

A Critique by the Immunisation Advisory Centre (IMAC) of the Immunisation Awareness Society brochure *“What’s all the fuss about?”*

“Everyone is entitled to their own opinions...but no one is entitled to their own facts.”

James Schlessinger, Essays on Science and Society. Science 279: March 13 1998.

The Immunisation Advisory Centre (IMAC), established as part of The University of Auckland in 1997, provides credible, scientific, evidenced-based information to health professionals, government agencies, and the New Zealand population regarding immunisation coverage, delivery, safety and recommendations. IMAC is primarily funded by the NZ Ministry of Health.

(IMAC has developed this critique to address a brochure written by the Immunisation Awareness Society (IAS) entitled “What’s all the fuss about?” The IAS believes that vaccines are not necessary, not effective, and not safe.

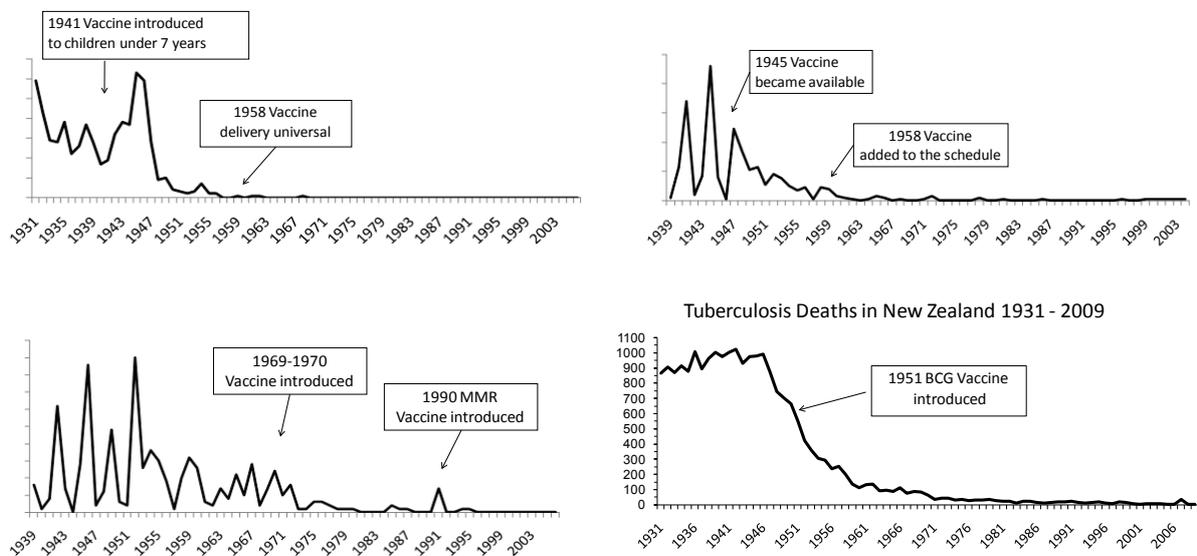
The IAS brochure makes a series of claims about immunisation and vaccines which are both inaccurate and misleading. It demonstrates a seriously flawed interpretation of current evidence on childhood immunisations and cites opinion based information from sources that lack credible scientific merit.

This critique responds to the themes raised in the IAS brochure (each of which are ***italicised*** below).

The Decline in infectious diseases

There is an enormous volume of scientific literature to support the major role of vaccination in disease control and eradication. “The impact of vaccination on the health of the world’s peoples is hard to exaggerate. With the exception of safe water, no other modality, not even antibiotics, has had such a major effect on mortality reduction and population growth”(1). It is undisputed that better living conditions and improved sanitation have had an immense impact on reducing the spread of infectious diseases, but vaccinations have played a significant role in keeping those diseases at bay, especially in New Zealand. The graphs depicted in the IAS brochure are somewhat misleading as they terminate at 1970 and are not sensitive enough to illustrate recent epidemics. With the most current data available from the Ministry of Health, the graphs below show the trends of disease mortality with regard to specific vaccine introductions in New Zealand (Figure 1).

Figure 1



In some cases, developed nations have experienced reductions in vaccine coverage following fears of vaccine safety perpetuated by the media, or a perception that vaccines were no longer required. In 1974, vaccine coverage for pertussis (whooping cough) dropped in Great Britain and subsequently resulted in 3 epidemics of more than 100,000 cases and 36 deaths over a 5 year period (2). Polio, a disease not seen in the European region since 2002 (3) has recently re-emerged in the country of Tajikistan. In 2007, Tajikistan’s oral polio vaccine coverage rate began to dip below the recommended 90% (4) which has contributed to an outbreak of more than 400 cases and 20 deaths in 2010 thus far (5). While much of the developed world has not experienced the burden of vaccine preventable diseases such as polio and diphtheria in recent decades due to successful immunisation strategies, there is potential for diseases to re-emerge if vaccination programmes and coverage rates are not maintained.

Disease, the Immune System and Vaccines

The immune system is a complex integrated network of organs, cells, and chemical messengers that fight infection. Vaccination works by triggering the body's natural immune response. Vaccines contain weakened or fragmented forms of specific disease causing viruses or bacteria. When a vaccine is administered, it stimulates the development and production of cells and antibodies specific to a particular disease. Some of these specialised cells will be very long lived providing a memory of the disease – without having actually experienced the real illness. Although healthy, well-nourished individuals are better equipped to fight off infection, this is not enough to guarantee protection against disease.

There are a range of methods that measure immunity to disease. One way to measure an individual's protection against a specific disease is by antibody titre laboratory tests. Threshold antibody levels in the bloodstream indicate the likelihood of individual immunity against specific disease (6). Titre tests provide a reliable measure of immunity for many specific diseases, but not all. In the case of pertussis (whooping cough), there are no reliable tests to confirm immunity. Nonetheless, the acellular pertussis vaccine is proven to stimulate both humoral and cellular immune responses (7), and evidence linking the pertussis vaccine directly with pertussis incidence reduction is widely demonstrated (8).

IAS argues against the use of immunisation citing that infants of immunised mothers are more vulnerable to disease. An example where this is indeed the case is measles. Immunised mothers pass lower concentrations of measles specific antibodies across the placenta compared to mothers who experienced the disease (9). But in either case maternal antibodies transferred to infants are temporary and do not develop into lifelong disease specific immunity for the child. For example, transferred pneumococcal antibodies last only a few weeks and measles antibodies only several months. In contrast, mothers do not pass any protection against pertussis on to their babies whether they have had the disease or been vaccinated (10-14). An infant who is immunised will mount his or her own active immune response which will translate into prolonged or lifelong disease protection.

Addressing another unfounded yet common concern, vaccines do not “overload” the immune system. The immune system is capable of responding to a vast number of foreign agents at one time, far more than are found in vaccines (15, 16). Newborn infants are naturally exposed to thousands of organisms every day. Vaccines are used to provide protection against only a few potentially severe and specific microorganisms. Although we have many more vaccines today than we did 20 or even 100 years ago, an infant receiving all the vaccines on the schedule today will receive fewer antigens than just one of the older vaccines such as smallpox or whole cell pertussis.

The IAS brochure misinterprets a study to support a claim that viral vaccines have been shown to depress cellular immunity. The study in question used a DNA vaccine to obtain optimal immune responses in mice. The DNA vaccine responses were better than the conventional vaccine which is not surprising as DNA vaccines show great promise as stimulators of the immune system. The results of this study do not suggest that conventional vaccines are responsible for “skewing” the immune system by “suppressing”

the cellular arm of the immune system. In this case, the immune response was relevant to the particular vaccine antigens used. This particular immune response does not inhibit the immune system in any way (17). It is also important to keep in mind that this study used mice, not humans. Conventional viral vaccines do not suppress the cellular arm of the immune system (18) further supported by a study using MMR vaccine which found evidence that primary measles immunisation induces predominantly a TH1 (cellular) type response (19), evidence that the vaccine, in fact, stimulates the immune system. In fact, immune memory cannot occur without the involvement of the cellular arm of the immune system. The only vaccines which do not induce a cellular response are polysaccharide vaccines which are not used in infants.

There is no evidence that vaccines predispose children to other illnesses. There is a large amount of data to show there is no causal association with allergy, autoimmunity or immune deficiencies – summarised well by the USA Institute of Medicine (20). In fact, recent data shows that some vaccines confer a small protective effect against asthma (21) and a more significant protective effect against Sudden Infant Death Syndrome (SIDS) also known as Cot Death (22-24).

Vaccine Manufacture

Vaccines contain antigens (which, in the case of vaccines, are the parts of the infectious organisms that stimulate a protective immune response) and adjuvants (components that enhance antigen-specific immune response) combined with the most efficient delivery systems (25). This includes components to ensure vaccine delivery is as safe and effective as possible. These added substances could be, preservatives, stabilisers, buffers, diluents, or residuals (26). All substances in vaccines are required to be closely monitored in the design phases and the safety trials before they are approved for use. It is also important to remember the quantity of any additive in a vaccine is exceptionally small.

The most common adjuvants in the current childhood vaccines Infanrix[®]-hexa, Infanrix[®]-IPV, Prevenar[®], Boostrix[®], and Gardasil[®] are aluminium salts. Aluminium is one of the most common elements on earth and a natural part of the environment and our bodies. The levels in vaccines are very low in comparison to the intake from food and other environmental factors, including breast milk (27, 28). Most injected aluminium is excreted within several hours (29). Contrary to some popular beliefs, aluminium has not been shown to cause Alzheimer's disease (AD) or dementia. AD is not related to aluminium levels. Three decades ago, there were studies linking contaminated kidney dialysis equipment with dialysis encephalopathy which included symptoms of dementia in some cases after discovering that aluminium blood levels had reached unsafe levels; a problem resolved by a protocol change to use purified water (30). The pathology of these encephalopathy cases did not resemble AD, and attempts to induce AD in animals using aluminium have failed (31).

Preservatives protect some vaccines from bacterial and fungal contamination and may include phenoxyethanol, phenol, or thiomersal. There is no evidence to suggest that 2-

phenoxyethanol poses a risk to children. It is a common ingredient used in cosmetics, baby care products, eye and eardrops and aromatherapy products, protecting against contamination. Thiomersal, a mercury derivative, is no longer found in any infant vaccines on the New Zealand schedule. Thiomersal is present in the adult diphtheria, tetanus (ADT®-Booster) vaccine and the adult hepatitis B (Engerix B Adult) vaccine. Thiomersal in vaccines has not been shown to be dangerous and is used to protect against contamination of vaccines by bacteria. As thiomersal is a mercury product it was deemed appropriate to phase it out from childhood vaccines to remove any theoretical risk of toxicity, particularly for very low birth weight babies. For all heavy metal elements, there is recommended maximum exposure and the trace amount in vaccines falls well below threshold limits. Following infant vaccination with thiomersal-containing vaccines, the levels in blood are much lower than prescribed limits and most is excreted in the faeces (32). The levels present in vaccines are not considered dangerous and there is no evidence to suggest otherwise (33, 34).

Vaccine components known as stabilisers help to maintain the composition and integrity of the vaccine. These can include sugars, amino acids, or proteins (gelatine or serum albumin) (35). Gelatine products can originate from pigs while the albumin stabilisers may originate from humans or cows (36).

As with any food or medication, there are residual substances in vaccines that are part of the manufacturing process. Formaldehyde, an example of a residual, is an inactivating agent used in the manufacture of certain vaccines, specifically used to inactivate the tetanus toxin protein or inactivation of viruses. Formaldehyde is not a component of the final purified vaccine product, however there may be traces remaining at levels as low as of 27 parts per million (37).

In regard to claims that vaccines contain foreign viruses, the only known incidence of vaccine contamination that affected New Zealanders was that of the polio vaccine used in the late 1950s and early 1960s. Some batches of this vaccine contained the Simian Virus 40 (SV40) which the technology available at the time could not have detected. There have since been ongoing investigations into the long-term implications of this and there is still debate over whether or not there has been any impact on public health (38, 39).

In 1965, the vaccine strain of rubella was derived from a rubella-infected foetus. This was then cultured in a second cell line that was also developed from foetal tissue (40). The reason for using these cells is that rubella is a human disease and requires human cells to replicate. Early attempts to use animal cell lines were unsuccessful. There has never been any further foetal tissue used in the production of rubella vaccine.

Several vaccines protect against cancer-causing viruses like hepatitis B virus and human papillomavirus. Speculating about theoretical possibilities for potential contamination of vaccines and the possible outcomes should not be regarded as reliable evidence. For instance, hepatitis B causes more cancer than any substance other than tobacco. The hepatitis B vaccine is arguably our first effective anti-cancer vaccine.

Concerns that children were at risk from contracting diseases from vaccines originated from the live polio vaccine. Live polio vaccine could cause paralytic polio in rare cases, approximately 1 in 4.6 million doses (41). However, New Zealand no longer uses live polio vaccine.

It is known that the MMR vaccine can cause disease in severely immunocompromised people and it is therefore contraindicated in people with a range of immunosuppressive disorders. There is no evidence to show that vaccine-associated disease has occurred as a result of transfer from an MMR-vaccinated individual to another. In fact, internationally it is used widely with children who are contacts of the immunocompromised (40). This would not be possible if the disease was transmissible through the vaccine.

There is some evidence of live varicella (chicken pox) vaccine transferring varicella to others. This has happened only very rarely. In the USA, where more than 55 million doses of varicella vaccine have been distributed, there have been three reports of secondary transmission of the vaccine-type virus from vaccine recipient to a healthy contact (42). All cases have been mild. The risk of spread to contacts from immunosuppressed individuals is greater (43). Varicella vaccine is not currently on the New Zealand National Immunisation schedule.

Vaccine manufacture components are very safe and have been described clearly in this section. The risk of disease associated with vaccines has also been explained. Vaccines are developed, monitored and administered to reduce the spread of harmful infectious diseases.

Vaccine Efficacy

The vaccines licensed in NZ are effective at preventing disease. Each vaccine licensed in New Zealand and used in the Immunisation Schedule has been implemented because of extensively researched and peer-reviewed evidence of efficacy. For example, the efficacy of measles vaccine is about 98% after 2 doses, and the current pertussis vaccine used in New Zealand has an efficacy of 86% after 3 doses (40).

Vaccinated children can still get disease because no vaccine is 100% protective. If 95% of children are immunised with a vaccine that protects 95% of vaccinees then half the cases of disease will be among immunised children. For example, if there is a measles outbreak in classroom of 30 children, 27 whom are vaccinated, the 3 unvaccinated children will all be infected. Of the 27 vaccinated, 1-2 will be infected. Clearly most vaccinated children will be protected.

To maximise vaccine efficacy for some diseases, at least 95% of the population must be vaccinated on time, according to the national schedule. A recent New Zealand study found that low vaccine coverage rates along with delayed immunisation were significant factors contributing to infant hospitalisation with pertussis (whooping cough) (44). In a similar study, infants who were behind with their immunisations, or who were unimmunised, were 4-6 times more likely to be admitted to hospital with whooping cough (45). These studies

further emphasise the need for a high immunisation coverage rate with timely administration according to the childhood schedule.

Vaccine Safety

There are many methods in which vaccine safety is assessed and monitored. Today, a new vaccine must undergo clinical trials involving tens of thousands of people where both efficacy and safety are closely monitored. Once a vaccine is licensed, ongoing monitoring of safety is conducted.

Passive safety monitoring relies on voluntary reports of events that occur after receipt of a vaccine. Health professionals and the public may make these reports. Such monitoring does not give any information about causality; however it provides a warning system for rare and potentially serious events.

Active monitoring actively seeks information about the effects of a vaccine. There is a range of ways this is done. For example, questions arose about whether there was a link between the MMR vaccine and autism. Around the USA, UK and Europe there have been a range of studies using different methodologies (cohort follow up, case control, retrospective analysis, linked database, etc) on many thousands of children and together these have shown there is no link between the vaccine and MMR. In addition to lack of causal evidence, the original study proposing the link between the MMR vaccine and autism has been retracted from the literature, proving to hold no scientific value (46).

A particularly useful vaccine safety research methodology used in the USA is the linked databases where very large managed care organisations link children's full medical history together with their vaccination history which provides good epidemiological data very quickly on any unexpected possible vaccine adverse event that may be proposed (47).

There are a range of methodologies used around the world that compare disease incidence between vaccinated and unvaccinated children. For example, comparing a population for a disease incidence prior to and after the introduction of a vaccine; linked databases comparing a child's immunisation status with their primary health care contacts and hospital admissions; and looking for time-related associations with diseases and vaccines to see if there is biological plausibility. By using a range of methodologies, such as those mentioned above, evidence has demonstrated no causal link between the MMR vaccine and autism (48-50).

Vaccines are one of the most closely monitored medicines in use (far more than food products or most other pharmaceutical products) with safety profiles that are well established through research (40, 51). Currently, New Zealand only has a passive reporting system and is reliant on data from other western countries for rates of rare reactions. This is mostly because our population size is small and rare events are difficult to pick up. An exception to this was when the New Zealand specific meningococcal B (MeNZB) vaccine was used. During this period, New Zealand had the best intensive safety monitoring system in place in the world.

The IAS brochure claims that “Vaccines have been linked with or shown to cause autism, meningitis, diabetes, SIDS and degenerative brain diseases leading to death” (52). The references cited by IAS have been overwhelmingly refuted by a large body of literature in these areas.

There are known risks for vaccination which are well documented (40) and continue to be reviewed. Some are serious, however the incidence of serious adverse events overall with the current New Zealand schedule vaccines is extremely rare.

- Vaccines **do not** increase the risk of SIDS (Sudden Infant Death Syndrome) and in fact appear to have a protective effect (53-56).
- Vaccines **do not** increase the risk for asthma and in fact may have a protective effect (16, 21, 57-59).
- Vaccines **do not** increase the risk of autoimmune diseases (16).
- Vaccines **do not** increase the risk for autism or other neurological disorders (60, 61).

Using all the raw data from passive surveillance systems as a measure of vaccine reactions does not give an incidence of adverse events. It is important to note that **any** event following immunisation can be reported but this does not necessarily mean that the event was caused by the vaccine. Once each case has been assessed then the cause of the event can be determined as ‘almost certain’ to ‘highly unlikely’. **There have been no known deaths in New Zealand caused by vaccines.** For other serious reactions reported to New Zealand’s Centre for Adverse Reaction Monitoring (CARM), the incidents are assessed on a case-by-case basis and then

It should also be noted that minor reactions to vaccines are not necessarily ‘adverse’ in that a minor event such as a moderate temperature, site reaction, etc. is evidence the body is mounting an immune response to the vaccine. A slightly feverish child 10 days following MMR vaccination shows an immune response to a weakened virus. The general aim of immunisation is to get the immune system to respond so it will have a memory of the disease and a minor reaction is evidence of this response.

The Money Trail and Big Business

Vaccine development is a highly regulated and specialised industry with only a small number of pharmaceutical companies equipped with the capacity for developing and producing safe and effective vaccines. The vaccine industry requires a commitment of 11-15 years on average and an estimated \$800 Million to introduce a new vaccine to the market (62). At the end of the day, vaccines contribute to only 1.5% of annual pharmaceutical profits.

In 1988, The United States introduced a ‘no fault’ compensation because of the litigious risk to vaccination manufacturers, many of whom were going out of business, leading to a potential crisis in vaccine supply (63). Many pharmaceutical companies are choosing not to

continue making vaccines due to the financial risks involved and potential for considerable loss (64). The increasing cost of vaccine development and production, mergers of manufacturers and relatively low revenues from vaccine sales compared with other pharmaceutical products such as lipid lowering drugs, may have contributed to the reduction in vaccine manufacturers in the past 25 years (64). Many US partners contribute to vaccine industry research and development including the National Institutes of Health, the Centers for Disease Control and Prevention, the Food and Drug Administration, the Department of Defence, the United States Agency for International Development, academia, and non-governmental organisations to ensure current vaccine supply production and novel vaccine development (62).

The IAS makes a claim that health professionals opposed to immunisation lose their funding (52). Many scientists are employed in academic positions, and an important part of their responsibilities is to examine and critique the validity and accuracy of research findings. An example of appropriate scientific research leading to action was the withdrawal of a rotavirus vaccine. When the flag was raised by the US passive reporting system showing a potential problem with the vaccine, it was promptly withdrawn from the market by the manufacturer(65). There are plenty of examples of funded studies questioning the safety of vaccines published and also a significant amount of active research in the area. However, one observation does not make a fact, one study does not prove anything, it only adds to the body of evidence – much as one building block adds to a wall.

Choosing Not To Vaccinate

The New Zealand Ministry of Health recommends that all children are fully immunised according to the National Immunisation Schedule by the age of 2 years. A similar strategy to reducing vaccine preventable diseases is employed by the World Health Organization in conjunction with the United Nations Children’s Fund (UNICEF) (66). Every country in the world has an immunisation programme. While New Zealand does not make immunisation compulsory, the Health (Immunisation) Regulations of 1995 (updated 01 December 2008) (67) require information regarding immunisation status for each child upon entry to early childhood education and care centres and primary schools. These centres and schools must in turn maintain immunisation registers in the event of a disease outbreak. Children who are unimmunised are at risk of spreading vaccine preventable diseases to other unimmunised children as well as to a small proportion of individuals who have been immunised.

Choosing To Vaccinate

Parents need to be well informed regarding all aspects of their child’s health and safety. General Practitioners are an excellent source of evidence based information regarding disease information, prevention, and treatment. While the national immunisation schedule is recommended for all children, there may be certain specific circumstances in which a child should not receive specific vaccines, known as contraindications.

There are a number of conditions that are contraindications to vaccination. If one of these is present the person should not be vaccinated. Contraindications vary for different vaccines.

Contraindications to sub-unit and inactivated vaccines:

- There is only one absolute contraindication for these vaccines which includes a history of an anaphylactice reaction to either a previous dose or one of the ingredients in the vaccine.
- An evolving neurological condition is a contraindication to pertussis vaccine.

Contraindications to live vaccines:

- A history of an anaphylactice reaction to either a previous dose or one of the ingredients in the vaccine.
- Certain immune deficiencies such as leukaemia
- Chemotherapy

Some precautions include:

- A high fever $>38^{\circ}\text{C}$
- An allergy to a component in the vaccine
- A previous serious reaction

Conditions that are **not** contraindications to immunisation:

- A cold
- A family history of reactions
- History of allergy such as asthma or eczema

Unvaccinated Children are Healthier

It is important to identify and understand the value of health information and research sources. Not all sources originate from scientifically reliable journals or are supported by credible scientific investigation. The surveys discussed in the IAS brochure are not referenced which means the validity cannot be verified. When conducting surveys, a sound methodology (such as a randomised sample) is essential for yielding valid and meaningful outcomes. In order to make inferences about the whole population, an adequate sample size must reflect statistically significant study power and all sources of recruitment bias must be minimised. Anyone can conduct a survey, but to produce valuable results, many methodology criteria must be met. The survey conducted by Mike Godfrey reported in the IAS brochure violates almost every rule for conducting a meaningful survey, such as lack of a randomly selected sample. Mike Godfrey has never published any research on vaccination in a peer-reviewed forum. A survey such as this would not meet the strict criterion for proper unbiased research.

A number of very large population based studies investigating differences between immunised and unimmunised children with regard to health outcomes have been conducted. These studies use validated research methods and have been published in respected peer reviewed medical journals.

Neurological disorders: Vaccination is not a risk factor for neurological disorders such as epilepsy, autism or developmental delay, and is consistently supported by the literature (60, 68, 69). One of the most serious complications from many vaccine preventable diseases is brain damage; therefore the prevention of the diseases with vaccines results in fewer intellectually disabled people. For example following a comprehensive vaccination campaign in Finland against Measles Mumps and Rubella, the most common form of encephalitis (caused by mumps virus) disappeared from the country (70). There is a rare association between the MMR vaccine and encephalitis at around 1 in 1,000,000.

Asthma: There is no association between vaccination and allergy including asthma (16, 21, 57-59). Some studies have demonstrated a slight protective effect (21).

Ear infections: Ear infections (otitis media) are caused by bacterial and viral organisms. These include streptococcal, pneumococcal and Haemophilus influenzae type b (Hib), viruses such as the respiratory syncytial virus and influenza. Vaccines against these agents can reduce the incidence of ear infections. Immunisation against influenza protects against some ear infections. New vaccines are under development which will act against more of the organisms that contribute to ear infections and have the potential to further reduce the problem (71-77).

Tonsillitis: While there is no present anti-tonsillitis vaccine, vaccines have the potential to be developed that could protect against this problem (78).

Apnoea: Vaccination decreases the incidence of apnoea (stopping breathing) in infants. As this condition is often caused by pertussis (whooping cough) this finding is not surprising. Monitoring babies following immunisation shows no increase in apnoea (79, 80). However very preterm babies may be at risk of increased apnoea following vaccination (81).

Diabetes: Reviews of the evidence have concluded that vaccination is not a risk factor for diabetes (16, 82).

Vaccination is used for selected diseases that are associated with risks of morbidity and mortality. The following are examples of potential serious consequences from vaccine preventable diseases.

- Measles infection causes death in 1/1,000-1/4,000 cases in healthy well-nourished children. A further 1/1,000-1/4,000 contract permanent brain damage (83). Other

complications are pneumonia (1/10 – 1/100), and otitis media (1/10- 1-100). Measles is extremely contagious.

- Pertussis (whooping cough) infection does not confer life-long immunity, immunity lasts approximately 10 years at most (84, 85). The highest risk for death from pertussis is among the under 1 year age group, which constitute 80% of all pertussis deaths(86). New Zealand infants who are behind in their immunisations or unimmunised have a 4-6 fold increased risk of being admitted to hospital with the disease (45).
- *Haemophilus influenzae* type b complications include a 7% risk of deafness, a 10-20% risk of permanent neurological impairment and a 5% risk of death (87).
- Hepatitis B. Babies have the highest risk of becoming chronic carriers of the hepatitis B virus (68%). Complications of this carrier state later in life include cirrhosis of the liver (5-10%) and cancer of the liver (5-10%) (87). The hepatitis B virus is extremely carcinogenic.

Informed Consent

There is a vast amount of information available about immunisation. Parents need to seek out the most scientifically accurate and credible information when looking for answers to immunisation concerns. Studies have shown that many anti-vaccination websites are not supported by scientific evidence and that they rely on emotional appeal to convey their message (88, 89). It is important that when evaluating information parents are critical and retain an open minded approach. Science is not always perfect but provides the best tools for evaluating available data.

For more evidence based immunisation information, please refer to the following websites:

New Zealand Ministry of Health

<http://www.moh.govt.nz/moh.nsf/indexmh/immunisation>

New Zealand Medicines and Medical Devices Safety Authority

<http://www.medsafe.govt.nz>

New Zealand Immunisation Advisory Centre

<http://www.immune.org.nz/>

World Health Organisation

<http://www.who.int/immunization/en/>

National Centre for Immunisation Research & Surveillance (NCIRS)

<http://www.ncirs.edu.au/>

UK National Health Service

<http://www.nhs.uk/Planners/vaccinations/Pages/Landing.aspx>

US Centers for Disease Control and Prevention

<http://cdc.gov/vaccines/>

Immunization Action Coalition (IAC)

<http://www.immunize.org/>

Immunisation Advisory Centre (IMAC)

Dept General Practice and Primary Health Care

University of Auckland

PO Box 17360 Greenlane

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Correspondence to Helen Petousis-Harris

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