has implications for herd immunity in the population (Nolan 2010 A79).

Summary:

The undone science in Australian government vaccination policies results in unpredictable health outcomes in the population. It needs to be acknowledged by the Australian government that increased morbidity in the Australian population is a possible outcome if vaccination policies are being implemented on a lack of comprehensive scientific evidence. Infectious diseases had declined in severity in Australia before most vaccines were introduced. Vaccines were not introduced to reduce the deaths and illness due to infectious diseases but to see if they could be *eliminated.* Infectious diseases were re-labeled *vaccine-preventable diseases* to imply that vaccines are the key to preventing disease, which contradicts the historical decline of infectious diseases. The contribution that vaccines may have made to the decline of infectious diseases is unknown because there has been no systematic assessment of their efficacy in preventing disease. Australian government vaccination policies have been founded on global directives from the WHO/GAVI that were designed by an alliance with industry. They have not been recommended as a result of an independent assessment of the need for vaccines in the ecological context of Australia. This is significant because environmental and host characteristics play a role in disease expression. Infectious agents on their own do not cause disease and this explains why many infectious diseases are not severe in countries with improved environmental and social conditions. The Australian government has not provided a risk/benefit assessment for each vaccine in the Australian context to support the claims that are made in vaccination policies.

Finally it must also be acknowledged that industry influence is pervasive and is affecting research findings as well as the research topics that are being investigated and the decisions being made in policy. Undone research in the government's vaccination policies includes the absence of studies of vaccination by scientists who are completely independent of industry

influence. In addition, decisions are being made by policy decision-makers with COI with industry that are not transparent to the Australian public, even if they are required to be declared before a meeting. The public is also not informed that directives for Australia's public health policies are provided by the WHO/GAVI alliance that includes partnerships with pharmaceutical companies. This synchronises with government vaccine advisory boards that do not have adequate representation of public members to present the public perspective in these policies. In this situation, the public is left to trust that officials are using evidence that is produced with integrity and rigour to develop policies that protect the public interest. Biomedical research produced in academic/industry research institutions contains trade secrets that prevent collaboration and an independent assessment of the science. There is also a lack of independent studies to assess the accuracy of the conclusions that are drawn. This leads to institutional biases in the political decisions that are made in national and global public health policies. Government policies are being promoted to the public in the interests of the community yet they are being designed and driven by industry interests. This misleads the public and endangers public health. Governments are also informing the public that they should seek their advice on vaccination from medical practitioners. Yet health professionals are unable to speak freely about the risks and benefits of vaccines because they are required to support government vaccination polices for their professional registration.

These conclusions emphasise the need for maintaining voluntary participation, without coercion, in public health policies that include a medical intervention. This is particularly the case for preventative health policies that promote a medical intervention to *healthy* individuals. Healthy communities are achieved by increasing individual autonomy, that is, the individual's right to choose how they care for their own bodies in the prevention of disease. This prevents indoctrination and it must be respected and promoted in public health policies to ensure that better health is the primary outcome of these policies.

Appendix 1

The Ingredients of Vaccines

Reference: The Australian Immunisation Handbook 10th Edition. 2013. Australian Technical Advisory Group on Immunisation (ATAGI). http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/Handbook10-home (Updated 30th May 2013).

Table A3.1: Components of vaccines used in the National Immunisation Program

Vaccine component*	Vaccine brand†	Antigen
Albumin/serum	Avaxim	Hepatitis A (HAV)
	ProQuad	Measles-mumps-rubella-varicella (MMRV)
	Quadracel	Diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis (DTPa-IPV)
	Vaqta	Hepatitis A (HAV) paediatric/adolescent
	Varilrix	Varicella (VV)
	Varivax Refrigerated	Varicella (VV)
Aluminium hydroxide	Avaxim	Hepatitis A (HAV)
	Cervarix	Human papillomavirus (HPV)
	Engerix-B	Hepatitis B (HBV) adult and paediatric
	Havrix Junior	Hepatitis A (HAV) paediatric
	H-B-Vax II	Hepatitis B (HBV) adult and paediatric
	Infanrix IPV	Diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis (DTPa-IPV)
	Menjugate Syringe	Serogroup C meningococcal conjugate (MenCCV)
	NeisVac-C	Serogroup C meningococcal conjugate (MenCCV)
	Vaqta	Hepatitis A (HAV) paediatric/adolescent

Vaccine component*	Vaccine brand†	Antigen
Aluminium hydroxide/ phosphate	Boostrix	Diphtheria-tetanus-acellular pertussis (dTpa) reduced antigen
	Gardasil	Human papillomavirus (HPV)
	Infanrix hexa	Diphtheria-tetanus-acellular pertussis-hepatitis B-inactivated poliomyelitis-*Haemophilus influenzae* type b (DTPa-hepB-IPV-Hib)
Aluminium phosphate	Adacel	Diphtheria-tetanus-acellular pertussis (dTpa) reduced antigen
	Meningitec	Serogroup C meningococcal conjugate (MenCCV)
	Prevenar 13	13-valent pneumococcal conjugate (13vPCV)
	Quadracel	Diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis (DTPa-IPV)
Borax/sodium borate	Gardasil	Human papillomavirus (HPV)
	Vaqta	Hepatitis A (HAV) paediatric/adolescent
Egg protein	*All influenza vaccines* Agrippal	Influenza
	Fluarix	Influenza
	Fluvax	Influenza
	Influvac	Influenza
	Vaxigrip	Influenza
Formaldehyde	Adacel	Diphtheria-tetanus-acellular pertussis (dTpa) reduced antigen
	Agrippal	Influenza
	Avaxim	Hepatitis A (HAV)
	Boostrix	Diphtheria-tetanus-acellular pertussis (dTpa) reduced antigen
	Fluarix	Influenza
	Havrix Junior	Hepatitis A (HAV) paediatric

Vaccine component*	Vaccine brand†	Antigen
	Infanrix hexa	Diphtheria-tetanus-acellular pertussis-hepatitis B-inactivated poliomyelitis-*Haemophilus influenzae* type b (DTPa-hepB-IPV-Hib)
	Infanrix IPV	Diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis (DTPa-IPV)
	Influvac	Influenza
	Quadracel	Diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis (DTPa-IPV)
	Vaqta	Hepatitis A (HAV) paediatric/adolescent
	Vaxigrip	Influenza
Gelatin	ProQuad	Measles-mumps-rubella-varicella (MMRV)
	Varivax Refrigerated	Varicella (VV)
Gentamicin	Fluarix	Influenza
	Influvac	Influenza
Glutaraldehyde	Adacel	Diphtheria-tetanus-acellular pertussis (dTpa) reduced antigen
	Quadracel	Diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis (DTPa-IPV)
Kanamycin	Agrippal	Influenza
Mannitol	Priorix	Measles-mumps-rubella (MMR)
	Priorix-tetra	Measles-mumps-rubella-varicella (MMRV)
Monosodium glutamate (MSG)	ProQuad	Measles-mumps-rubella-varicella (MMRV)
	Varivax Refrigerated	Varicella (VV)
Neomycin	Agrippal	Influenza
	Avaxim	Hepatitis A (HAV)
	Fluvax	Influenza
	Havrix Junior	Hepatitis A (HAV) paediatric
	Infanrix hexa	Diphtheria-tetanus-acellular pertussis-hepatitis B-inactivated poliomyelitis-*Haemophilus*

Vaccine component*	Vaccine brand†	Antigen
		influenzae type b (DTPa-hepB-IPV-Hib)
	Infanrix IPV	Diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis (DTPa-IPV)
	Priorix	Measles-mumps-rubella (MMR)
	Priorix-tetra	Measles-mumps-rubella-varicella (MMRV)
	ProQuad	Measles-mumps-rubella-varicella (MMRV)
	Quadracel	Diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis (DTPa-IPV)
	Vaqta	Hepatitis A (HAV) paediatric/adolescent
	Varilrix	Varicella (VV)
	Varivax Refrigerated	Varicella (VV)
	Vaxigrip	Influenza
Phenol	Pneumovax 23	23-valent pneumococcal polysaccharide (23vPPV)
Phenoxyethanol	Adacel	Diphtheria-tetanus-acellular pertussis (dTpa) reduced antigen
	Avaxim	Hepatitis A (HAV)
	Quadracel	Diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis (DTPa-IPV)
Polymyxin	Fluvax	Influenza
	Infanrix hexa	Diphtheria-tetanus-acellular pertussis-hepatitis B-inactivated poliomyelitis-*Haemophilus influenzae* type b (DTPa-hepB-IPV-Hib)
	Infanrix IPV	Diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis (DTPa-IPV)
	Quadracel	Diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis (DTPa-IPV)
Polysorbate or sorbitol	Agrippal	Influenza
	Boostrix	Diphtheria-tetanus-acellular pertussis (dTpa) reduced antigen

Vaccine component*	Vaccine brand†	Antigen
	Fluarix	Influenza
	Gardasil	Human papillomavirus (HPV)
	Havrix Junior	Hepatitis A (HAV) paediatric
	Infanrix hexa	Diphtheria-tetanus-acellular pertussis-hepatitis B-inactivated poliomyelitis-*Haemophilus influenzae* type b (DTPa-hepB-IPV-Hib)
	Infanrix IPV	Diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis (DTPa-IPV)
	Influvac	Influenza
	Prevenar 13	13-valent pneumococcal conjugate (13vPCV)
	Priorix	Measles-mumps-rubella (MMR)
	Priorix-tetra	Measles-mumps-rubella-varicella (MMRV)
	ProQuad	Measles-mumps-rubella-varicella (MMRV)
	Quadracel	Diphtheria-tetanus-acellular pertussis-inactivated poliomyelitis (DTPa-IPV)
	RotaTeq	Rotavirus
Yeast	Engerix-B	Hepatitis B (HBV) adult and paediatric
	Gardasil	Human papillomavirus (HPV)
	H-B-Vax II	Hepatitis B (HBV) adult and paediatric
	Infanrix hexa	Diphtheria-tetanus-acellular pertussis-hepatitis B-inactivated poliomyelitis-*Haemophilus influenzae* type b (DTPa-hepB-IPV-Hib)

* If the person to be vaccinated has had an anaphylactic reaction to any of the vaccine components, administration of that vaccine may be contraindicated. Specialist advice should be sought to identify the component and to review if the person can be vaccinated in future.

† Please also refer to Appendix 4 *Commonly asked questions about vaccination* for more specific information about these various constituents.

Thimerosal was listed as an ingredient of some vaccines in March 2013 in The Australian Immunisation Handbook 9th Edition. Components of Vaccines. Appendix 4. Australian Technical Advisory Group on Immunisation (ATAGI). Page 343.

http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/78CDF41C283426A8CA2574E40020CCAB/$File/handbook-9.pdf (accessed March 2013).

Appendix 2

Case Study: Thimerosal and Mercury Toxicity in Humans

The Preservative Thimerosal

Thimerosal is a preservative that was invented in 1920 by the chemist, Eli Lilly, the founder of the pharmaceutical company of the same name (Kirby 2005 p48). It is an organomercurial compound that is almost 50% mercury by weight and metabolises to *ethylmercury* and *thiosalicylate.* Its brand name is Merthiolate and it is a cream-coloured water soluble crystalline powder (Kirby 2005). This preservative has never been tested for safety and effectiveness since it was first used in the 1930's (FDA p1). The first requirement for preservatives to be included in the US Code of Federal Regulations (CFR) was in 1968 but preservatives were present in many products prior to this time. The CFR requires that 'the preservative shall be sufficiently non-toxic so that the amount present in the recommended dose of the product will not be toxic to the recipient... ' (FDA p1). Yet the FDA does not test preservatives for safety and efficacy. FDA safety and effectiveness standards only apply to collecting safety and effectiveness data on the product that is being licensed not on the preservative that is in the product for licensing.

Whilst the FDA states that the concentration of thimerosal in vaccines meets the *preservative* standards set by the *United States Pharmacopeia* these standards do not refer to the safety of the preservative – only to its effectiveness. In other words, it kills the specified challenge organisms and is able to prevent the growth of the fungi when it is at a concentration in the range of 0.001% - 0.01%. Thimerosal at a concentration of 0.01% contains 50 micrograms of thimerosal per 0.5 ml dose or 25 micrograms of mercury in a 0.25 ml dose. A trace amount of thimerosal is considered to contain 1 microgram or less of mercury per dose. Whilst the FDA claims several studies have indicated thimerosal has a 'long record of safe and effective use' (p2) these studies are mostly for the effectiveness of thimerosal in topical products and not for the safety and effectiveness of thimerosal injected into the tissues (FDA p7). During the 1990's many thimerosal-containing vaccines were added to the childhood schedule in all countries. Yet there is no safety data on the health effects of trace amounts of thimerosal in vaccines or accumulated or synergistic effects of thimerosal with other vaccine

ingredients (FDA 2012 p3). It is also known that organomercurial compounds have the potential for neurotoxicity even at low levels in the human body.

Cases of mercury poisoning that occurred from the administration of thiomersal-containing products in the 1970-1990's (including the administration of immune globulin) reported necrosis, acute hemalysis, disseminated intravascular coagulation, acute renal tubular necrosis and central nervous system injury including obtundation, coma and death (IOM in FDA p3). Animal studies prior to 1990 demonstrated that the maximum dose of thimerosal that could be tolerated without causing death was 20 micrograms of thimerosal/kg in rabbits and 45 micrograms/kg in rats (FDA p3). There is no mention of the health effects that occur in these animals (prior to death) when exposed to these levels of mercury. In addition, the FDA has not established definitive data on the time it takes to remove ethyl mercury from the body of animals or humans. The FDA uses the Magos et al (1985) study of rats to make the claim that 'ethylmercury is less neurotoxic than methylmercury', the organomercury compound that the safety guidelines are based on. There is no evidence provided by the FDA to support this statement and no description of the health effects in the rats after exposure to 5 daily doses of ethyl and methyl mercury to illustrate the conclusion that 'it is less neurotoxic' (FDA p3). Instead the FDA uses other studies to observe that there are differences in the way thimerosal and methyl mercury are distributed, metabolized and excreted in the body, therefore the FDA concludes 'Thimerosal appears to be removed from the blood and body more rapidly than methyl mercury' (FDA p3). This is not a definitive statement about the removal of thimerosal.

The guidelines that do exist for the health effects of mercury in humans have been established from accidents with the related organomercury compound, methylmercury and its consumption in the diet - not injection into the body (FDA p2; TEACH). The FDA states that ethyl and methyl mercury are expected to have different toxicological profiles but as there is a 'lack of definitive data on the comparative toxicities' the FDA has considered them equivalent in its risk evaluation (p2). It is also known that exposure from ingestion is very different to exposure from injection of the substances into the tissues (Gilbert 2004). Ethyl and methylmercury are both organic compounds which mean they contain carbon and are easily absorbed by lipids and fatty membranes (Kirby 2005 p48). The difference between the compounds is that ethylmercury has one extra carbon molecule making it a larger structure (Kirby 2005). Organomercury is more

dangerous than inorganic mercury because inorganic mercury can dissolve in water and be more easily excreted by the kidneys in urine (Gilbert 2004). Ethylmercury is less readily eliminated from the body because it is an organic mercury compound.

FDA Guidelines for the Use of Methyl and Ethyl Mercury

Several agencies have developed guidelines for safe exposure to methyl mercury including the US Environmental Protection Agency (EPA) (1997) 0.1 mg/kg/day, the Agency for Toxic Substances and Disease Registry (ATSDR) (1999) 0.3 mg/kg/day, the FDA (1979) 0.4 mg/kg/day and WHO (1996) 0.47 mg/kg/day (FDA p2). These exposure levels range from 0.1 micrograms/kg body weight/day (EPA) to 0.47 micrograms/kg body weight /day (WHO). The FDA claims that the figures vary between agencies due to:

I. Varying safety margins
II. The different emphasis placed upon various sources of data
III. The different missions of the agencies and
IV. The population that the guideline is intended to protect. For example, adult or child.

The FDA's guideline has been based partly on an adult who ingests 30 micrograms/day of methyl mercury in the diet. This is equivalent to 0.43 micrograms/kg/day for a 70kg adult. Although there are variations in the guidelines between the different agencies the FDA considers that they all fall within the same order of magnitude. However, if this data is assessed in the perspective in which it is used i.e. the safety of toxins in a new born infant compared to a mature adult of 70kg then these guidelines vary considerably between the agencies. The 0.1 mg/kg body weight recommended by the EPA is significantly less than 0.43 (FDA) and 0.47 mg/kg body weight (WHO) – particularly as the FDA's standard is based on a 70 kg adult. Toxins are known to have a 10 fold increased effect in infants compared to adults (Gilbert 2004).

Ideally the guidelines should also describe the route of entry of the exposure: ingestion (diet), inhalation or injection. This is essential because injection ensures that most of the substance is absorbed into the circulatory system and is accessible to all organs whereas ingestion via the diet results in a large proportion of the mercury being excreted in the faeces (Gilbert 2004). In animal studies methylmercury has been shown to cross the

placenta and accumulate in foetal brain, kidney and liver of mice, hamsters, rats and monkeys. Methyl mercury is transferred to infants via breast milk in both rats and hamsters but it transfers more efficiently across the placenta (TEACH p8).

Based on the FDA's guidelines it recommends that pregnant women, nursing mothers and young children do not consume certain kinds of fish that may contain high levels of methyl mercury (FDA p7; TEACH p1), in particular, shark, swordfish, king mackerel and tilefish which are the higher order consumers. In contrast, governments in 2013 are recommending the influenza vaccine to pregnant women (DHA IAP 2013) even though some influenza vaccines contain thimerosal and other non-inert excipients that are injected into the tissues and have access to the foetus and body organs. Every dose of influenza vaccine that comes from a multi-dose vial contains 24.5 micrograms of mercury (CSL PI). This is recommended even though the FDA has not established a safe dose of ethyl mercury in the foetus, infants, adults or pregnant women (FDA p3).

The Health Effects of Ethyl and Methyl Mercury

Ethyl and methyl mercury are classified as neurotoxins that destroy cells in key centers of the brain and nervous system. Mercury is especially hazardous to foetuses and small children. This is of concern when it is also known that the majority of substances that are taken in by a pregnant woman will cross the placental membrane ensuring that the foetus will experience the same level of any drug that the mother is exposed to (Gilbert 2004 p28). However, compounds such as methylmercury are found in higher concentrations in the foetus than in the mother because the developing infant is a storage site for maternal mercury (Gilbert 2004 p28). Further protection is provided to the adult brain by the blood-brain barrier to filter out hazardous substances however the foetus and infant up to 6 months of age do not have this protection (Gilbert 2004). The blood-brain barrier is able to prevent large molecules from passing into the brain tissue but it cannot stop water soluble agents from entering the brain (Gilbert 2004 p28). Mercury is known to affect the central nervous system, skin and kidneys (FDA; NCIRS THIM FS p1). As the body systems of infants are still developing even a 'trace' amount of a toxin (particularly in combination with other substances) could affect the proper development of the kidneys and therefore inhibit the removal of mercury from an infant's body. The NCIRS states that 'ethyl mercury is rapidly converted in the body to inorganic mercury which is excreted in the stool' (p1). This statement is unreferenced

and may not apply to infants whose systems are still developing. In addition, it may also give the mercury greater access to the brain when the blood-brain barrier is not developed. The effects of mercury exposure in adults include kidney damage and digestive tract problems including diarrhea, nausea and ulcers (TEACH p4).

Mercury is known to inhibit cell division and migration within the forming brain and has been shown to bind to DNA thereby interrupting chromosomal reproduction and blocking several essential proteins (Kirby 2005 p48). The uptake of a chemical by different tissues and organs is also known to be affected by exposure to multiple chemicals at the same time (Gilbert 2004 p28). A combination of chemicals (such as the excipients in multiple vaccines or exposures to pesticides and other chemicals in the environment) can interact to affect absorption of the substance or to affect the body's reaction to a specific chemical. Knowledge of these interactions on the metabolism and elimination of substances from the human body is limited (Gilbert 2004 p28). This is particularly the case for the foetus and infants because their body systems are still developing. Most detoxification occurs in the liver by breaking down toxic substances into less toxic substances. Heavy metals such as mercury are unable to be degraded so removal is dependent upon the functioning of the kidneys (Gilbert 2004 p29). Mercury is removed from the body by the kidneys which concentrate the toxin in the urine ready for excretion. A significant factor in the ability of a toxin to cause harm is the half-life of the substance.

Methyl mercury has a half life of approximately 70 days but it is believed to be slightly less for ethyl mercury (PHAC 2002 p6). This is not a definitive statement supported with evidence. The Australian NCIRS states that the half-life of methyl mercury is 50 days and for ethyl mercury is considerably less at 7-10 days but this statement is not referenced (NCIRS THIM p1). The half-life of any substance will be influenced by the genetics of the individual and the variations that occur in physiology at different ages or under different conditions. For example, metabolism varies considerably between individuals and in response to hormonal changes at different stages in life – infant, adult or pregnant mother (Gilbert 2004 p29). The half-life of a toxin can increase considerably during pregnancy due to physiological changes that affect the absorption, distribution and metabolism of an agent (Gilbert 2004 p 31). A compromised immune system or genetic trait can result in low level exposures being completely intolerable to some individuals (Gilbert 2004 p31). In addition, rapid weight loss can cause excess

toxins to be redistributed into the blood as fat is metabolised. Young people are particularly susceptible to health effects from toxins because the organs are rapidly developing and the dividing cells are more easily harmed than mature cells (Gilbert 2004 p31).

The brain grows rapidly in the first 7 years of life and mercury is a neurotoxin that specifically targets the nervous system and brain (TEACH). When children have been exposed to methyl mercury during pregnancy (in utero) it has been associated with delays in reaching developmental milestones and decreases in intelligence (TEACH p2). The foetus is found to be more sensitive to the effects of mercury and conditions such as severe neurologic injury including a condition similar to cerebral palsy have been acquired even when the mother has shown few or no symptoms (FDA p2). The larger the dose the greater the severity of the neurological condition (TEACH). When children in utero were exposed to low levels of methyl mercury they experienced sensory and motor neurological dysfunction and developmental delays (FDA p2). Children exposed to high doses of methyl mercury may experience mental retardation, cerebral palsy, reduced muscle coordination, blindness, deafness, seizures, muscle weakness and an inability to speak (TEACH p2 and 4). Studies from the Faroe Islands reported subtle cognitive disabilities including, impaired performance on attention, language and memory tests, associated with levels of methyl mercury that were previously thought to be safe (Grandjean et al 1997 in FDA p3).

Children and adults exposed to high levels of methylmercury can also develop a disorder called *acrodynia* or *pink disease* (TEACH p4). Symptoms of this disorder include leg cramps, irritability, redness, peeling of hands and skin, nose and soles of feet, fever, itching, sweating, salivating, rashes, sleeplessness, weakness and neurological tics (TEACH). Pink disease is another name for mercury poisoning and the symptoms are consistent with autism spectrum disorders (American Psychiatric Assoc in PHAC 2002 p3).

Mercury Toxicity and Autism

Some epidemiological studies have also linked ethylmercury exposure with autism and other neurological disorders in children (TEACH p4; PHAC 2002 p3). However, due to variations in methodology the results from different studies have been inconsistent.

Evidence is also available that demonstrates autism is a common disorder in vaccinated children but a rare disorder in unvaccinated children (Vaccine Injury). This evidence is consistent with the fact, that neurodevelopmental disorders such as autism have similar symptoms to those of mercury poisoning (Coulter 1990; Kirby 2005 p73; PHAC 2002 p3; US Congressional Record).

Autism is characterised by impaired social interaction and communication, repetitive and stereotypic behaviours, interests and activities (PHAC 2002 p3). Symptoms generally appear at 18 to 30 months of age and range from mild to severe resulting in the term Autism Spectrum Disorders (ASD) (PHAC 2002 p3). Causes that have been implicated in this disorder are genetics, exposure to heavy metals such as lead and mercury, nutritional deficiencies and metabolic disease. One theory is that a genetic pre-disposition to metallothionein protein dysfunction could cause autism in children after exposure to heavy metals (PHAC 2002 p3). Some children have a genetic problem with expelling mercury from the body and these predisposed children are more at risk of permanent neurological damage particularly when exposed to the live-virus MMR vaccine at eighteen months of age (Kirby 2005). This genetic predisposition appears to be four times more common in boys than girls (El-Dahr in 2001 in Kirby 2005 p143) This correlates with the statistics on autism, Attention Deficit Disorder (ADD), tics, speech delay and most other neurological disorders, which are also higher in boys compared to girls in the same ratio (American Psychiatric Association 1994 in PHAC 2002). The sulfur-based protein metallothionein (MT) which performs many key functions in the human body is dysfunctional or depleted in autistic children.

The History of Mercury as a Preservative in Vaccines

In 1982, the FDA Register stated *mercury compounds used in medicinal products should be classified as 'not generally recognized as safe and effective'* (Burton 2003). At this time, the FDA independent panel also described mercury as an unreliable preservative. It was described as more bacteriostatic than bactericidal – it slowed the growth of new bacteria but did not kill them altogether. In fact, it was found to be more deadly to healthy cells than it was to harmful bacteria e.g. 35.3 times more toxic for embryonic heart tissue than for *Staphylococcus aureus* (FDA 1982 in Kirby 2005 p83).

Studies indicated that thimerosal was one of the most toxic and highly allergenic of twenty or more mercury compounds that the panel examined (FDA 1982 in Kirby 2005). Whilst the FDA knew in 1982 of mercury's potential to cause cell damage and delayed allergenic responses, it did not use caution by insisting that it was removed from vaccines (Burton 2003). Instead the FDA called for the removal of all mercury-based preservatives, including thimerosal from over-the-counter topical products, such as eardrops, eyedrops, nasal sprays and mercurochrome but it did not call for its removal from vaccines that are injected into the tissues of infants. It wasn't required to be removed from vaccines until 1998 after parents began investigating the ingredients of vaccines. Many parents were associating the escalation of chronic illness in children during the 1990's with the increase in the number of vaccines being used and the increase in the vaccination rates in children (Bernard et al 2001 in FDA p3; Burton 2003). In particular the reported cases of autism increased dramatically in the 1990's (10 to 17 percent per year) and the exposure of infants to ethylmercury increased threefold (Burton 2003).

It was estimated that children in the 1990's were receiving many times more than the daily limit of mercury because of the addition of many new thimerosal-containing vaccines (FDA p1). When Hepatitis B and Haemophilus Influenza Type B vaccines were added to the schedule in the early 1990's the cumulative levels of ethylmercury that children were exposed to increased almost 3 fold (Burton 2003). Parents informed Congress of these concerns in 1997 and the FDA was mandated to evaluate the human exposure to mercury that children were receiving (Burton 2003). Due to the variations in safety standards that existed between agencies the National Academy of Sciences was asked by Congress to provide a recommendation for a justifiable level of mercury for protecting human health (FDA p3). It was agreed that the EPA's guide of 0.1 microgram/kg/day was considered scientifically justifiable (Burton 2003; FDA p3). Consequently the FDA discovered that the amount of ethyl mercury that infants were exposed to in the first 6 months of life through mandatory vaccinations was higher than the recommended standard for organomercury compounds (Burton 2003).

A 'safe' cumulative level of mercury in infants depends upon the standard that is used and the size of the infant (Gilbert 2004; Halsey 1999). Halsey (1999) observed that using the EPA guideline of 0.1 microgram/kg/day 'many children at 2 months of age received almost 90 times the daily limit in a single doctor's visit. And the smallest

babies were given approximately eight months worth of daily exposures (240 times the daily limit) in a single day' (Halsey 1999 in Kirby 2005 p81). Halsey (1999) the Director of Vaccine Safety in America, is quoted as saying in an American Academy of Pediatrics (AAP) committee report 'doctors should be told soon about the amount of mercury in vaccines and the conflict with a federal health guideline' (Halsey 1999 (57 and 59) in Kirby D 2005 p70). Halsey N, (1999) also stated 'no-one knows what dose of mercury, if any is safe, and we can claim there is no evidence of harm but the truth is no-one has looked' (Kirby 2005 p71).

After parents and researchers highlighted the correlation between vaccines and increased neurodevelopmental disorders in children the FDA reviewed the list of regulated products containing mercury that were listed under the *FDA Modernization Act of 1997.* The review was conducted in 1999 and concluded that 'there was no evidence of harm from the use of thimerosal as a vaccine preservative, other than local hypersensitivity reactions (Bell et al 2001 in FDA p4). The FDA stated that as a precaution vaccines would be reformulated without thimerosal. In 2001 the Institute of Medicine (IOM) stated that an association between mercury exposure and neurodevelopmental disorders including autism, attention deficit hyper-activity disorder (ADHD) and speech or language delay was biologically plausible (FDA p3). However it was considered that further studies were needed to prove a causal link. After assessing further epidemiological studies, the IOM in 2004 rejected a causal relationship between thiomersal containing vaccines and neurodevelopmental disorders (FDA p3). Many of the epidemiological studies conducted or funded by the CDC have been claimed to be of poor design, under-powered and fatally flawed (Burton 2003).

The statement made by the Institute of Medicine (IOM) Immunisation Safety Review Committee in 2004 made the following conclusion:

> The body of evidence favoured rejection of a causal relationship between thimerosal-containing vaccines and autism and that the hypothesis generated to date, concerning the biological mechanism for such causality, are theoretical only. The committee also stated that the benefits of vaccination are proven and the hypothesis of susceptible populations is presently speculative and that widespread rejection of vaccines would lead to increases in incidences of serious infectious diseases (FDA p3).

It is claimed by the FDA that 'there is only a theoretical potential of toxicity from trace amounts of thimerosal in vaccines' (IOM, FDA, NCIRS THIM). This is a value judgment made without definitive knowledge of a safe level of mercury in children or adults. Mercury is classified as a neurotoxin and exposure to organic mercury is known to target the nervous system resulting in a disease similar to autism (TEACH p4; PHAC 2002 p3). Whilst the FDA considered that it was unethical to determine a safety profile of ethyl mercury in infants it did not consider it unethical to use ethyl mercury in vaccines for many years without knowing what level was harmful to an infant.

The FDA has used ethylmercury in vaccines for many years and it has been detected in the blood, urine, and faeces of vaccinated infants (PHAC 2002; Kirby 2005). These infants present a good opportunity to study the effects of different levels of mercury in children but the FDA has not used this opportunity to systematically study the health outcomes of ethyl mercury after 60 years of using thimerosal-containing vaccines. In 1999 the US Federal health officials conceded that the amount of thimerosal in vaccines exceeded 2 safety thresholds (Burton 2003). They also conceded that the amount of mercury in one dose of DTaP or Hepatitis B vaccines (25 micrograms each) was many times above the threshold set by the EPA (Burton 2003). Whilst there is inadequate research on the neurotoxicity and nephrotoxicity of ethyl mercury in infants, there is a large body of evidence indicating the dangers to health of ethyl mercury in animals and humans. Yet the FDA did not consider it unethical to use this preservative in numerous vaccines for children when it did not have empirical evidence of its safety.

Appendix 3

The Australian Government's Recommended Schedule of Vaccines

This information is referenced from the Australian Government's Immunise Australia Program (IAP) website 2013, Frequently asked questions related to payments and immunisation http://immunise.health.gov.au/internet/immunise/publishing.nsf/Content/faq-related-payments#immunised (accessed July 2013).

Definition of 'fully immunised' for the Family Tax Benefit Part A Supplement From 1 July 2012

Age	Disease immunised against
2 months	Diphtheria Tetanus Pertussis Polio Hib Hepatitis B
4 months	Diphtheria Tetanus Pertussis Polio Hib Hepatitis B
6 months	Diphtheria Tetanus Pertussis Polio Hib Hepatitis B (or at 12 months)
12 months	Measles Mumps Rubella Hib Hepatitis B (or at 6 months)
4 years	Diphtheria Tetanus Pertussis Polio Measles

	Mumps Rubella

Definition of 'fully immunised' for the Family Tax Benefit Part A Supplement From 1 July 2013

Age	Disease immunised against
2 months	Diphtheria Tetanus Pertussis Polio Hib Hepatitis B Pneumococcal
4 months	Diphtheria Tetanus Pertussis Polio Hib Hepatitis B Pneumococcal
6 months	Diphtheria Tetanus Pertussis Polio Hib Hepatitis B (or at 12 months) Pneumococcal
12 months	Measles Mumps Rubella Hib Hepatitis B (or at 6 months) Meningococcal C
18 months	Measles Mumps Rubella Varicella Pneumococcal*
4 years	Diphtheria Tetanus Pertussis Polio

Vaccines for Occupational Groups

Reference: The Australian Immunisation Handbook 10th Edition. 2013. Australian Technical Advisory Group on Immunisation (ATAGI).

Table 3.3.7 Recommended vaccinations for persons at increased risk of certain occupationally acquired vaccine-preventable diseases

Occupation	Vaccine
Healthcare workers (Hcw)	
All HCW Includes all workers and students directly involved in patient care or the handling of human tissues	Hepatitis B Influenza MMR (if non-immune)‡ Pertussis (dTpa) Varicella (if non-immune)
HCW who work in remote Indigenous communities or with Indigenous children in NT, Qld, SA and WA, and other specified healthcare workers in some jurisdictions	Vaccines listed for 'All HCW', plus hepatitis A
HCW who may be at high risk of exposure to drug-resistant cases of tuberculosis (dependent on state or territory guidelines)	Vaccines listed for 'All HCW', plus consider BCG
Persons who work with children	
All persons working with children, including: • staff and students working in early childhood education and care • correctional staff working where infants/children cohabitate with mothers • school teachers (including student teachers) • outside school hours carers • child counselling services workers • youth services workers	Influenza MMR (if non-immune)‡ Pertussis (dTpa) Varicella (if non-immune)
Staff working in early childhood education and care	Vaccines listed for 'Persons who work with children', plus hepatitis A
Carers	

Occupation	Vaccine
Carers of persons with developmental disabilities[§]	Hepatitis A Hepatitis B Influenza
Staff of nursing homes and long-term care facilities for persons of any age[§]	Influenza MMR (if non-immune)[‡] Varicella (if non-immune)
Providers of home care to persons at risk of high influenza morbidity	Influenza
Emergency and essential service workers	
Police and emergency workers	Hepatitis B Influenza Tetanus (dT or dTpa)
Armed forces personnel	Hepatitis B Influenza MMR (if non-immune)[‡] Tetanus (dT or dTpa) Other vaccines relevant to deployment
Staff of correctional facilities	Hepatitis B Influenza MMR (if non-immune)[‡] Tetanus (dT or dTpa)
Staff of detention and immigration centres	Hepatitis B Influenza MMR (if non-immune)[‡] Tetanus (dT or dTpa)
Laboratory personnel	
Laboratory personnel handling veterinary specimens or working with Q fever organism (*Coxiella burnetii*)	Q fever
Laboratory personnel handling either bat tissues or lyssaviruses (including rabies virus and Australian bat lyssavirus)	Rabies
Laboratory personnel routinely working with these organisms: *Bacillus anthracis* Vaccinia poxviruses Poliomyelitis virus *Salmonella enterica* subspecies *enterica* serovar Typhi (*S.* Typhi) Yellow fever virus *Neisseria meningitidis*	Anthrax Smallpox Poliomyelitis (IPV) Typhoid Yellow fever Quadrivalent meningococcal conjugate vaccine

Occupation	Vaccine
Japanese encephalitis virus	(4vMenCV) Japanese encephalitis
Persons who work with specific communities	
Workers who live with, or make frequent visits to, remote Indigenous communities in NT, Qld, SA and WA	Hepatitis A
Workers assigned to the outer Torres Strait Islands for a total of 30 days or more during the wet season	Japanese encephalitis
Persons who work with animals	
Veterinarians, veterinary students, veterinary nurses[#]	Influenza Q fever Rabies
Agricultural college staff and students (aged >15 years) exposed to high-risk animals[#]	Q fever
Abattoir workers and contract workers in abattoirs (excluding pig abattoirs) Livestock transporters Sheep shearers and cattle, sheep and dairy farmers Those culling or processing kangaroos or camels Tanning and hide workers Goat farmers Livestock saleyard workers Those handling animal products of conception	Q fever
Wildlife and zoo workers who have contact with at-risk animals, including kangaroos and bandicoots	Q fever
Persons who come into regular contact with bats (both 'flying foxes' and microbats), bat handlers, bat scientists, wildlife officers, zoo curators	Rabies
Poultry workers and others handling poultry, including those who may be involved in culling during an outbreak of avian influenza, and swine industry workers	Influenza
Other persons exposed to human tissue, blood, body fluids or sewage	
Embalmers	Hepatitis B
Workers who perform skin penetration procedures (e.g. tattooists, body-piercers)	Hepatitis B
Funeral workers and other workers who have regular contact with human tissue, blood or body fluids and/or used needles or syringes	Hepatitis B
Plumbers or other workers in regular contact with untreated sewage	Hepatitis A Tetanus (dT or dTpa)

Australian Government
Department of Health

National Immunisation Program Schedule

From 20 April 2015

Child programs	
Age	**Vaccine**
Birth	• Hepatitis B (hepB) [a]
2 months	• Hepatitis B, diphtheria, tetanus, acellular pertussis (whooping cough), *Haemophilus influenzae* type b, inactivated poliomyelitis (polio) (hepB-DTPa-Hib-IPV) • Pneumococcal conjugate (13vPCV) • Rotavirus
4 months	• Hepatitis B, diphtheria, tetanus, acellular pertussis (whooping cough), *Haemophilus influenzae* type b, inactivated poliomyelitis (polio) (hepB-DTPa-Hib-IPV) • Pneumococcal conjugate (13vPCV) • Rotavirus
6 months	• Hepatitis B, diphtheria, tetanus, acellular pertussis (whooping cough), *Haemophilus influenzae* type b, inactivated poliomyelitis (polio) (hepB-DTPa-Hib-IPV) • Pneumococcal conjugate (13vPCV) • Rotavirus [b]
12 months	• *Haemophilus influenzae* type b and meningococcal C (Hib-MenC) • Measles, mumps and rubella (MMR)
18 months	• Measles, mumps, rubella and varicella (chickenpox) (MMRV)
4 years	• Diphtheria, tetanus, acellular pertussis (whooping cough) and inactivated poliomyelitis (polio) (DTPa-IPV) • Measles, mumps and rubella (MMR) (to be given only if MMRV vaccine was not given at 18 months)
School programs	
10–15 years (contact your State or Territory Health Department for details)	• Varicella (chickenpox) [c] • Human papillomavirus (HPV) [d] • Diphtheria, tetanus and acellular pertussis (whooping cough) (dTpa)
At-risk groups	
Aboriginal and Torres Strait Islanders	
12–18 months (in high risk areas)[e]	• Pneumococcal conjugate (13vPCV)
12–24 months (in high risk areas)[f]	• Hepatitis A
6 months to less than 5 years	• Influenza (flu)
15 years and over	• Influenza (flu) • Pneumococcal polysaccharide (23vPPV) (medically at risk)
50 years and over	• Pneumococcal polysaccharide (23vPPV)
Other at-risk groups	
6 months and over (people with medical conditions placing them at risk of serious complications of influenza)	• Influenza (flu)
12 months (medically at risk)[e]	• Pneumococcal conjugate (13vPCV)
4 years (medically at risk)[e]	• Pneumococcal polysaccharide (23vPPV)
Pregnant women (at any stage of pregnancy)	• Influenza (flu)
65 years and over	• Influenza (flu) • Pneumococcal polysaccharide (23vPPV)

* Please refer to reverse for footnotes

IMMUNISATION

Footnotes to the National Immunisation Program (NIP) Schedule

a. Hepatitis B vaccine: should be given to all infants as soon as practicable after birth. The greatest benefit is if given within 24 hours, and must be given within 7 days.
b. Rotavirus vaccine: third dose of vaccine is dependent on vaccine brand used. Contact your State or Territory Health Department for details.
c. Varicella vaccine: contact your State or Territory Health Department for details on the school grade eligible for vaccination.
d. HPV vaccine: is for all adolescents aged between 12 and 13 years. Contact your State or Territory Health Department for details on the school grade eligible for vaccination.
e. Pneumococcal vaccine:
    i. Medically at risk children require a fourth dose of 13vPCV at 12 months of age and a booster dose of 23vPPV at 4 years of age.
    ii. Aboriginal and Torres Strait Islander children require a fourth dose of pneumococcal vaccine (13vPCV) at 12-18 months of age for children living in high risk areas (Queensland, Northern Territory, Western Australia and South Australia). Contact your State or Territory Health Department for details.
f. Hepatitis A vaccine: two doses of Hepatitis A vaccine for Aboriginal and Torres Strait Islander children living in high risk areas (Queensland, Northern Territory, Western Australia and South Australia). Contact your State or Territory Health Department for details.

Further information

Further information and immunisation resources are available from the Immunise Australia Program website at **www.immunise.health.gov.au** or by contacting the infoline on **1800 671 811**.

You should contact your State or Territory Health Department for further information on the program specific to your State or Territory:

State/Territory	Contact Number
Australian Capital Territory	(02) 6205 2300
New South Wales	1300 066 055
Northern Territory	(08) 8922 8044
Queensland	13 HEALTH (13 4325 84)
South Australia	1300 232 272
Tasmania	1800 671 738
Victoria	1300 882 008
Western Australia	(08) 9321 1312

IMMUNISE AUSTRALIA PROGRAM

A joint Australian, State and Territory Government initiative

www.immunise.health.gov.au

All information in this publication is correct as at June 2015

11178 June 2015

Appendix 4

Governance of the National Immunisation Program (NIP)

This information is referenced from the Australian Government's Immunise Australia Program (IAP) website 2014.

An overview of the main committees and advisory boards involved in designing Australia's vaccination policies is provided here. Further details of their roles and the stakeholder composition of some of these boards are provided in chapter 6. The National Immunisation Committee (NIC) is the body that is responsible for the development, implementation and delivery of the Immunise Australia Program (IAP). This body reports to the Australian Health Protection Committee (AHPC) within the Communicable Diseases Network Australia (CDNA).

Members of the NIC include:

- National, state and territory government agencies;
- Australian General Practice Network (AGPN);
- Australian Medical Association (AMA);
- Consumer Health Forum (CHF);
- National Centre for Immunisation Research and Surveillance (NCIRS);
- Royal Australian College of General Practitioners (RACGP);
- Rural Doctors Association of Australia (RDAA)
- National Indigenous Immunisation Coordinator (NIIC)

The Australian Technical Advisory Group on Immunisation (ATAGI) works within the NIC and provides advice to the Minister for Health and Ageing. In addition to technical experts on the ATAGI committee, membership includes a consumer, a nurse and general practitioners. The Terms of Reference of ATAGI as stated on the government website are to (AG IAP 2012):

- 'provide technical advice to the Minister for Health and Ageing on the medical administration of vaccines available in Australia, including those on the National Immunisation Program;

- through the department provide advice to research funding bodies regarding the status of current immunisation research and areas where additional research is required.
- advise the Pharmaceutical Benefits Advisory Committee on matters relating to the ongoing strength of evidence pertaining to existing, new and emerging vaccines in relation to their effectiveness and use in Australian populations;
- produce the Australian Immunisation Handbook for the approval of the National Health and Medical Research Council;
- consult with the National Immunisation Committee (NIC) on the content and format of the Australian Immunisation Handbook and implementation strategies; and
- consult with the Communicable Diseases Network Australia (CDNA), the Australian Drug Evaluation Committee (ADEC) and the Adverse Drug Reactions Advisory Committee (ADRAC) on matters relating to the implementation of immunisation policies, procedures and vaccine safety.'

The Population Health Division, within the Department of Health and Ageing, is responsible for the development, implementation and evaluation of national immunisation policies and programs. There are several bodies within this division that are involved with implementing and managing the policy.

The Therapeutic Goods Administration (TGA)

The Therapeutic Goods Administration is the Australian regulator of vaccines and is responsible for both approving medicines/vaccines for the Australian market and monitoring their safety in the population. The board is operated on a cost-recovery system that requires the manufacturers of the products to provide 100% of the funding for the regulatory functions that it performs. A more detailed description of the role of this government organisation is described in chapter 7.

The Pharmaceutical Benefits Advisory Committee (PBAC)

This board has the responsibility of evaluating the cost-effectiveness of vaccines to determine whether they should be funded under the NIP. This is a legislated process and the government cannot recommend a vaccine unless this board agrees that it is cost-effective to the community. The cost-effectiveness of vaccines is determined by examining the evidence of the benefit of the vaccine from large clinical trials. This can then be used to estimate the cost of saving one quality-adjusted life year (QALY) which translates to the number of doses that need to be given at the vaccine cost to gain one extra year of full quality life (McIntyre 2012).

Commencing 1 July 2009 the essential vaccines for the State and Territory Governments were being purchased directly by the Commonwealth under the National Immunisation Program. These arrangements are described in the document titled *National Partnership Agreement on Essential Vaccines*. Nolan concludes that Australian vaccination policy development is founded on 'high-quality scientific foundations embedded in a national health funding model founded on equity and access for all' (Nolan 2010 A82).

Appendix 5

Comment on the Hawke, Lea and Berryman Paper

Answering human papillomavirus concerns; a matter of science and time

In June 2013 the journal *Infectious Agents and Cancer* published two papers that made opposing conclusions about the safety and efficacy of HPV vaccines. These papers were titled 'Answering human papillomavirus concerns; a matter of science and time' (Hawkes, Lea and Berryman 2013) and 'HPV vaccines have not been demonstrated to be cost-effective in countries with comprehensive Pap screening and surgery' (Wilyman 2013). Whilst the first paper claimed HPV vaccines have been demonstrated to be safe and effective in preventing cervical cancer the second paper claimed that HPV vaccines have not been demonstrated to be safe and effective in preventing cervical cancer. It is necessary to investigate the type of evidence being used in both papers to see how the different conclusions have been drawn.

Below is a critique of the evidence provided by Hawkes et al to illustrate how claims about the safety and efficacy of HPV vaccines can be made on a lack of scientific evidence.

1. HPV vaccines have not been tested for efficacy in preventing cervical cancer. HPV vaccines have been tested for efficacy by investigating the effect of the vaccine in preventing pre-cancerous lesions (CIN 2 and 3) in young women 15-26 years old. The authors of this paper state 'this is a good predictor of cervical cancer risk' yet they have not provided evidence that pre-cancerous lesions in this age-group are a good predictor of the risk of cervical cancer later in life. It is known that the majority of pre-cancerous lesions in this age-group clear naturally and never progress to cancer later in life so this end-point is inadequate for predicting the efficacy of this vaccine in preventing cervical cancer.
2. The authors also inform the reader that 'HPV infection rates' are a good predictor of cervical cancer'. Yet the majority of women with high-grade HPV infections in developed countries are not at risk of cervical cancer because an HPV infection on its own does not cause cervical cancer. Co-factors are required for an HPV infection to progress to cervical cancer and these co-factors are not prevalent in developed countries such as Australia, UK, and the US. In other

words, an HPV infection on its own is not the only factor needed for the development of cervical cancer.

3. The data in Table 1 of the Hawkes et al paper is incorrectly labelled as data from 'Phase III Trials'. This table contains data from phase 1, 2 and 3 trials. The only data collected from phase III trials for Gardasil (quadrivalent) vaccine was the Future II study conducted from 2003-2007. This study was the first trial of the efficacy of Gardasil vaccine in preventing pre-cancerous lesions in 15-26 year old women.

   This fact needs to be clarified by the authors because this 4 year study was the only trial for the efficacy of this vaccine in the prevention of cervical cancer. As it is known that the majority of pre-cancerous lesions in this age-group (15-26 years) will never lead to cervical cancer then this end-point cannot be considered a good predictor of the efficacy of the vaccine in preventing cervical cancer.
4. The authors incorrectly suggest that there is conclusive evidence of cross-protection against the other 13+ HPV types that are not covered in the vaccine but are associated with cancer development. Scientists do not agree that HPV vaccines will protect against other high-grade HPV strains that are not included in the vaccine.
5. The authors claim 'CIN 2/3 are pathological signs of an HPV infection'. This is misleading because these lesions (CIN 2/3) associated with an HPV infection do not produce disease symptoms and may never progress to disease. An HPV infection does not produce disease on its own – co-factors are required. This point is not clarified in the paper.
6. Hawkes et al state "HPV vaccination reduces CIN lesion incidence" (p.7).
   This needs to be qualified because the ability of the vaccine to reduce lesions depends upon an individual receiving all 3 doses of the vaccine and being naive for HPV 16/18. The correct statement is "HPV vaccine may reduce CIN lesions if specific criteria are met". If these criteria are not met then efficacy is variable and unknown in different populations.

   In addition, reducing CIN in the majority of women in developed countries where the risk factors for pathogenesis are not common is not reducing the burden of disease (either warts or cancer) because HPV infection (and CIN 2/3) in most women does not progress to disease. This needs to be clarified by Hawkes et al.

7. Hawkes et al incorrectly stated that "Overall HPV can be associated with 99.7% of cervical cancers and can be considered as a necessary cause of cancer".
   This figure comes from a small study of 1,000 tumours (Bosch et al 1995) which were re-analysed using different assay techniques by Walboomers et al in 1999. The figure cannot be extrapolated to 'all cancers worldwide'.
   In addition, HPV infection is considered a necessary cause of 'most' cervical cancer but not all cervical cancer. Some scientists claim 5-10% of cervical cancer does not contain HPV infection (Haverkos 2005; Schiffman 2002).
8. Hawkes et al state that 'the safety of the ingredients has been well established' yet they have not provided definitive evidence to support this claim. The authors have provided only a single reference for this claim and they have ignored all the adverse events and deaths that have been documented as linked to this vaccine by VAERS. Slade et al (2009) indicate that these cases cannot be properly reviewed because the vaccine manufacturers did not collect enough medical information to allow a review of the reported cases and therefore the VAERS database cannot establish causal links with the vaccine.
   In addition, Slade et al agree that a passive post-vaccination surveillance system is inadequate for determining causal events and their frequency in the population. Hawkes et al have also not discussed the evidence produced by Tomljenovic et al, Harper, Haug, Slade et al and others that questions the safety of this vaccine.
9. Hawkes et al have made the following claim 'there was no increase in relative risk (RR) of experiencing an autoimmune event compared with a control group that containing nonadjuvanted, or aluminium-/aluminium hydroxide-adjuvanted vaccines (RR 0.98, confidence intervals 0.8, 1.21).' [sic] (p.7)
   The authors do not clearly state whether the vaccinated group was compared to a 'non-adjuvanated' group or an 'adjuvanated' group – it refers to both and gives no clear discussion or evidence. Table 2 indicates that Cervarix was compared to the Hepatitis A vaccine and the AS04 adjuvant and not an inactive placebo.
   There is no evidence provided that systemic adverse events were compared to an unvaccinated group with a true inert placebo. The discussion is not clear and it mixes data for Gardasil with data for Cervarix.

10. Hawke et al state ‘However when systemic adverse events were examined there was no difference between vaccine and placebo’ (p.7).
    The authors do not explain that a true inert placebo was not used in the clinical trials to obtain this data. This data was obtained for Gardasil using the aluminium adjuvant that was present in the vaccine. This adjuvant has been linked to causing autoimmune diseases and it is not a suitable inert placebo for establishing the safety of the vaccine. It is important to clearly describe the placebo that was used for each vaccine and to clarify the reactions that occurred in a transparent manner.
11. The paper describes the inadequacies of the passive monitoring system with an example of the significant disparity between the number of adverse events (AE’s) reported in the US compared to Australia (p.8) yet the authors conclude: ‘The benefits of HPV vaccines far outweigh the risk and the mechanisms are in place to continue monitoring possible adverse events into the future.’
    The claim that ‘the benefits of HPV vaccines far outweigh the risks’ is unsubstantiated and adequate mechanisms for monitoring adverse events into the future are not in place.
12. The conclusions drawn by Hawkes et al (2013) and quoted below have not been sustained or discussed with evidence in this paper:
    ‘This review describes studies that have demonstrated the safety of vaccines and answered the very specific concerns raised particularly in regards to nervous system reactions, interactions with other vaccines and HPV vaccine influencing the course of existing lesions.’ [sic].

    .

Appendix 6

Frequently Asked Questions about Immunisation

This information is referenced from the Australian Government's Immunise Australia Program (IAP) Website 2014:

What is immunisation?

Immunisation protects people against harmful infections before they come into contact with them in the community. Immunisation uses the body's natural defence mechanism - the immune response - to build resistance to specific infections. Immunisation helps people stay healthy by preventing serious infections.

What's the difference between immunisation and vaccination?

- *Vaccination* means having a vaccine - that is actually getting the injection.
- *Immunisation* means both receiving a vaccine and becoming immune to a disease, as a result of being vaccinated.

Most people use the terms 'vaccination' and 'immunisation' interchangeably but their meanings are not exactly the same.

The term 'immunisation' is used in this website, as it's most commonly used in the community.

How does immunisation work?

All forms of immunisation work in the same way.

When a person is vaccinated, their body produces an immune response in the same way their body would after exposure to a disease, but without the person suffering symptoms of the disease. When a person comes in contact with that disease in the future, their immune system will respond fast enough to prevent the person developing the disease.

What is in vaccines?

Vaccines contain either:

- a very small dose of a live, but weakened form of a virus;
- a very small dose of killed bacteria or virus or small parts of bacteria; or
- a small dose of a modified toxin produced by bacteria.

Vaccines may also contain either a small amount of preservative or a small amount of an antibiotic to preserve the vaccine.

Some vaccines may also contain a small amount of an aluminium salt which helps produce a better immune response.

What childhood vaccines contain thiomersal?

Thiomersal is a compound used in small amounts to prevent bacterial and fungal contamination of vaccines. Thiomersal is partly composed of mercury in the form of ethylmercury. Mercury causes a toxic effect after it reaches a certain level in the body. Whether or not it reaches a toxic level depends on the amount of mercury consumed and the person's body weight. As a result of these concerns, in particular for newborn babies and very young children, thiomersal was removed or reduced from vaccines.

Currently, all vaccines on the National Immunisation Program for children under 5 years of age are now either thiomersal free or have only trace amounts of thiomersal.

It is not possible to completely remove thiomersal from all vaccines, some vaccines like Energix-B are still most effectively manufactured using a trace amount of thiomersal as a preservative.

How long do immunisations take to work?

In general, the normal immune response takes approximately two weeks to work. This means protection from an infection will not occur immediately after immunisation.

Most immunisations need to be given several times to build long lasting protection. For example, a child who has been given only one or two doses of diphtheria-tetanus-pertussis vaccine (DTPa) is only partially protected against diphtheria, whooping cough (pertussis) and tetanus, and may become sick if exposed to these diseases. However, some vaccines give protection after only one dose.

How long do immunisations last?

The protective effect of immunisations is not always for a lifetime. Some can last up to 30 years. Due to frequent changes to the influenza virus, annual influenza vaccination is needed to provide protection against the most recent virus.

Is everyone protected from disease by immunisation?

Even when all the doses of a vaccine have been given, not everyone is protected against the disease.

Measles, mumps, rubella, tetanus, polio and Hib vaccines protect more than 95% of children who have completed the course. One dose of meningococcal C vaccine at 12 months protects over 90% of children. Three doses of whooping cough (pertussis) vaccine protects about 85% of children who have been immunised, and will reduce the severity of the disease in the other 15% if they do catch whooping cough.

The protection levels provided by vaccines differ. For example, if 100 children are vaccinated with MMR, 5-10 of the fully immunised children might still catch measles, mumps or rubella (although the disease will often be milder in immunised children). However, if you do not immunise 100 children with MMR vaccine, and the children are exposed to measles, most of them will catch the disease with a high risk of complications like lung infection (pneumonia) or inflammation of the brain

(encephalitis).
Booster doses are needed because immunity decreases over time.

Why do children get so many immunisations?

A number of immunisations are required in the first few years of a child's life to protect the child against the most serious infections of childhood. The immune system in young children does not work as well as the immune system in older children and adults, because it is still immature. Therefore more doses of vaccine are needed.

In the first months of life, a baby is protected from most infectious diseases by antibodies from her or his mother, which are transferred to the baby during pregnancy. When these antibodies wear off, the baby is at risk of serious infections and so the first immunisations are given before these antibodies have gone.

Another reason why children get many immunisations is that new vaccines against serious infections continue to be developed. The number of injections is reduced by the use of combination vaccines, where several vaccines are combined into one shot.

Why should children be immunised?

There are two reasons for immunising every child in Australia:

1. Immunisation is the safest and most effective way of giving protection against the disease. After immunisation, your child is far less likely to catch the disease if there are cases in the community. The benefit of protection against the disease far outweighs the very small risks of immunisation.
2. If enough people in the community are immunised, the infection can no longer be spread from person to person and the disease dies out altogether. This is how smallpox was eliminated from the world and polio has disappeared from many countries.

Where can I find more information on childhood immunisation?

Parents and guardians are able to find information on routine childhood immunisation in the Understanding Childhood Immunisation booklet. This is a detailed booklet which informs parents and guardians on why child/ren should be immunised against vaccine preventable diseases, common side effects of immunisation, how long immunisations last, vaccines their child/ten require at specific ages including the diseases they prevent and frequently asked questions. A handy quick guide to understanding childhood immunisation is also available.

Should parents be immunised?

Parents and other people (including grandparents, carers, etc) who come into contact with young children are commonly carriers of some childhood infections and should be vaccinated against these diseases. For example, several studies of infant pertussis (whooping cough) cases have indicated that family members, and parents in particular, were identified as the source of infection in more than 50% of cases. For more information on immunisations against childhood diseases, visit your local doctor or immunisation provider.

Are there any reasons to delay immunisation?

There are very few medical reasons to delay immunisation. If a child is sick with a high temperature (over 38ºC) then immunisation should be postponed until the child is recovering. A child who has a runny nose, but is not ill can be immunised, as can a child who is on antibiotics and obviously recovering from an illness.

What are the side-effects of immunisation?

Many children experience minor side effects following immunisation. Most side effects last a short time and the child recovers without any problems. Common side-effects of immunisation are redness, soreness and swelling at the site of an injection, mild fever and being grizzly or unsettled. You should give extra fluids to drink, not overdress the baby if hot and may consider using paracetamol to help ease the fever and soreness.

Serious reactions to immunisation are very rare, however if they do occur consult your doctor immediately. It is important to remember that vaccines are many times safer than

the diseases they prevent.

What about natural immunity?

Natural immunity and vaccine-induced immunity are both natural responses of the body's immune system. The body's immune response in both circumstances is the same. In some cases, vaccine-induced immunity may diminish with time; natural immunity, acquired by catching the disease is usually life-long. The problem is that the wild or natural disease has a high risk of serious illness and occasionally death. Children or adults can be re-immunised (required with some vaccines but not all) if their immunity falls to a low level. It is important to remember that vaccines are many times safer than the diseases they prevent.

Can immunisation overload the immune system?

No. Children and adults come into contact with many antigens (substances that provoke a reaction from the immune system) each day, and the immune system responds to each antigen in specific ways to protect the body. Without a vaccine, a child can only become immune to a disease by being exposed to infection, with the risk of severe illness. If illness occurs after vaccination, it is usually insignificant.

Why is immunisation still necessary in this day and age?

Many diseases prevented by immunisation are spread directly from person to person, so good food, water and hygiene do not stop infection. Despite excellent hospital care, significant illness, disability and death can still be caused by diseases which can be prevented by immunisation.

What does the Australian Government do for immunisation?

A number of Australian Government initiatives in the past decade have led to the immunisation success story. They include funding immunisation-related financial incentives for parents and providers and the National Childhood Immunisation Register. The Government also funds state and territory governments to purchase vaccines.

The National Immunisation Program (NIP) Schedule lists the diseases for which immunisation is available and the ages at which doses should be given for those currently funded under the National Immunisation Program.

Although vaccines are provided free under the National Immunisation Program for the ages outlined in the Schedule, a GP consultation fee may be charged for the immunisation visit.

Where can I find information about travel vaccinations?

Some health problems associated with international travel are vaccine preventable. Travellers should consult a travel medical centre, or their local doctor, at least 6 - 12 weeks before departure, for a check-up and to discuss required and recommended vaccinations for specific regions.

The websites below provide information about vaccinations and tips for staying healthy while overseas:

- Travel Clinics Australia (Travel Clinic Australia)
- Smartraveller (Department of Foreign Affairs and Trade);
- International travel and health (World Health Organization)
- Travelers' health (US Center for Disease Control & Prevention).

How do I get a copy of my child's vaccination history?

Records are kept by the Australian Childhood Immunisation Register (ACIR) which is run by Medicare Australia.

ACIR was established in 1996 and is a national register administered by Medicare Australia that records details of vaccinations given to children under seven years of age who live in Australia. You can obtain a record of your child's immunisation history from ACIR through the Medicare Australia website. You will need to register for online services at the following link, and then you will be able to request a history statement.

Department of Human Services Website

Alternatively, you can call ACIR on 1800 653 809 and request a statement be sent to you.

If your child was born before 1989 you will need to get in contact with the general practice, health centre or immunisation provider your child attended for the first two years of their life. They will be able to provide you with a copy of their medical records, including all immunisations they have had.

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Prior to February 2014 the following Q & A was also provided by the Australian Government on the IAP website:

How safe are vaccines?

All vaccines currently available in Australia must pass stringent safety testing before being approved for use by the Therapeutic Goods Administration (TGA). This testing is required by law and is usually done over many years during the vaccine's development. In addition, the safety of vaccines is monitored once they are in use, by the Adverse Drug Reactions Advisory Committee (ADRAC) and other organisations.

Before vaccines are made available for use they are rigorously tested in thousands of people in progressively larger clinical trials. These trials are strictly monitored for safety. The approval process can take up to 10 years. As a result of such detailed testing, a number of vaccines that failed in these early tests have never been released.

Appendix 7

Timeline of Events in the Development of HPV Vaccination Policies

Date	Events
1989	Haruld zur Hausen discovered HPV-DNA in cervical cancer tumors. He found HPV 16 in ~50% of tumours and HPV 18 in ~20% of tumours (zur Hausen 2008). At this time it was believed that cervical cancer had a multifactorial etiology and it was not known whether HPV was a causal or a passenger virus in cervical epithelial tissue (Henderson 1989; Pfister 1990).
	IARC stated there is no clear evidence that HPV infection is causally related to cancer of the cervix (Munoz et al 1989; Pfister 1990 p248).
	CSL provided funding for Professor Ian Frazer and Dr. Jian Zhou to develop a drug at University of Queensland using new biotechnology that would prevent carcinogenic changes believed to result from HPV infections (Uniquest).
1990	Pfister stated that there are no strains of HPV that are able to induce cancer right away and fully on their own; co-factors are required.
1991	Frazer and Zhou successfully produced a recombinant virus-like particle (VLP) of the capsid protein L1 and L2 implicated in the cause of HPV pathogenesis. Uniquest patented this vaccine technology in 1991. The role of HPV in cervical cancer pathogenesis wasn't established until 1995.
1995	New hybridization techniques for identifying HPV DNA were described as being highly sensitive and specific and Bosch et al found HPV-DNA in 93% of their study of 1,000 tumours. These scientists claimed 'the association of genital human papillomavirus (HPV) with cervical cancer is strong, independent of other risk factors and consistent in several countries' (p796).
	The IARC stated HPV DNA is not predictive of cancer because 90% of HPV infections have no clinical consequences. This indicates they are not an independent cause of cervical cancer. Lifestyle and environmental factors have been known to be risk factors for cervical cancer for decades (Haverkos 2005) Carcinogenicity of HPV 16/18 is supported by experimental evidence that proteins of these viruses interfere with the functions of cellular regulatory pathways (IARC 1995). Prior to 1995 it was not known whether HPV 16 and 18 were the most common strains worldwide.

1995	The recombinant technology developed by Frazer and Zhou was licensed to CSL and sub-licensed to Merck & Co whilst still retaining the rights to market the technology in Australia and New Zealand (Uniquest; CSL Ltd). CSL received royalties and milestone payments in return for providing Merck with exclusive worldwide rights to market the vaccine (Williamson 2005).
1999	Walboomers et al (1999) re-analysed the Bosch et al (1995) results using different techniques and assumptions and found 99.7% of the 1,000 tumors had HPV DNA. Scientists declared human papillomavirus (HPV) was associated with *virtually* all cervical cancer tumors.
2002	Bosch et al (2002) claimed 'The causal role of HPV infections in cervical cancer has been documented beyond reasonable doubt' (p244). These scientists also stated that cervical cancer is a *rare* outcome from any strain of HPV infection.
2003	Clifford et al (2003) state there are at least 16 high-risk oncogenic HPV sub-types but ~70% of ICC is associated with HPV16/18. This figure is dependent upon the technology used to identify HPV in different studies. It was suggested that a multivalent vaccine could prevent the global burden of ICC. This was stated even though the Global Cancer Statistics for 2002 did not show a correlation between the incidence of HPV16/18 infections and a higher risk for cervical cancer (Parkin et al 2005).
	Phase 3 trials to test the HPV-16/-18 vaccine for efficacy in preventing high-grade CIN lesions (grade 2/3) in women 15-26 years of age were started. This surrogate for cervical cancer was chosen even though it was known that CIN 2/3 lesions in this age-group mostly (95%) clear naturally and never lead to cervical cancer (WHO 2008).
2005	CSL entered into a cross-licensing agreement with GaxoSmithKline, the pharmaceutical company producing the competitor HPV vaccine Cervarix (Uniquest)
	Merck, Sharp and Dohme Corporation (MSD) (a subsidiary of the company Merck and Co Inc that is based in the US) is a member of Medicines Australia (MSD). Merck & Co Inc established an external licensing system in Australia in 2005 and Gardasil was licensed in Australia in 2006 (MSD)
	Prof Ian Frazer: '90% of ICC occurs in the developing world' (Williamson

	2005).
	The World Health Organisation (WHO) established the global HPV laboratory network (LabNet) to standardize assay tests and laboratory procedures. Prior to 2005 a comparison between different studies of HPV subtypes was difficult because there was no global standardisation of assay performance or methodology for quality assurance (Eklund et al 2012).
2006	The US FDA supervised the safety and efficacy clinical trials for quadrivalent HPV vaccine and fast-tracked the vaccine for market approval. The HPV vaccine was approved in 2006 for *all* women 9-26 years of age even though the risk of cervical cancer is significantly higher in the developing world, indicating that there are clear risk factors that are necessary for cervical cancer development.
	Within 3 weeks of the US FDA approving the marketing of the vaccine the US CDC recommended the HPV vaccine for inclusion in the US National Schedule of Vaccines. The FDA monitors the post-vaccination surveillance program with the CDC – both of these government agencies have financial ties to the marketing of the vaccine and to Merck pharmaceutical company (Blaxill and Olmsted 2013).
	Promotional campaigns stated that 'cervical cancer is the second most common cancer in women worldwide' even though this statistic is not representative of the risk of cervical cancer in all countries.
	In 2006 the vaccine was still being trialled for efficacy against warts and pre-cursor lesions (O'Neill 2006). Frazer stated 'we are fairly optimistic that this vaccine will protect against HPV6 and 11 (warts) and if trials go well we are optimistic it will work against HPV16 and 18 (cervical cancer)' (O'Neill 2006).
	MSD claimed Gardasil was 100% successful in preventing pre-cursor lesions and non-invasive cervical cancers associated with HPV infection (MSD). Gardasil was licensed in Australia in 2006 (MSD).
	Ian Frazer was awarded 'Australian of the Year' in 2006 for creating a vaccine that had the potential to wipe out cervical cancer within a generation (NADC). Between 2006-2008, the US and Australian inventors of the vaccine - Frazer, Lowry and Schiller - were bestowed with prestigious awards for their role in

	developing VLP's (Blaxill and Olmsted 2013 p183). Frazer credited his partner Jian Zhou with suggesting the idea for the new capsid technology underpinning the development of HPV vaccines (AG, Dept. Innovation and Industry 2008).
2007	The marketing campaign for Gardasil began in Australia and the global campaign made US $1.5 billion for this year (Uniquest).
	The Phase 3 clinical trials determining the efficacy and safety of HPV vaccines in preventing high-grade CIN lesions (2 and 3) were published (Future II 2007). These trials concluded the vaccine *may* prevent some cervical cancer. Scientists stated the vaccine was 'expected' to reduce cervical cancer rates because HPV infects all sexually active women. This ignores the fact that the majority of HPV infections (90%) are asymptomatic and never progress to disease because environmental factors are also required. Consequently the majority of women receiving the vaccine are not at risk from cervical cancer.
2008	Haruld zur Hausen won the Nobel Prize for discovering HPV DNA in ICC. CSL's profits increased by 63% from the previous year. CSL received royalty payments of $161 million from international sales of Gardasil and $159 million from the Australian government's vaccination program.
2009	The US FDA approved Gardasil for use in males aged 9–26 years of age (CSL 2009). At this time it was approved for males for genital warts that are caused by HPV subtypes 6 and 11. Further data supporting the use of the vaccine against anal cancer and its pre-cursor anal intraepithelial neoplasia (AIN) was provided in 2012. Use of the vaccine was expanded to women 27-45 years of age (CSL Ltd) even though this demographic is most likely to have previous exposure to HPV16/18 and will not be protected by the vaccine.
	CSL was granted an extended patent for the vaccine that will be effective until 2026 (CSL Ltd).
2010	Gardasil vaccine has been a blockbuster success for Merck &Co making $6 billion from 2007-2010 (Blaxill and Olmsted 2013).
2012	HPV vaccines recommended for all boys (12-13 years) in Australia in subsidised school vaccination programs (AG IAP 2012).
2013	HPV vaccines recommended for boys in subsidised programs in the US (CDC 2013).

Appendix 8

The Limitations of the Bosch et al (1995) Study and the Re-Analysis by Walboomers et al (1999)

Whilst Bosch et al, (1995), claim their international study of 1000 tumors confirms the role of HPV's as the central etiological factor in cervical cancer worldwide, their evidence does not explain why there is a higher risk of cervical cancer in developing nations than developed nations. They claim that "HPV prevalence was remarkably homogonous among the countries' (Bosch et al 1995). These authors claim "our results confirm the role of genital HPV's as the central etiological factor in cervical cancer worldwide" (Bosch et al 1995 p796). This statement relies upon the detection methods used for HPV DNA and can only be made by ignoring the 5-10% of tumours that were known to be HPV negative in 1995. It should be noted that the primary researchers involved with the studies making this claim have links to pharmaceutical companies which make significant profits from vaccines (Bosch et al 1995; Walboomers 1999; Franco 1995; Munoz et al 2006).

The limitations of this study Bosch et al (1995) study include:

1. This study only included 10 of 18 regions for which cervical cancer incidence has been recorded
2. It did not include a representative number of Asian countries which have very high rates of cervical cancer
3. In each country the size of the study is limited and the cases cannot be claimed to be representative.
4. The results vary according to the method of detection used. For example, analysis of the 66 HPV-negative specimens using additional HPV detection methods (e.g. other primers) alters the number of negative tumors to fewer than 5%.
5. In the final analysis HPV-negative results were only accepted from specimens with adjacent, confirmed tumor tissue. 'This was to avoid false-negative results'. However, by doing this the researchers were missing some genuine HPV-negative results.

6. The researchers state that their prevalence estimate of 93% maybe slightly inflated because the only restrictions for HPV-positive specimens were diagnostic confirmation and PCR sufficiency.
7. Whilst it is stated that all HPV detection was carried out by one expert laboratory and by one histological reviewer, it would be important for the results to be confirmed by another reviewer to ensure there is agreement. This is because there is subjectivity in assessing specimens. The study does not state that the specimens were checked by another independent researcher.

The Strength of Evidence for HPV genotypes in Cervical Carcinomas

Despite the significant evidence illustrating environmental and lifestyle factors are necessary in the etiology of this cancer, Bosch et al stated in 1995 that epidemiological studies have shown that the association of genital human papillomavirus with cervical cancer is 'strong, independent of other risk factors and consistent in several countries' (Bosch et al 1995 p796). This contradicts all the evidence of previous studies. Prior to 1995 most scientists were claiming a multifactorial etiology for cervical cancer. At this time Bosch et al, realized it was necessary to show that HPV is present in all cases of cervical cancer in order to prove that HPV is the main factor in cancer etiology. With the new technology they set out to conduct an international study of HPV sub-types in cervical cancer. The aim of this study was to characterize the distribution of HPV types in cervical cancer in different geographical regions. They state 'this is essential to the development of vaccination strategies to curb the burden of cervical cancer' (Bosch et al 1995 p797). So even though studies were indicating HPV on its own does not result in cervical cancer, Bosch et al were already thinking of a vaccine to prevent this disease.

Prior to this study it was believed that HPV DNA rates in tumor specimens were about 60-90% (Franc 1995). By 1995 it was believed that the filter in situ hybridization technique used to identify HPV DNA in epidemiological studies in the 1980's had inadequate specificity and sensitivity (Franco 1995). There was great concern regarding the variation in laboratory methods with different levels of specificity and sensitivity for detecting HPV DNA. Therefore a new technique was used in the 1995 study that was believed to be highly specific and sensitive (Franco 1995). The technique used by Bosch et al was a polymerase chain reaction (PCR) protocol based on consensus primers flanking a relative conserved region in the L1 gene of HPV. This technique is

also called MY09/11. Bosch et al (1995) concluded from their study that new molecular biology techniques are 'truly sensitive and specific' and they believed their result confirmed the plausibility of HPV infection as the pre-cursor event leading to cervical cancer. It is interesting that this claim has been made based upon cases using a particular biological test when the IARC states that these case series only provide suggestive results and can never serve as a basis for causal inferences (IARC 1995). Causality of infectious diseases should be based upon the epidemiological triangle - agent, host and environment. A claim of causality based on PCR tests ignores these factors. It is known that there are 35 + distinct HPV types and these complicate the ability to attribute causality to different types (Bosch et al 1995).

The Bosch et al (1995) study tested nearly 1000 tumors and the negative-HPV tumors were re-tested using different methods and assumptions in 1999 (Walboomers 1999). Franco believes that the article by Bosch et al (1995) can be viewed as a critical contribution to our understanding of the etiology of cervical cancer. He claimed that on the basis that traces of HPV were detected in 95% of the 1,000 tumours studied that HPV infection might 'be the first cause of a human cancer shown to be a necessary one' (p780). This was stated even though >5% of tumours were HPV negative and the claim was dependent upon the technology that was used. In addition, it ignored that fact that it was known that HPV on its own was not sufficient to cause disease. This is consistent with the epidemiological triad of causality that has been used for decades to determine causality. At this time (1995) the recombinant technology for the HPV vaccine that was developed by Frazer and Zhou was being licensed to CSL and sub-licensed to Merck & Co whilst still retaining the rights to market the technology in Australia and New Zealand (Uniquest; CSL Ltd). CSL received royalties and milestone payments in return for providing Merck with exclusive worldwide rights to market the vaccine (Williamson 2005) – before it was tested for efficacy against pre-cursor lesions (2003-2007). This was also before it was established that HPV DNA 16 and 18 were found in 70% of tumours worldwide and it was known that HPV was not an independent cause of cervical cancer – environmental co-factors area also necessary (IARC 1995).

On the evidence of the Bosch et al study, Franco (1995) questions the existence of cervical cancers that are induced by carcinogenic routes other than HPV infection. He suggests HPV free cancers might be reflecting loss of the HPV genome as the disease progresses (p780). This is speculation. Rather than accepting that it's possible some

tumors are induced by factors other than HPV, he suggests researchers will have to demonstrate that 'failure to detect HPV DNA is not due to insufficient *sensitivity*' of the test (p780). Franco has taken the position that an absence of HPV genome is not because *there is an absence of HPV genome* but rather a loss due to disease progression and he is *assuming* the HPV was there in the first place. This is called interpreting the results to produce the desired picture. In addition, if HPV DNA is found in organs and tissues where it is not expected to be found he claims 'researchers will have to prove that an occasional HPV- tissue association is not due to insufficient *specificity* or contamination' (p790). Franco is suggesting that the reason for not getting the result they expected was again because the test was inadequate and therefore the result should not be accepted.

Franco states earlier in his article that 'an easily diagnosed viral infection as the pre-cursor event leading to cervical cancer calls for action on 2 fronts' (p779):

1. Primary prevention by immunisation against HPV and
2. Secondary prevention by cytology screening with testing for cervical HPV infection.

It would appear that the researchers were pre-empting the result in order to find evidence to support the preventative measures listed above.

Analysis of the Evidence from the 'Worldwide' Study of HPV Prevalence (Bosch et al 1995)

Despite the limitations of the study and the fact that the study found the prevalence of HPV 16 was the pre-dominant sub-type in all countries whilst other high-risk sub-types varied between countries, these authors still claimed that the results confirmed that genital HPV's were the central causal factor in cervical cancer globally. Yet this distribution of HPV sub-types did not explain the higher risk of cervical cancer in developing countries than developed countries. Bosch et al attempt to explain the geographical distribution of cervical cancer by suggesting that HPV sub-types might need to be studied *in conjunction with host genetics.* Again this is suggesting that the etiology of cervical cancer may be dependent upon host genetics in combination with HPV. This is not evidence for a disease that can be treated by vaccination and it does

not support their claim that HPV is the central etiological factor in most cervical cancer worldwide.

In 1999, Walboomers et al re-analysed the 66 HPV negative carcinomas found in the Bosch et al 1995 study. After re-analysis Walboomers et al claimed the HPV- negative tumors were mostly a result of 'sample inadequacy or integration events affecting the HPV L1 gene, which is the target of the polymerase chain reaction (PCR)-based test which was used'. The re-analysis was on 49 of the 66 cases using a different detection method to that used in 1995. The results were compared with 48 of the 866 carcinoma cases that were originally positive for HPV DNA. After re-analysis 38 of the negative cases were now declared positive. Another 21 cases were considered 'qualitatively inadequate' and these were not included in the final result. Walboomers et al (1999) then concluded that 99.7% of the 1000 cervical tumors in the worldwide study were now positive for HPV DNA. This led to the claim by Walboomers et al that HPV-negative cancers are an 'extreme rarity' – this was despite the limitations of this 'worldwide study' and despite the fact that the samples were not considered to be representative of each country. The sample size and lack of representation of all global regions are insufficient to give this study statistical significance in a worldwide context. Yet it is this study that has been quoted in future papers as being the evidence for the conclusion that HPV is the main cause of cervical cancer (Munoz et al 2006).

Walboomers et al go on to claim that the virtual absence of HPV-negative cancers (in this small unrepresentative worldwide study) implies that effective prophylactic vaccination might almost eliminate cervical cancer worldwide. They continue 'This is especially relevant in developing countries, where screening may not be economically feasible' (Walboomers et al 1999 p18). This conclusion has been made by ignoring all the lifestyle factors that have been suggested as risk factors in the etiology of cervical cancer for one hundred years. It also ignores the fact that developing countries have a higher incidence of other high-risk HPV types that would not be covered by the quadrivalent HPV vaccine.

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