NEW SOUTH WALES
Public Health Bulletin

Volume 8
Numbers 8-9
August-September, 1997

NSW HEALTH DEPARTMENT

ISSN 1034 7674
State Health Publication No. 97-0144

ONE HUNDRED YEARS OF VACCINATION

In the December 1996 issue of the *NSW Public Health Bulletin* we foreshadowed that some of the papers presented at the 1996 NSW Public Health Network conference would be published in future issues. The paper leading this issue is based on an address given at the conference by Dr Brian Feery: One hundred years of vaccination.

– Editor

Vaccination has been the most successful medical procedure ever introduced. It has saved more lives than any other intervention, and it has prevented more disability[1]. The risk of serious adverse reactions has remained extraordinarily low for all modern vaccines[2]. Within the past 30 to 50 years, the common vaccine-preventable diseases have been controlled and largely eliminated from the developed world, and these successes are being repeated in the developing world. Edward Jenner had predicted that smallpox vaccine would rid the world of smallpox and this was finally achieved in 1977[2]. In 1978 Albert Sabin stated that poliomyelitis, measles, rubella and mumps could also be eradicated if enough people were willing and able to take the responsibility for doing so[3]. In addition, it is possible to control and virtually eradicate the bacterial diseases such as pertussis, diphtheria and *Haemophilus influenzae* disease if universal vaccination is achieved and maintained.

Australia embraced vaccination procedures much earlier than many other countries[4]. Smallpox vaccine was imported in 1803, just five years after the publication of Jenner's monograph. The vaccine was produced in Sydney in 1847 and in Victoria in 1882 and used to curtail outbreaks in this country[5]. Soon after the development of bacterial vaccines in Europe in the 1880s and 1890s, plague vaccine was imported to Australia to control an outbreak in Sydney[6]. In the earliest years of this century vaccines and antisera were imported from the Pasteur Institute in France, the British Institute of Preventative Medicine in London, the Behring Institute in Germany, and from Parke Davis in the United States[7]. After the demonstration that typhoid vaccines were effective in the Boer War, the production of this vaccine began in several laboratories in Australia.

When World War I began in 1914 Australia remained dependent on the importation of vaccines, antisera and diagnostic agents.

Continued on page 62 ▶

Contents

Correspondence

Please address all correspondence and potential contributions to:

The Editor,
NSW Public Health Bulletin,
Public Health Division,
NSW Health Department
Locked Bag 961,
North Sydney NSW 2059
Telephone: (02) 9391 9191
Facsimile: (02) 9391 9029

TABLE 1

DEATHS IN AUSTRALIA FROM COMMON PREVENTABLE DISEASES, 1926 TO 1995

Period	Diphtheria	Pertussis	Tetanus	Poliomyelitis	Measles[a]	Population average
1926–1935	4,073[b]	2,808	879	430	1,102	6,600,000
1936–1945	2,791	1,693[b]	655	618	822	7,200,000
1946–1955	624	429	625[b]	1,013	495	8,600,000
1956–1965	44	58	280	123[b]	210	11,000,000
1976–1985	2	14	31	2	62	14,900,000
1986–1995	2	9	21	0	32	17,300,000

Notes:
(a) These numbers exclude deaths from subacute sclerosing panencephalitis.
(b) Decade in which community vaccination started for the disease.

Source:
Commonwealth year books. Canberra: Australian Government Publishing Service.

TABLE 2

REDUCTION IN MORTALITY WITH VACCINATION FOR COMMON PREVENTABLE DISEASES IN AUSTRALIA

Disease	Year of onset of public vaccination	Reduction in mortality rate (%)
Diphtheria	1932	100
Pertussis	1942	99
Tetanus	1953	99
Poliomyelitis	1956	100
Measles	1970	91

Source:
Commonwealth year books. Canberra: Australian Government Publishing Service.

FIGURE 1

MEASLES NOTIFICATIONS, AUSTRALIA, JAN 1992 TO DEC 1995

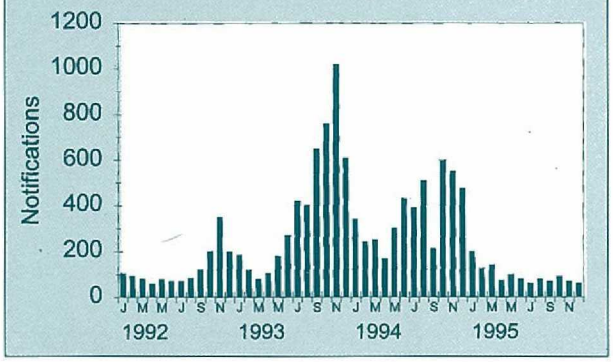
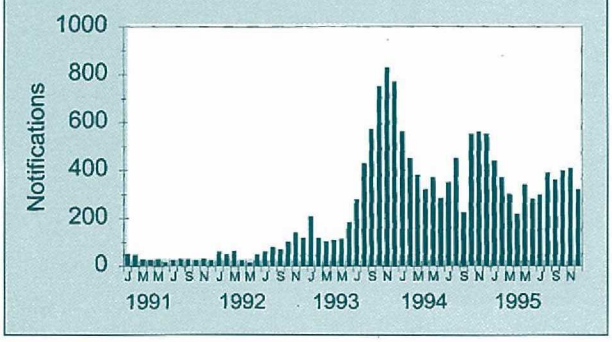


FIGURE 2

PERTUSSIS NOTIFICATIONS, AUSTRALIA, JAN 1991 TO DEC 1995



One hundred years of vaccination

▶ *Continued from page 61*

Limited shipping rapidly led to a shortage of these agents, and in 1915 the Commonwealth government decided to start a federal institute in Melbourne on the site of the present Commonwealth Serum Laboratories.

The first stimulus to the production of vaccines and antisera in Australia was the threat of shortages during the war. The second was the decision that all service personnel should be vaccinated with smallpox vaccine and typhoid vaccine. The third was the outbreak of pandemic influenza in Europe in 1918, and the demonstration that a bacterial vaccine containing respiratory pathogens could reduce mortality from secondary pneumonia[4]. A mixed bacterial vaccine was produced at the Serum Laboratories from pathogens derived from throat cultures from some of the earliest cases. Three million doses were used in the course of the epidemic. Interestingly, there was good evidence that the mortality from influenza infection was reduced by vaccination but there was naturally no impact on the incidence of influenzal infection.

The widespread use of vaccines during the war and the success of vaccine in the influenza epidemic induced confidence in this form of preventive medicine. In the 20 years between the influenza epidemic and World War II there was a steady increase in the development and use of vaccines.

The outbreak of World War II provided another stimulus to the development of vaccines. There was a fear that a pandemic of influenza might recur and decimate the armed services. The influenza virus had been isolated from swine in 1930 and from humans in 1933. In Australia, Burnet was developing live virus vaccines when Francis and his colleagues in America showed that killed influenza virus vaccines were effective. The armed services decided that killed vaccines should be prepared to protect the armed personnel and so these vaccines were produced in Australia and released for use in the Australian and British services in 1945.

In the 50 years after the end of the war, the introduction of cell culture technology enabled the production of the modern viral vaccines for the prevention of poliomyelitis, measles, rubella, mumps and hepatitis. In addition, the older bacterial vaccines were purified, and standardised according to international requirements to ensure that efficacy,

potency and safety could be maintained. Multi-component vaccines were also formulated to simplify vaccine schedules and reduce the number of doses required. The modern age of vaccination had arrived.

What does the Australian experience reveal about the success of vaccination? The results of the national campaigns are shown in Table 1 and Table 2. It can be seen that soon after community-based campaigns were introduced a dramatic reduction occurred in the number of deaths resulting from the common vaccine-preventable diseases. In the decade in which public vaccination began in Australia 9,292 children died from these diseases where only 29 deaths occurred in the past decade[8]. Notification rates are not available for these diseases over this time. It is important to remember that improvements in nutrition and environmental conditions also contribute to the reduction in death rates and that the sulphonamide drugs and antibiotics have played an important role in the management of complications of these diseases. Nevertheless, the data remain crucial in an evaluation of disease control as do the data which appear when vaccination rates fall and diseases recur. Unfortunately, in the past five or six years, there have been large outbreaks of pertussis and measles[9,10]. The data from these outbreaks are shown in Figures 1 and 2. These results contrast with the gratifying success of the campaign against *Haemophilus influenzae* which is shown in Figure 3.

In the past 20-30 years vaccination campaigns have been conducted in many developing countries and the control and eradication of vaccine-preventable diseases is being achieved. A summary of some recent data is shown in Table 3[11]. It can be seen that an estimated three to four million children die each year from the diseases and another four million are disabled. Nevertheless, the World Health Organization anticipates that poliomyelitis can be eliminated by 2000 and measles soon after. In order to achieve these results, high levels of vaccination must be reached and maintained.

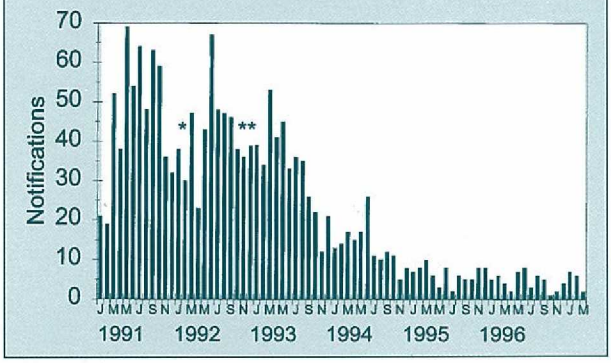
The past century has seen extraordinary success in the control of vaccine-preventable diseases in Australia and throughout the world. With the development of newer technologies in vaccine development in the next few years, it is possible to anticipate great success in the coming century. One can now envisage the production of therapeutic vaccines for infections such as *Helicobacter pylori* and recent evidence suggests the use of vaccines against certain neoplastic diseases is within reach.

ACKNOWLEDGMENT

Data on infectious diseases have been gratefully received from the Communicable Diseases Network – Australia, New Zealand – National Notifiable Diseases Surveillance Systems, personal communication.

FIGURE 3

HAEMOPHILUS INFLUENZAE TYPE B INFECTION NOTIFICATIONS, AUSTRALIA, JANUARY 1991 TO MARCH 1997



* PRP-D vaccine approved February 1992
** Infant vaccine approved September 1992

TABLE 3

ESTIMATES OF WORLDWIDE BIRTHS, DEATHS AND DISABILITIES, INFANTS AND CHILDREN

Number	Number (million)
Births per year	138
Deaths per year	15
Vaccine-preventable deaths	3 to 4
Deaths from measles	1
Disabled per year	4

Source: World Health Organisation epidemiological data, 1996.

1. Galazka AM, Lauer BA, Henderson RH and Kena J. Indications and contraindications for vaccines used in the Expanded Program on Immunisation. *Bull WHO* 1984; 62:357-366.
2. Fenner F, Henderson DA, Arita I, Josek Z, Ladnyi ID. Smallpox and its eradication. Geneva: WHO, 1988, 540-592.
3. Sabin AB. Perspectives on the use of some current viral vaccines in the USA. *Ped Research* 1979; 13(5)674-683.
4. Feery B. Impact of immunisation on disease patterns in Australia. *Med J Aust* 1981; 2:172-176.
5. Cumpston JHL. The History of Smallpox in Australia, 1788-1908. Commonwealth of Australia Quarantine Service Publication No 3, 1914.
6. Thompson JA. Preventive inoculation against plague. *Aust Med Gaz* 1903; 1:33.
7. Feery B, Webster AF. Vaccines and diagnostic reagents. In: Fenner F, ed. History of Microbiology in Australia. Australian Society of Microbiology Publication, 1990; 499-518.
8. Feery B. What has 200 years of vaccine development achieved? 200-Year Celebration of Vaccine Development, 1796-1996. South Australian Health Commission Publication 1996; 7-9.
9. National Notifiable Diseases Surveillance System. Pertussis Notifications 1991-1994. *Communicable Dis Intell* 1994; 18:465.
10. National Notifiable Diseases Surveillance System. Measles Notifications Jan 1992 - Aug 1994. *Communicable Dis Intell* 1994; 18:443.
11. EPI Data. WHO 1996.