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TEARS OFTEN SHED

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In seeking a theme for this Oration, I was drawn to a small volume on my bookshelf, given to me by Sir Lorimer Dods, who was the first Professor of Child Health in Australia. The book, entitled *Tears often shed*, was written by Dr Bryan Gandevia and was published in 1978.¹

The book tells the history of child health in Australia from the first European settlement in 1788, and it emphasises the fact that the health of children very accurately reflects the living conditions of the entire community. As Gandevia writes: 'Children, their health and welfare, their morbidity and mortality, necessarily offer a most sensitive reflection of the social and physical environment in which they find themselves.' In tracing the history of child health in Australia from the time of the first penal settlement at Port Jackson, Gandevia noted the tears that 'were often shed' by parents of infants dying of communicable diseases which are now prevented by vaccination.

Today the Australian community is remarkably free of deaths from measles, diphtheria, tetanus, poliomyelitis and congenital rubella, all of which caused significant morbidity and mortality until 50 years ago. New vaccines are providing a wider spectrum of disease protection than ever before. In contrast, about two million children die each year globally from infections that could be prevented by vaccines that are currently available in the Australian vaccination schedule. However, as the diseases they prevent disappear, vaccines are more and more in the news, sometimes unfairly reported. Vaccine safety is of importance to all. Scientific rigour therefore must always inform the processes leading to the development, approval and introduction of new vaccination programs.

THE COLONIAL ERA

The long voyage from England to Botany Bay was one that, even in the late 1780s, was almost too much to contemplate. Smallpox, cholera and tetanus were common

on board the transport ships and, in the colony, sexually transmissible infections were rife. By 1800 there were about 1,000 children in the settlement—almost half that number were orphans. Infant mortality was 11 per cent, 20 times higher than today's rate of 5.2 per 1,000, and 10 per cent of infant deaths were due to syphilis. Pertussis appeared for the first time about 1827, measles and diphtheria a few years later; the mortality from each was very high, especially from diphtheria (estimated to be about 150 per 100,000 population). There was a very large outbreak of measles in Sydney in 1880, by which time children's hospitals had been established in Melbourne, Brisbane, Adelaide and Sydney. However, child mortality remained high and Henry Lawson, a popular poet of the time, poignantly drew attention to this state of affairs:

*Our first child took—a cruel week in dyin', ...
I've pulled three through and buried two
Since then—and I'm past carin'.*

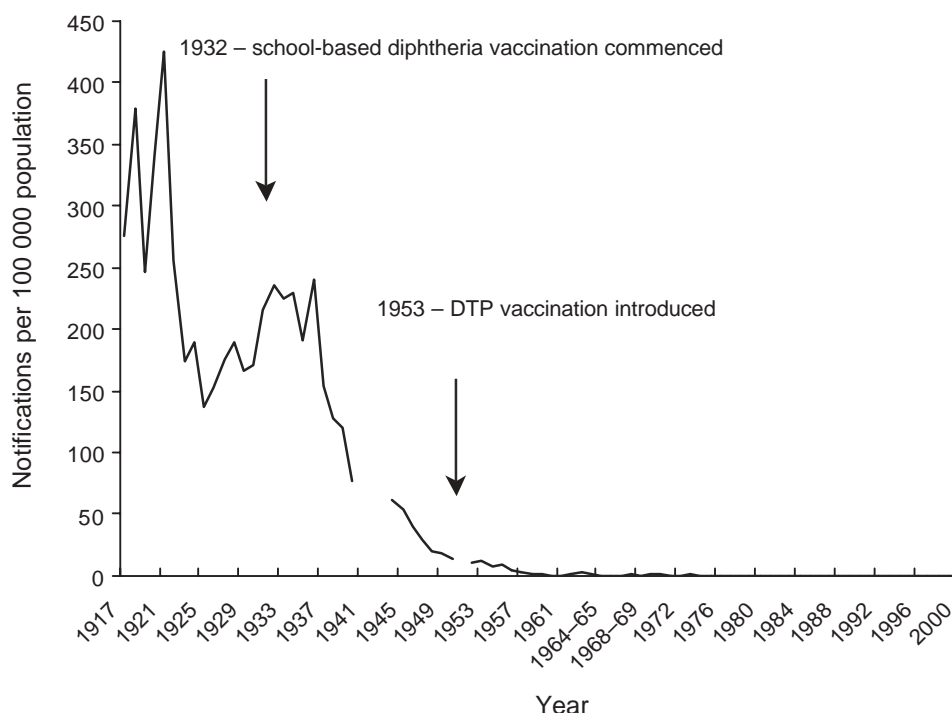
INTRODUCTION OF VACCINES

The first use of vaccines in Australia commenced with smallpox in 1804. It was not until the 1890s that plague and typhoid vaccines and diphtheria antiserum became available.²

A major milestone in the early 20th century was the establishment, by the Commonwealth Government, of the Commonwealth Serum Laboratories (CSL) in Melbourne in 1916. CSL rapidly commenced production of vaccines for typhoid, cholera, plague, smallpox and diphtheria antitoxin. In the 1920s childhood vaccination with a combined toxin–antitoxin vaccine resulted in a marked fall in the incidence of diphtheria (Figure 1), but this vaccine was withdrawn following a serious incident due to bacterial contamination of a multidose container of the vaccine in Bundaberg, Queensland.² Following the introduction of school-based programs (using diphtheria toxoid vaccine in single-dose vials) which became widespread by the mid-1930s, there was a further marked decline in diphtheria. Infant vaccination for diphtheria was not routine until the early 1940s, and emergency tracheostomy for diphtheria was still commonly seen in children's hospitals through to the early 1950s.

FIGURE 1

DIPHTHERIA NOTIFICATIONS, AUSTRALIA, 1917–2000



Source: Hall R. Notifiable disease surveillance, 1917 to 1991. *Commun Dis Intell* 1993;17:226–36. Updated with NNDSS data 1992–2000.

The late 1940s and early 1950s saw large outbreaks of poliomyelitis, many polio deaths and many young people handicapped for life. The introduction of inactivated poliovirus vaccine (IPV—Salk vaccine) in 1956 resulted in an immediate fall in the incidence of polio (Figure 2). Australia did not use live oral poliomyelitis vaccine (OPV—Sabin) until 1966.³

Another important milestone for Australia in the first half of the 20th century was the discovery, by the Sydney ophthalmologist Norman Gregg in 1941, that rubella in pregnancy could cause congenital malformations.^{4,5} After the introduction of rubella vaccination in 1970, there was a rapid fall in the incidence of congenital infection: up to 200 cases had occurred nationally in some outbreak years. As a result of vaccination, there have been no cases of congenital rubella syndrome in Australia over the past five years, apart from one recent imported case (Forrest JM, personal communication).

In the 1990s, Australia was fortunate to have the early introduction of *Haemophilus influenzae* type b (Hib) vaccine. Hib infection was responsible for more than one-third of the cases of bacterial meningitis in children. It also caused epiglottitis, cellulitis, other localised infections and the aggressive early meningitis seen so extraordinarily frequently in Aboriginal and Torres Strait Islander children. Hib disease rapidly disappeared following the introduction of vaccination.⁶

CONTEMPORARY AUSTRALIA

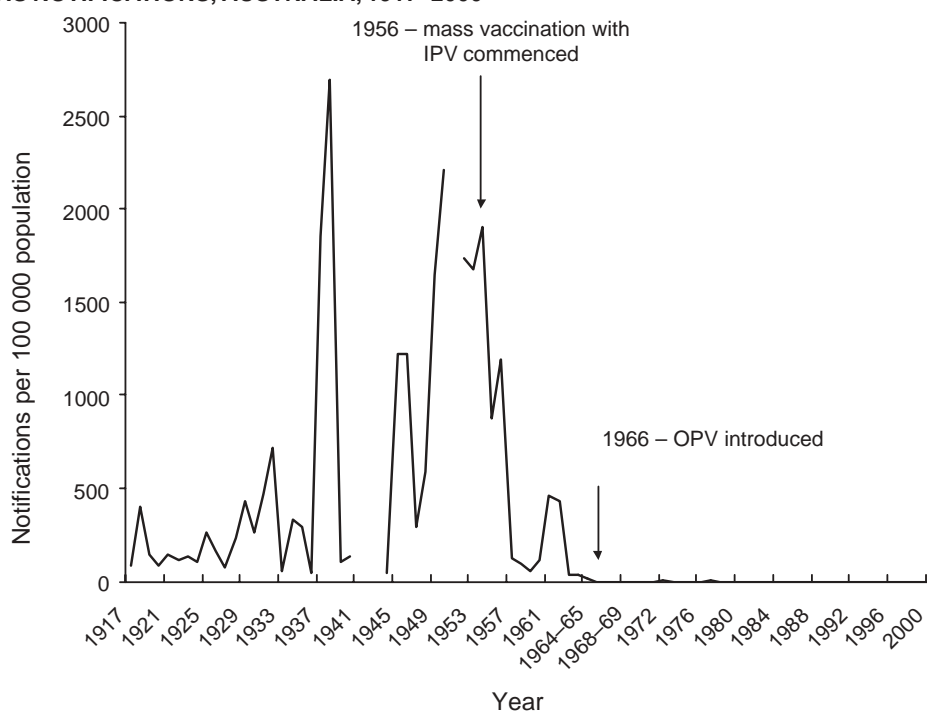
By the mid-1990s infant mortality had reached a rate (5.2 in 1000) only dreamt of by paediatricians such as Sir Lorimer Dods. The new generation of parents had no experience of the outbreaks and fears that surrounded polio, diphtheria and tetanus. Immunisation coverage had plateaued, and warning signals were seen in small but important outbreaks of vaccine-preventable diseases. About the same time there was a rebirth of interest in alternative therapies and anti-vaccination sentiment.

This situation set the scene for the Commonwealth's *Immunise Australia* program: the Australian Childhood Immunisation Register (ACIR) was established, parent and provider incentives were offered, the Measles Control Campaign was accomplished and the National Centre for Immunisation Research and Surveillance (NCIRS) was established.

These initiatives have been very successful. Australia now has the highest immunisation coverage ever recorded; the lowest rates of measles, rubella and Hib disease; and the lowest number of deaths from the diseases for which children are routinely vaccinated.^{6,7} Studies of coverage indicate that 90–95 per cent of children receive all scheduled vaccines and that parent incentives have influenced at least four or five per cent to make sure their children are up to date with vaccination.⁷ But two to three per cent of parents have serious concerns about or disagree

FIGURE 2

POLIOMYELITIS NOTIFICATIONS, AUSTRALIA, 1917–2000



Source: Hall R. Notifiable disease surveillance, 1917 to 1991. *Commun Dis Intell* 1993;17:226–36. Updated with NNDSS data 1992–2000.

IPV: Inactivated poliovirus vaccine (Salk) OPV: Oral poliomyelitis vaccine (Sabin)

with immunisation. It is not always easy to address these concerns—in doing so it is important to listen and respond to genuine concerns; to anticipate public reaction to new initiatives; to know the facts; to use graphic illustrations and convincing spokespersons; and to remember that statistics are frequently misunderstood.⁸

GLOBAL HEALTH

In contrast to Australia, communicable diseases, many of them preventable, cause 25 per cent of deaths worldwide and 63 per cent of child deaths. Globally, acquired immunodeficiency syndrome (AIDS), tuberculosis (TB) and malaria cause more than 13 million deaths each year. There is a great need to establish a regional vaccine manufacturing capacity. We need a huge increase in the availability of hepatitis B, Hib, and pneumococcal vaccines, and the development of new or more effective vaccines for measles, TB, rotavirus, malaria, human immunodeficiency virus (HIV) and meningococcal serogroup A infection.

Internationally, the polio elimination program is almost complete. In 2001 there were fewer than 500 cases notified to the World Health Organization (WHO). WHO recognises that we need better coverage for the routine Expanded Program for Immunization (EPI) vaccines, better infrastructure, waste disposal, cold chain (the ‘chain of cold’ required to keep vaccines effective from manufacture

to delivery) and attention to adverse events. This goal requires finance, collaboration and technology transfer.

Vaccines, by improving child survival, can provide a key to global poverty. Child survival is closely linked with population control and therefore with economic progress at a local level. Economic progress reduces poverty and reinforces the cycle of improved child health. The Global Alliance for Vaccines and Immunisation (GAVI)—a consortium of WHO, United Nations Children’s Fund (UNICEF), the World Bank and the Bill and Melinda Gates Foundation—is endeavouring to accelerate this cycle by providing money for the purchase of vaccines and the strengthening of immunisation infrastructures in the world’s poorest countries. In this decade, we can anticipate worldwide eradication of poliomyelitis (by 2005) and possibly also of measles.

AUSTRALIA IN THE 21ST CENTURY

There is overwhelming public support in Australia for childhood immunisation and there are some wonderful opportunities, both nationally and internationally, in the decade ahead for prevention and treatment using vaccines.⁹ Soon we will need to address questions related to the use of a number of new vaccines, probably in the first instance for rotavirus, intranasal live attenuated influenza, enterotoxigenic *Escherichia coli*, and *Helicobacter pylori*; and then later cytomegalovirus, human papilloma virus, group A streptococcus and HIV.

In assessing the need for these vaccines, we must first be sure that there is accurate information about the burden and cost of disease; we must know that the vaccines are safe, effective, easily administered and programmed, as well as cost-effective and acceptable to the community. It is also very important that there are satisfactory surveillance mechanisms in place to monitor disease incidences and vaccine-related adverse events.

As we enter an era where new vaccines are introduced that have been produced by sophisticated new biotechnologies, we will, at least in the short- to medium-term, see these vaccines costing very much more than previously. There will be a need to assess the community's willingness to pay for this progress.

Of over-riding importance will be working to obtain a better understanding of the communication of risk, and of the behavioural and social changes affecting attitudes in our community—especially among parents of young children.

Historically, vaccines have prevented countless deaths and have brought long-term benefits that go far beyond health.

This article has been adapted from the Feery Oration, which was presented at the 8th National Public Health Association of Australia Immunisation Conference in Melbourne, during May 2002.

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MAPPING IMMUNISATION COVERAGE AND CONSCIENTIOUS OBJECTORS TO IMMUNISATION IN NSW

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The Australian Childhood Immunisation Register (ACIR) commenced operation on 1 January 1996 and is now an important component of the *Immunise Australia Program*. Immunisations are generally notified to the ACIR either by electronic means—by email or the internet—or by hard copy notification forms.¹ Parents with children who have a personal, philosophical, religious or medical belief that immunisation should not occur can ask their doctor or immunisation provider to complete a conscientious objection form and send it to the ACIR. In practice, this form is usually only completed if a parent wishes to receive means-tested child-care benefits and maternity allowances that are not paid unless a child is fully immunised or a conscientious objection form has been lodged.

From the immunisation data finally entered in the ACIR, the Health Insurance Commission (HIC) provides regular quarterly immunisation coverage reports at the national

and state and territory level. Coverage for these reports is calculated using the cohort method.² With this method, a cohort of children is defined by date of birth in three-month groups. This birth cohort has the immunisation status of its members assessed at the three key milestones of 12 months, 24 months and six years of age. Definitions of coverage are based on the Australian Standard Vaccination Schedule and are described elsewhere.^{3,2}

Calculation of immunisation coverage estimates by the HIC at the national and state level can hide pockets of low coverage within a state, and within a capital city. By calculating immunisation coverage for smaller geographical areas, it is possible to examine differences in immunisation coverage within states, and within capital cities, to identify specific areas of low coverage.

Poor uptake of immunisation is generally a result of a host of factors including: issues related to the medical history of a child; issues related to beliefs about the risks and benefits of vaccination; parental forgetfulness or poor access to immunisation services.⁴ The relative contribution of each of these factors to under-immunisation varies by population. One of the important