A Report On The Health of British Columbians

Provincial Health Officer's

Annual Report

1998

Feature Report: Immunization

Ministry of Health and
Ministry Responsible for Seniors

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Ministry of Health and
Ministry Responsible for Seniors
Victoria, B.C.

February 26, 1999

The Honourable Penny Priddy
Minister of Health and
Minister Responsible for Seniors

Madam:
I have the honour of submitting the Provincial Health Officer's Annual Report for 1998.

Dr. Shaun H.S. Peck
Acting Provincial Health Officer

Highlights

Immunization is one of the miracles of this century. With the exception of safe drinking water, no other intervention – not even antibiotics – has had such a major impact on people's health and survival. Yet, because immunization has been so successful, it is easy to forget how important this preventive measure is.

This year's annual report takes a look at immunization programs in British Columbia – what we are aiming to achieve, how well we are doing, and what improvements are possible in the future. This report is intended to be a call to action – a challenge to all those involved in immunization – to make our programs even better, so that we can achieve the best possible benefits to health from immunization.

Successes and Savings

(Chapter 3)

We can be proud of our accomplishments to date. Thanks to immunization, smallpox was eradicated twenty years ago, and the global eradication of polio is expected to be declared within the next few years. Here in British Columbia, more than 900 diphtheria cases were reported in 1928, the year before diphtheria immunization was introduced. Today, diphtheria cases and deaths are extremely rare. Other success stories include our excellent progress towards eliminating measles and Haemophilus ("Hib") meningitis, a disease that used to be a common cause of deafness, brain damage, and death in young children. In British Columbia, immunization prevents an estimated 108 cases of Hib, 2,800 cases of measles, 2,000 cases of rubella, between 2 and 20 cases of congenital rubella syndrome, and 280 cases of polio each year. Each case prevented means one illness avoided, along with the accompanying risk of complications, suffering, and death.

Immunization is also a bargain. The Ministry of Health will spend $11 million this year – $2.75 per person – to purchase vaccines. Depending on the vaccine, studies have shown that each dollar invested in immunization can save between $7 and $80 in medical care and other costs. Since Hib vaccine was introduced in B.C., hospitalizations due to Hib infections, many of which used to require admission to intensive care units, have been reduced dramatically. Yet, vaccine-preventable diseases still account for 2,200 hospital cases and 17,000 bed-days each year – enough to fill 46 hospital beds every day, at a cost of $9.7 million per year. Maintaining and improving our immunization programs are the best way to keep people healthy and to reduce these health care costs.

Immunization in B.C. Today

(Chapter 4)

British Columbia has one of the most comprehensive immunization programs in the world, in terms of the number of vaccines available and the groups targeted. All children have access to immunizations to protect them from nine serious diseases. Other immunizations are available for adults and for special population groups and situations.

About 80 per cent of **infants and preschool children** have been immunized by the time of their second birthday. This is below the national target of 97 per cent. Of the 80 per cent immunized by age two, there are many who did not receive their shots on time at the recommended age, and thus could have been protected earlier but were not. We must do better.

Within the province, there are regional differences. In some regions and communities, almost all two-year-olds are fully immunized, but there are other areas where the level of coverage needs to be improved. On-reserve First Nations children – who as a group have poorer health on many other health measures – have immunization rates that are comparable to, or better than, the provincial average.

British Columbia does a commendable job in immunizing **school-age children and youth**. Immunization rates have remained at or above 90 per cent for most vaccines, and we are close to meeting the national target for hepatitis B, which is 95 per cent. For school-age children, the challenge is to maintain current high levels of immunization and to ensure that no groups of children are missed – for example, immigrant children or children who are not living with their families.

Most **adults** lack complete and up-to-date immunization records, and we do not know what proportion of the population has received the recommended vaccines. Adults age 65 and older should receive influenza vaccine each year and at least one dose of pneumococcal vaccine. Only 53 per cent of British Columbians age 65 and older had an influenza shot in 1998 – far below the target of 90 per cent.

Special populations – whose age, medical condition, occupation, living conditions, or lifestyle put them at risk for vaccine-preventable diseases – are growing in numbers, and immunization programs are expanding to reach them. Among care facility residents in 1998, 75 per cent were immunized for pneumococcal disease and 83 per cent for influenza. For staff of care facilities, who can transmit influenza to residents, the immunization rate was much too low – only 28 per cent. We lack data for other special populations, but we know that many people in high-risk groups are not being fully protected.

International travel has grown dramatically in the past decade, and travel-related diseases are becoming increasingly common. There are provincial and national recommendations for travel-related immunizations, but there is no provincial program to provide vaccines free of charge. Each area of the province chooses how to implement travel health services, which include information, specialized advice, and immunization services.

The Future

(Chapter 5)

A vaccine for chickenpox was licensed for use in Canada in December 1998. Within the next few years, we can expect to see improved vaccines for influenza, a new combined vaccine that will boost pertussis protection among adolescents and adults, and a vaccine that will allow infants and young children to receive vaccines for six diseases in one injection. Much further in the future, research is under way that may lead to vaccines for preventing – and treating – chronic infections such as HIV, sexually transmitted diseases, cancers, and arthritis.

Issues and Challenges

(Chapter 6)

Because most immunizations are publicly-funded and available to all eligible British Columbians free of charge, it should be possible to achieve and maintain very high immunization rates. Yet, we still have some distance to go to meet provincial goals and targets for immunization. Making better use of current vaccines and taking advantage of new vaccines will require:

- Making continued commitments to immunization – in funding, human and other resources.
- Identifying and removing immunization barriers that people may face, such as not knowing which vaccines are required, forgetting when immunizations are due, scheduling problems, believing that people should not be immunized when they have a mild illness, or fear of side effects.
- Keeping consumers informed about the vaccines recommended for themselves and their family and the purpose, benefits, and risks of immunization.
- Managing the delivery system so that the doctors and nurses who provide immunizations are supported efficiently through activities such as vaccine distribution, professional training and advice, and disease surveillance.
- Working together with governments, health authorities, professional associations, the research community, schools and day care centres, employers, community organizations, the media, and other groups who can support immunization.
- Developing better information and evaluation tools.
- Improving accountability, through regular reports on immunization coverage, disease reduction, vaccine safety and effectiveness, and other aspects of immunization program delivery.

Recommended Actions

(Chapter 7)

This report identifies 81 specific actions we can take to strengthen our current immunization programs and to prepare for the future. Priority actions are:

1 Achieving better immunization coverage rates, in the following areas:

- On-time immunization of all infants and preschool children
- Influenza immunization for all risk groups, especially people age 65 and older, people with chronic diseases in all age groups, and health care workers

2 Providing funding to expand current immunization programs to cover additional ages and risk groups in three areas:

- Hepatitis B immunization for all infants and children, including children who immigrate to B.C. from countries where hepatitis B is common
- Pneumococcal immunization for people with chronic diseases in all age groups
- Hepatitis A immunization for men who have sex with men

3 Providing funding for continued development of a province-wide, electronic registry for immunizations, communicable diseases, and adverse reactions. Ways and means should be found to ensure that all age groups, all immunization providers, and all areas of the province are able to participate in, and benefit from, this essential health information system.

4 Developing a strategic plan, so that we are prepared to:

- Adopt and meet provincial goals and targets for immunization and for the control of vaccine-preventable diseases.
- Introduce chickenpox vaccine, acellular pertussis vaccine for adolescents, and other new, cost-effective vaccine products that are expected to become available in the next few years.
- Offer publicly-funded immunizations to all target groups recommended in the *Canadian Immunization Guide*, through a coordinated provincial program.
- Manage the expected world-wide epidemic ("pandemic") of influenza.

For a complete list of recommended actions for Individuals and Families, Immunization Providers, Local Health Authorities, Provincial Authorities, and Community Partners, see pages 76-82. References and statistical data may be found in the Appendices.

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1. Introduction

British Columbia offers excellent immunization programs, but many of us take these for granted. This report is a call to action – a challenge to all those involved in immunization – to make our programs even better, so that we can achieve the best possible benefits to health from immunization.

Immunization is one of the miracles of this century. With the exception of safe drinking water, no other intervention – not even antibiotics – has had such a major impact on people's health and survival (Plotkin & Plotkin, 1994).

Immunization helps to protect us all from certain "vaccine-preventable" diseases. Today, many diseases that previously caused serious illness and death have been eliminated or greatly reduced as a result of immunization. Because immunization has been so successful, it is easy to forget how important this preventive measure is. If the number of people who are immunized drops substantially, diseases that have been eliminated could return. Other diseases are still common, but would become rare if more people were immunized.

This year's annual report takes a look at immunization programs in British Columbia – what we are aiming to achieve, how well we are doing, and what improvements are possible in the future. Some of the specific questions discussed in this report are:

- What immunizations are available to British Columbians today?
- What goals and targets are we aiming to achieve, in terms of immunization coverage and disease reduction?
- Are people receiving the recommended immunizations, at the correct time?
- How can we achieve better immunization coverage rates? What are the barriers, and how can we remove them?
- What funding or other actions are required in order to ensure that British Columbians continue to receive these highly effective services?
- What are the responsibilities of individuals and families, communities, and the health care system?

In British Columbia, immunizations are currently available to protect all children from nine serious diseases. Other immunizations are available for adults and for special population groups and situations.

As new, cost-effective vaccines are developed and tested, they are introduced into the provincial immunization program. To ensure that everyone receives the immunizations they need, coordinated efforts are required. Successful immunization programs require:

- Well-informed consumers and caregivers;
- Specific objectives for immunization and for the reduction or elimination of disease;
- The selection of effective vaccine products;
- A sufficient number of skilled and dedicated health care workers to provide the vaccines, along with the resources they need to support their immunization activities;
- Evaluation of performance, including immunization coverage rates, vaccine effectiveness, side effects, and storage and handling of vaccines (the "cold chain").

Everyone has a part to play in making and keeping our programs effective in our communities and responsive to global issues and trends. This report – and the actions recommended in the last chapter – are for individuals and families, physicians and nurses who provide immunizations, and those who fund, manage, and support immunization programs at local and provincial levels.

Provincial Health Officer's Reports

Since 1993, the Provincial Health Officer has been required by the *Health Act* to report annually to British Columbians on their health status and on the need for policies or programs that will improve their health. Some of the reports produced to date have given a broad overview of health status, while others have focussed on particular topics such as women's health, child health, and injection drug use.

Provincial Health Officer's reports are one means for reporting on progress towards the provincial health goals. The six goals, approved by Cabinet, go beyond health services and include the many factors that affect our health. Along with the goals, there are 44 specific objectives and accompanying indicators for measuring progress. One of the objectives – to reduce or maintain current very low levels of vaccine-preventable disease – provides the focus for this year's report on immunization.

Copies of the Provincial Health Officer's reports and the health goals document, *Health Goals for British Columbia*, are available from the Office of the Provincial Health Officer. See page B-8 for a list of publications and ordering information.

2. What is Immunization?

Immunization is one of the safest and most effective tools we have for preventing illness and death. At least twenty diseases can be prevented through immunization. By receiving all the recommended vaccines, we protect not only ourselves, but also our family, friends, neighbours, and communities.

How Immunization Works

Immunization is a process that helps the human body fight off diseases caused by certain viruses and bacteria.

Immunization works by exposing the body to vaccines, usually by injections. These vaccines contain tiny amounts of material that make the immune system produce antibodies that attack and destroy infections.

After receiving a vaccination, the immune system responds by making protective antibodies and saving the information in its memory bank. Later – even many years later – when the body is exposed to that same disease organism, it remembers how to make the antibodies. The body quickly produces those antibodies again, stopping the organism from making you sick.

In addition to receiving a vaccine, people may become immune to diseases in other ways. Babies receive antibodies from their mother while in the womb or from breastfeeding, and these help protect the baby during the first year of life. People may also become immune by being infected with – and surviving – the disease itself. In certain circumstances, such as after exposure to a disease, short-term immunity can be achieved by receiving an injection of immune globulin or other protective antibodies.

Immunization protects the person who receives the vaccine. It also protects the entire population, through a phenomenon called "herd immunity". If a sufficiently high percentage of the population is immune to a disease, there is less chance that the disease organism will find people to infect. The organism's survival is jeopardized, and infections with that particular virus or bacterium tend to be seen less often, or may disappear entirely if the organism is capable of infecting only humans. Smallpox is one disease that was eradicated worldwide through immunization.

What proportion of the population needs to be immunized for herd immunity to work? That depends on the size of the population and the characteristics of the disease organism – how the disease is transmitted, the time it takes the disease to develop, the number of years that immunity lasts, whether animals can get or spread the disease, and whether the disease is treatable or not. For diseases such as measles or pertussis, as much as 95 per cent of the population may need to be immunized for herd immunity to provide its full protective effect.

The principle of herd immunity is one of the reasons that immunization programs try to attain very high levels of coverage. There is also a social responsibility to keep our immunizations up-to-date. There will always be some individuals who cannot be immunized because of an allergy or who cannot respond fully to immunization because of an underlying disease. By receiving all the recommended vaccines, we are protecting not only ourselves, but also our family, friends, neighbours, and communities.

Terms

Immunity: Ability to resist a particular disease. The body's immune system responds quickly to prevent infection.

Immunization: The process of becoming immune. A broader term than vaccination. Includes the act of administering the vaccine and the creation of immunity.

Immunization rate: Proportion of the population who have been immunized against a disease. Also called "immunization coverage" or "uptake" rate.

Pertussis: Whooping cough.

Vaccination: Administering a vaccine, usually by injection.

Vaccine: A product that is given to increase immunity to a particular disease.

Vaccine-associated adverse events: Reactions ("side effects") that are related to immunization.

Vaccine-preventable diseases: Diseases that can be prevented through immunization.

Types of Vaccines

Vaccines are prepared in different ways. Some are inactivated or "killed" vaccines, containing organisms that have been killed by the production process. Examples are influenza and inactivated polio vaccine (IPV). A number of the newest vaccines, like those for Haemophilus influenzae b (Hib) and hepatitis B, are made from small, purified components of bacteria or viruses.

Some vaccines, like those for measles, mumps, and rubella, contain actual living organisms that have been modified so they can stimulate immunity without causing disease. For these "live" vaccines, only a small dosage is needed, and the immunity lasts for many years. All vaccines must be stored and handled carefully, but live vaccines often require special care, and the spacing of doses is important. Most live vaccines are not given to pregnant women or to people with weakened immune systems.

Many vaccines require a series of doses, a few weeks or months apart. Even then, protection will diminish over the years, because the immune system's memory can fade over time. Booster shots remind the immune system's memory and are an important part of most immunization programs, even for adults.

Immunizations are Safe

Vaccines are among the safest tools of modern health care. Serious side effects are very rare — less than one in a million for vaccines used in Canada. Effective treatment has meant that even those who experience serious side effects usually recover completely.

While serious side effects are very rare, minor side effects from vaccines are more common. These include swelling and soreness at the part of the body where the vaccine was injected, as well as mild fevers. These side effects may cause discomfort. However, minor side effects clear up in a few hours or days, and the person quickly returns to their normal state of health.

The benefits of immunization far outweigh the risks associated with the diseases the vaccines are intended to prevent. Table 1 on the following pages compares the risks of nine diseases with the common or serious side effects of receiving the vaccine. These figures are drawn from different studies and represent the best estimates of risk. In most cases, the figures vary according to the person's age, sex, state of health, and other factors.

The safety of vaccines is of great concern to everyone. Before a new vaccine is introduced in Canada, it has to undergo laboratory testing and field testing, as well as a thorough licensing procedure by Health Canada. Even when the vaccine is approved and introduced, every batch produced is tested for safety and quality. Vaccines are continually and vigorously monitored for side effects. Canada, and British Columbia in particular, are considered to be world leaders in this area. Everyone who receives a vaccine is asked to report any unusual side effect after a vaccination. When serious side effects are reported, each incident is carefully reviewed by experts in immunization and vaccine research.

Scientists continue to work to develop better and safer vaccines. As vaccines with fewer side effects become available, they are incorporated into the provincial immunization program. Some recent examples are an enhanced injectable polio vaccine, which eliminated all risk of vaccine-associated polio, and an acellular pertussis (whooping cough) vaccine, which has milder and fewer side effects than the previous whole-cell vaccine. Although improved vaccines will continue to be developed, current vaccines are very effective and very safe.

Table 1 Comparing Risks: Disease Risks and Immunization Risks

Possible Effects from Having the Disease		Common or Serious Side Effects of Vaccine	
Diphtheria			
Nerve damage	20 - 75 per cent	Soreness and/or redness where injection given	20 per cent
Heart damage	10 - 25 per cent		
Death	5 - 10 per cent	Fever	5 per cent
Tetanus			
Death	10 per cent	Soreness and/or redness where injection given	20 per cent
		Fever	5 per cent
		Nerve damage to arm	1 per 1 million
Pertussis (children under age 1)			
Pneumonia	22 per cent	Soreness and/or redness where injection given	20 per cent
Convulsions	1 - 3 per cent		
Brain damage	1 to 3 per 1,000	Fever	5 per cent
Death	0.5 per cent	Crying	6 per cent
Under 6 months of age	5 per cent		

Table 1 (continued) Comparing Risks: Disease Risks and Immunization Risks

Possible Effects from Having the Disease		Common or Serious Side Effects of Vaccine	
Haemophilus influenzae type b (Hib meningitis)			
Deafness	15 - 20 per cent	Soreness and/or redness where injection given	5 per cent
Brain damage	10 - 20 per cent		
Death	5 per cent	Fever	2 per cent
Polio			
Meningitis	1 - 5 per cent	Soreness and/or redness where injection given	5 per cent
Paralysis	1 to 10 per 1,000		
Measles			
Ear infection	7 - 10 per cent	Soreness, fever, and/or rash	5 - 15 per cent
Pneumonia	1 - 10 per cent	Temporary changes to blood clotting	1 per 24,000
Diarrhoea	6 per cent		
Inflammation of the brain	1 per 1,000	Inflammation of the brain	1 per 1 million
Death	1 per 1,000		
Mumps			
Swelling of salivary glands	90 per cent	Swelling of salivary glands	1 per cent
Meningitis	10 - 15 per cent	Meningitis	1 per 800,000 to 1 per 3 million
Swelling of testes	20 - 40 per cent		
Swelling of ovaries	5 per cent		
Inflammation of the brain	1 per 400		
Pancreatitis	4 per cent		
Deafness	1 per 200,000		
Sterility	Occurs rarely		
Death	1 per 5,000		
Rubella			
Birth defects	85 per cent*	Soreness and/or redness where injection given	10 per cent
Miscarriage	20 per cent*		
Inflammation of the brain	1 per 6,000	Swollen glands, stiff neck, or joint pain	1 per cent (children) 15 per cent (adults)
Pain in joints (teens/adults)	50 per cent		
Hepatitis B			
Acute illness	50 per cent	Soreness where injection given	15 per cent
Death from acute illness	1 - 2 per cent		
Become hep B virus carrier	90 - 95 per cent (infants) 20 - 50 per cent (children) 5 - 10 per cent (adults)		
Results of carrying virus Liver cancer	5 - 15 per cent		

* *Rubella: Risk of birth defects (85 per cent) and miscarriage (20 per cent) are for disease contracted during the first two months of pregnancy. Birth defects can include blindness, deafness, cataracts, heart defects, and/or brain damage.*

Data in this table represent a range of estimates compiled from published sources, including:
Canadian Immunization Guide, 5th edition, National Advisory Committee on Immunization, Health Canada Cat. H49-8/1998E.
Your Child's Best Shot – A Parent's Guide to Vaccination. Canadian Pediatric Society, 1997.
Immunization Choices: Protect Your Child. New Zealand Ministry of Health, April 1997.

Which Diseases can be Prevented through Immunization?

Of the several hundred communicable diseases that exist in the world today, at least twenty can be prevented to some extent through immunization.

An ideal vaccine would give life-long, 100 per cent protection against disease. It would be inexpensive enough for population use, stable enough to withstand shipping and storage conditions, and have no negative side effects on the recipient. Some vaccines come close to meeting this ideal, while others do not. Each vaccine has its own characteristics.

Most vaccines are extremely effective in preventing disease. More than 95 per cent of those who receive the recommended vaccine series for diphtheria, tetanus, measles, mumps, rubella, Hib, and polio develop antibodies that protect them from disease (Table 2).

Some vaccines have lower rates of effectiveness in preventing the disease itself. However, they may still be highly effective in preventing complications and death. Influenza vaccine, for example, is between 30 per cent and 70 per cent effective in preventing influenza illness, depending on the age and health of the person immunized. However, influenza vaccine is very effective in preventing pneumonia and influenza hospitalizations among the elderly, and can prevent up to 85 per cent of influenza deaths among those living in nursing homes (National Advisory Committee on Immunization, 1998).

Immunization is just one part of a comprehensive program to control communicable diseases, even those that are vaccine-preventable. Maintaining the highest possible immunization rates and promptly identifying people who are infected or who have been in contact with the disease are the best ways of controlling highly contagious diseases such as diphtheria and measles. For diseases such as hepatitis A and typhoid, promotion of good personal hygiene, adequate standards of living, and safe methods of handling food are the first line of defense, but immunization of high-risk groups is also important in controlling disease. Providing immune globulin or other preparations can provide short-term protection for certain diseases such as hepatitis B or rabies. Educating people about prevention and treatment of diseases is always an important part of reducing risks.

For information about the symptoms and prevention of measles, hepatitis A, and other vaccine-preventable diseases, please see the Health Files on these topics. Health Files are available through your local public health unit, your family doctor, or on the Internet at http://www.hlth.gov.bc.ca/hlthfile/

While the ultimate goal is to eliminate vaccine-preventable diseases, this is not always possible, even with high immunization rates. The current vaccine might not provide life-long immunity, or the disease organism might change.

For diseases that cannot be completely eliminated, the goal is to reduce occurrence, spread, and complications of disease to the lowest possible level, while continuing to study and to improve our approach to controlling the disease.

Table 2 Effectiveness of Vaccines Used in British Columbia Today

Vaccine	Effectiveness
Vaccines that most or all people should receive, beginning in childhood:	
Diphtheria	95% - 99%
Haemophilus influenza b (Hib)	95% - 99%
Hepatitis B	90% - 99%
Measles (2 doses)	95% - 99%
Mumps	95%
Pertussis (acellular)	85%
Polio	99%
Rubella	95% - 97%
Tetanus	95% - 99%
Vaccines recommended for everyone age 65 and older and for at-risk people in all age groups:	
Influenza	30% - 70%
Pneumococcal	50% - 80%
Other vaccines recommended for special population groups or special situations:	
BCG (for tuberculosis)	30% - 66%
Cholera	80% - 90%
Hepatitis A	97% - 99%
Japanese B Encephalitis	91% - 99%
Meningococcal	90% - 95%
Rabies	99%
Typhoid	40% - 93%
Yellow Fever	99%

Effectiveness: Approximate percentage of people receiving the vaccine series who develop antibody response that gives protection against the disease.
Note: For some vaccines, the initial series provides life-long immunity. For others, booster doses are required. For information about the number and timing of doses required to maintain protection, see the immunization schedules in Appendix C.
Sources: Canadian Immunization Guide, 5th edition, 1998. National Advisory Committee on Immunization. Health Canada Cat. H49-8/1998E. Immunization Program, British Columbia's Communicable Disease Control Policy Manual, Appendix 11.

3. Past Experiences

We can be proud of our accomplishments to date. Thanks to immunization, polio has been eradicated from the western hemisphere, and we have witnessed a dramatic decline in diphtheria and tetanus. Other success stories include our excellent progress toward eliminating measles and Haemophilus ("Hib") meningitis, a disease that used to be a common cause of deafness, brain damage, and death in young children. Immunization not only prevents suffering and saves lives, it also saves money in health care and other costs. But we cannot become complacent. Diseases currently controlled can reappear, if we do not maintain high levels of immunization.

Successes

Vaccines work! In fact, it has been said that the two public health interventions that have had the greatest impact on the health of the world are clean drinking water and vaccines. Vaccines prevent illness and death for millions of people every year, and have contributed to the disappearance of some major diseases. Other than safe water, no other intervention – not even antibiotics – has had such a major impact on survival (World Health Organization, *The history of vaccination*; Plotkin & Plotkin, 1994).

Smallpox

Smallpox was the first vaccine developed, nearly two hundred years ago (Table 3). Since that time, this deadly disease has been eliminated world-wide ("eradicated") due to widespread use of the vaccine. Because it is no longer needed, the smallpox vaccine is no longer in use.

During the late 19th century and early years of the 20th century, great vaccine scientists such as Pasteur began to develop vaccines. During the 1920s, diphtheria, tetanus, pertussis (whooping cough), and BCG vaccines were developed, followed by yellow fever vaccine. After the Second World War, there was an explosion of technology, which resulted in production of vaccines for polio, measles, mumps, and rubella. This "golden age of vaccine development" has continued. Using new technologies, scientists are continuing to find safer and more effective ways to protect people from disease.

In addition to smallpox, several other diseases have been eradicated or have been greatly reduced as a result of vaccines.

Table 3 Date of Development of First Generation of Vaccines for Use in Humans

Date	Vaccine
1798	Smallpox
1885	Rabies
1896	Typhoid
1896	Cholera
1897	Plague
1923	Diphtheria
1926	Pertussis (Whooping Cough)
1927	BCG (for Tuberculosis)
1927	Tetanus
1935	Yellow Fever
1936	Influenza
1955	Injectable Polio Vaccine
1962	Oral Polio Vaccine
1964	Measles
1967	Mumps
1970	Rubella
1971	Meningococcus
1978	Pneumococcus
1981	Hepatitis B
1981	Acellular Pertussis
1985	Haemophilus influenzae type b (Hib)
1986	Hepatitis A
1994	Chickenpox

Sources: Plotkin. S.A., & Mortimer, E.A. (Eds.). (1994). Vaccines (2nd edition). Philadelphia, PA: W.B. Saunders Company. And The History Of Vaccination, http://www.who.int/gpv-dvacc/history/. Note: This table shows the year that each vaccine was first developed. Often, a few years elapse between the development of the vaccine, its licensure for use in Canada, and its widespread use in immunization programs.

Polio

Polio, a crippling and sometimes fatal disease, is another example of an immunization success story. The last major epidemic of polio occurred in Canada in 1959, when 1,887 paralytic cases occurred.

Polio immunization programs began in British Columbia and around the world in the mid to late 1950s. By the 1970s, only a handful of cases were reported in Canada each year. Polio was eradicated from the western hemisphere by 1991, and the World Health Organization aims to rid the entire world of this disease by the year 2000.

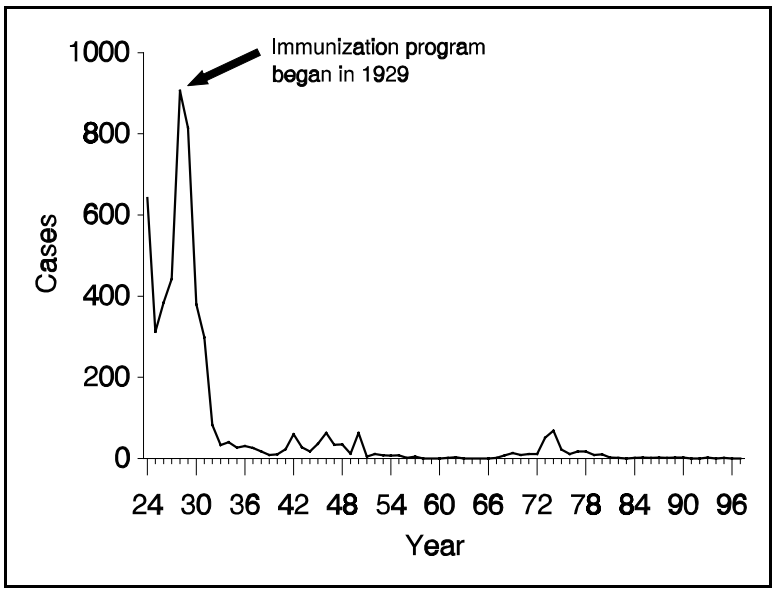
Diphtheria

Diphtheria is another disease that has all but disappeared in Canada thanks to continued high levels of immunization. In 1928, the year before immunization was introduced, more than 900 diphtheria cases were reported in British Columbia. Despite advances in medical treatment that were helping to reduce the number of diphtheria deaths, as many as 68 deaths were occurring in a single year in this province.

Once immunization was in widespread use, diphtheria cases (Figure 1) and deaths dropped dramatically. Today, cases and deaths are extremely rare in British Columbia.

Note: For numerical data contained in Figure 1 and other graphs in this report, please refer to Appendix E and Appendix F.

Figure 1 Reported Cases of Diphtheria, B.C., 1924-1997



Diphtheria toxoid was licensed in Canada in 1926. An immunization program began in B.C. in 1929.
Source: Epidemiology Services, B.C. Centre for Disease Control Society. Unpublished tables, January 1999.

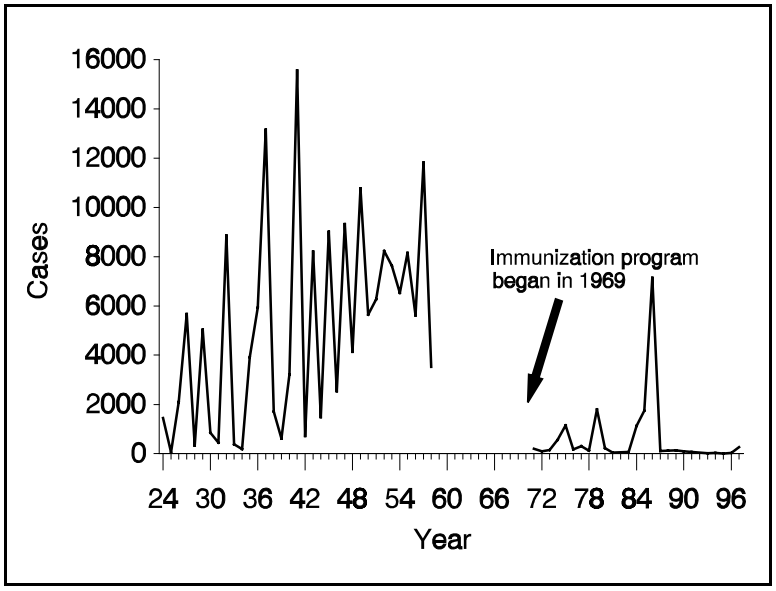
Measles

Before immunization, measles occurred in cycles, with an outbreak taking place every two or three years. The 1937 outbreak caused 173 deaths. In 1941, more than 15,500 cases were reported.

After immunization was introduced, measles cases declined Outbreaks still happened, but the intervals between them were farther apart, and fewer people were affected (Figure 2). To make further reductions in disease, a two-dose measles schedule was introduced in 1996, along with a catch-up program for students through post-secondary school. With these measures in place, it should no longer be possible for large outbreaks to occur, provided all children are appropriately immunized. With continued efforts, it should be possible to achieve the national goal of eliminating measles by the year 2005.

Note: Reported cases are usually not all the cases that occur. There were probably many other cases of disease that were not recognized or that were not reported.

Figure 2 Reported Cases of Measles, B.C., 1924-1997



Measles vaccine was introduced in Canada in 1963. An immunization program began in B.C. in 1969. Before universal immunization, measles occurred in cycles, with outbreaks every two to three years. After immunization programs were in place, outbreaks still occurred, but the intervals were further apart, and fewer people were affected.
Source: Epidemiology Services, B.C. Centre for Disease Control Society. Unpublished tables, January 1999. Data not available for 1959-1970; measles was not reportable during those years.

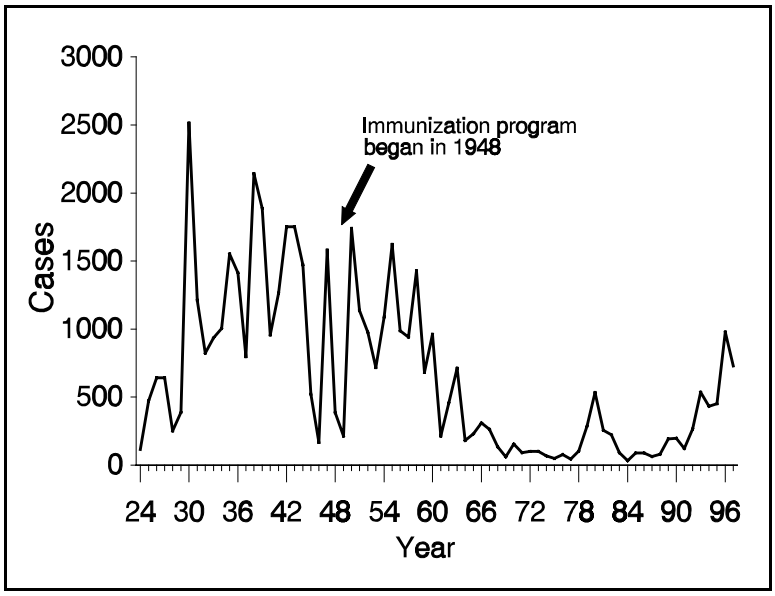
Pertussis (Whooping Cough)

Routine immunization has made pertussis much less common. However, this disease has been more difficult to control than diphtheria and measles, in part because pertussis vaccine was not as effective as some others. In 1997, 730 pertussis cases were reported (Figure 3).

Pertussis can be fatal — two B.C. children died from pertussis in 1996. Some children suffer severe complications, including seizures and permanent brain damage. The whole cell vaccines used since 1945 caused minor side effects in about 50 per cent of recipients and caused concern among parents. Development of a new "acellular" vaccine was a major advance, as the new vaccine is more effective in preventing pertussis and has milder, less frequent side effects than the previous vaccine. The acellular vaccine was introduced in B.C. in 1997, and should lead to a reduction in pertussis cases in the coming years.

Pertussis can occur in adults, too, because pertussis vaccine does not always provide life-long immunity. Looking ahead, it may soon be possible to provide a booster dose of the new vaccine to adolescents and young adults — an option not feasible with the old vaccine. By blocking the spread of infection in the general population, fewer infants and young children will be exposed to this potentially fatal disease.

Figure 3 Reported Cases Of Pertussis, B.C., 1924-1997



Pertussis vaccine was introduced in Canada in 1943. An immunization program began in B.C. in 1948. Source: Epidemiology Services, B.C. Centre for Disease Control. Unpublished tables, January 1999.

Hib

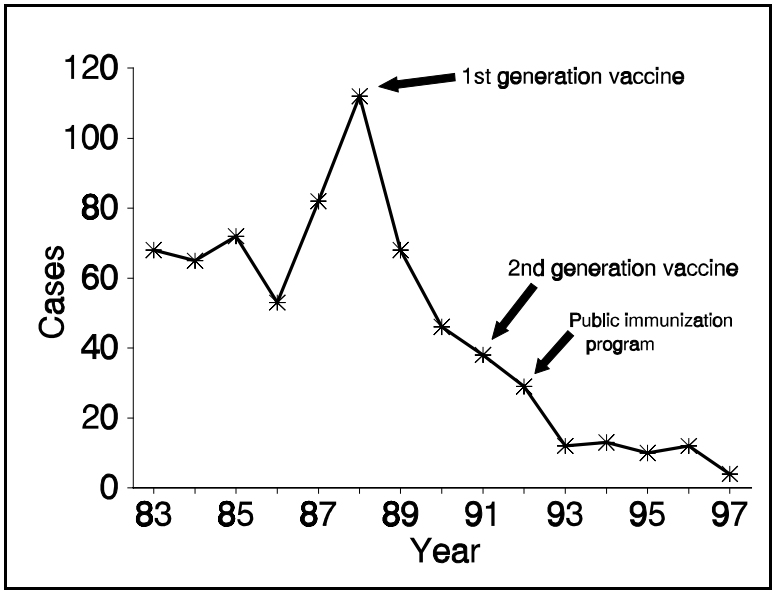
Haemophilus influenzae type b, commonly called Hib, was once the leading cause of bacterial meningitis, an infection of the lining of the brain and spinal cord, in young children. Hib infections, which can result in deafness, brain damage, and death, have been almost completely eliminated by immunization.

In spite of its name, Haemophilus influenzae is caused by bacteria and has nothing to do with influenza (the flu), which is caused by a virus. For convenience and to prevent confusion with influenza, the bacteria are commonly called Hib (Canadian Paediatric Society, Your Child's Best Shot, 1997. See Appendix D for more information about this publication).

The first generation Hib vaccine was introduced in Canada in 1988, and was used in children between two and five years old. In 1991 a second generation vaccine became available, which provided protection for infants age two months and older – the age group at highest risk. In the spring of 1992, Hib vaccine was incorporated into British Columbia's routine immunization program, and more than 80 per cent of young children were immunized.

The Hib vaccine, along with better treatment of the disease, has dramatically reduced the occurrence of Hib meningitis (Figure 4). The number of invasive Hib infections dropped from 112 in 1988 to 4 in 1997, and only one of these cases was a young child. Before Hib vaccine, 4 or 5 children died each year from Hib meningitis or its complications. Due to the vaccine, no child has died in British Columbia from Hib since 1993, and the number of children admitted to hospital because of Hib has declined dramatically (see page 18).

Figure 4 Cases Of Haemophilus Influenzae b (Hib) Meningitis, B.C., 1983-1997



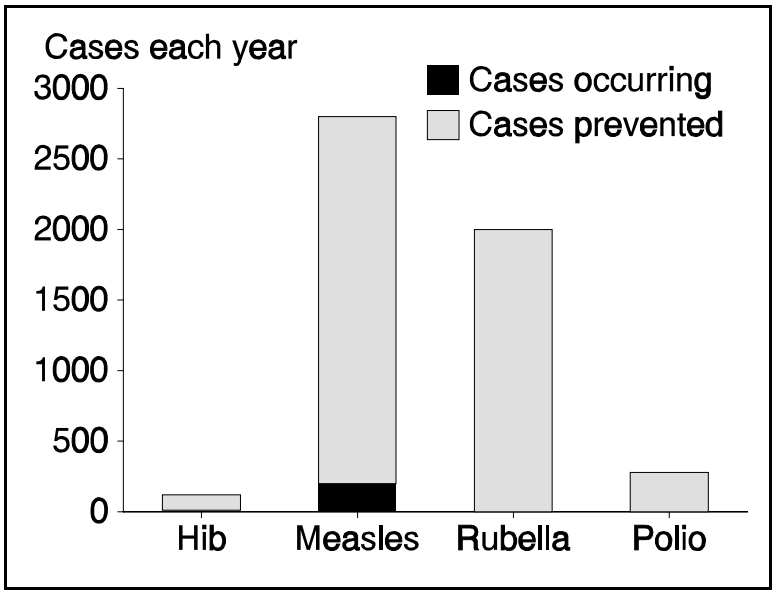
Source: Epidemiology Services, B.C. Centre for Disease Control Society. Unpublished tables, January 1999.

Savings as a Result of Immunization

How much disease is currently being prevented through immunization?

To illustrate the impact of immunization programs, Figure 5 shows an estimate of cases that are being prevented each year in British Columbia for just four diseases – Hib, measles, rubella, and polio. Disease rates just prior to introduction of immunization programs have been compared with rates after immunization (using 5-year averages). Based on these calculations, immunization programs are preventing 108 cases of Hib, 2,600 cases of measles, 2,000 cases of rubella, and 280 cases of polio in British Columbia **each year**.

Figure 5 Cases Of Disease Prevented By Immunization In 1998, B.C.



Cases prevented: Additional cases that would occur each year in B.C. if the disease occurred at rates experienced before immunization programs were in place. Source: Hoefer, M., & Bigham, M. Immunization Saves Lives!....The Real Numbers, 1998.

Immunization – World's Greatest Health Bargain

Not only does immunization prevent disease and save lives, it also saves money. In fact, immunization has been called "the world's greatest health bargain" (UNICEF, 1998).

Immunization is one of the few interventions where benefits exceed costs by a very wide margin (Table 4). Depending on the vaccine, studies have shown that each dollar invested in immunization programs can result in cost savings of between $7 and $80 (National Advisory Committee on Immunization, 1998).

Table 4 Cost per Life-Year Saved for Selected Life-Saving Interventions

Intervention	Cost per Life-Year Saved
Immunization for infants and preschool children	$0
Cessation advice for pregnant women who smoke	$0
Mandatory seat belt law	$69
Screening mammography for women age 50+	$810
Chlorination of drinking water	$3,100
Smoking cessation advice for people who smoke more than one pack a day	$9,800
Driver and passenger airbags/manual lap belts	$61,000
Smoke detectors in home	$210,000
Ban on products containing asbestos	$220,000
Low cholesterol diet for men over age 20 and cholesterol level above 180 mg/dL	$360,000
Crossing control arm for school buses	$410,000
Radiation emission standard for nuclear power plants	$100 million
Chloroform private well emission standard at pulp mills	$99 billion

"$0" means that the intervention saves more dollars than it costs. Source: Tengs, T.O., Adams, M.E., Pliskin, J.S., Safran, D.G. Siegel, J.E., Weinstein, M.C., & Graham, J.D. (1995). Five Hundred Life-Saving Interventions And Their Cost-Effectiveness. Risk Analysis, 15(3), 369-390. In Canadian Immunization Guide, 5th Edition, National Advisory Committee on Immunization, 1998.

Many of the large research studies comparing the costs and benefits of immunization have taken place in other countries. Cost-benefit studies that have been conducted in Canada have found that immunization programs here, as elsewhere, result in a net cost savings. Each dollar spent resulted in savings of $2.50 to $3 for two-dose measles-mumps-rubella vaccine and $6 to $8 for pertussis (Health Canada, 1997).

Costs in B.C.

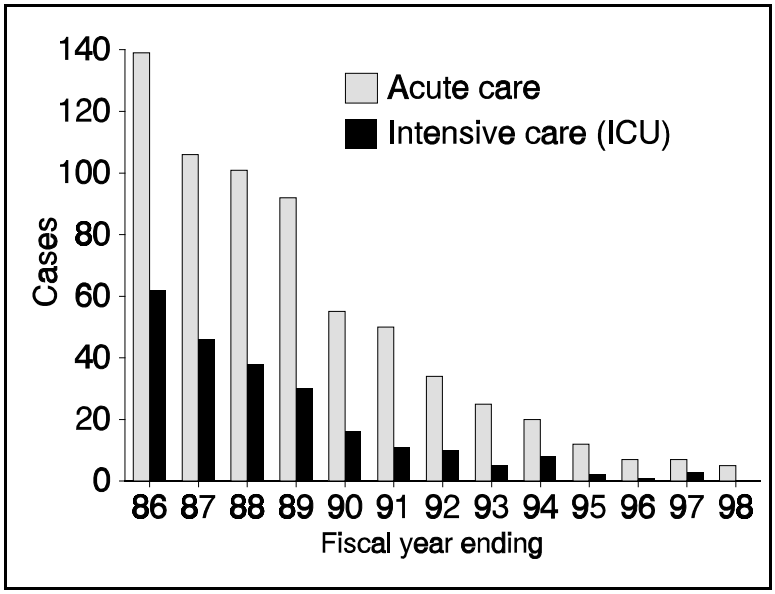
In British Columbia, vaccines to fully immunize a child against nine diseases, from infancy through adolescence, cost $154 – about as much as keeping someone in hospital for six hours (at $575 per hospital-day). Influenza vaccine, offered annually to all adults 65 and older and those with chronic diseases in all age groups, costs only $1.88 per dose. The benefits of these vaccines – to individuals and to the health care system – far outweigh the costs. British Columbia data for Hib illustrate some of the cost savings that can result from immunization.

Saving Hospital Costs

Hib vaccine has spared children and their parents much suffering (see page 15). It has also saved many thousands of dollars each year in hospital costs. In 1985/86, 139 children age 0 to 4 were admitted to hospital because of Hib. These children stayed in hospital an average of 11 days (for a total of 1,548 bed-days in 1985/86), and about half of the children required costly admission to intensive care units.

Since Hib vaccine was introduced, hospital caseloads due to Hib infections have decreased significantly (Figure 6), allowing the equivalent of two paediatric beds (one of which is at B.C. Children's Hospital) to be closed province-wide.

Figure 6 Hospitalizations due to Hib Meningitis and Acute Epiglottitis, Children Age 0-4, B.C., 1985/86-1997/98



Source: Canadian Institute for Health Information (CIHI) data for acute and rehabilitation care by principal diagnosis, Hib meningitis (ICD9 320.0) and acute epiglottitis (ICD9 464.3). Prepared by Information and Analysis Branch, B.C. Ministry of Health.

Table 5 shows that there are opportunities to further reduce British Columbia's hospital costs associated with vaccine-preventable diseases. As a group, these diseases account for 2,200 admissions and 17,000 hospital-days each year – enough to fill 46 hospital beds every day, at a cost of $9.7 million per year.

Table 5 Hospitalizations due to Vaccine-Preventable Diseases, B.C., Annual Average for Three-Year Period 1995/96-1997/98

Disease	Hospital Cases	Days Spent in Hospital
Diseases for which everyone should be immunized, beginning in childhood:		
Diphtheria	1	14
Hepatitis B	55	429
Hib meningitis	64	206
Measles	6	19
Mumps	3	10
Pertussis	103	475
Polio	<1	3
Rubella	4	9
Congenital rubella	1	26
Tetanus	2	19
Diseases for which immunization is recommended for everyone age 65 and older and for at-risk persons in all age groups:		
Influenza	518	2,107
Pneumococcal pneumonia	1,019	7,295
Other diseases that are less commonly reported and/or for which universal immunization is not recommended at this time:		
Chickenpox	79	315
Hepatitis A	36	182
Meningococcal meningitis	39	382
Plague	1	3
Tuberculosis	209	5,275
Typhoid	11	57
Total	2,151	16,827

Source: Canadian Institute for Health Information (CIHI) data for acute and rehabilitation care by principal diagnosis. Hib meningitis includes cases of acute epiglotittis, another infection that can be caused by the Hib bacteria. Unpublished tables, prepared by Information and Analysis Branch, B.C. Ministry of Health. For disease codes and time trend data, see Appendix E.

The hospitalizations is Table 5 (previous page) are potentially preventable, if each vaccine could provide a high level of life-long protection and if enough of the population were fully immunized.

At the present time, not all cases are preventable. For example, pertussis immunity declines in adults, and booster protection is not yet available. Many cases of hepatitis B were acquired by immigrants prior to arrival in B.C, and thus were not preventable through provincial immunization programs.

Although we cannot prevent all hospitalizations due to vaccine-preventable diseases, maintaining and improving our immunization programs are still the best way to keep people healthy and to reduce these hospital costs.

Will Immunization Programs Always Save More Money than they Cost?

In general, the first vaccines were the easiest to develop and least expensive to produce. New generations of vaccines tend to be more complex and expensive to develop. Some vaccines may even cost more than they are able to save in dollars spent on doctors, hospitals, and treatments.

However, all recommended vaccines will provide excellent value for money, when all costs and benefits – such as time missed from work or school – are considered.

What Happens when Immunization Levels are not Maintained?

Although many diseases are controlled by immunization, there is a need for continued vigilance. If immunization rates fall significantly, serious outbreaks of disease can happen.

In England, for instance, there were anti-immunization groups in the 1970s whose activities caused a major drop in immunization for pertussis. Soon after, two epidemics of the disease broke out, and dozens of children died. Following these outbreaks, immunization rates increased again, and the rate of pertussis dropped back to its previous, lower levels. Diphtheria in Russia is another example of what can happen when immunization levels are not maintained. When immunization rates in Russia fell in the 1980s, diphtheria cases began to appear, and the number of cases grew to epidemic proportions.

In some ways, immunization is a victim of its own success. As the public and health care workers become less familiar with vaccine-preventable diseases, complacency tends to increase. Most people do not remember the days when it was common for children to be stricken with diphtheria or polio, but we must pay attention to our immunization rates for these and other diseases. A drop in rates would be a dangerous development, which could lead to increased occurrence of preventable disease and death.

Furthermore, we must pay attention to the levels of vaccine-preventable diseases world-wide. Globally, we have made tremendous advances in protecting children through immunization. Today, about 8 of every 10 of the world's children are immunized against the major childhood diseases, while twenty years ago only about 20 per cent – one child in five – was protected. However, there is still a long, long way to go. World-wide, nearly 5,000 children each day – 2 million children each year – die from vaccine-preventable diseases (World Health Organization, 1998).

Although diseases such as diphtheria, polio, Hib, and measles have been well controlled by immunization here in British Columbia, they occur in large numbers in other parts of the world. If we fail to maintain high levels of immunization coverage here, diseases could be re-introduced from other nations with high disease rates. As a global partner in disease prevention, we need to take care of diseases in our own population, and help those countries that still experience high rates of vaccine-preventable disease to control theirs.

4. Immunization in British Columbia Today

British Columbia has one of the most comprehensive immunization programs in the world. Yet, this chapter points out some areas where we can do better. About 80% of two-year-old children are immunized, and 53% of seniors received influenza vaccine last year. These rates are well below national and provincial targets. Although we lack hard data, we know that many adults and people in special risk groups are not adequately protected against vaccine-preventable diseases.

Roles and Responsibilities

British Columbia has one of the most comprehensive and progressive immunization programs in the world, in terms of the number of vaccines provided and groups of people eligible to receive them. In 1992, we became the first jurisdiction in North America to provide hepatitis B immunization for all grade six students. We are the first and only Canadian province to offer hepatitis A vaccine free of charge to persons with hepatitis C and injection drug users, two groups at high risk of death if they become infected.

Immunization is not the responsibility of any one individual or organization. To make and keep our programs at the forefront, everyone has a role to play.

Individuals and Families

Individuals are responsible for knowing which vaccines they and their family need, and for making sure their immunizations are kept up-to-date. They should also keep their immunization records up-to-date and accessible.

Personal Immunization Records

Everyone should have a personal record of their immunizations. Records should be kept safe and accessible, and should be produced for updating whenever a vaccination is received.

The *Child Health Passport*, the *Personal Health Record*, and the *International Certificate of Vaccination* are the most common immunization records in use in British Columbia. These can be obtained from public health departments or from family doctors.

National and International Agencies

Through Health Canada, the federal government is responsible for licensing vaccines for use in Canada and monitoring vaccine safety. A federal/provincial bulk purchasing program ensures that all jurisdictions are able to obtain vaccines at the most favourable price.

General recommendations on the use of vaccines are developed by the National Advisory Committee on Immunization (NACI), a committee of health experts from across the country. NACI gives advice to Health Canada, issues regular statements on the use of vaccines, and publishes an immunization guidebook, the *Canadian Immunization Guide*.

Many health organizations and professional associations are involved in educating professionals and the public about immunization. One example of a collaborative effort is the Canadian Immunization Awareness Program, which promotes infant and child immunization. This awareness program is sponsored by a coalition that includes the Canadian Public Health Association, the Canadian Medical Association, the Canadian Nurses Association, the Canadian Paediatric Society, the Canadian Pharmacists Association, the Council of Chief Medical Officers of Health, and Health Canada.

To find out more about the Canadian Immunization Awareness Program, visit their Internet website http://www.nald.ca/ciap.htm

The Canadian Public Health Association is the lead agency for Canada's International Immunization Program, a program that helps developing countries to strengthen their immunization activities. The Canadian International Development Agency (CIDA), Rotary clubs, and other Canadian non-government organizations are partners in this program. At the international level, the World Health Organization and the Pan American Health Organization provide leadership in immunization efforts.

Provincial Government

The provincial government has overall legal authority and responsibility for immunization program delivery in British Columbia.

After considering recommendations from national and provincial health experts, the British Columbia government decides which immunization programs it will implement and fund. The B.C. Ministry of Health provides about $11 million per year for purchasing vaccines, as well as funding for public health nurses and doctors who provide immunization services to the public. The Ministry of Health, in collaboration with the Ministry for Children and Families, then ensures that local health authorities, along with physicians, manage and deliver immunization services in compliance with provincial policies, standards, and other requirements.

The provincial government also makes laws and regulations about immunization and the prevention and control of communicable diseases. In British Columbia, immunization is not mandatory. However, children attending school and pre-school programs and people living in care facilities are asked to provide their immunization history as a prerequisite to entering. Health care and child care workers who provide direct care must also keep their immunizations up-to-date as a condition of employment. The *Health Act* allows exclusion of unimmunized students from school during outbreaks of vaccine-preventable diseases, in order to protect the unimmunized student and others.

B.C. Laws and Regulations about Immunization

Health Act: Section 5 authorizes the provincial government to make regulations about the immunization of people entering or living in British Columbia. Section 9 allows B.C. residents to declare a conscientious objection to immunization, if they believe that immunization would be prejudicial to their health or to the health of their child. Section 84 requires medical health officers to use all possible precautions to prevent the spread of contagious diseases.

Health Act, Communicable Disease Regulation: Sections 2 and 3 require that all cases of a communicable disease (vaccine-preventable or otherwise) be reported to the local Medical Health Officer, who must forward the report to the Provincial Health Officer.

Community Care Facility Act, Adult Care Regulations: Sections 4(3) and 6(3) require that all residents and staff of licensed adult care facilities comply with provincial immunization programs.

Community Care Facility Act, Child Care Regulation: Section 17 requires licensed child care facilities to keep immunization records for each child enrolled. Section 14 requires staff to keep their immunizations up-to-date, as a condition of employment.

Infants Act: Section 16 allows children under the age of 19 to give consent for immunizations, if they are able to fully understand the risks and benefits.

B.C. Centre for Disease Control Society

The B.C. Centre for Disease Control Society is the primary coordinating body for prevention and control of communicable disease in the province. The Society acts on behalf of the Provincial Health Officer in carrying out surveillance of reportable diseases, in accordance with the *Health Act*, Communicable Disease Regulation.

The Society develops and recommends provincial immunization policies, programs, procedures, and standards to the Ministry's Communicable Disease Policy Committee. The Society also purchases and distributes vaccines to immunization providers, provides information and advice to health professionals, and monitors trends related to vaccine-preventable and other reportable diseases.

Local Health Authorities

At the local level, immunization programs are carried out by local health authorities, which include 11 regional health boards, 34 community health councils, and 7 community health services societies. Among on-reserve First Nations communities, immunization programs are managed and delivered by Health Canada or by First Nations themselves; in some areas, this is carried out in cooperation with local public health nurses. Immunization has been designated as an essential or "core" service that must be provided in each region of the province.

Within each health authority, the medical health officer is responsible for prevention and control of communicable diseases in the community. As part of this responsibility, medical health officers aim to ensure that good immunization practices are maintained and that immunization goals are achieved. Public health nurses work in close collaboration with the Medical Health Officers to provide immunizations and, where applicable, distribute vaccines to physicians and health care facilities in the community.

Immunization Providers

Immunization providers are nurses, doctors, or other health professionals who are qualified to give vaccines. Providers also play a key role in educating people about immunization. Their advice is often a very important factor affecting whether a person is immunized or not (Nichol, MacDonald, & Hauge, 1996; National Advisory Committee on Immunization, 1998).

In British Columbia, many people receive their immunizations from nurses working in public health units. Immunizations are also given by physicians or their nursing staff, who order vaccines from their local public health units. Hospitals and long term care facilities are other settings in which immunizations are provided. Who provides immunization depends on the type of vaccine, the region of the province (Table 6), and people's preferences.

Table 6 Who Provides Immunizations in British Columbia?

Age Group	ROUTINE IMMUNIZATIONS		SPECIAL IMMUNIZATIONS	
	Urban Areas	Rural Areas	Urban Areas	Rural Areas
Infants and preschool children	Mixed*	Mainly public health	Mixed	Mainly public health
School-age children	Mainly public health	Public health	Mixed	Public health
Adults	Mainly physician	Mixed	Mainly physician	Mixed

Routine immunizations are those recommended for most of the population, such as measles vaccines for children or tetanus boosters for adults. Special immunizations are those provided to specific groups, such as people with chronic health problems.

** Mixed: Immunizations are provided by public health departments and other providers, including private physicians, hospitals, long term care facilities.*

While the primary provider of immunization may differ, policies and methods are the same. All immunization providers agree to follow provincial immunization schedules, ensure vaccines are correctly stored and handled, report to the local health unit regarding persons immunized, and report adverse events following immunization. The public health system plays a coordinating role for all immunization providers, by providing services such as vaccine distribution, monitoring immunization coverage and disease rates, and managing mass immunization campaigns.

Research Groups

New vaccines are extensively tested for safety and effectiveness before they can be licensed for routine use. Ideally, some of the testing should be done in British Columbia to ensure that test results will apply to our populations. B.C. has three research groups that have been involved in vaccine testing for the past ten to twenty years. Two groups are closely affiliated with public health departments in the South Fraser and Simon Fraser regions, and the third is jointly sponsored by B.C.'s Children's Hospital and the University of British Columbia. In total, these groups have participated in hundreds of vaccine studies, involving more than 25,000 volunteers of all ages.

Research continues after vaccines have been licensed and introduced. Such "post-marketing" studies are important for confirming the effectiveness of the vaccine and the immunization program, as well as for identifying any rare, unexpected adverse effects. Studies are needed to determine how long protection lasts, and if booster doses are needed.

Groups involved in post-marketing studies are located at B.C.'s Children's Hospital in Vancouver, the University of British Columbia, and the B.C. Centre for Disease Control. The latter agency has some limited research funds for studies in support of provincial programs, and frequently contracts with other groups in carrying out studies. Other vaccine studies are funded by granting agencies such as the B.C. Medical Services (Vancouver) Foundation and the B.C. Health Research Foundation. Health Canada funds an innovative network of children's hospitals which monitors vaccine-preventable cases and vaccine-associated adverse events. B.C. Children's Hospital plays a leading role in this network, through its Vaccine Evaluation Center. Results are shared with provincial authorities to assist them with fine-tuning of programs.

Community Partners

Schools, day care centres, employers, non-government organizations, community agencies, and the media are important partners in immunization.

Schools provide enrollment information, distribute information, and provide clinic space so that students can be immunized. Employers support immunization through their occupational health and safety programs. Locally, community organizations have assisted with promoting immunization programs generally or for specific groups such as street youth or men who have sex with men. In some areas, Girl Guides and Boy Scouts have organized activities advocating high levels of childhood immunization. The local and provincial media provide consumers with information about immunization issues and services.

Goals and Targets

It is appropriate to set goals and targets for vaccine-preventable diseases. There are measurable outcomes (reduction or elimination of disease), programs of proven effectiveness (immunization), and indicators for measuring progress (rates of immunization and disease). Establishing official goals and targets is one way of demonstrating a commitment to immunization.

At the international level, the Declaration of the 1990 World Summit of Children established a number of child health goals in disease reduction and immunization coverage. Canada has signed this international declaration. National goals and targets have been developed for nine vaccine-preventable diseases of infants and children (National Goals, 1995). One goal – elimination of measles by the year 2005 – was officially adopted as a national goal by the 1995 Conference of Deputy Ministers of Health. Although the full set of goals has not received political endorsement, the goals have been endorsed by many professional organizations across Canada.

In British Columbia, the national goals have been endorsed by the Ministry of Health and by the Ministry for Children and Families in its 1997 report, *Measuring Our Success*. An objective to reduce vaccine-preventable disease is also included in the provincial health goals (B.C. Ministry of Health, 1997).

Table 7 shows British Columbia's progress in meeting national goals for the reduction of nine vaccine-preventable diseases in infants and children. The national targets are ambitious, and not all have been achieved. However, with the exception of hepatitis B rates, British Columbia is doing as well or better than other parts of Canada in meeting the goals.

In assessing performance, it is important to remember that tremendous advances have been made over the years. Before immunization programs were in place, diseases such as diphtheria, polio, and measles were rampant. Today, when immunization levels are generally high and most vaccine-preventable diseases are under control, further improvements are more challenging and time-consuming to achieve. Eliminating the last cases can be hard, labour-intensive work.

Table 7 Progress in Achieving Reduction or Elimination of Diseases, B.C.

Disease	Goals/Targets	Current Status
Diphtheria	Eliminate indigenous cases by 1997	● Achieved. No cases in 1996 or 1997.
Invasive Hib infections	Achieve and maintain absence of preventable cases in children by 1997	⊙ One case in a child in 1997. Prior to the introduction of Hib vaccine, there were more than 100 cases of invasive Hib disease each year, and most of these were young children.
Hepatitis B	Reduce prevalence of indigenously acquired chronic infections in children and young adults by 90% by 2015	? 43 chronic cases reported in children (age 0-14) and 289 in youth (age 15-24) in 1997. No provincial information on whether cases were acquired indigenously (locally) or through migration or travel to an infected area. Acute cases also occur in children (7 acute cases age 0-14 reported in 1997).
Measles	Achieve incidence of less than 1 per 100,000 by 2000	⊙ Rate was at or below 1 per 100,000 between 1993 and 1996. Increased to 7 per 100,000 in 1997 due to an outbreak that started among students at Simon Fraser University.
	Eliminate indigenous cases by 2005	⊙ Two-dose measles schedule introduced in 1997. The goal to eliminate indigenous cases by the year 2005 is attainable.
Mumps	Maintain active prevention program to minimize serious effects	? Control being maintained through high immunization rates. Serious effects resulting from mumps not tracked on a regular basis. In a 1997 outbreak, effects (severe headache, testicular swelling/pain, pancreatitis) occurred at rates similar to those reported in the literature.
Pertussis	Reduce illness and deaths related to pertussis	○ Rates of illness have been increasing, and deaths still occur (two children died from pertussis in 1996). New vaccine introduced in 1997 should lead to reduction in cases in the coming years.
	Have all reported cases managed appropriately	? There are procedures for treatment of cases and contacts. Case management is reviewed locally, but no provincial information for evaluating compliance.
	Reduce intensive care admissions 50% (from 1995 level) by 1997	○ 50 per cent reduction not achieved. However, the number of intensive care admissions is very small (2-9 cases per year over past decade).
Polio	Maintain elimination of wild indigenous cases	● Achieved. Last B.C. case reported in 1979.
	Prevent future imported cases	⊙ Risk of imported cases is still present. Immunization rates must be maintained.
Rubella	Eliminate congenital rubella syndrome by 2000	⊙ Two cases of congenital rubella syndrome were diagnosed and reported in 1997, in children who were born in 1984 and 1995.
Tetanus	Maintain elimination of tetanus in newborns and children	● Achieved. No cases in newborns or children in past decade.

Goals and targets are from National Goals and Objectives for the Control of Vaccine-Preventable Disease of Infants and Children, Canada Communicable Disease Report, 21(6), pages 49-53, March 30 1995.
See Appendix E for provincial data and time trends.

● *= achieved* ⊙ *= partially achieved or on track* ○ *= not achieved* *? = no information*

Infants and Preschool Children

Although vaccine-preventable diseases can strike people of all ages, these diseases tend to be more serious among infants and young children. Pertussis, for example, is a very serious infection that can occur at any age. For babies under one year old, pertussis can be particularly serious, causing brain damage or death – even with the best of modern medical care. Vaccines greatly reduce this risk.

An unimmunized child can also put other people at risk for vaccine-preventable diseases. Even before parents realize that their child is ill, the child may have spread that disease to other family members, friends and neighbours, or children and staff at child care facilities.

If the disease is rubella, any pregnant woman who is not immune and who comes into contact with the child may also become infected and pass it on to her developing baby. Should this happen in the first three months of pregnancy, the baby can be born with blindness, deafness, heart defects, or mental retardation. Thus, an unimmunized child is not the only one at risk for vaccine-preventable disease. Immunization coverage for children attending day care or preschool is particularly important, as this is usually their first exposure to large groups of children.

In British Columbia, infants are routinely immunized against eight diseases (Table 8). Vaccines for diphtheria, pertussis, tetanus, polio, and Hib are available to all children, starting at age two months, and are given again at 4, 6, and 18 months of age. At age 12 and 18 months, children are given the measles, mumps, and rubella (MMR) vaccine. National goals for this age group are to have 97 per cent of children immunized (95 per cent for pertussis) by their second birthday.

Table 8 Routine Immunizations for Infants, B.C.

Age	Vaccine
2 months	DaPT/IPV/Hib (Pentacel™)
4 months	DaPT/IPV/Hib
6 months	DaPT/IPV/Hib
12 months	Measles/Mumps/Rubella (MMR)
18 months	DaPT/IPV/Hib Measles/Mumps/Rubella (MMR)

DaPT/IPV/Hib is a pentavalent vaccine (five vaccines in one injection): Diphtheria, acellular Pertussis, Tetanus, Inactivated Polio, and conjugated Haemophilus influenzae type b (Hib).

Concerns

In general, parents in British Columbia respond well to advice to have their children immunized. In 1998, most two-year-old children – over 80 per cent – had been adequately protected. However, there are a number of reasons to be concerned about immunization coverage among infants and preschool children:

- We remain far from achieving national and provincial targets for infants and preschool children.

  Table 9 (page 32) shows that our provincial average is below national immunization targets for eight of the nine diseases (for hepatitis B immunization of at-risk infants, we lack data to measure progress). **We can and must do better.**

Table 9 Progress in Achieving and Maintaining High Levels of Immunization, Infants and Preschool Children, British Columbia

Disease	Goals/Targets	Current Status Provincial Average and Range
Diphtheria	97% fully immunized by second birthday	○ 83% (68% - 100%)
Invasive Hib infections	97% fully immunized by second birthday	○ 82% (68% - 98%)
Hepatitis B	Screen 100% of pregnant women and immunize 100% of babies born to carrier mothers	? Testing available to all pregnant women. It is believed that almost all at-risk babies receive immunization, but screening and immunization statistics are not tracked.
Measles	97% fully immunized by second birthday	○ 81% (67% - 98%)
Mumps	97% fully immunized by second birthday	○ 81% (67% - 98%)
Pertussis	95% fully immunized by second birthday	○ 82% (68% - 98%)
Polio	97% fully immunized by second birthday	○ 83% (68% - 100%)
Rubella	97% fully immunized by second birthday	○ 81% (67%- 98%)
	Ensure all women of childbearing age have documented history of immunization	? Policy in place, but no data for evaluation
	Screen all pregnant women	? Screening available, but statistics are not tracked
Tetanus	97% fully immunized by second birthday	○ 83% (68% -100%)

Goals and targets are from National Goals and Objectives for the Control of Vaccine-Preventable Disease of Infants and Children, Canada Communicable Disease Report, 21(6), pages 49-53, March 30 1995.

Unless otherwise stated, targets are for the year 1997. Current Status is based on a one-month sample of children who were two years old in April of 1998 and for whom child health records were available.
Range: Range among regions within the province excluding Vancouver, Burnaby, North Shore, and South Fraser regions; 38% of B.C.'s population under age 2 live in these 4 regions. See Appendix F for regional data.

● *= achieved* ⊙ *= partially achieved or on track* ○ *= not achieved* *? = no information*

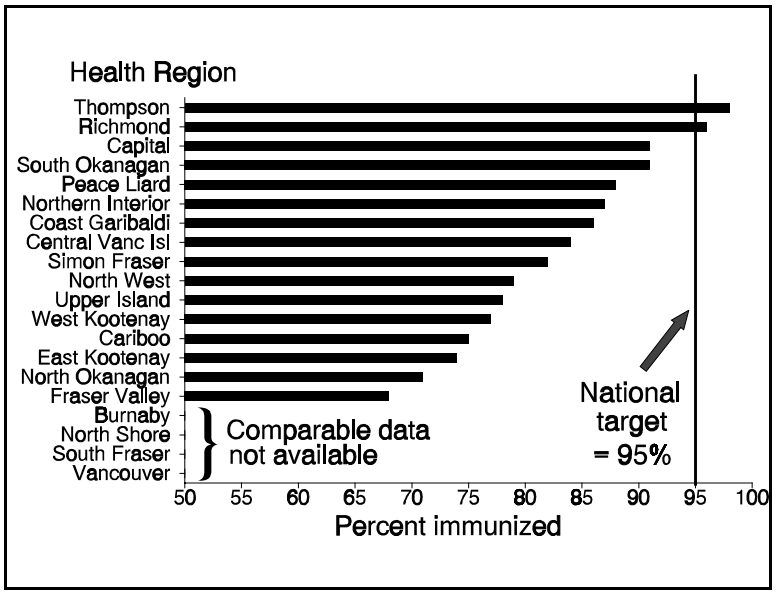
- Some jurisdictions are not achieving an adequate level of coverage.

  In 1998, the Thompson and Richmond health regions achieved national targets for most of the vaccines. However, there were several regions where immunization coverage for two-year-olds was below 75 per cent (Figure 7).

  These low levels put unimmunized or partially immunized children at risk. They also allow a large pool of susceptible children to accumulate, and this represents an ongoing risk for outbreaks.

For additional graphs and regional data, see Appendix F. Appendix G gives the names, locations, and abbreviations of the geographic regions used in this report.

Figure 7 Immunization Rates for Children 24 Months of Age, Pertussis (4 doses), B.C., 1998



Source: Immunization Status of Children Age 2. B.C. Ministry of Health Administrative Circular No. 98:014. Note: Data are based on a one-month sample of children who were two years old in April 1998 and for whom Child Health Records were available.

- Some areas of the province do not monitor immunization coverage of preschool children on a regular basis.

  Some health authorities – Burnaby, North Shore, South Fraser, and Vancouver – have chosen not to routinely measure immunization rates for two-year-olds, in part due to difficulties in gathering statistics from doctors' offices. These four regions provide services for more than one-third (38 per cent) of B.C.'s children under age two.

Priority Action: Provide funding for continued development of a province-wide, electronic registry for immunizations, communicable diseases, and adverse reactions. Ways and means should be found to ensure that all age groups, all immunization providers, and all areas of the province are able to participate in, and benefit from, this essential health information system (see pages 72-74).

- Current information systems do not provide a complete picture of immunization for preschool children.

  British Columbia lacks an electronic system for immunization tracking, so immunization statistics must be tallied manually. Because locating and auditing each child's record would be a very time-consuming task, rates for two-year-olds (Table 9 and Figure 7) are based on a one-month sample of child health records (records for children who had their second birthday in April 1998).

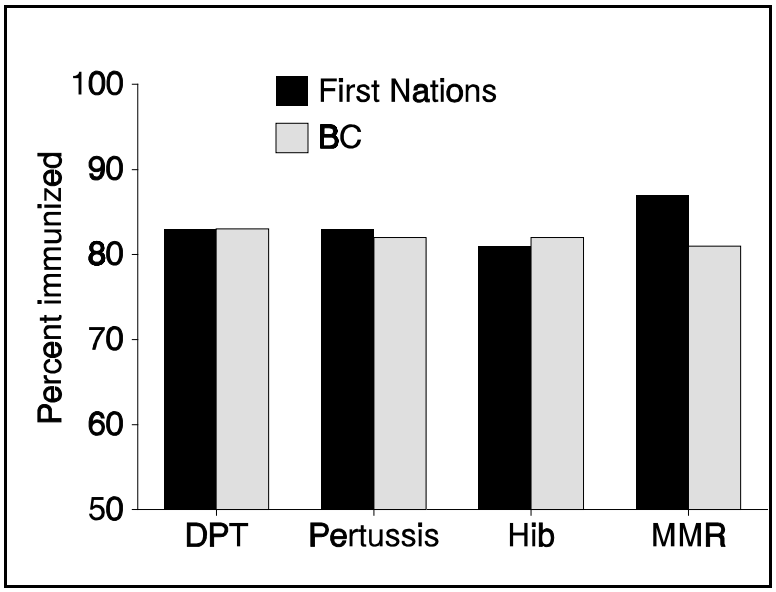
  While a one-month sample may be a statistically satisfactory way of measuring coverage, the one-month sample, along with the lack of data from Burnaby, North Shore, South Fraser, and Vancouver, mean that provincial immunization figures are based on records for only a small proportion – about 5 per cent – of two-year-old children in the province. We do not know the extent to which this 5 per cent represents the immunization status of all British Columbia children.

First Nations Children

Immunization rates for two-year-old First Nations children are comparable to the provincial average for most vaccines, and better for measles-mumps-rubella (Figure 8). These figures include First Nations children served by Health Canada's Medical Services Branch and some Contribution Agreement and Transferred First Nations Authorities. Figures do not include on-reserve children who receive coverage from provincial health authorities, as these figures are reported through the provincial system.

Because the number of on-reserve First Nations children is relatively small, immunization records for all children can be more easily accessed and included in these rate calculations, rather than the provincial method of using a one-month sample. Thus, we have a more complete picture of coverage rates for these on-reserve First Nations children. However, data gathering is still time-consuming, and assessing First Nations' coverage would be simplified if a computerized immunization registry were in place.

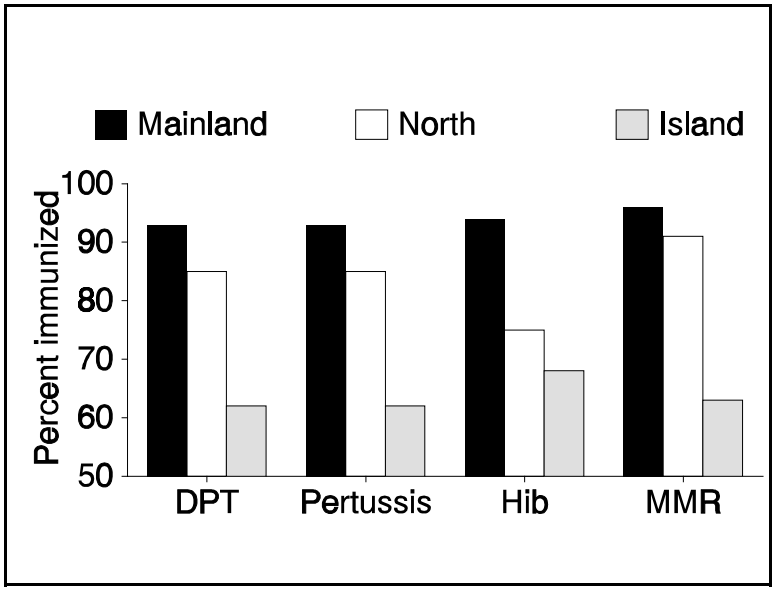
Figure 8 Immunization Rates for Two-Year-Old Children, First Nations, 1997 and B.C., 1998



First Nations data in Figures 8 and 9 are for on-reserve children who were two years old in 1997. Approximately 80% of Health Centres submitted immunization status reports, and 100% of children in each age group were counted. Source: Medical Services Branch – Pacific Region, Health Canada. Unpublished tables, December 1998.
B.C. data in Figure 8 are based on a one-month sample of children who were two years old in April 1998 and for whom Child Health Records were available. Source: Immunization Status of Children Age 2, B.C. Ministry of Health Administrative Circular No. 98:014.

First Nations children in the mainland areas of the province have achieved immunization rates that are very close to national targets, while those living on Vancouver Island are less likely to be fully immunized (Figure 9). The reasons for these regional differences require further investigation.

Figure 9 Immunization Rates for Two-Year-Old First Nations Children by Region, 1997



Timeliness

The immunization rates in the previous section tell us what proportion of young children have completed the recommended number of doses of a vaccine by their second birthday.

Completeness of immunization is important. So is timeliness – the extent to which children receive each particular dose of vaccine at the recommended age. Children who start their shots on time receive optimal protection from disease and are more likely to continue on schedule towards becoming fully immunized. Children with a late start or delayed booster doses suffer loss of protection. Giving vaccines too early can also be a problem, because children may be too young to develop optimal immunity.

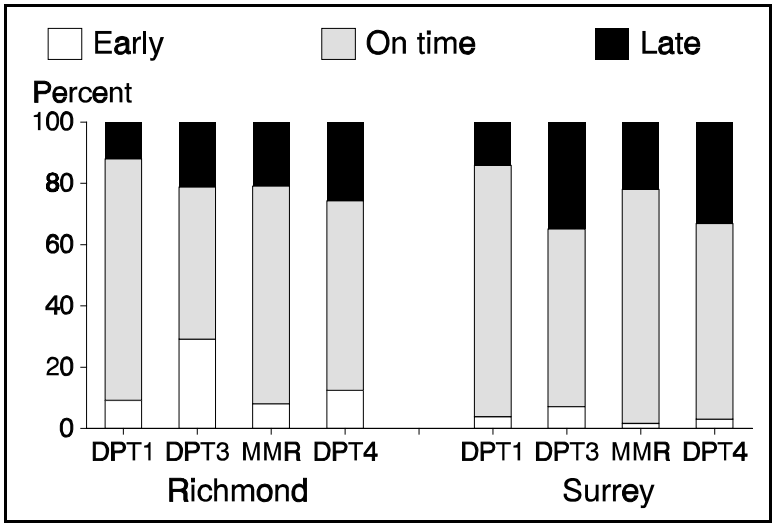
Statistics that measure on-time or "age-appropriate" immunization provide an accurate reflection of the level of protection. Unfortunately, without a computerized system for recording immunizations, it is difficult to examine whether vaccines are being given at recommended intervals.

Province-wide information is not available on this topic, and there is no standard definition for "on-time" immunization. However, timeliness of early childhood immunizations has been studied in several B.C. settings: Richmond and North Okanagan health departments (which have computerized immunization databases), Boundary Health Unit (now South Fraser Health Region), and Children's Hospital in Vancouver.

These studies found that most children begin their immunizations in a timely way. In the Richmond and Surrey surveys, about 80 per cent received the first dose of DPT as recommended – in the second month of life (Figure 10). There was less compliance with recommended timing for later and booster doses. Between one-quarter and one-third of children were late in receiving their 18-month booster dose of DPT, and, in a small proportion of cases, doses were given earlier than ecommended. These figures leave room for improvement.

Priority Action: Achieve better rates for on-time immunization of all infants and preschool children.

Figure 10 Timeliness of Immunizations Given, Two-Year-Old Children Born in April 1991-1993 (Richmond) and April 1993 (Boundary Health Unit, Surrey), B.C.



Immunizations considered "on time" if given at 8-11 weeks for DPT/DT 1st dose (recommended at age 2 months), 26-29 weeks for DPT/DT 3rd dose (recommended age 6 months), 12-13 months for MMR (recommended age 12 months), and 18-19 months for DPT/DT 4th dose (recommended age 18 months). Sources: Scheifele, D.W., LaJeunesse, C., Marty, K., & Chen, L. (1996). Comparison of physicians and health-department staff as timely providers of childhood vaccines. BC Medical Journal, 38(7), 372-374. Scheifele, D., Lightle, G., LaJeunesse, C., Garry, J., Addison, J., & Price, P. (1996, February/March). Timeliness of uptake of early childhood immunizations - Richmond, BC. BC Health and Disease Surveillance, 5(2/3), 14-18.

Timely delivery can be improved through audits and reminders to parents, which can be done most efficiently through the development and use of a computerized immunization registry. But reminders alone are not always successful in improving timeliness. Among 18-month-olds in Boundary Health Unit, mailed reminder notices did not increase on-time immunization rates (Bjornson, Scheifele, LaJeunesse, & Bell, 1998).

North Okanagan Health Region, which has a computerized system for generating reminders, has found that some parents still forget when their children's immunizations are due. Delays due to illness and parent's scheduling problems are other reasons for incomplete immunization (Table 10). Educating parents about the importance of immunization and the appropriate reasons for deferring immunization are important strategies for improving timeliness (see "Removing Barriers To Immunization", pages 61-63).

Table 10 Reasons for Children's Incomplete Immunization Status, North Okanagan Health Region

Reason Given by Parent/Caregiver	Percent
Illness (self or child)	36%
Forgot	19%
Not aware immunization was due	7%
Busy/hard to find time	7%
No transportation	5%
Reaction to previous immunization	4%
Opposed to immunization	4%
On vacation/out of town	3%
Family emergency or other family problems	3%
Clinic time inconvenient	2%
Other reasons	9%
Total reasons given*	100%

** A total of 233 reasons were given. Some parents/caregivers gave more than one reason.*
Source: Public Health Nursing, North Okanagan Health Region. Data are based on a survey of all children not immunized for age who attended child health clinics in the months of January and February 1998.

School-Age Children and Youth

School-age children have many social interactions, both at school and in the community. This provides more opportunities for catching and spreading vaccine-preventable diseases. For school-age children and youth, immunization remains an important focus, both to protect the young person and others with whom they interact.

Kindergarten is the time for giving booster doses of early childhood vaccines and for catch-up immunization of children who have missed their recommended shots. Hepatitis B vaccine is currently given to grade six students, and an additional booster of Tetanus/diphtheria is given in grade nine (Table 11). The national goal is to achieve very high levels among school age children – 95 per cent coverage for hepatitis B and pertussis, and 99 per cent for other vaccines.

Table 11 Routine Immunizations for School-Age Children and Youth, B.C.

Age/Grade	Vaccine
School entry (age 4-6 years)	DaPT/IPV
Grade 6	Hepatitis B (3 doses)
Grade 9	Tetanus-Diphtheria (Td)

DaPT/Polio: Diphtheria, acellular Pertussis, Tetanus, Inactivated Polio (four vaccines in one injection).

Note: This schedule is for children who have completed their primary series during infancy. Children who were not immunized during infancy will require additional vaccines.

British Columbia continues to achieve a high level of immunization coverage for school-age children. In terms of national and provincial goals, we are quite close to meeting targets for hepatitis B (Table 12).

Table 12 Progress in Achieving and Maintaining High Levels of Immunization, School-Age Children, British Columbia

Disease	Goals/Targets	Current Status Provincial Average and Range
Diphtheria	99% fully immunized by seventh birthday	○ 90% (78% - 98%) of kindergarten students are immunized
Hepatitis B	Establish routine immunization for children	● Program to immunize grade 6 students established in 1992
	95% of children immunized	⊙ 92% (82% - 97%) of grade 6 students are immunized
Measles	99% fully immunized by seventh birthday by 2000	○ 91% (80% - 99%) of kindergarten students are immunized
Mumps	99% fully immunized by seventh birthday	○ 91% (80% - 99%) of kindergarten students are immunized
Pertussis	95% fully immunized by seventh birthday	○ 89% of kindergarten children immunized (estimated to be 1% below rates for diphtheria and tetanus; pertussis coverage is not tracked separately for this age group)
Polio	99% by seventh birthday	○ 90% (79% - 99%) of kindergarten students are immunized
Rubella	99% fully immunized before school entry	○ 91% (80%-99%) of kindergarten students are immunized
	99% of 14-to 15-year olds fully immunized	? Statistics not collected for this age group
Tetanus	99% fully immunized by seventh birthday	○ 90% (78% - 98%) of kindergarten students are immunized

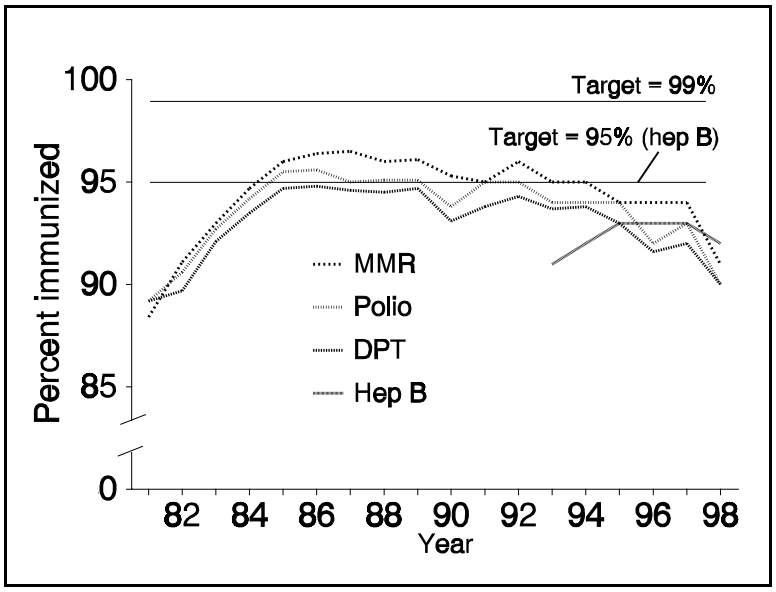
Goals and targets are from National Goals and Objectives for the Control of Vaccine-Preventable Disease of Infants and Children, Canada Communicable Disease Report, 21(6), pages 49-53, March 30 1995. Unless otherwise stated, targets are for the year 1997. Current Status figures are for the school year ending June 1998.
Range: Range among regions within the province. See Appendix F for regional data.

● *= achieved* ⊙ *= partially achieved or on track* ○ *= not achieved* *? = no information*

Maintaining High Levels of Coverage

Provincial rates have remained at or above 90 per cent for DPT, polio, and MMR, although coverage has dropped somewhat in recent years (Figure 11). Unlike the data for two-year-old children (pages 31-34), rates for school children are based on records for almost all children and areas of the province. Although the data gathering is time-consuming, it provides a fairly complete and accurate reflection of immunization coverage in this age group.

Figure 11 Immunization Rates for Kindergarten Children (DPT, Polio, MMR) and Grade Six Children (Hepatitis B), B.C., 1981-1997



Source: Public Health Nursing, B.C. Ministry of Health. Figures are as of June each year.

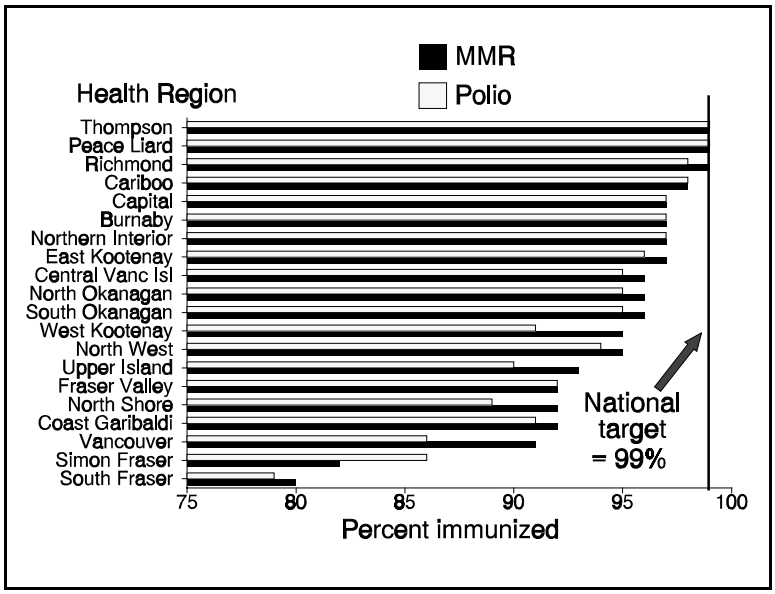
Recent declines in immunization rates may be due to rapid population growth in some areas of the province, time required to adjust to new organizational structures as a result of regionalization (see page 67), or less time being allocated for pursuing records for unimmunized children. Without a computerized immunization registry, it is not possible to fully analyze the reasons for the decline in rates.

Reaching All Groups of Children

Overall, British Columbia does a commendable job in immunizing school-aged children and youth. Many regions of the province (Figure 12) and on-reserve First Nations communities in the lower mainland (Figure 13) report immunization levels that are close to national targets.

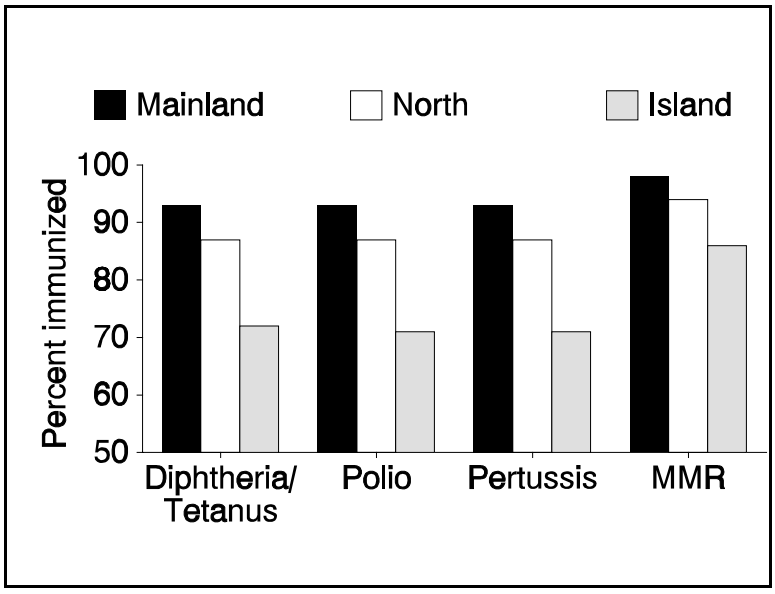
For children and youth, the challenge is to maintain high levels of immunization in regions that are currently doing well, while increasing rates in regions that could do better and ensuring that no groups of children are missed, for example, children who are not living with their families or immigrant children – each year, more than 9,000 children age 12 and under move to B.C. from other provinces or other countries (Statistics Canada, unpublished tables).

Figure 12 Immunization Rates for Kindergarten Children, B.C., 1998



Percent of children who, by the end of the school year, have received the appropriate number of vaccine doses. Source: British Columbia School Immunization Rates 1997/98. B.C. Ministry of Health Administrative Circular No. 98:016.

Figure 13 Immunization Rates for Six-Year-Old Children, First Nations, B.C., 1997



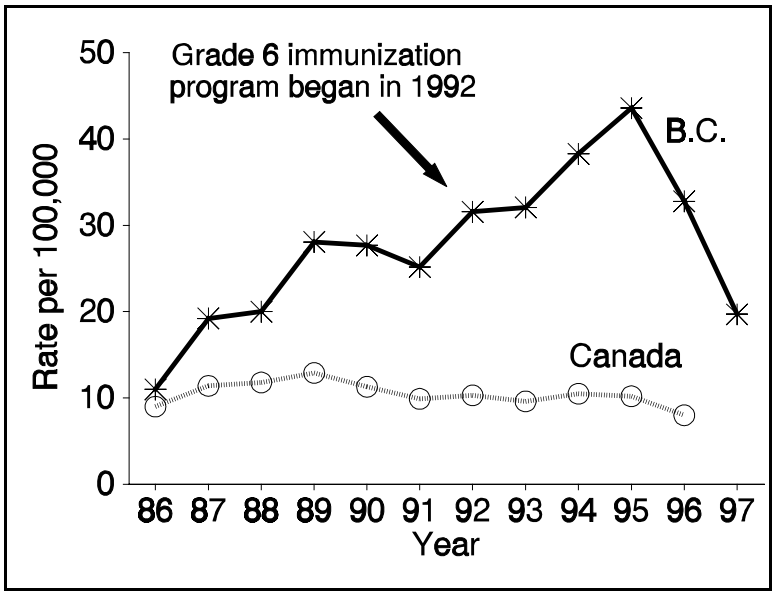
Figures are for on-reserve children who were six years old in 1997. Source: Medical Services Branch – Pacific Region, Health Canada. Unpublished tables, December 1998.

Hepatitis B

The grade six immunization program for hepatitis B has been in place since 1992. This program has been well accepted by parents and students, with uptake rates exceeding 90 per cent in most regions of the province.

After experiencing rising rates – and rates that were much higher than the national average – the number of new (acute) cases of hepatitis B began to decline in 1996 (Figure 14). This decrease may reflect early results from a number of interventions, including the grade six program and increased efforts to target individuals in risk groups (injection drug users, persons with multiple sexual partners, and household and sexual contacts of chronically-infected persons). As the grade six group moves into adulthood in the coming decade, a decrease in the rate of new hepatitis B cases can be expected.

Figure 14 Reported Cases of Hepatitis B, B.C. and Canada, 1986-1997



Sources: B.C. data from Epidemiology Services, B.C. Centre for Disease Control Society. Unpublished tables, January 1999. Canada data from Laboratory Centre for Disease Control. Disease Surveillance On-Line, http://www.hc-sc.gc.ca/hpb/lcdc/webmap/

Although we are beginning to see a progressive decline in this disease, hepatitis B remains a problem in British Columbia. Vaccine-preventable cases are occurring in young children – an estimated 30-100 acute, vaccine-preventable cases each year in children 12 years and under. Often, these children have been infected by family members who are unaware they are chronic carriers of hepatitis B. In some cases, family members are immigrants who were infected in their country of origin, as many countries do not offer hepatitis B as part of their universal immunization programs.

Priority Action: Provide funding to expand the hepatitis B immunization program to cover all infants and children.

Because immunizing all children early in life can prevent many of these cases – at a cost that will be more than offset by savings from reduced medical care – plans are under way to introduce hepatitis B immunization for all infants, with a catch-up program for children entering kindergarten and high-risk children. If funding is secured, this program could begin in April 1999.

Adults

Vaccine-preventable diseases are not just childhood diseases – they cause illness and death in adults, too. Immunization is a lifelong process, and keeping adults immunized will grow in importance as the average age of our population continues to increase.

Healthy adults should receive a tetanus and diphtheria booster every ten years, or at least a booster at age 50 if more than ten years since their previous booster, and any other vaccines that may be required because of their occupation, health condition, or lifestyle. Those who are not already immune to measles and rubella should be immunized, especially women of childbearing age. After age 65, everyone should receive influenza vaccine each year and at least one dose of pneumococcal vaccine.

Many adults lack complete and up-to-date immunization records, and we do not know what proportion of the population has received the recommended vaccines. A large national survey found that only one-fifth (21 per cent) of Canadian adults had an immunization booklet at home, and many were not aware of the vaccines they should be receiving or when the next one was due (Duclos, 1994). Two 1997 outbreaks – measles in Burnaby and mumps in Vancouver – affected primarily young adults who were not fully immunized. This indicates that there are many B.C. adults who are susceptible to disease outbreaks because they are not adequately protected.

Pneumococcal Disease and Influenza

Pneumococcal disease and influenza are major causes of illness, hospitalization, and death among the elderly and among people with certain medical conditions.

These two diseases are not classified as "reportable" under Schedule A of the Communicable Disease Regulations, which means there is no requirement to report all cases to health authorities. Instead, influenza is monitored through a surveillance network that involves selected ("sentinel") physicians, the Provincial Laboratory, and reports about high levels of influenza-like illness in care facilities and schools. Invasive pneumococcal disease will be designated as reportable in the near future.

Influenza and pneumococcal disease can cause death, although the more common outcome is a long, miserable illness that may result in hospitalization. The large number of cases admitted to hospital shows that British Columbians – and the health care system – are being over-burdened by these two illnesses.

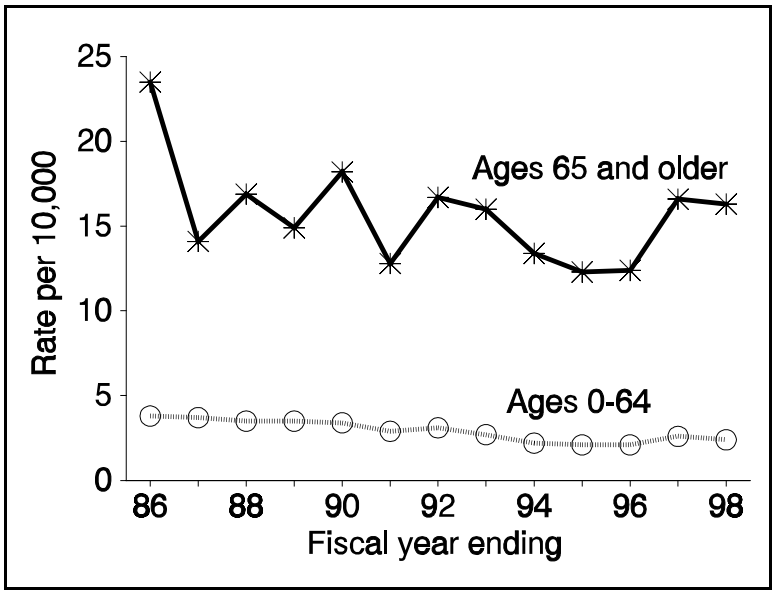
Among persons age 65 and over, 823 cases of influenza and pneumococcal pneumonia were admitted to hospital in 1997/98, with each case requiring an average of eight days in hospital. The 65 and older population accounts for about half of the hospital cases and almost two-thirds of the hospital-days for these diseases, and hospitalization rates are more than four times that of younger age groups (Figure 15).

Pneumococcal Disease

Pneumococcal disease is a serious and common cause of pneumonia (infection of the lungs), meningitis (infection of the lining of the brain and spinal cord), and septicemia (infection of the blood). Pneumococcal disease is caused by bacteria called "pneumococci" (*Streptococcus pneumoniae*).

Not all pneumonia is caused by pneumococci. Pneumonia can be caused by many different types of bacteria and viruses, as well as by chemical irritants and parasites. It is difficult to identify the specific cause of pneumonia without a laboratory test, and even then cultures are frequently negative. Among adults, it is estimated that one-quarter to one-third of pneumonia cases are due to pneumococci.

Figure 15 Hospitalizations due to Pneumococcal Pneumonia and Influenza, B.C., 1985/86-1997/98



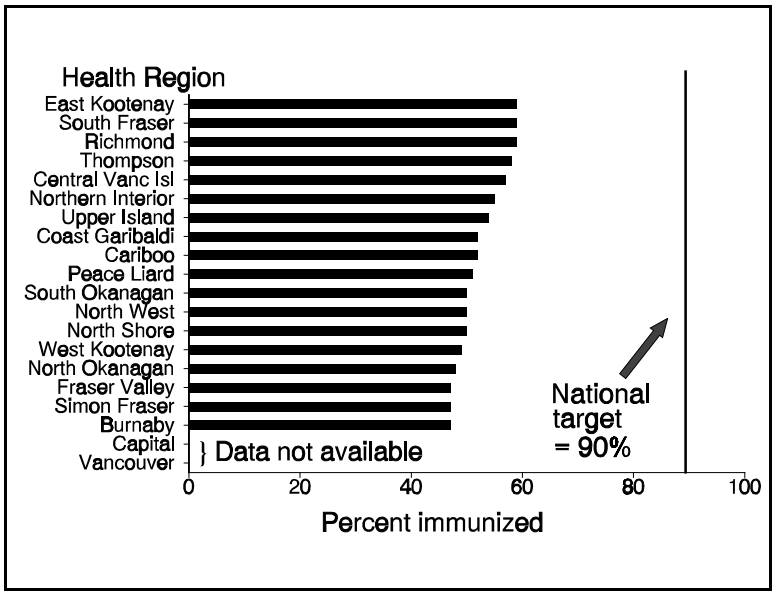
Source: Canadian Institute for Health Information (CIHI) data for acute and rehabilitation care by principal diagnosis, pneumococcal pneumonia (ICD9 481) and influenza (ICD9 487). Unpublished tables. Prepared by Information and Analysis Branch, B.C. Ministry of Health.

For people age 65 and older, influenza and pneumococcal vaccines are an excellent investment, as they can both improve health and save money. For elderly persons, these vaccines are reported to be more cost-effective than all other prevention, screening, and treatment interventions that have been studied. At least half of the deaths, hospitalizations, and physician visits for influenza and pneumococcal disease can be prevented with full implementation of the recommended immunization program (National Advisory Committee on Immunization, 1998).

Because the influenza virus regularly changes the way it looks to the immune system, a new vaccine must be formulated each year so that the vaccine will protect against the most common strains of the virus. Therefore, people for whom the vaccine is recommended should be immunized against influenza each year. Results for influenza vaccine show that much improvement will be needed – in all areas of the province – to reach the national target of 90 per cent coverage. Only half (53 per cent) of British Columbians age 65 and older had an influenza shot in 1998 – far below the target (Figure 16).

Priority Action: Achieve better coverage rates for influenza immunization among the population age 65 and older, people with chronic diseases in all age groups, health care workers, and other eligible groups.

Figure 16 Immunization Rates for Influenza, Population Age 65 and Older, B.C., 1997/98



Source: Influenza Vaccine for the 1998/1999 Season. B.C. Ministry of Health Administrative Circular No. 98:015, Appendix E.

For pneumococcal vaccine, a one-time dose provides life-long protection for most people (a booster dose is recommended for specific risk groups). Publicly-funded pneumococcal immunizations for all people age 65 and older began in April 1998*, and statistics for this program are not yet available.

* *In First Nations communities served by federal nurses or by First Nations themselves, pneumococcal vaccine has been provided to persons age 65 and older since 1990.*

Special Population Groups and Situations

While some vaccines are recommended for most or all people, other vaccines are recommended only for certain population groups - people whose age, occupation, medical condition, or lifestyle places them at increased risk for vaccine-preventable disease. Special population groups and situations include:

- **Impaired immunity**. This group includes people who have HIV/AIDS or a chronic illness such as diabetes, liver or kidney disease, heart or lung disease, or certain cancers, and people who have received a bone marrow or organ transplant. These health conditions can make people much more susceptible to complications or death from a variety of vaccine-preventable diseases.

  Although exact figures are not available, we know that the number of people with impaired immunity is growing. A careful assessment of individual circumstances is required, so that each person with impaired immunity receives optimal protection from immunization.

- **Residents of care facilities**. Another large and growing population group is residents of care facilities. About 5% of the population age 65 and older – and more than 11% of those over age 75 – live in long term care facilities. Because of their age, medical condition, and group living situation, this group is particularly vulnerable to pneumococcal disease and influenza.

  For residents of other facilities, such as those for the mentally or developmentally challenged or correctional facilities, immunization against hepatitis A and/or hepatitis B may be recommended.

- **Household contacts**. This group includes individuals who live or spend a significant amount of time in the same household with someone who is infected or potentially infected with a vaccine-preventable disease.

  If one member of a household is a chronic carrier of hepatitis B, immunization can protect others in the family from exposure to the disease. If the household includes an elderly or chronically ill person, annual influenza immunization of the family or other caregivers helps to protect the vulnerable person from exposure to influenza illness.

- **Work or environmental exposure**. Certain occupational groups are at risk of exposure to vaccine-preventable diseases through contact with infectious people, animals, or materials. Health care workers, child care workers, laboratory workers, veterinarians, and staff working in schools, correctional facilities, or other institutional settings are some of the groups who are at increased risk of occupational infection.

  For groups with occupational exposure, immunization can protect both the employees and the clients they serve. Ensuring that at-risk employee groups are fully immunized is an important part of each industry's occupational health and safety programs.

- **Lifestyle risk**. Individuals can also be at risk due to behaviours such as injection drug use, sexual contact with infected persons, or high-risk sexual practices. Immunizations for hepatitis A and hepatitis B are recommended for people in these risk groups.

- **Outbreak control**. Vaccines can also be recommended to control disease outbreaks in schools, institutions, or other community settings. Meningococcal vaccine can be used to halt the spread of meningococcal meningitis, a rare but very serious disease. Hepatitis A is another vaccine that has proven useful in community-wide outbreaks, often in rural or remote areas with inadequate water and sewage disposal systems and crowded housing.

For each vaccine, the aim is to immunize most or all of the eligible people. For many of these special groups and situations, the number who are eligible (the "target population") is not known precisely, and uptake rates are, therefore, difficult to measure.

Are All Recommended Vaccines Publicly-Funded?

As more vaccines become available for more groups of people, it will be important to keep up with experts' recommendations for usage of each vaccine, so that all British Columbians receive the best possible protection. In general, British Columbia follows recommendations in the *Canadian Immunization Guide*. However, vaccines recommended by the B.C. Ministry of Health are not publicly-funded in all cases. Some examples of vaccines that are recommended but not provided free of charge to all risk groups are:

Priority Action: Provide funding to expand current immunization programs to cover pneumococcal immunization for people with chronic diseases in all age groups and hepatitis A immunization for men who have sex with men.

- **Pneumococcal vaccine**. Pneumococcal vaccine is recommended for all people age 2 and over who have chronic health conditions. Currently, the provincial program excludes an estimated 280,000 people between the ages of 2 and 64 with chronic diseases who are at risk of pneumococcal disease. Annual savings from introducing vaccine for this target group have been estimated at between $1 and $3 million per year. Ontario, Alberta, and Nova Scotia offer a publicly-funded pneumococcal vaccine to persons at risk in all ages groups. British Columbia does not currently fund vaccine for individuals younger than age 65.

- **Hepatitis A**. Hepatitis A vaccine is recommended for men who have sex with men, a group at high risk as a result of their sexual practices. British Columbia has had numerous outbreaks of hepatitis A among this group, and the vaccine has been used in curbing outbreaks in Vancouver and Nanaimo. As men who have sex with men continue to be at risk throughout the province, we should provide the vaccine to all people in this target group, as recommended in the *Canadian Immunization Guide*.

- **Hepatitis B**. Hepatitis B vaccine is recommended for health care workers and other workers who may be exposed to blood, blood products, or bodily fluids that may contain the virus. Vaccine for exposed health care students is publicly-funded, but other workers are excluded from provincial immunization funding. In most cases, health care employers cover the cost of immunizing their employees. However, vaccine could be provided more cost-effectively if there were a coordinated provincial program in place.

Priority Action: Develop a strategic plan, so that we are able to offer publicly-funded immunizations to all target groups recommended in the *Canadian Immunization Guide*, through a coordinated provincial program.

Ultimately, we should work towards providing publicly-funded vaccines to all risk groups identified in the *Canadian Immunization Guide*, so that all groups are able to obtain the maximum benefits from immunization in the most cost-effective way and without financial barriers.

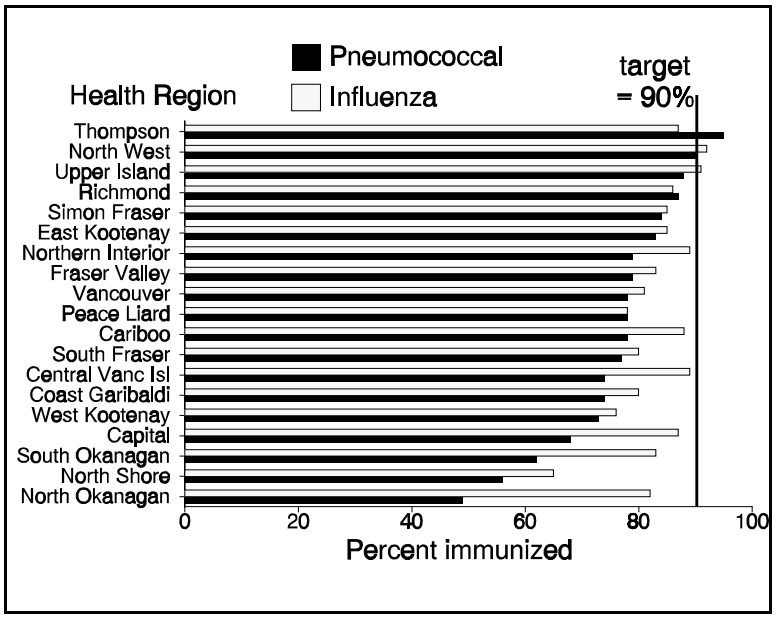
Care Facility Residents

In fiscal year 1997/98, health authorities collected information on the percentage of long term care residents and staff who were immunized against influenza and pneumococcal disease. For facility residents, vaccine uptake was reported at 75 per cent for pneumococcal and 83 per cent for influenza vaccine. In many regions, rates are approaching the national goal of 90 per cent (Figure 17). Results for pneumococcal immunization were particularly commendable, since 1997 was the start-up year for this publicly-funded program.

Priority Action: Achieve better coverage rates for influenza immunization among the population age 65 and older, people with chronic diseases in all age groups, health care workers, and other eligible groups.

To protect health care workers and caregivers – and to safeguard the vulnerable people they care for – it is vitally important that health staff be immunized. In 1997/98, the influenza immunization rate for staff of care facilities was only 28 per cent – far below the 90 per cent target. Data on numbers of staff immunized are incomplete, and data collection methods need to be improved. In gathering the 1997/98 statistics, staff immunization data were not available for Vancouver (45 facilities) and for a total of 46 facilities in other regions.

Figure 17 Influenza and Pneumococcal Immunization Rates, Care Facility Residents, B.C., 1997/98



Source: Report of Pneumococcal and Influenza Immunization in Care Facilities 1997. B.C. Ministry of Health Administrative Circular 98:13. "Simon Fraser" includes Burnaby. For regional data on percent of facility staff immunized, see Appendix F.

Other Special Groups

For other special population groups, we lack British Columbia data on the proportion who are immunized. However, the information we have available suggests that we are not reaching all those who would benefit from immunization. A national survey estimated that only 20 to 40 per cent of children and adults with medical conditions that put them at risk from influenza complications actually receive influenza vaccine as recommended (National Advisory Committee on Immunization, July 1997).

Those who provide care for the population groups listed on pages 48-49 should make a special effort to ensure that vaccines are offered to those for whom they are recommended. Methods need to be developed to allow regions to track and report immunization coverage rates for these special population groups.

From Special to General Use

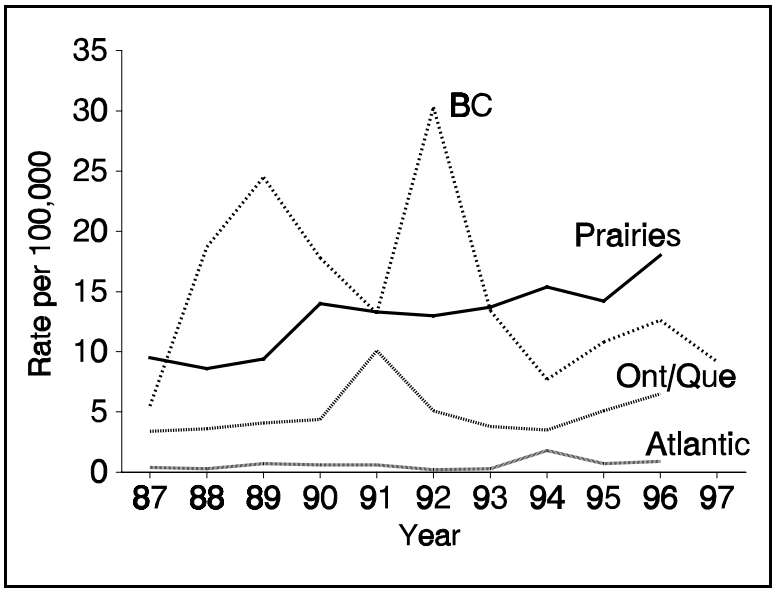
Some immunization programs start out by targeting high-risk groups or special-use situations. Later, if the need is demonstrated, the program may be expanded.

Hepatitis B is one example of a vaccine that has been expanded from special to more universal use. The immunization program began in 1984 by offering vaccine to babies born to mothers who were infected with hepatitis B. Over time, the vaccine was made available free of charge to people who were in other recognized risk groups: household and sexual contacts of chronically-infected people, injection drug users, persons with multiple sexual partners, and students in selected health care programs. In 1992, immunization was further expanded to include all grade six students.

In the future, hepatitis A vaccine could follow this pattern. Hepatitis A, a virus that affects the liver, can be spread through contaminated food or water or close personal contact. The number of cases reported in B.C. has varied from year to year, but B.C.'s reporting rate has generally been higher than that of other provinces (Figure 18).

When hepatitis A vaccine was first licensed in Canada several years ago, it was recommended for certain risk groups, including people planning to live, work, or travel in developing countries, residents and staff of institutions for the developmentally challenged, patients with haemophilia, homosexual males with multiple sex partners, and injection drug users.

Figure 18 Reported Rates of Hepatitis A, B.C. (1987-1997), Prairies, Ontario/Quebec, Atlantic (1987-1996)



The number of cases reported in B.C. has ranged from 161 in 1987 to more than 1,000 cases in 1992; 382 cases were reported in 1997. B.C. data for 1997 from Epidemiology Services, B.C. Centre for Disease Control Society. All other figures from Notifiable Diseases Annual Summary 1996. Canada Communicable Disease Report, Volume 23S6 (Supplement), October 1998.

Hepatitis A vaccine has also been used in outbreak situations. In 1996, an outbreak occurred in the Central Vancouver Island area. Hepatitis A vaccine was administered to control the outbreak, the first such use of the vaccine in Canada. In 1997, the vaccine was successfully used to control a Vancouver outbreak among men who have sex with men.

Currently, British Columbia provides hepatitis A vaccine free of charge to persons with haemophilia, who have hepatitis C, or who are injection drug users. The vaccine is recommended for people planning to visit countries where hepatitis A is common and other high risk groups, but is not routinely given to the general population at this time.

In the United States, Oklahoma recently became the first state to require hepatitis A immunization for children entering school. The Center for Disease Control and Prevention in Atlanta recommends that states with annual rates twice the national average (10 cases per 100,000) consider implementing a universal program. In 1997, British Columbia's rate was 9.2 cases per 100,000.

Offering hepatitis A immunization to the general public could be considered in the future, especially if British Columbia's disease rate increases, and as combination vaccines that incorporate hepatitis A become available.

To know whether and when hepatitis A should made available to the public, we must keep up with latest knowledge about the disease, its patterns in the population, and vaccines and other methods available for prevention. A recent survey of grade six students in Vancouver found that 7 per cent had evidence of prior infection with hepatitis A, with foreign-born students having the highest rates (Ochnio, Scheifele, Lightle, & Ho, 1997). Such surveys should be carried out on a regular basis, to determine the level of infection and immunity in the community and the need for new or expanded immunization programs.

Travellers to Other Countries

People travelling to other countries are susceptible to certain vaccine-preventable diseases and often require further immunizations. In addition, some countries require proof of immunizations such as yellow fever as a condition of entry.

International travel has grown dramatically in the past decade, and travel-related diseases are increasingly common. As we control the number of cases originating in British Columbia, a growing proportion of our vaccine-preventable diseases become associated with travel.

Hepatitis A is the most frequent vaccine-preventable infection among travellers, and about one-quarter of B.C.'s hepatitis A cases are estimated to be travel-related. Among travellers to rural areas of developed countries, the risk of hepatitis A is up to 500 times higher than the B.C. rate. Hepatitis B is also a risk for travellers, particularly if they stay in areas with high levels of disease or engage in unprotected sex, injection drug use, or other high-risk behaviours. Meningococcal disease, Japanese encephalitis, rabies, typhoid fever, and cholera are other diseases that have been reported in travellers. Many countries require visitors to have yellow fever vaccination, and some countries require immunizations under specific circumstances, such as meningococcal vaccine for pilgrims to Mecca.

Provision of advice and information related to health risks in international travel is a specialized service. Immunization recommendations change frequently, and there is no single schedule for immunization. Recommendations depend on the countries and areas to be visited, the type of travel (whether staying in urban hotels or small villages), the legal requirements for entry into countries to be visited, personal immunization history, and duration of travel.

While there are national and provincial recommendations for travel-related immunizations (Appendix C), there is no provincial program to provide vaccines for travellers free of charge. Each area of the province chooses how to implement travel health services and how much to charge users for immunizations. Health authorities use various levels of cost recovery, ranging from vaccine costs to total cost recovery.

There are several ways in which travel health services can be provided. Regional travel clinics are one way to provide accurate, current, and comprehensive information on travel health. Such clinics may be staffed by public health nurses or by private or salaried physicians. In some areas of the province, travel health services are provided by individual physicians in their offices.

Whatever model is in place, it is critical that international travellers have access to appropriate and accurate information and recommended immunizations. Current, comprehensive travel medicine information and access to travel-related vaccines can help people practise responsible health behaviours during their travels, and will increase their chances of returning to the province in good health.

Travel Health Services

Immunization is an important component of travel health services, and all persons travelling overseas should ensure their immunizations are up-to-date.

Many of the health problems experienced by international travellers are not preventable by immunization. In addition to immunization, travel health services involve providing advice and current information on various health risks that may arise and measures available to protect against them. Risks that travellers may face include:

- injuries, e.g., motor vehicle accidents;
- risks from food and drink;
- sexually transmitted diseases, including HIV;
- diseases specific to certain areas of travel, such as malaria.

People planning to travel outside of Canada should consult their local public health unit, travel clinic, or family doctor two to three months in advance of departure. This will allow time for immunization schedules to be completed and for any other preparations to be made, such as obtaining anti-malarial medications.

5. The Future

Within the next few years, we can expect to see chickenpox vaccine for children, acellular pertussis vaccine for adolescents and young adults, an improved vaccine for influenza, and a vaccine that allows infants to receive six vaccines in one injection. Much further in the future, research is under way that may lead to vaccines for preventing chronic infections such as HIV, sexually transmitted diseases, arthritis, and certain cancers.

Immunization has been called the "greatest public health success story in history" (Henderson, 1998). With so noble a past, what can we expect to see in the future?

Increasingly rapid advances in technology are taking us into a new era in vaccine development. Soon, we will see vaccines against more diseases, one-shot vaccines that eliminate the need for multiple and booster shots, vaccines that work for younger infants or additional groups of people, to protect them at vulnerable stages of life, and new vaccines that are eaten, breathed in, or spread on the skin. Even more than in the past, this new generation of vaccines has potential to prevent diseases, suffering, and death.

A number of developments are on the horizon, both in terms of vaccines and ways of providing them. New or improved vaccines expected in the next few years include:

Improved Vaccines

Influenza. Longer-lasting vaccines are being developed that can provide immunity against more strains of the influenza virus. Also being tested in clinical trials is a vaccine that can be administered by nasal spray.

Tetanus Diphtheria acellular Pertussis vaccine for adolescents and adults. This new, combination vaccine could be used to boost pertussis protection among adolescents and adults, blocking the spread of infection more effectively in the general population. The change to a new acellular pertussis vaccine has made this advance possible; the older, whole cell vaccine was not recommended for use after age six.

One-shot vaccine for early childhood immunizations. A new combined vaccine would allow infants and young children to receive six vaccines in one shot: diphtheria, acellular pertussis, tetanus, polio, Hib, and hepatitis B.

New Vaccines

Chickenpox. A vaccine for chickenpox was licensed for use in Canada in December 1998. The vaccine is safe and effective - 85 per cent effective against the infection, and nearly 100 per cent effective against moderate or severe disease. Although safe and effective, the vaccine must be stored in the freezer at -15^{o} Celsius, making it difficult to transport and handle. Researchers are trying to improve the vaccine so that it can withstand higher temperatures. The vaccine is also relatively expensive – $60 per dose.

Chickenpox is a common and costly disease, if all costs are considered. More than 90% of children get the disease during childhood (0-14), and at least 95% have had it by adulthood (Benenson, 1995). About half of children with chickenpox go to the doctor. In 1996, chickenpox caused 10,472 B.C. children age 0-14 to visit their family doctor, at a cost $295,349. Many parents miss work to stay home caring for their sick children, incurring costs to themselves and/or their employers. It is estimated that every dollar spent on chickenpox immunization could save five dollars in costs, if the time parents spend off work is considered.

Priority Action: Develop a strategic plan, so that we are prepared to introduce chickenpox vaccine, acellular pertussis vaccine for adolescents, and other new, cost-effective vaccine products that are expected to become available in the next few years.

A publicly-funded universal program is highly desirable. It is the implementation details that need to be fleshed out. A working group has been established to consider when and how the chickenpox vaccine should be introduced into the provincial program.

Lyme Disease. The organism that causes Lyme Disease is found in certain types of ticks. Humans may get the disease if they are bitten by an infected tick. A new vaccine is available and is being considered for high-risk groups. Because of the small number of cases that occur in British Columbia, immunizing the entire population would not be cost-effective.

Rotavirus. Rotavirus infections are an important cause of severe diarrhoea and dehydration in children under age five, especially in developing countries. An oral vaccine is expected to come on the market in the next few years.

RSV Vaccine. The respiratory syncytial (RSV) virus causes serious respiratory infections in infants as well as in the elderly. Vaccines are under development.

Other Vaccines On The Horizon

Much further in the future, research is under way that may lead to the development of vaccines for preventing – and treating – chronic infections such as HIV, sexually transmitted diseases, arthritis, and peptic ulcers. Cancer vaccines are under development and entering the research trial stage.

Scientists are also working to develop different types of malaria vaccines. A cost-effective malaria vaccine would have a major impact on the health of developing countries, as well as offering protection to Canadians who travel to these areas.

6. Issues and Challenges

Making better use of current vaccines and taking advantage of new vaccines will require a continued commitment – in funding, human and other resources. Lack of awareness, complacency, scheduling problems, or other barriers to immunization must be identified and tackled. We will continue to need skilled and dedicated health care workers to provide immunizations, along with resources to support them. Immunization services must continue to be provided efficiently, and we must prepare for new vaccines that come on the market or disease outbreaks that may occur. Keeping consumers informed and working together with groups who can support immunization will be critical to success. Research, better information and evaluation tools, and regular reports on results will help us provide better services and make good decisions about future improvements.

British Columbia has one of the best immunization programs in the world, and we have made great strides in controlling vaccine-preventable diseases. However, preventable cases of these diseases continue to occur, and ongoing effort is required to achieve provincial and national targets for immunization coverage and disease reduction. New and improved vaccines are on the horizon, providing opportunities to further protect British Columbians against diseases and their complications.

What are some of the issues and challenges we face in improving our immunization programs – today and in the future?

Commitments to Immunization

Traditionally, the delivery of immunization programs has been the cornerstone of public health services, and a solid foundation of immunization services is in place. To make current programs even better, a continued commitment is required, and this will involve devoting attention, funding, and human resources to immunization.

One way to demonstrate a commitment is through setting of goals and targets. National immunization goals and targets should be officially adopted by the province, and local health authorities should do the same.

Priority Action: Develop a strategic plan, so that we are prepared to adopt and meet provincial goals and targets for immunization and for the control of vaccine-preventable diseases.

The provincial Ministry of Health has demonstrated its willingness to invest in immunization. Currently, the Ministry spends $11 million each year on vaccines – a substantial increase from the $5 million vaccine budget in 1991/92. But $11 million – about $2.75 per person – is a still modest amount to spend on such a cost-effective preventive health service. Additional commitments are required for new and expanded immunization programs.

Although British Columbia's immunization programs are comprehensive, we do not provide publicly-funded immunizations to all groups recommended in *Canadian Immunization Guide*. Some priorities for 1999, based on information presented in chapter 4 of this report, include expanding current immunization programs to cover additional ages and risk groups, in three areas:

Priority Action: Provide funding to expand current immunization programs to cover additional ages and risk groups in three areas: hepatitis B immunization for all infants and children, pneumococcal immunization for people with chronic diseases in all age groups, and hepatitis A immunization for men who have sex with men.

- Hepatitis B immunization for all infants, with a catch-up program for children entering kindergarten and for high-risk children
- Pneumococcal immunization for people with chronic diseases in all age groups
- Hepatitis A immunization for men who have sex with men

The above programs will require funds for vaccines, as well as funds for human and technical resources to deliver and support them. To implement these will cost $8.7 million in the first year and $6.4 million in the second year. All three expansions are a wise investment. They will produce immediate and long-term cost savings because of diseases and outbreaks avoided.

Funding for immunization should be set aside each year, so that we are prepared to introduce new and improved vaccines as they become available in the future, when safety and cost-effectiveness are demonstrated.

A further way to demonstrate commitment is to find ways to reward immunization providers and regions for achieving up-to-date immunizations in the populations they serve. Incentives such as financial bonuses, distributing computers and guidebooks, and giving feedback on immunization performance have been successful in raising immunization coverage levels in the United Kingdom (Kouides, Lewis, Bennett, 1993) and in the United States (Fairbrother, Hanson, Friedman, & Butts, 1999).

Removing Barriers to Immunization

In order to obtain maximum benefits from vaccines, everyone's immunizations should be as complete and as up-to-date as possible, based on the recommended ages for vaccination.

Because most immunizations are publicly-funded and available to all eligible British Columbians without charge, it should be possible to achieve and maintain very high immunization rates. Yet, we still have some distance to go in meeting national and provincial goals and targets. What, then, are the barriers to immunization, and how can they be tackled?

Within British Columbia, there have been no province-wide surveys about barriers to immunization. One study of 219 children admitted to Children's Hospital found that every parent had intended to give all the routinely recommended vaccines, and most parents (84 per cent) believed their children's immunizations were up-to-date for their ages. In fact, a significant proportion of these children had not had the recommended immunizations or were off-schedule due to late or missed doses (Scheifele, 1995).

In a North Okanagan survey (see page 38), parents were asked why their children had not received their immunizations on time. Parents cited scheduling problems and delays due to illness as major barriers to timely immunization. Some of these can be addressed by providing more convenient clinic times or by making parents and immunization providers more aware of appropriate reasons for delaying immunization. There are very few medical reasons for postponing immunization – a child with a cough, cold, or other minor illness can be safely immunized.

When should immunization be delayed? A severe illness at the scheduled time of immunization usually warrants a delay, but it is not necessary to postpone immunization because of a minor illness such as a cough, cold, or low-grade fever. For more information about conditions for delaying immunization, see Appendix D, pages D-16 and D-17.

Some groups may face language or cultural barriers to accessing immunization services. Immigrants are one group who may be under-immunized, especially if they have come from developing countries where immunization programs include fewer vaccines and where vaccine quality may be difficult to maintain. Although there are no data for tracking the immunization status of immigrants, it has been recognized that some immigrants may be "falling through the cracks". In partnership with immigrant and refugee-serving agencies, an immunization outreach program for immigrants should be developed. The time of each immigrant's arrival into B.C. could provide an opportunity to screen, educate, and refer immigrants for any immunizations they may require.

Of the overall population, it is estimated that about 1 per cent are firmly opposed to immunization, while up to 6 or 7 per cent have mixed or uncertain feelings (Health Canada, 1997). Questions and concerns can be addressed by providing accurate information and opportunities to discuss the benefits and risks of immunization.

Some studies in the United States have found that poor children have lower immunization rates than non-poor children, in part because they lack health insurance or have difficulty finding a physician who will accept low-income patients (Mayer, Clark, Konrad, Freeman, & Slifkin, 1999). Because British Columbians have access to most immunizations and other essential health services free of charge, financial barriers should not pose a major problem. However, some recommended immunizations are not publicly-funded, and users are charged fees to receive them (see discussion on publicly-funded vaccines, page 50, and charges for travel-related immunizations, page 55).

Priority Action: Develop a strategic plan, so that we are able to offer publicly-funded immunizations to all target groups recommended in the *Canadian Immunization Guide*, through a coordinated provincial program.

We do not know the extent to which British Columbians choose not to receive immunizations because fees are charged. We should work towards removing financial barriers, so that all groups are able to receive all immunizations recommended in the *Canadian Immunization Guide*. For travel-related immunizations, a first step should be to review the benefits and costs of providing travel vaccines free of charge, because of the importance of preventing disease in returning travellers.

Priority Action: Achieve better immunization coverage rates, in the following areas: on-time immunization of all infants and preschool children and influenza immunization for all people age 65 and older, people with chronic diseases in all age groups, health care workers, and other eligible groups.

Achieving our immunization targets will require identifying and removing various barriers that may exist. Table 13 shows some examples of barriers and their possible solutions. Based on data presented in Chapter 4, efforts should be directed to achieving better immunization coverage rates in these areas:

- On-time immunization of all infants and preschool children
- Influenza and pneumococcal immunization for all eligible groups
- Immunization of groups who require specific vaccines because of their medical condition, occupation, lifestyle, or other exposure
- Routine immunization of adults

Table 13 Barriers to Immunization

Barrier	Possible Solutions
Lack of knowledge about the importance of immunization	• Education and awareness campaigns
Lack of awareness about which immunizations are required and when immunizations are due	• Improved record-keeping • Mailed reminders • Personal contact
Difficulties in accessing services, e.g., lack of time or transportation	• Outreach clinics • More convenient clinic hours • Offering immunization at each visit to a doctor, hospital, or community health service
Fear of side effects	• Discuss benefits and risks
Conscientious objections to immunization	• Discuss benefits and risks of immunization and social responsibility to protect community at large
Lack of understanding about contraindications or reasons for postponing immunization	• Provide information to clients • Provide training and continuing education to immunization providers
Language or cultural barriers	• Outreach programs • Involve community in planning and carrying out programs
Financial barriers (for immunizations that are recommended, but not publicly-funded)	• Reduce operating costs • Reduce or eliminate fees charged to users

Keeping Consumers Informed

Consumers need to be aware of which vaccines are recommended for themselves and their family, and they must make an informed choice about the immunizations they receive. Before being given a particular vaccine, people must be informed of its specific purpose, benefits, and risks. As with other medical procedures, there is a legal and ethical duty to obtain this "informed consent" before any vaccine is given.

In the past, pamphlets and individual counselling during immunization visits were the primary methods of providing information. As the number of available vaccines and target groups increases, the task of informing consumers gets harder.

New education strategies and marketing tools are needed. Videos, computer-based education, or other technologies could be used to increase public knowledge and awareness of immunization. Partnerships could be strengthened with pharmacists, teachers, the media, and other groups who provide or support health and social services and who can act as educators and advocates for immunization.

Effective communication with consumers requires understanding their particular information needs and their ways of making decisions. Some people prefer short, simple messages, while others want as much scientific information as is currently available, along with opportunity for dialogue. Whatever approach is used, the goal should always be informed decision-making, based on trust and sound information (Evan, Bostrom, Johnston, Fisher, & Stoto, 1997).

Dealing with Immunization Myths

A small but vocal proportion of both the public and alternative health practitioners are openly sceptical about or antagonistic to immunization. Public confidence in immunization can be undermined when misinformation is spread by anti-vaccination groups. This is a potentially dangerous development, which could lead to lower immunization rates and outbreaks of preventable disease.

To counter false and misleading claims, consumers need accurate information about the benefits and risks of immunization. As well, consumers need to become critical reviewers of information they encounter regarding immunization, especially if the messages are one-sided. Not all information, on the Internet or elsewhere, is accurate or truthful or has been critically reviewed.

Concerned about the need for immunization, or its safety? See "Questions and Answers about Vaccination", a chapter from Your Child's Best Shot, in Appendix D.

The most common misconceptions are that vaccines are unnecessary and unsafe. The information presented throughout this report shows that these are immunization myths, not facts.

For additional information about immunization concerns, readers may wish to consult some of the references listed in Appendix B. One excellent resource for parents is *Your Child's Best Shot*, which includes questions and answers to common concerns about vaccines (Canadian Pediatric Society, 1997). A more technical discussion of vaccine safety issues and Canada's programs for monitoring side effects can be found in the *Canadian National Reports on Immunization* (Health Canada, 1997; 1998), which are available from local public libraries or from the Internet addresses listed in Appendix B.

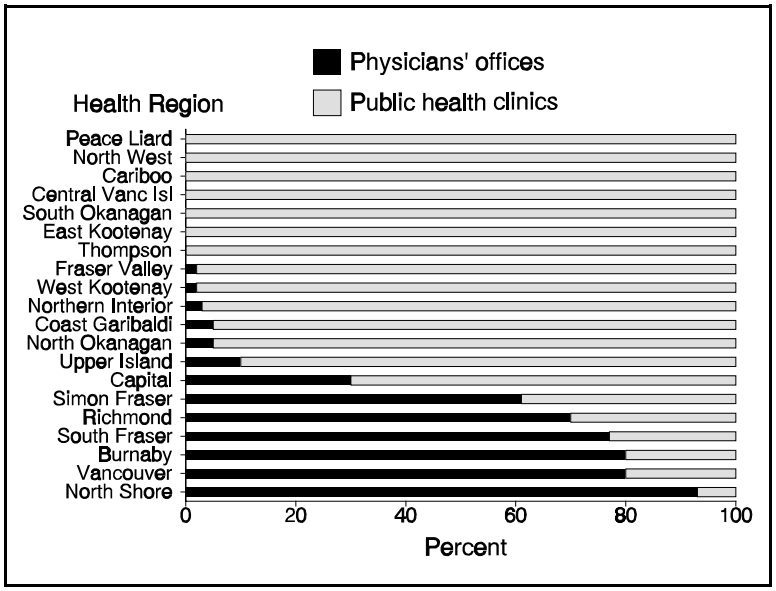
Managing the Delivery System

To improve immunization programs so that goals and targets can be achieved requires a coordinated and efficient delivery system. Providing immunization services to four million British Columbians presents some management challenges.

Working with Multiple Providers

Although there are provincial policies and immunization schedules, each health authority can implement them in the way that is most appropriate for the communities they serve. As we saw in Chapter 4, different groups provide immunizations depending on the vaccine and the area of the province. About 60 per cent of B.C. children receive their immunizations at public health clinics. In some parts of the province, the Lower Mainland in particular, much of the childhood immunization is provided in doctors' offices (Figure 19).

Figure 19 Who Provides Childhood Immunizations in British Columbia? Estimated Percent of Childhood Immunizations Given in Public Health Clinics and Physicians' Offices, B.C., 1998

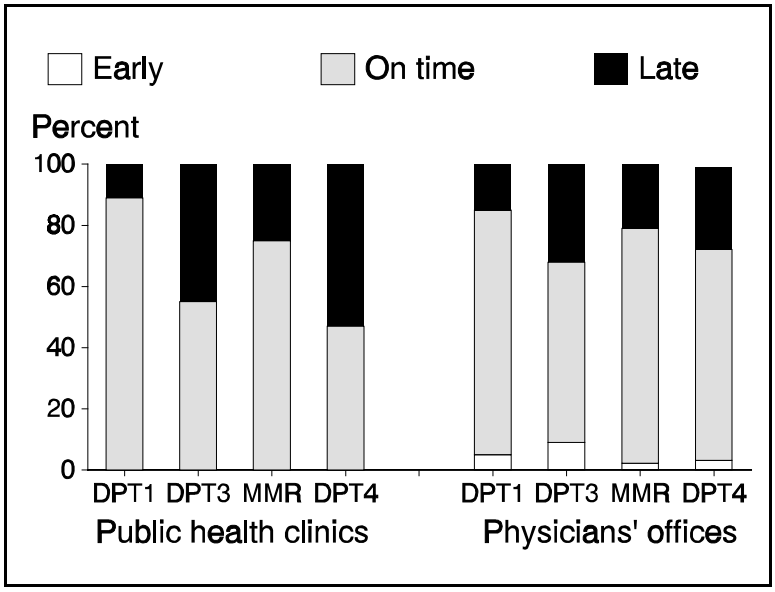


"Childhood immunizations" refers to the routine childhood series, recommended for all infants and preschool children. Source: Public Health Nursing, B.C. Ministry of Health.

Is one method of delivery – public health or private physicians – better than the other? A review undertaken in 1998 concluded that public health delivery is likely to be more cost-effective, although the case was not sufficiently compelling to recommend changing British Columbia's "mixed delivery" model at this time (Watts, 1998).

Based on data available for British Columbia, there are no major differences in the performance of physicians and public health staff in terms of providing immunizations. A study in Surrey found that children who attended public health clinics and doctors' offices were equally likely to be immunized on-time (Scheifele, LaJeunesse, Marty, & Chen, 1996) (Figure 20). Further, the two health regions with consistently the highest childhood immunization rates are at the extreme ends of the spectrum – Richmond has 100% physician delivery, and in Thompson region, 99.9% of immunizations are provided by public health.

Figure 20 Timeliness of Immunizations Given in Public Health Clinics and in Physicians' Offices, Two-Year-Old Children Born in April 1993, Boundary Health Unit (Surrey)



Immunizations considered "on time" if given at 8-11 weeks for DPT/DT first dose (recommended at age 2 months), 26-29 weeks for DPT/DT third dose (recommended at age 6 months), 12-13 months for MMR (recommended at age 12 months), and 18-19 months for DPT/DT fourth dose (recommended at age 18 months). Source: Scheifele, D.W., LaJeunesse, C., Marty, K., & Chen, L. (1996). Comparison of physicians and health-department staff as timely providers of childhood vaccines. BC Medical Journal, 38(7), 372-374.

Both public health nurses and physicians can do a good job of providing immunizations. Their success depends in part on the infrastructure – vaccine distribution, professional education and advice, management of mass immunization campaigns, and information systems – that are available to assist them. The key to success is having dedicated immunization providers and an organizational infrastructure that supports their immunization activities.

Having multiple providers does make it more difficult to track immunization statistics, however. In theory, those who provide vaccinations are required to report their results to public health units. However, because the reporting system is cumbersome, immunization data from physicians' offices are often missing from provincial statistics. This issue is discussed in more detail under "An Immunization Registry For B.C.", pages 73-74).

Regionalization

Since 1994, the provincial Ministry of Health has moved towards decentralizing the governance, management, and provision of health services. Most decisions about the day-to-day delivery of health services are now made at the local health authority level. For the provision of immunization and other public health services, this provides both opportunities and challenges.

Decentralization allows regions to adapt implementation plans to suit their local situation. Regional initiatives can be good, because they pave the way for new programs and new ways of providing services. On the other hand, the organizational changes accompanying decentralization can make it harder to maintain programs and high levels of immunization coverage. In the longer term, decentralization can make it more difficult to harmonize immunization schedules and programs across the province. The challenge is to leave room for flexibility and innovation at the local level, while ensuring that provincial standards are maintained and goals achieved.

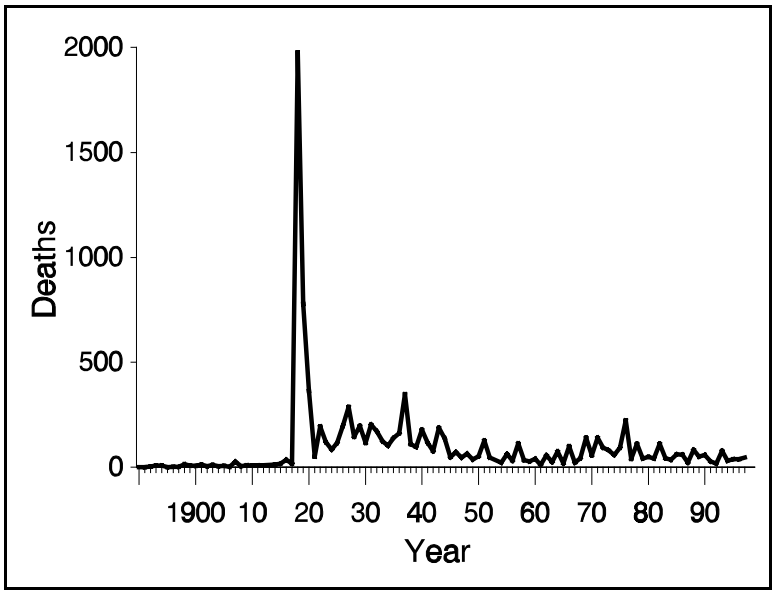
Being Ready for Outbreaks

Even with good immunization programs in place, outbreaks of vaccine-preventable diseases can still occur. Recent outbreaks in British Columbia include measles among university students, influenza in long term care facilities, and hepatitis A among men who have sex with men. Like earthquakes and other disasters, disease outbreaks require advance planning and preparation if we are to respond rapidly and effectively.

Many experts believe that a world-wide epidemic (a "pandemic") of influenza is overdue. Influenza pandemics, which come in intervals of about 30 years, have been called "the largest, most important predictable public health disaster there is" (Pandemic Planning, 1998).

Several varieties of the influenza virus cause disease. Certain types occur in pandemic form. They can spread rapidly around the world, creating widespread illness. Some strains have a very high death rate. The 1918 pandemic caused between 15 and 25 million deaths worldwide, with almost two thousand deaths in British Columbia alone (Figure 21); many of the deaths occurred in younger, previously healthy persons.

Figure 21 Influenza Deaths, B.C., 1890-1997



Source: B.C. Vital Statistics Agency, B.C. Ministry of Health.

Based on historical trends and scientific knowledge, it is predicted that another pandemic could occur with a new virus strain, for which the present vaccine is ineffective, within the next three to five years. This pandemic could result in between 4,000 and 180,000 Canadian deaths within 6 to 12 months after its detection anywhere in the world. To protect against influenza, an effective vaccine can be prepared, but it takes time – at least 3 to 4 months – to identify the specific new strain of virus and to produce sufficient vaccine. Tremendous efforts would be required to mobilize and immunize virtually all of British Columbia's four million residents, once the vaccine became available.

In general, the best way to prepare for outbreaks is to maintain high levels of immunization at all times, so that fewer people will need to be immunized when an outbreak does occur. High immunization levels between outbreaks are not enough to control influenza, because changes in the virus create the need for a new vaccine. Being ready for situations such as an influenza pandemic requires planning and resources beyond those needed for routine immunization programs. Our health care system must have the resources needed for outbreak planning, early identification, and quick response.

Priority Action: Develop a strategic plan, so that we are prepared to manage the expected world-wide epidemic ("pandemic") of influenza.

A national pandemic plan is being developed by Health Canada in conjunction with the provinces. Within B.C., each local health authority, as well as province overall, should prepare for outbreaks, as part of their overall emergency planning.

Partnerships and Coordination

Immunization programs require coordinated efforts by many groups, including governments, health authorities and their staff, physicians, professional and training associations, the research community, hospitals and care facilities, schools and day care centre, employers, community organizations, and the media. Partnerships and coordination among these groups can help to ensure that immunization programs are planned and delivered to all who need them.

Each stakeholder group can promote immunization among its members and can contribute to making immunizations more available and accessible. Health partners can work together to ensure that immunization services are evidence-based and of consistently high quality.

Best Practices

To assist providers in keeping pace with the development of knowledge in immunization, the National Advisory Committee on Immunization has published guidelines that describe the many aspects of the task (Table 14). Similar guidelines for adult immunizations are under development, although all of the practices in Table 14 also apply to adult immunization. All those who provide vaccines should examine these guidelines closely and comply with them. Monitoring compliance is best done at the local level. In the future, provider audits could be undertaken as part of a regular review process.

Accreditation standards for hospitals and community health services currently require that each client's or patient's immunization status be assessed and documented (Canadian Council on Health Services Accreditation, 1994; 1996). A standard could be considered requiring each facility or service to have a mechanism for determining whether health care workers and the population of clients/patients they serve are all fully up-to-date with their recommended immunizations. Initially, this standard could be applied to residential care facilities or services with a relatively small number of staff and clients, where record-keeping would pose fewer difficulties. Over time, once an electronic immunization registry is in place, all hospitals and community health services could monitor the immunization status of their staff and clients.

Training

Knowledge and skills are needed to provide immunizations and to act as advocates. All medical, nursing, and other health care students should receive basic training in immunization practices. This may require increasing the content in medical and nursing curricula related to vaccine-preventable diseases, immunization as a cost-effective preventive strategy, safety of vaccines, contraindications and reasons for deferring immunization, and how to evaluate the results of the immunization work they do.

Establishing an immunization certification process and/or continuing education credits for physicians and nurses should be considered. This would support high standards among immunization providers. Professional colleges and institutions must work together to find the best way to provide the training and support that immunization providers need, in a way that works best for each group.

Table 14 Guidelines for Childhood Immunization Practices

1	Immunization services should be readily available.	10	Providers should maintain easily retrievable summaries of vaccination records to facilitate age-appropriate vaccination.
2	There should be no barriers or unnecessary prerequisites to the receipt of vaccines.	11	Providers should report clinically significant adverse events following vaccination – promptly, accurately, and completely.
3	Routine childhood immunization services should be publicly funded.	12	Providers should report all cases of vaccine-preventable diseases as required under provincial and territorial legislation.
4	Providers should use all clinical encounters to screen for needed vaccines and, when indicated, vaccinate children.	13	Providers should adhere to appropriate procedures for vaccine management.
5	Providers should educate parents about immunization in general terms.	14	Providers should maintain up-to-date, easily retrievable protocols at all locations where vaccines are administered.
6	Providers should inform parents in specific terms about the risks and benefits of vaccines their child is to receive.	15	Providers should be properly trained and maintain ongoing education regarding current immunization recommendations.
7	Providers should recommend deferral or withholding of vaccines for true contraindications only.	16	Providers should operate a tracking system to generate reminders of upcoming vaccinations and recalls for children who are overdue for their vaccinations.
8	Providers should administer all vaccine doses for which a child is eligible at the time of each visit.	17	Audits should be conducted in all immunization clinics to assess the quality of immunization records and assess immunization coverage levels.
9	Providers should ensure that all vaccinations are accurately and completely recorded.		

Source: National Advisory Committee on Immunization. Guidelines for Childhood Immunization Practices. Canada Communicable Disease Report, Volume 23(ACS-6), December 1, 1997.

Responding to New Vaccines

Because of new technologies, new and improved vaccines are rapidly being developed. This, plus our growing understanding of diseases, leads to a continuous need for additions or changes to immunization programs. As new vaccines become available, decisions must be made about whether, when, and how to introduce them. These decisions will require collaborative efforts.

Table 15 illustrates the process of developing a new immunization program. The first step is to form a working group to study the effectiveness and safety of the vaccine, the amount of illness that it can prevent, and estimates of the health and social costs that can be saved. In addition to science and epidemiology, there are practical considerations – can we deliver the program here in British Columbia, and how can it best be done? If the program is economically and organizationally feasible, a detailed proposal and funding request must be developed and submitted. Once funding is approved, final plans are made, and the program begins.

Table 15 Process for Developing New Immunization Programs in British Columbia

Step	Activity
1	Review scientific evidence on vaccine effectiveness and safety.
2	Analyze the benefits and costs of the vaccine.
3	Develop plan for providing the vaccine in British Columbia, including costs.
4	Develop program proposal.
5	Review program proposal and submit request for funding.
6	Develop final implementation plans once budget is approved.
7	Evaluate results of the program.

New vaccines are not always endorsed for routine use. There are limits to public resources, and choices must be made among the many services that could be provided from British Columbia's $7.4 billion health budget ($11 million, 0.14% of the budget, is currently spent on vaccines). Careful evaluation and planning are required before introducing a new vaccine product or program, to ensure that it provides the best possible use of public funds.

The need to spend wisely will become even more important in the coming decade, as more advanced – and more expensive – vaccines come on the market. As more vaccines are targeted to additional groups of people, adopting a "social marketing" approach becomes important, too. We will need to find ways of best reaching target groups and removing any barriers that may exist.

Research

The need for research will increase considerably as more vaccines become available. As more vaccines are given at the same time, we need to know if the margins of safety or effectiveness are being compromised. Similarly, as competing versions of new vaccines come on the market, comparison studies will be helpful to identify the best ones for use in provincial programs.

Periodic surveys will help to determine the level of infection and immunity in the community and the need for new and expanded immunization programs. Research can also answer questions about how to make immunization programs run better, what barriers to immunization exist, and how they may be reduced.

Research initiatives at B.C. Children's Hospitals and other places represent some of the most important work under way. British Columbia is fortunate to have a solid record of research in immunization. However, this must continue to be supported. We will need to encourage testing of new vaccines by independent research groups, through collaboration with health departments, access to provincially-funded research granting agencies, and other means as necessary to ensure British Columbia's participation in such projects.

Information and Evaluation Tools

Information provides the foundation for developing programs, for improving immunization coverage levels, for keeping consumers informed, for managing the day-to-day delivery of immunization programs, and for evaluating results.

An efficient record-keeping system is one of the most important tools needed to achieve our goals for control of vaccine-preventable diseases. A computerized immunization registry is essential, not only to monitor immunization coverage, but also to help improve coverage levels. At this time, a computerized registry is not in place throughout British Columbia.

With our current systems, most immunization records are paper documents and must be accessed manually. Without easy access to records, opportunities for immunization may be missed.

In a study of children admitted to Children's Hospital in Vancouver, more than 20 per cent were found to be in need of immunization. Hospitalization provided an opportunity to bring these children's shots up-to-date, but inaccessibility of accurate immunization records made a hospital-based program impractical (Scheifele, 1995).

With paper-based systems, health staff must rely on surveys, chart reviews, and tallies of vaccine records – primitive and labour-intensive tools – to monitor coverage and to determine who needs immunization if a community outbreak occurs.

An electronic system will allow us to know who is due for which vaccine and to use every contact to immunize a person, whether at the doctor's office, public health unit, hospital, or other health facility.

Computerized systems can be programmed to generate reminder letters for people who are late for immunizations, or even to perform automated telephone reminders. Computerized registries can help to identify groups within the population who have poor immunization coverage, and these groups can then be targeted for improvement initiatives. Ideally, immunization tracking should be part of an electronic system that is linked with reporting of communicable diseases. This would allow outbreaks to be identified earlier, and lists of people requiring immunization could be automatically produced.

In short, a computerized immunization registry will give us a tool we need to provide better service and to evaluate results.

An Immunization Registry for B.C.

An electronic system called CHILD, developed in the North Okanagan Health Region, was British Columbia's first step towards a provincial immunization registry. This work was expanded to become the Public Health Information System (PHIS), which was then pilot tested in the Capital and Simon Fraser health regions. PHIS contains an electronic record of a child's immunization status. The system allows public health nurses to find children's records quickly and to send out reminders to parents so that they can make sure children do not miss their initial immunizations and booster shots.

Currently, the B.C. Centre for Disease Control Society is partnering with health authorities throughout the province to implement the PHIS system. Work is also in progress to develop linkages to information systems in on-reserve First Nations communities.

Priority Action: Provide funding for continued development of a province-wide, electronic registry for immunizations, communicable diseases, and adverse reactions. Ways and means should be found to ensure that all age groups, all immunization providers, and all areas of the province are able to participate in, and benefit from, this essential health information system.

These efforts are a good start, but additional and ongoing efforts will be required. At the present time, PHIS only has the capacity to include preschool children. As quickly as possible, PHIS needs to be expanded to encompass all age groups, all immunization providers, and all regions of the province. Linkages to birth registrations and school enrollment information should also be incorporated, so that immunization records can be started at birth and maintained throughout life.

Ways need to be found to encourage private physicians to participate. Collecting and providing information is part of providing the immunization service, and when feasible, all physicians who provide immunizations should be connected to the immunization registry. In the short term, physicians' offices could report through the Medical Services Plan billing system.

Components of an Immunization Registry

An immunization registry for British Columbia should have the following characteristics:

Universal enrollment. The registry should contain information about all immunizations that each British Columbian receives throughout their lifetime. All areas of the province and all immunization providers – doctors, public health departments, hospitals, care facilities – should be included.

Recording of all immunization-related events. All immunizations given should be recorded, along with information about adverse reactions and reports of vaccine-preventable diseases.

Locally-based operations. All immunization providers should be able to enter data and to produce reports. British Columbia should operate a provincial system, with national support.

Common definitions. Data and reports should be standardized, so that information can be shared, where appropriate, and so that statistics can compared between regions and over time.

Electronic linkages. The registry should be able to draw enrollment directly from birth records, medical insurance enrollment records, school and day care enrollment records, and immigration notifications.

Based on characteristics identified at the Canadian Consensus Conference on a National Immunization Records System. Canada Communicable Disease Report, 24(17), pages 137-140, September 1, 1998.

Standards for Information and Reports

Along with an immunization registry, health information standards should be developed, so that all health authorities are able to report immunizations and communicable diseases in a consistent and comparable way.

Ways should be found to link reporting requirements so that essential data collection and analysis are encouraged, yet streamlined as much as possible.

A future activity is the development of national information standards for immunization records. A consensus conference was held in 1998 to begin this work (Health Canada, 1998).

Accountability

As receivers of immunizations and as taxpayers, British Columbians are interested in knowing what they are getting for their money.

In British Columbia, the provincial Ministry of Health, in collaboration with the Ministry for Children and Families, is responsible for health funding, establishing policies, and monitoring of results. Health authorities decide how to provide and manage immunization services, within the requirements and conditions set by the province. Health authorities are required to report annually to the ministry on their performance with respect to priorities identified in their strategic plans.

Immunization should be a component of the various plans and accountability reports. Health authorities should include immunization goals and targets in their plans, and track and report performance with respect to immunization coverage levels. In turn, the province should publish regular reports on immunization coverage as measured against goals and targets, vaccine safety and effectiveness, cold chain maintenance, and other aspects of immunization program delivery. These accountability functions should be adequately resourced.

Issuing regular reports is an important way to keep taxpayers informed about how their tax dollars are being spent and to encourage discussion about the various ways in which dollars and other public resources are being used. Because resources are finite and limited, it is essential that we invest wisely, so as to make the best possible contribution to improving the health of British Columbians.

7. Recommended Actions

What can be done to ensure that British Columbians continue to receive the best possible immunization programs? This chapter identifies specific steps individuals and families, communities, and the health care system can take to strengthen current immunization programs and to prepare for the future. Priority actions include achieving better coverage rates among infants and preschool children, improving influenza immunization rates, expanding the hepatitis B, hepatitis A, and pneumococcal programs to cover additional ages and risk groups, implementing a province-wide immunization registry, and developing a strategic plan for the control of vaccine-preventable diseases.

Immunization protects British Columbians from many diseases, much suffering, and death. Immunization is a wise investment, both from an economic standpoint, as well as from the perspective of improving people's health. Although we are doing a good job in protecting British Columbians from vaccine-preventable diseases, we must continue to invest in maintaining and improving our immunization programs.

What can be done to ensure that British Columbians continue to receive the best possible immunization programs? Based on information presented throughout this report, the following recommendations are made.

Individuals and Families

- Keep informed about immunization. Know which vaccines you and others in your family should be getting.
- Ask your public health unit or family doctor for *Health Files* or other information about immunization.
- Obtain a copy of *Your Child's Best Shot* (see Appendix D).
- Be critical in analyzing information and advice that may be one-sided and where someone stands to profit from selling you an alternative to immunization.
- Make sure all family members have an immunization record – a Child Health Passport, a Personal Health Record, or an International Certificate of Vaccination.
- Take care of your immunization records, and advise your regular immunization provider of any immunizations you receive elsewhere.
- Make sure all family members' immunizations are up-to-date.
- Report any vaccine reactions to your doctor or public health unit.
- Consult your public health unit, travel clinic, or family doctor before travelling internationally.
- Ensure that household pets are properly immunized, particularly against rabies.

Immunization Providers

(doctors and nurses who are qualified to give vaccines)

- Ensure you have the latest (1998) edition of the *Canadian Immunization Guide*.
- Examine the *National Guidelines for Childhood Immunization Practices* (pages 48-53 of the *Canadian Immunization Guide*) and ensure you are in compliance.
- Keep abreast of immunization issues and controversies.
- Properly store, handle, and transport all vaccines.
- Use every opportunity to promote immunization and to ensure that your clients' immunizations are up-to-date.
- Make a special effort to offer immunization to clients whose age, occupation, medical condition, or lifestyle places them at higher risk from vaccine-preventable diseases.
- Ask for a travel history when patients present with a vaccine-preventable disease.
- Provide clients with *Health Files* or fact sheets concerning immunization.
- Help clients develop critical appraisal skills for information they find on the Internet or in unregulated sources.
- Develop a system to generate reminders and recalls for patients who are overdue for their immunizations.
- Monitor immunization coverage rates for clients within your practice.

Local Health Authorities

(regional health boards, community health councils, community health services societies, First Nations health authorities)

Commitments to Immunization

- Adopt provincial immunization coverage goals and targets, and make plans for how to achieve them.
- Make immunization a high priority within the region's overall health plan.
- Dedicate resources to carry out all public health functions necessary for the control of vaccine-preventable diseases, including immunization, follow-up of disease cases and contacts, disease surveillance, and timely reporting to provincial authorities.

Removing Barriers to Immunization

- Identify and overcome immunization barriers, such as inconvenient clinic hours, lack of transportation, cost (for vaccines that are recommended but are not provided free of charge), literacy and language barriers.

Keeping Consumers Informed

- Publicize the benefits of immunization at every opportunity.
- Promote and participate in annual Immunization Week and other provincial and national initiatives to raise awareness of immunization.
- Supply *Health Files* and other educational materials to all immunization providers.
- Identify and respond to misinformation about immunization in the media.

Managing the Delivery System

- Liaise with other local health authorities to ensure consistency in access and in services provided.
- In your emergency plans, be prepared to deliver a mass immunization program.
- Develop a contingency plan for the expected pandemic of influenza.

Partnerships and Coordination

- Strengthen partnerships among groups that can help improve immunization coverage: schools, child care centres, employers, public health units, hospitals, long term care facilities, the local medical community, employers, professional organizations and unions, and organizations that serve groups at special risk from vaccine-preventable diseases.
- Implement a certification process for immunization providers, once it has been developed.
- Provide sufficient continuing education to immunization providers.

Information and Evaluation Tools

- Participate in the implementation of a provincial immunization registry, in collaboration with the B.C. Centre for Disease Control.
- Report any vaccine-preventable diseases and the population level of immunization achieved to the B.C. Centre of Disease Control.

Accountability

- Provide adequate funding and resources for accountability activities.
- Ensure that all immunization providers within the region are in compliance with the *Canadian Immunization Guide* and the *Guidelines for Childhood Immunization Practices*.
- Monitor, evaluate, and report on the region's overall performance with respect to immunization goals and the *Guidelines for Childhood Immunization Practices.*
- Include immunization goals and results in annual reports and other accountability documents prepared for the public, accreditation agencies, and other stakeholders.

Provincial Authorities

(Ministry of Health, Ministry for Children and Families, B.C. Centre for Disease Control Society, health organizations and professional associations)

Commitments to Immunization

- Formally adopt the national goals for vaccine-preventable diseases as part of the Ministry of Health's strategic plan.
- Develop a strategic plan for vaccine-preventable diseases, so that we are prepared to meet national and provincial goals and targets for immunization and for the control of vaccine-preventable diseases.
- In 1999, introduce hepatitis B vaccine for infants into the childhood immunization program, along with a catch-up program for children entering kindergarten and high-risk children.
- Provide publicly-funded immunizations to all risk groups as recommended in the *Canadian Immunization Guide*. As a priority for 1999, expand the pneumococcal vaccine program to protect persons with chronic diseases in all age groups and expand the hepatitis A program to include men who have sex with men.
- Provide funding to introduce new or improved vaccines, such as chickenpox and acellular pertussis for adolescents, into provincial immunization programs, when safety and cost-effectiveness are demonstrated.
- Provide funding for continued development and maintenance of a province-wide, electronic immunization registry.
- Continue to organize and fund applied research projects in support of provincial immunization programs.

Removing Barriers to Immunization

- Support local health authorities in identifying and overcoming barriers to achieving immunization coverage targets, among all ages and groups – infant and preschoolers, school-age children, adults, special population groups, and travellers to other countries.
- Collaborate with regions to improve their immunization levels, e.g., by allowing regions to keep cost-savings resulting from immunization programs, providing funds for an electronic immunization system.
- Screen, immunize, educate, and provide referral and follow-up services for immigrants.
- Provide immunizations free of charge to British Columbians who travel overseas, where cost-effective.

Keeping Consumers Informed

- Promote and participate in annual Immunization Week and other national campaigns to promote public awareness of immunization.
- Develop innovative ways for keeping consumers informed about immunization, such as the use of videos or computers or through encouraging individuals and groups to act as immunization advocates.

Managing the Delivery System

- Ensure consistency across health regions in access and services provided.
- Once an immunization registry is in place, evaluate the effectiveness of the current "mixed delivery" system (immunizations are provided by public health departments and by private physicians).
- Develop a contingency plan for the expected pandemic of influenza.

Partnerships and Coordination

- Promote and participate in national activities for coordination of immunization policies, programs, and standards.
- Encourage immunization providers to work together in immunizing hard-to-reach populations.
- Develop a coordinated provincial program to provide health care workers with immunizations recommended in the *Canadian Immunization Guide*.
- Ensure that medical and nursing students receive basic training in immunization practices and that they are knowledgeable about immunization products and programs.
- Develop an immunization certification process and/or continuing education credits for physicians and nurses.
- Encourage immunization providers to monitor their compliance with the *Guidelines for Childhood Immunization Practices*, as part of a regular process of provider reviews and audits.
- Develop best practice standards for cold chain monitoring.
- As part of the accreditation process, encourage the Canadian Council on Health Services Accreditation to include a standard that hospitals and community health services have a mechanism for ensuring that all staff and, where feasible, the population of clients/patients they serve, are fully up-to-date with their recommended immunizations.
- Carry out periodic surveys to determine the level of infection and immunity in the community, to help determine the need for new and expanded immunization programs.
- Encourage testing of new vaccines by independent research groups, through collaboration with health departments, access to provincially-funded research granting agencies, and other means as necessary to ensure British Columbia’s participation in such projects.

Information and Evaluation Tools

- Continue to implement an electronic immunization registry for reporting communicable diseases, immunizations, and adverse reactions. This should include records for the whole population and from all immunization providers, and should enable measurement of the costs and outcomes of immunization programs, including disease reduction.
- Develop efficient ways to allow physicians' offices, hospitals, and other settings where immunizations are provided to participate in an electronic immunization registry. For example, physicians' offices could report through the Medical Services Plan billing system.
- Develop information standards, so that all jurisdictions within and between provinces are able to report immunizations, communicable diseases, and adverse reactions in a consistent and comparable way.
- Link reporting requirements so that essential data collection and analysis are encouraged, yet streamlined as much as possible.
- Once the immunization registry is in place, audit the registry regularly to ensure that the information is of high quality and that it is being used efficiently and effectively.

Accountability

- Provide adequate funding for accountability functions – activities that evaluate and report on the delivery and results of provincial immunization programs.
- Require local health authorities to track and report performance with respect to immunization coverage levels.
- Reward regions for improvements in the proportion of their population that is fully immunized.
- Publish regular reports on immunization coverage as measured against provincial goals and targets, vaccine safety and effectiveness, cold chain maintenance, and other aspects of immunization program delivery.

Community Partners

(schools, child care facilities, employers, community groups and organizations, the media, and others who can support immunization activities)

- Promote and participate in annual Immunization Week and other campaigns to raise awareness of immunization.
- Distribute accurate information about immunization to your clients and staff.
- Share enrollment information (birth registrations, day care enrollment, school enrollment) with the immunization registry.
- Provide space for holding immunization clinics.
- If you work with groups that are at high risk for certain vaccine-preventable diseases, know which special immunizations your clients and/or staff require, and encourage them to receive all recommended immunizations.

Priority Actions

Each of the above actions is important and will contribute to improving our immunization programs. To get the maximum benefit from existing vaccines and to prepare for the future, the most urgent priorities for British Columbia are:

1 Achieving better immunization coverage rates, in the following areas:

- On-time immunization of all infants and preschool children
- Influenza immunization for all risk groups, especially people age 65 and older, people with chronic diseases in all age groups, and health care workers

2 Providing funding to expand current immunization programs to cover additional ages and risk groups in three areas:

- Hepatitis B immunization for all infants and children, including children who immigrate to B.C. from countries where hepatitis B is common
- Pneumococcal immunization for people with chronic diseases in all age groups
- Hepatitis A immunization for men who have sex with men

3 Providing funding for continued development of a province-wide, electronic registry for immunizations, communicable diseases, and adverse reactions. Ways and means should be found to ensure that all age groups, all immunization providers, and all areas of the province are able to participate in, and benefit from, this essential health information system.

4 Developing a strategic plan, so that we are prepared to:

- Adopt and meet provincial goals and targets for immunization and for the control of vaccine-preventable diseases.
- Introduce chickenpox vaccine, acellular pertussis vaccine for adolescents, and other new, cost-effective vaccine products that are expected to become available in the next few years.
- Offer publicly-funded immunizations to all target groups recommended in the *Canadian Immunization Guide*, through a coordinated provincial program.
- Manage the expected world-wide epidemic ("pandemic") of influenza.

Appendices

Appendix A: Acknowledgements

Many individuals contributed to the preparation of this year's annual report. An advisory committee assisted in defining the report's content. The advisory committee and other reviewers provided comments and suggestions on drafts at various stages. Several individuals and organizations provided data and technical support. All contributors are gratefully acknowledged for their support and assistance.

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Your Child's Best Shot

Canadian Pediatric Society. (1997). Your child's best shot – a parent's guide to vaccination. Ottawa, ON: Canadian Pediatric Society. Available in some local libraries or from the Canadian Paediatric Society at http://www.cps.ca or by calling (613) 526-9397 ext. 245.

Health Files

Fact sheet on immunization and on the symptoms and prevention of specific vaccine-preventable diseases. Available from public health units, doctors' offices, and on the internet http://www.hlth.gov.bc.ca/hlthfile/

Internet Resources on Immunization

B.C. Centre for Disease Control Society, Vancouver
http://admin.moh.hnet.bc.ca/bccdc

- Information for health professionals, accessible through the Ministry of Health Intranet site. Users must register at http://admin.moh.hnet.bc.ca/bccdc prior to accessing the site.

B.C. Ministry of Health Library
http://www.hlth.gov.bc.ca/exsites/

- Links to Internet resources on communicable disease. Click on "Community Health Resources", "Communicable Disease".

B.C. Health Files
http://www.hlth.gov.bc.ca/hlthfile/

- Health-related information on a variety of topics, including immunization and prevention and symptoms of vaccine-preventable diseases. B.C. Ministry of Health website.

Canadian Immunization Awareness Program
http://www.nald.ca/ciap.htm

- Information about this national initiative, as well general information and a list of resources.

Canadian Public Health Association
http://cpha.ca

- Information about national and international initiatives such as the Canada Immunization Program and Canadian International Immunization Program.

Centers for Disease Control and Prevention, Atlanta
http://www.cdc.gov (home page)
http://www.cdc.gov/travel (travel information)

- Immunization and travel-related health information for health professionals and the public.

Health Data Warehouse, B.C. Ministry of Health
http://admin.moh.hnet.bc.ca/hdw/

- Statistics on immunization and communicable diseases in British Columbia. The Warehouse is available to health stakeholders in British Columbia. This includes Ministry of Health and related staff in Local Health Authorities and Ministry for Children and Families. Users must register at http://admin.moh.hnet.bc.ca/hdw/ prior to accessing the website. For further information, please contact the Information and Analysis Branch, B.C. Ministry of Health, 250-952-3179.

Immunization Action Coalition
http://www.immunize.org/

- Information about immunization and vaccine-preventable diseases, prepared by a coalition of experts in the field of immunization.

Institute for Vaccine Safety
http://www.vaccinesafety.edu

- Information from Johns Hopkins University, USA.

Laboratory Centre for Disease Control, Health Canada
http://www.hc-sc.gc.ca/hpb/index_e.html

- Publications and guidelines on immunization and links to other sites.
- Division of Immunization home page http://www.hc-sc.gc.ca/hpb/lcdc/bid/di
- Canada Communicable Disease Report and updates to the Canadian Immunization Guide are available from http://www.hc-sc.gc.ca/main/lcdc/web/publicat/ccdr/
- Travel Medicine Program provides information for travellers and for travel medicine professionals at http://www.hc-sc.gc.ca/main/lcdc/web/osh/tmp_e.html or through a FAXlink service, 613-941-3900.

UNICEF
http://www.unicef.org

- International statistics and publications on children's health, including immunization rates.

World Health Organization
http://www.who.int/gpv/

- Information for parents, health professionals, and the public, from the Global Programme for Vaccines and Immunization.

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Publications Available from the Office of the Provincial Health Officer

Copies of the following publications are available free of charge from:
Office of the Provincial Health Officer
B.C. Ministry of Health and Ministry Responsible for Seniors
Room 3002, 1810 Blanshard Street
Victoria, B.C. Canada V8V 1X4
Telephone (250) 952-0876 Facsimile (250) 952-0877
http://www.hlth.gov.bc.ca/pho/

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HIV, Hepatitis, and Injection Drug Use in British Columbia - Pay Now or Pay Later? A report by Dr. John Millar, Provincial Health Officer, June 1998.
Protocol for Protecting Emergency Responders from Communicable Disease. Office of the Provincial Health Officer, June 1998.
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Report on the Health of Canadians: Technical Appendix. Prepared by the Federal, Provincial, and Territorial Advisory Committee on Population Health for the Meeting of Ministers of Health, Toronto, Ontario, September 10-11, 1996.
Strategies for Population Health: Investing in the Health of Canadians. Prepared by the Federal, Provincial, and Territorial Advisory Committee on Population Health for the Meeting of the Ministers of Health, Halifax, Nova Scotia, September 14-15, 1994.

Appendix C: Immunization Schedules British Columbia, February 1999

Note: Immunization schedules change from time to time. For current information about who should be immunized, please contact your local public health unit or your family doctor.

Routine Immunizations for Infants

Age	Vaccine
2 months	DaPT/IPV/Hib (Pentacel™)
4 months	DaPT/IPV/Hib
6 months	DaPT/IPV/Hib
12 months	MMR
18 months	DaPT/IPV/Hib MMR

DaPT/IPV/Hib is a pentavalent vaccine (five vaccines in one injection): Diphtheria, acellular Pertussis, Tetanus, Inactivated Polio, and conjugated Haemophilus influenzae type b (Hib).

MMR: Measles, Mumps, Rubella (one injection).

Routine Immunizations for School-Age Children

Age/Grade	Vaccine
School entry (age 4-6 years)	DaPT/IPV
Grade 6	Hepatitis B (3 doses)
Grade 9	Tetanus-diphtheria (Td)

DaPT/IPV: Diphtheria, acellular Pertussis, Tetanus, Inactivated Polio (four vaccines in one injection).

Note: This schedule is for children who have completed their primary series during infancy. Children who were not immunized in infancy will require additional immunizations.

Routine Immunizations for Adults

Vaccine	Age and Frequency
Tetanus-diphtheria (Td)	All adults, every 10 years. Or, as a minimum, at least a booster at age 50, if more than 10 years since last Td booster.
Influenza	Adults age 65 and over and persons with chronic disease in all age groups should receive one dose each year.
Pneumococcal	Adults age 65 and older and persons with chronic disease in all age groups should receive a single dose of vaccine. A booster dose is recommended for specific risk groups.
Measles, Mumps, Rubella	Adults not already known to be immune should be immunized, especially health care and child care workers, students attending post-secondary institutions, and women of childbearing age.
Other vaccines	Adults should receive other vaccines that may be required because of their occupation, health condition, household exposure, or lifestyle. For detailed information about who should be immunized, contact your local public health unit or your family doctor.

Immunization of Travellers

Vaccine/ Disease	Recommendations
BCG	May be considered for persons planning a long-term stay in areas where tuberculosis is common.
Cholera	May be considered for travellers in specific circumstances.
Hepatitis A	Recommended for persons travelling to developing countries where hepatitis A is common.
Hepatitis B*	Recommended for travellers who will be residing in areas where hepatitis B is common, travellers working in health care facilities, and travellers who are likely to have contact with blood or sexual contact with residents of such areas.
Influenza*	Recommended for persons at high risk of influenza complications who will be travelling to areas where influenza is present.
Japanese encephalitis	Recommended for longer-term travel (greater than 4 weeks) to areas where this disease is common.
Measles*	Recommended for those persons over one year of age who are unimmunized (or not already known to be immune) and who are travelling to an area where the disease is common.
Meningococcal meningitis	Should be considered for travel to areas where the disease is common. May be required by certain countries in specific circumstances.
Polio*	Travellers who plan to visit an area where polio disease is common should be adequately immunized against polio.
Rabies	Should be considered for those who will be living or working in areas where rabies is common.
Rubella*	Recommended for unimmunized children and for women of childbearing age who have not been immunized.
Tetanus and diphtheria*	Booster recommended every 10 years. An early booster may be recommended for travellers to developing countries.
Typhoid	Recommended for travellers who anticipate prolonged exposure to contaminated food and water, especially if travelling to rural and undeveloped areas of certain countries.
Yellow fever	Mandatory for entry into certain countries in South America and Africa.
Malaria	As yet, there is no vaccine available to protect against malaria. Taking antimalarial medications and avoiding mosquito bites (by using insect repellents and bed nets, for example) are the best ways to protect against malaria infection at this time.

** Recommended as part of routine immunizations for children and adults. See tables on previous pages.*

Note: Recommendations change frequently and vary according to traveller's age, health condition, and type of travel. Travellers should consult their public health unit or family doctor 2 to 3 months advance of departure.

Source: National Advisory Committee on Immunization (1998). Canadian Immunization Guide, 5th edition, pages 191-197. Cat. H49-8/1998E. Ottawa, ON: Health Canada.

Appendix D
Questions and Answers about Vaccination

British Columbia's Provincial Health Officer gratefully acknowledges the Canadian Paediatric Society for granting permission to reprint the following material from Your Child's Best Shot – A Parent's Guide To Vaccination, pages 117-135, Canadian Paediatric Society, 1997. Copies of Your Child's Best Shot may be ordered from the Canadian Paediatric Society, 100-2204 Walkley Road, Ottawa, Ontario K1G 4G8, telephone (613) 526-9397, fax (613) 526-3332. Information about the publication and an Order Form are available from the Society's internet site http://www.cps.ca. Your Child's Best Shot is also available in some bookstores and local libraries.

How serious are the infections discussed in this book?

(*Your Child's Best Shot*)

Each vaccine has been developed to prevent a certain infection. All of the target infections can be very serious or even fatal – even with today's advanced medical care.

Diphtheria. Diphtheria still kills about 1 out of 10 people who get it. It can damage the heart muscle and lead to death. Diphtheria bacteria still occur in Canada. There is a direct relationship between the rates of immunization and disease; whenever the rate of immunization against diphtheria declines, the occurrence rate of disease increases.

Tetanus. Tetanus spore are in dust and soil everywhere. If these spores get into a wound (no matter how small), tetanus bacteria may grow and release toxin in the body. Tetanus is a very serious disease. Even with modern treatment, tetanus still kills 10-20 per cent of those infected.

Pertussis. Pertussis remains a serious illness in infants. Babies with pertussis cough for six weeks or more, and often lose weight because of feeding problems and vomiting. They also have a high rate of ear and lung infections. In Canada, about 1 in 5 infants with pertussis is admitted to hospital. Of these infants, 1 in 200 dies and about 1 in 400 suffers permanent brain damage. Children who have pertussis in infancy are more likely to have learning and behaviour problems than children who do not get the disease.

Polio. Polio can cause paralysis of various parts of the body, including nerve centres controlling respiration, circulation, and other vital functions. Death can occur. Paralytic polio has been eradicated from the Western Hemisphere by vaccination of children, but it still occurs in other parts of the world. We must continue to vaccinate children because of the risk of travellers bringing poliovirus back to Canada.

***Haemophilus influenzae* type b (Hib)**. Before routine vaccination, about 1 in every 300 Canadian children developed meningitis or other severe Hib infections by 5 years of age. Even with treatment, Hib meningitis killed 1 in 20 children and caused detectable brain damage in 1 in 3 survivors. Hib can also cause serious infections of the throat, lungs, blood, joints, and bones.

Measles. Those opposed to vaccination often claim that measles is not as serious as claimed by public health authorities. They often make statements such as: "Most people I know survived measles in their childhood." This is true in many cases; but many children did not survive the disease. No one claims that there is a high death rate from measles in Canada. But we should not ignore an infection that can kill 1 child in 1,000 and cause brain damage in 1 child in 3,000. This disease *can* be prevented.

Measles is a serious illness even in healthy, well-nourished children. Complications such as ear infections and bacterial pneumonia occur in 1 out of 10 children. Encephalitis occurs in about 1 out of 1,000 cases. It causes death in one-third of cases, and it causes severe brain damage in another third. Measles causes subacute sclerosing panencephalitis (SSPE) in about 1 in 100,000 cases. SSPE occurs years after the attack of measles and leads to seizures, dementia, coma, and death because of progressive destruction of brain cells.

Mumps. Mumps is usually not a severe illness in children, but it can cause deafness, meningitis, and encephalitis. It can also cause inflammation of the testicles (orchitis) in older boys and adult men, which can lead to sterility.

Rubella. The most serious complication of rubella occurs if a women becomes infected during pregnancy. If a women gets rubella during the first three months of pregnancy, the risk of death or severe malformations of her baby is very high.

Hepatitis B. Hepatitis B is usually not a severe illness in children. However, it can cause chronic infection of the liver, which often leads to scarring of the liver and liver cancer later in life. Both of these liver diseases are usually fatal.

Weren't the diseases disappearing long before vaccines became available?

No. A common argument of those opposed to immunization is that vaccine-preventable diseases were declining in frequency in Canada and other developed countries long before vaccines became available. This is not true. Until vaccines became available, there was no significant change in the numbers of cases of diphtheria, tetanus, pertussis, polio, measles, mumps, rubella, Hib or hepatitis B.

What *was* changing before vaccines became available was the death rate from some of these infections. Improvements in social and economic conditions led to declining death rates for many common infections. Children who are healthy and well-nourished are much less likely to die from measles or pertussis than malnourished children.

Do vaccines really work?

Yes! All vaccine-preventable disease rates have declined significantly in countries with successful immunization programs. Wherever vaccination rates are high, disease rates are low.

Even smallpox has disappeared because of vaccination! There have been no cases of smallpox anywhere in the world since 1979.

Paralytic polio has been eliminated from the Western Hemisphere by vaccination. A global vaccination program is expected to completely eradicate the disease within the next decade.

Why do some children still get measles after they've been vaccinated?

Opponents of vaccination are quick to point out that many cases of measles occur in vaccinated children. They claim this proves that the vaccine doesn't work. In recent outbreaks of measles in Canada and the United States, it is true that over half of the cases occurred in school-age children who had been given measles vaccine. But to say that this means the vaccine doesn't work is incorrect. This argument is too simplistic, and it uses faulty logic.

We know that one dose of measles vaccine is not 100 per cent effective. We know that about 5-10 per cent of children are not protected after a single dose of vaccine. Let's use these facts in an example.

In a school with 1,000 students, assume 95 per cent of children get vaccinated. This means that there are 950 vaccinated children and 50 unvaccinated children. The number of children who are still susceptible to measles is 145: 50 unvaccinated children, plus 95 vaccinated children (10 per cent of the 950 vaccinated children who are unprotected after one dose).

One child in the school comes back from a holiday with measles. Measles is so contagious that it quickly spreads in the school. One-half of the 145 susceptible children catch it: half of the 50 unvaccinated children (or 25) get measles, and half of the 95 vaccine-failure children (or 47) get measles.
Therefore, there are 72 cases of measles. The proportion of cases that occurred in vaccinated children is 47 of the total 72, or 65 per cent! This seems very high, but it does not mean that the vaccine works only 65 per cent of the time.

Whenever a vaccine is not 100 per cent effective and most children have been vaccinated, more cases will occur in vaccinated than in unvaccinated children during outbreaks, only because there *are* more vaccinated than unvaccinated children.

The 25 cases of measles in the unvaccinated group came from a total of 50 children; the attack rate is then 50 per cent. The 47 cases among vaccine failures came from a total of 950 children; their attack rate was only 4.9 per cent.

From these numbers, we can see that unvaccinated children were 10 times more likely to catch measles! The vaccine was 90 per cent effective. This is the commonly observed figure when only one dose of measles vaccine is given. When two doses are routinely given to children, the vaccine is nearly 100 per cent effective, and outbreaks no longer occur among vaccinated children.

If the first dose of measles vaccine doesn't work, won't a second dose also fail?

The main reason infants fail to respond to measles vaccine is the presence of antibody to measles, which infants get from their mothers during pregnancy. It takes only a very small amount antibody to kill the measles vaccine. About 5 per cent of infants still have enough measles antibody at 12 months of age to do just that.

Studies of children who failed to respond to the first dose of vaccine at 12 to 15 months of age have shown that over 99 per cent of them *did* respond normally to the second dose. Studies of outbreaks in schools have confirmed that measles is very rare in children who have had two doses of measles vaccine.

How can immunization, which is artificial, be as good as immunity resulting from natural infection?

Opponents of vaccination often claim that natural immunity (from an infection) is better than artificial immunity (from a vaccine). But opponents ignore the fact that infection *always* has a much greater risk of causing harm than does immunization.

There are two functions of the immune system: immediate response and long-term response. The immediate response kills infectious germs and promotes recovery from the infection. The long-term response maintains immunity so that the person will be protected against infection if exposed to the organisms in the future.

Immediate response. The parts of the immune system involved in destroying bad germs are called antibodies and lymphocytes. Antibodies are proteins made by immune cells. The antibodies attach to the surface of the germ and kill it either by damaging it directly or by allowing other white blood cells to kill the germ. Lymphocytes (white blood cells) can attack some germs directly. Usually, though, lymphocytes work indirectly by killing the cells that are infected with the germ.

Unfortunately, it takes time for the body to develop an immune response. Sometimes, the infections kills the person before the immune response kicks in.

Vaccines are used to stimulate both antibody and lymphocytes so that they are present in the body *before* exposure to an infection occurs. The vaccine fools the immune system into thinking infection has occurred. In response, the immune system starts working. There may be a difference in the *amount* of antibody made after infection compared with after vaccine, but the same *kinds* of antibody and immune cells are made. The antibodies and lymphocytes produced in both cases are aimed at the identical chemicals on the surface of the germ.

Long-term response. The second function of the immune system is to establish immune memory. When we say a person is immune to a certain disease, we mean that immune memory against that particular infection has been established. Special lymphocytes, called memory cells, are stimulated by both infection and vaccination. These memory cells live (remain active) for a very long time, perhaps even for life. If a person with established immunity to a certain infection is exposed to that infection again, the active memory cells respond very quickly and signal both the cells that make antibody and the cells that attack germs to get to work.

It is important to note, however, that each type of infectious germ is attacked by a separate, distinct set of antibodies and lymphocytes. Immunity to one infection does not "create" immunity to other infections. Antibodies and lymphocytes made in response to measles infection or measles vaccine react only to measles virus. Memory cells for rubella infection will *not* activate antibody to fight against diphtheria.

Does immunity wear off over time?

The levels of antibody in the blood decline over time following both natural infection and vaccination. But even though antibodies disappear, immune memory persists. Most vaccines produce immune memory that lasts a very long time, if not for life. But others, for example diphtheria and tetanus toxoids, must be repeated every 10 years to maintain adequate levels of protection. These are called boosters. The presence of immune memory means that the immune system can respond very quickly, to either infection or a booster dose of vaccine. When a booster is given to a person who already has immune memory (perhaps from a previous booster), the immune response is much faster and stronger than when a booster is given to a person with no immune memory.

Won't adults be at risk of catching these infections if immunity wears off?

Infections such as measles, mumps, and rubella are more severe in adults than in children. Therefore, there is some concern that adults might be at risk if immunity from childhood vaccination wears off. Natural infections with measles, mumps, and rubella do induce lifelong immunity. Vaccination also produces very long-lasting immunity. Immune memory resulting from vaccination seems to persist even if there is no antibody detectable in the blood. The occurrence rate of measles, mumps, and rubella among those who were the first to be vaccinated has not been affected by the passage of time.

Diphtheria and tetanus are somewhat different. Protection against these diseases requires the actual presence of antibody in the blood at the time a person is exposed to the toxin. Even though immune memory lasts 40 years or more after vaccination, antibody levels decrease over time. These infectious toxins are so potent that disease can occur before the immune system has time to respond. Adults must receive boosters every 10 years to be protected against diphtheria and tetanus.

Is there a risk of catching the illness from the vaccine itself?

Inactivated vaccines (such as inactivated polio vaccine or killed pertussis vaccine) and purified protein vaccines (such as diphtheria and tetanus toxoids, Hib vaccines, and hepatitis B vaccine) *do not* have any living germs in them. These vaccines stimulate the immune system without causing any infection.

Live, attenuated vaccines (such as measles, mumps and rubella vaccines) *do* infect cells and multiply in the body. The vaccine viruses have been sufficiently weakened, or attenuated, in the laboratory that they stimulate immunity without causing a full-blown infection. They do not spread from a vaccinated child to another person.

Oral polio vaccine (OPV), however, not only infects the intestinal tract, but is also excreted in the feces. The vaccine strains *can* spread from person to person. Such spread is usually helpful, though, because those who get the polio vaccine virus this way may also become immunized. OPV is a very safe and effective vaccine. There is, however, an incredibly small risk of getting paralytic polio from the vaccine. The most recent estimate of the risk of vaccine-associated paralytic polio after the first dose of OPV (given in infants) is 1 out of every 1.3 million doses. The risk is much smaller for susceptible persons exposed to a vaccinated child.

To avoid the very small risk of disease associated with the oral vaccine, all Canadian provinces except Manitoba have switched to the inactivated polio vaccine (IPV). Switching to IPV should maintain the remarkable accomplishment of eradication of paralytic polio in the Western Hemisphere.

What about the risk of side effects from the vaccine?

The risks associated with vaccines are infinitely less than the risks associated with the diseases themselves.

Fever can occur after vaccination and may cause convulsions in a few cases. But fever-induced convulsions do not cause permanent brain damage and do not increase the risk of epilepsy or any other brain disorder. The risk of convulsions is much higher after natural measles or pertussis than after vaccination.

Pertussis. Pertussis kills 1 to 3 infants every year in Canada and an equal number suffer severe brain damage. Brain damage after pertussis vaccine is extremely rare, if it occurs at all.

Measles. Measles causes encephalitis (inflammation of the brain) in about 1 out of 1,000 cases. One-third of those with measles encephalitis die and one-third survive with brain damage. Encephalitis occurs about once in every one million measles vaccinations. This occurrence rate is so low that it is unclear whether the vaccine or some other infection is responsible.

Mumps. Meningitis occurs in 1 in 10 cases of mumps. Meningitis occurs after 1 in 800,000 mumps vaccinations.

Rubella. If a woman becomes infected during the first 20 weeks of pregnancy, chances are high (8 out of 10) that the fetus will also be infected. Joint pain affects twice as many women with natural infection as women who are vaccinated.

Can vaccines cause seizures?

Yes, indirectly. Vaccines can cause fever, which can cause convulsions. Therefore, vaccine-induced fevers can cause convulsions in children who are susceptible (children whose parents or siblings have had convulsions are more likely to have a convulsion than those with no such history).

Fever from any cause triggers a convulsion in about 3 per cent of healthy young children. Fever is the most common cause of seizures or convulsions in infants between 6 months and 6 years of age. Seizures caused by fever *do not* cause brain damage.

Can vaccines cause brain damage?

Pertussis vaccine is sometimes blamed for causing brain damage in infants and young children. A review of all of the scientific evidence carried out by the Institute of Medicine in the United States found that there is no proof that pertussis vaccine causes brain damage. Four American studies involving over 415,000 children who received nearly one million doses of pertussis vaccine failed to find a single case of acute illness involving the brain, other than convulsions. Such convulsions *do not* cause permanent damage. A study in the United Kingdom was also unable to find a single case of permanent brain damage that was clearly the result of vaccination. If brain damage does occur after vaccination, it is *extremely* rare.

Why then, has pertussis vaccine been blamed for causing brain damage? Vaccination is a very common and recognizable event in the first six months of life of most infants. Brain abnormalities, on the other hand, are uncommon and often unrecognizable in the first six months of life. Most infants who have malformations of the brain or who suffer brain damage before birth or during labour and delivery appear to be normal for the first few months of life because the brain is not fully developed.

Many babies are 4 to 6 months of age or more before it becomes clear that something is wrong with their development. The diagnosis of cerebral palsy, mental retardation or developmental delay can usually not be made until the infant is several months old. By this time, the baby has already received one or more vaccinations, often with minor side effects such as fever, crying and fussiness. Since the infant appeared to be normal until the vaccine was given, the vaccine is blamed.

The following facts make it extremely unlikely that pertussis vaccine can cause brain damage:

- acute illness involving the brain has not been shown to be more common after vaccination than at any other time (except for febrile or fever-induced convulsions, which do not cause brain damage);
- studies of large numbers of children have found that brain damage after vaccination is very rare, if it occurs at all;
- in searching for a link between brain damage and pertussis vaccine, no pattern of symptoms or abnormalities of laboratory tests have been found, and upon examination of the brain after death, no findings have been described that would establish pertussis vaccine as the cause of brain trauma;
- the damage in the brains of children who die of natural pertussis is caused by lack of oxygen and bleeding from small blood vessels as a result of severe coughing spells, not as a result of a toxin from the bacteria;
- no plausible mechanism has been found by which pertussis vaccination could cause brain damage.

Can vaccination cause cancer?

Cancer is relatively uncommon in children, affecting about 1 in 10,000 children under 15 years old. But because of the marked decline in death caused by infections that used to rank No. 1 (e.g., diphtheria, pertussis, etc.), cancer now is the second most common cause of death in children. (Accidents are No. 1.) There has been no significant increase in leukemia in children since the start of routine vaccination in the 1940s. While it is difficult to prove that immunization never causes cancer, there is no scientific evidence of a link between the two.

On the other hand, vaccination can prevent cancer, indirectly. Persons infected with hepatitis B virus are over 40 times more likely to develop cancer of the liver compared with those not infected. The vaccine prevents the infection with hepatitis B virus and this, in turn, prevents the liver cancer.

Can vaccines cause multiple sclerosis, chronic fatigue syndrome or Crohn's disease?

There are more cases of multiple sclerosis (MS) today than 30 or more years ago. The reasons for this increase are earlier and improved methods of diagnosis, improved treatment, and longer survival of MS patients. The cause of MS is not yet known. There is some evidence suggesting that infection in childhood might play a role in the development of MS. There is no evidence that immunization causes MS.

The cause of chronic fatigue syndrome is not known. Some opponents of vaccination have alleged that hepatitis B vaccination causes this illness. However studies, comparing vaccinated and unvaccinated adults failed to show any increased risk of chronic fatigue syndrome after hepatitis B vaccination.

There are many other conditions for which causes are not yet known, such as rheumatoid arthritis, Crohn's disease, ulcerative colitis and lupus erythematosus (SLE). Since most persons with these disorders were vaccinated in childhood, it is easy to blame the vaccine when no other cause can be found. However, there is no evidence to prove that these conditions are caused by vaccination.

One recent study in England claimed that Crohn's disease (a chronic inflammation of the small intestines of unknown causes) was more common in young adults who had received measles vaccine than in unvaccinated adults. However, the methods used in this study had serious flaws, making it difficult to accept the study's conclusions. Moreover, two other laboratories, have failed to confirm the study's finding that measles virus is present in samples of inflamed tissue from patients with Crohn's disease.

Can immunization cause SIDS?

There is no scientific evidence that immunization causes sudden infant death syndrome (SIDS). Claims have been made that babies are dying of SIDS following vaccination. However, the number of deaths after vaccination is no greater than would be expected by chance alone. Most cases of SIDS occur in infants less than 6 months of age. As we know, this is the same period during which babies are vaccinated. There, the probability of the two events (vaccination and SIDS) occurring within a short time is extremely high.

Several large studies have found that there is no association between vaccination and SIDS. In fact, all of the studies found that babies who died of SIDS were *less likely* to have been vaccinated recently than control babies (babies chosen to match the babies who died of SIDS, according to factors such as age, sex, and weight).

Can vaccines "wear out" the immune system?

The human immune system has a truly enormous capacity to recognize different proteins and other chemicals called antigens. It can respond to intense and repeated stimulation. The food we eat, the air we breathe, and the water we drink every day is filled with antigens that our immune system recognizes as foreign. Its job is to make appropriate responses to help the body get risk of any foreign substances. The challenge that vaccination presents to the immune system is not likely to be a significant addition to the daily load of foreign antigens entering the body, even for a 2-month-old baby.

A study of the effects of repeated immunization with several vaccines was carried out in a group of employees who worked at the United States Army Biological Warfare Research Laboratory in Maryland. The employees had frequently been vaccinated with many routine and experimental vaccines to protect them against the hazards associated with working with dangerous germs. They had also received many skin tests to detect immunity to different germs. Since 1950, the workers had received an average of over 190 injections of 21 different vaccines, and 55 skin tests. These 77 highly immunized workers were compared with 26 workers at the same laboratory who had not received special immunizations or been exposed to laboratory infections. At follow-up intervals of 10, 16, and 25 years, there were no important differences in history, physical examination, or laboratory tests. There was no evidence of increased rates of cancer, immune disorders, or death in the highly immunized group.

Why do vaccines contain formaldehyde, aluminum, mercury, or other toxic chemicals?

Pertussis and inactivated polio vaccines are made from live bacteria or viruses that are killed with formaldehyde. Both tetanus and diphtheria toxins are inactivated with formaldehyde to make the toxoids. Following the inactivation process, purification of the vaccines removes almost all of the formaldehyde. The diphtheria, pertussis, tetanus, polio and Haemophilus b 5-in-1 vaccine contains less than 0.02 per cent formaldehyde per dose, or less than 200 parts per million. This amount of formaldehyde is several hundred times lower than the amount known to cause harm to humans.

Some vaccines, such as the diphtheria, tetanus, pertussis and hepatitis B vaccines, are made with a mercury-containing preservative called thimerosal. It is used to prevent bacterial contamination during production of the vaccine. The amount of thimerosal is 0.01 per cent per dose, or 100 parts per million. This compound of mercury is not toxic to humans and does not release free mercury in the body. Any vaccine that is combined with inactivated polio vaccine (IPV), such as the DPT/IPV now used in Canada, does *not* contain thimerosal.

Several vaccines (such as diphtheria and tetanus toxoids, and hepatitis B vaccine) contain a complex salt of aluminum called alum. The amount of aluminum is less than 1 mg per dose. This amount of aluminum is not known to cause any harm to humans. Much larger quantities of aluminum salts are taken and absorbed into the body in the form of antacids (e.g., 200-400 mg of aluminum hydroxide per tablet) without any serious side effects.

Some vaccines contain trace amounts of antibiotics used during the manufacturing process. The purpose of the antibiotics is to prevent bacterial contamination of the tissue culture cells in which the viruses are grown. Measles, mumps and rubella (MMR) vaccine and inactivated polio vaccine (IPV) each contains less than 25 ug of neomycin per dose (less than 0.000025 grams).

Do vaccines contain blood, serum, animal tissue or fetal tissue?

No vaccine contains human blood or serum. Trace amounts of human albumin (a protein fractionated from whole blood) are used as a stabilizer in rabies vaccine. No vaccine contains animal or human cells. Viral vaccines are grown in cells derived from animals (chick embryo or monkey cells) or humans (fetal cells). At certain stages of production, calf serum may be added to fluid in which the cells are growing. (Calf serum is necessary for proper growth of cells in the test tube.) During purification of the vaccine, all calf serum and all cells (animal or human) are removed. Trace amounts of some proteins from the cells may remain in the vaccine.

Don’t some vaccines contain brain tissue, which can cause mad cow diseases?

No. The only vaccine that contained brain tissue was the original rabies vaccine, which contained rabbit brain tissue. That vaccine is no longer used in Canada or the United States.

Why do chiropractors and homeopaths advise against vaccination?

Although some chiropractors and homeopathic physicians are against vaccination, the policy of the Faculty of Homeopathy at the Royal London Homeopathic Hospital is: "Where there is no medical contraindication, immunisation should be carried out in the normal way using conventional tested and approved vaccines."

Many believers in homeopathy and other alternative systems of medicine seem to believe that nature’s way is best and that "foreign", "unnatural", or "artificial" things like vaccines should be avoided. It is difficult to comprehend why a disease like measles is considered "natural" and "beneficial" when it kills and damages so many children – even healthy, well-nourished children.

The only infections that are natural and beneficial are those that lead to the successful growth and multiplication of many kinds of bacteria within our bodies within a few days of birth. These bacteria are called "normal flora" because they live on our skin and within us on the lining of the nose, throat, stomach, and intestines without making us sick. They are beneficial to us because they make it harder for harmful bacteria to infect us. They are also beneficial because they make certain vitamins for us from chemicals in our food.

The bacteria and viruses that make us sick are part of nature, but like many things in nature, they are harmful, not helpful. Being natural is not always good for human beings.

Vaccines are also part of nature. Some vaccines are made from live viruses that have undergone natural mutations (weakenings). They have been altered so that they no longer make us sick, but still induce immunity to the natural, "wild" virus. Other vaccines are actually chemicals that have been extracted or purified from viruses or bacteria. When injected into the body, they stimulate the immune system in a way very similar to the infection, again without making us sick.

Won't breastfeeding and good nutrition prevent these childhood diseases?

Breastfeeding is not an alternative to infant vaccination, and it does not enhance the responses to vaccination. Breastfeeding provides some protection against many infections because special antibodies are made in the breast and are present in human breast milk. Babies who are breastfed generally have lower rates of many infections including viral respiratory infections, ear infections and diarrhea. The protection provided by breast milk is incomplete and can be overcome if the baby is exposed to a large amount of a disease-causing organism. Moreover, the protection disappears rapidly as soon as breastfeeding stops.

Good nutrition helps the body's defences against infection to function normally. Infections are more severe in anyone with poor nutrition. Special immune cells called lymphocytes are easily damaged if one's diet does not include enough protein. For this reason, malnourished children are much more likely to die of infections such as measles or pertussis than well-nourished children. Vitamin A deficiency, in particular, greatly increases the risk of severe illness.

The manufacturer of one brand of infant formula has recently claimed that its formula enhances the response to vaccination. This claim is based on the results of a single study of one of the Hib vaccines. Unless the same successful results are achieved with studies of other vaccines, there is no reason to pay extra for this special formula.

Aren't the only children who die of these infections suffering from malnutrition or defects of the immune system?

Although infections such as measles and pertussis are much more likely to kill a child who is malnourished, these infections can also kill healthy, well-nourished children. Malnutrition was not a contributing factor in the deaths of any of the children who died of pertussis in the United States in 1992-1993.

Don't infections like measles stimulate the immune system and lead to better overall health?

Recently, 180 Swiss naturopaths and homeopaths claimed that infection with measles in childhood is very important because it helps the immune system to develop in a natural and healthy way. They claimed that measles vaccine does not provide the same kind of stimulation and will weaken the immune strength of the population.

But it is *not* true that infection with measles is needed for normal development of the immune system. No infection acts as a general stimulus to the immune system. There is no scientific evidence that infection with measles or any other germ is necessary or important for natural and healthy development of the immune system. In fact, what we know of measles makes it extremely unlikely that measles plays any role whatsoever in the normal development of the human immune system. For example, we know that measles cannot survive among small groups of people, like those living in isolated tribes in the Amazon rain forest or on islands. Yet such people have perfectly normal immune systems.

For most of human history, we were without measles. It became common only after the development of agriculture and the rise of cities, as measles thrives only in highly populated areas. Because the infection is so contagious, it spreads rapidly to all susceptible members of a group. In a city, there are always new, susceptible individuals entering the group as a result of large number of births. In a small tribe on an island, the measles virus would quickly die out.

Natural infection with measles does not provide a general form of stimulation of the immune system. It stimulates immunity to measles only. In fact, measles infection results in marked suppression of many parts of the immune system, which lasts for several months. During this time, the child is more susceptible to a number of other infections. This suppression of the immune system caused by measles actually leads to the high rate of other infections that complicate measles.

Thus, measles does nothing good to the immune system other than stimulate immunity to measles. Infection with measles not only results in a severe illness, which has a high rate of complications and general impairment of health, but it also suppresses the immune system for several months.

Other infections may produce similar types of immune suppression, but to a lesser degree than measles.

Is vaccination safer when my child is older, rather than at 2 months of age?

There is no evidence that side effects from vaccination are more common in younger infants. The purpose of starting vaccination at 2 months of age is to protect the child against pertussis and Haemophilus b disease as early in life as possible. Complications and deaths from pertussis are most common in infants less than 6 onths of age. And infants *can* respond to vaccination at a very young age.

The combination product used in Canada containing diphtheria and tetanus toxoids, pertussis vaccines, inactivated polio vaccine, and Haemophilus b vaccine minimizes the number of injections given to each child. Giving several difference vaccines at the same time does *not* increase the rate of side effects. The protection achieved by the combined vaccine is as great as giving the vaccines as separate injections.

Who should not be vaccinated?

Anyone who has had anaphylaxis or any other severe allergic reactions after a vaccine should not be vaccinated again until the cause of the reaction has been determined. Anaphylaxis is a severe allergic reaction in which the person goes into shock and has difficulty breathing. It usually occurs within minutes of exposure to the source of the allergy.

Anyone with a serious disorder of the immune system should not receive live virus vaccines such as oral polio, measles, mumps, and rubella vaccines. This includes persons with severe congenital immune deficiency disorders, persons receiving chemotherapy for cancer, persons who have had a bone marrow or other organ transplant, and persons receiving high doses of steroids.

When should vaccination be delayed?

Severe illness at the scheduled time of vaccination warrants a delay, but minor illnesses such as colds, coughs, or low-grade fevers do not. Children with minor illnesses of this sort respond normally to vaccination and have no added side effects.

Parents should discuss with their child's doctor whether to postpone vaccination if their child has had a hypotonic-hyporesponsive episode (HHE) after a previous dose of pertussis vaccine. Although no permanent damage has followed any HHE associated with pertussis vaccination, delaying vaccination may be an alternative if the frequency of pertussis in the family's community is known to be low. If pertussis *is* occurring, it would be better for the child to be vaccinated.

Pertussis vaccination is often deferred in children with progressive or changing neurologic conditions. Such conditions include tuberous sclerosis, recurrent convulsions that are not prevented by medication, and neurodegenerative diseases. The reason for deferral is to avoid introducing a variable (e.g., the vaccine) that may be viewed as causing changes in the child that otherwise would be attributed to the disorder. Deferral should be reassessed at each visit to the doctor; pertussis vaccine should be given when the condition has resolved, been corrected or controlled.

If pertussis vaccine is withheld, diphtheria and tetanus toxoids can still be administered without the pertussis vaccine.

Anyone who has received immune globulin by injection into muscle or a vein should not receive measles, mumps, or rubella vaccine for three months or more, depending on the dose of immune globulin. The antibodies in the immune globulin can interfere with establishment of immunity after vaccination.

What conditions are ***not*** reasons to delay vaccination?

Sometimes it is necessary to delay vaccination, as discussed in the previous question. However, it is *not* necessary to delay vaccination for the following reasons:

- minor infections such as colds, coughs, diarrhea (assuming there is no serious change in the child's behaviour);
- high fever ($40^{o}C/104^{o}F$ or higher) after a previous dose of vaccine;
- prolonged inconsolable crying (for more than three hours) after a previous dose of vaccine;
- large local reactions (more than 5 cm) after a previous dose of vaccine;
- history of convulsions, with or without fever;
- active allergy, asthma, eczema;
- allergy to eggs;
- current antibiotic treatment;
- infant born prematurely;
- recent exposure to a minor infection (such as a cold – again, assuming there is no serious change in the child's behaviour);
- family history of sudden infant death syndrome (SIDS);
- breastfeeding (both the breastfeeding women and breastfed baby can be safely vaccinated);
- child's mother is pregnant.

Appendix E

Immunization Indicators and Targets: B.C. Time Trends

Note:

This appendix contains time trend data and targets, at the provincial level, for the immunization and disease indicators used throughout this annual report. For regional breakdowns, see Appendix F.

Immunization Indicators and Targets - B.C. Time Trends

Indicator	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	National/Provincial Target
1 Immunization rates - two year olds															
Diphtheria/Tetanus	66%	66%	70%	74%	76%	75%	75%	73%	75%	78%	83%	81%	81%	83%	97% by 1997
Pertussis											83%	80%	81%	82%	95% by 1997
Polio	66%	78%	73%	75%	77%	77%	76%	74%	76%	79%	85%	90%	81%	83%	97% by 1997
Haemophilus influenzae b (Hib)	-	-	-	-	-	77%	78%	80%	89%	75%	82%	81%	81%	82%	97% by 1997
Measles/Mumps/Rubella	86%	83%	86%	88%	92%	92%	89%	87%	88%	89%	93%	92%	77%	81%	97% by 1997
2 Immunization rates - kindergarten															
Diphtheria/Tetanus	95%	95%	95%	94%	95%	93%	94%	94%	94%	94%	93%	91%	92%	90%	99% by 1997
Pertussis														89%	95% by 1997
Polio	95%	96%	95%	95%	95%	94%	95%	95%	94%	94%	94%	92%	93%	90%	99% by 1997
Measles/Mumps/Rubella	96%	96%	97%	96%	96%	95%	95%	96%	95%	95%	94%	94%	94%	91%	99% by 2000
3 Immunization rates - grade 6, hepatitis B	-	-	-	-	-	-	-	-	91%	92%	93%	93%	93%	92%	95% by 1997
4 Immunization rates - influenza															
B.C. population age 65+					56%	60%	83%	65%	53%	51%	52%	57%	53%		90%
Residents of care facilities													83%		90%
Staff of care facilities (see NOTE)													28%		90%
5 Immunization rates - pneumococcal															
B.C. population age 65+													**		90%
Residents of care facilities													75%		90%
6 Immunizations given by public health (%)															
Routine childhood series									63%					59%	
Kindergarten booster														73%	
School-age children														97%	
Influenza														38%	

Notes and Sources

1. Percent of children who, by their second birthday, have completed the primary series for immunization, according to the Provincial Immunization Schedule. Rates are based on a one-month sample of children who were two years old in April of each year and for whom child health records (HLTH 182s) were available. Source: Public Health Nursing, B.C. Ministry of Health. Data for 1985-1994 acquired from the Health Planning Database. Data for 1995-1998 from Ministry of Health Administrative Circulars. NOTES:

- For 1985-1994, "Diphtheria/Tetanus" figures are for Diphtheria/Pertussis/Tetanus or Diphtheria/Tetanus; coverage for pertussis was not tracked separately until 1995.
- Figures for 1985-1998 do not include Vancouver, Burnaby, or North Shore. For 1996-1998, figures do not include South Fraser Health Region (formerly Boundary Health Unit). Comparable data not available for these regions.
- For Measles/Mumps/Rubella, a two-dose schedule was introduced in 1996.

2. Percent of children who, by the end of their school entry (kindergarten) year, have received the appropriate number of vaccine doses, according to the Provincial Immunization Schedule. Figures are for the school year ending June each year. Source: Public Health Nursing, B.C. Ministry of Health. Note: "Diphtheria/Tetanus" figures are for Diphtheria/Pertussis/Tetanus or Diphtheria/Tetanus. Coverage for pertussis is not tracked separately; the 1998 figure is an estimate, based on data for two-year olds showing pertussis coverage rates to be approximately 1% lower than rates for Diphtheria/Tetanus.

3. Percent of children who, by the end of grade six, have received three doses of hepatitis B vaccine during in-school immunization. Figures are for the school year ending June each year. Source: Public Health Nursing, B.C. Ministry of Health.

4. Percent immunized against influenza, B.C. population age 65 and older, 1989/90-1997/98 and residents/staff of care facilities, 1997/98.

- Data for population age 65+ are from Epidemiology Services, B.C. Centre for Disease Control Society. Figures do not include all regions in all years; for example, the 1997/98 figure does not include Vancouver or Capital health regions.
- Data for residents/staff of care facilities are from *Report of Pneumococcal and Influenza Immunization in Care Facilities 1997*, B.C. Ministry of Health Administrative Circular No. 98:13. **NOTE: Data on facility staff immunized are incomplete. Staff immunization data not available for Vancouver (45 facilities) and for a total of 46 facilities in other regions.**

5. Percent immunized against pneumococcal disease, of care facility residents eligible to receive pneumococcal vaccine, 1997/98. Source: *Report of Pneumococcal and Influenza Immunization in Care Facilities 1997*, B.C. Ministry of Health Administrative Circular No. 98:13. **** Publicly-funded pneumococcal immunizations for the population age 65 and older began in April 1998; statistics for this program are not yet available.**

6. Estimated percentage of immunizations given by public health departments. In British Columbia, most immunizations not provided by public health departments are given by private physicians; other providers include hospitals, long-term care facilities, Medical Services Branch (Health Canada), and First Nations health agencies. Percentage provided by public health is an estimate based on surveys of public health nursing administrators. Data compiled by Public Health Nursing, B.C. Ministry of Health.

Vaccine-Preventable Diseases - B.C. Time Trends

Indicator	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
7 REPORTED CASES													
Diphtheria	2	1	2	1	2	2	0	0	2	0	1	0	0
Pertussis	89	89	63	81	193	197	121	266	537	433	452	979	730
Tetanus	1	3	1	1	1	1	1	1	1	1	1	0	0
Polio	0	0	0	0	0	0	0	0	0	0	0	0	0
Measles	1756	7148	116	131	146	107	68	45	20	36	15	41	275
Mumps	-	78	67	84	96	72	56	60	63	56	39	50	141
Rubella	908	371	95	82	559	85	47	73	30	40	28	20	5
Congenital rubella syndrome	2	4	0	0	0	1	0	0	0	0	0	1	2
Hib (meningitis)	72	53	82	112	68	46	38	29	12	13	10	12	4
Hepatitis B - acute/undetermined	-	-	-	-	-	-	-	1096	1142	1402	1638	1260	774
Hepatitis B - carrier/chronic	-	-	-	-	-	-	-	58	196	1946	1951	2032	2388
Hepatitis B - total reports	388	333	588	626	903	915	852	1154	1338	3348	3589	3292	3162
RATES PER 100,000													
Diphtheria	0.1	<0.1	0.1	<0.1	0.1	0.1	0.0	0.0	0.1	0.0	<0.1	0.0	0.0
Pertussis	3.0	2.9	2.1	2.6	6.0	6.0	3.6	7.7	15.1	11.8	12.0	25.5	18.6
Tetanus	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0	0.0
Polio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Measles	58.7	236.7	3.8	4.2	4.5	3.2	2.0	1.3	0.6	1.0	0.4	1.1	7.0
Mumps	-	2.6	2.2	2.7	3.0	2.2	1.7	1.7	1.8	1.5	1.0	1.3	3.6
Rubella	30.4	12.3	3.1	2.6	17.4	2.6	1.4	2.1	0.8	1.1	0.7	0.5	0.1
Congenital rubella syndrome	0.1	0.1	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	<0.1	0.1
Hib (meningitis)	2.4	1.8	2.7	3.6	2.1	1.4	1.1	0.8	0.3	0.4	0.3	0.3	0.1
Hepatitis B - acute/undetermined	-	-	-	-	-	-	-	31.6	32.1	38.3	43.6	32.8	19.7
Hepatitis B - carrier/chronic	-	-	-	-	-	-	-	1.7	5.5	53.2	52.0	52.9	60.9
Hepatitis B - total reports	13.0	11.0	19.2	20.0	28.1	27.7	25.2	33.3	37.6	91.5	95.6	85.6	80.6

Note: For the nine vaccine-preventable diseases listed in this table, there are national goals and targets for disease reduction. For information about British Columbia's progress towards achieving the goals and targets, see pages 28-29 of this report.

Notes and Sources

7. Number of reported cases and rates per 100,000 total population. Source: Epidemiology Services, B.C. Centre for Disease Control Society. Unpublished tables, February 1999.

M Congenital rubella syndrome: Two cases were diagnosed and reported in 1997, in children who were born in 1984 and 1995.

M Hepatitis B: Acute cases are persons recently infected. Undetermined cases are cases in persons in whom it could not be determined on the basis of the bloodwork at hand whether they were acute or chronically infected; some of these undetermined cases will ultimately be classified as chronic; breakdowns for acute, undetermined, and chronic cases not available prior to 1992.

NOTE: For many diseases, the number of reported cases does not represent all the cases that occur; there were other cases that were not recognized or that were not reported.

Vaccine-Preventable Diseases - B.C. Time Trends (continued)

Indicator	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
7 REPORTED CASES													
Hepatitis A	239	157	161	557	749	556	425	1017	475	281	410	491	362
Meningococcal disease (invasive)	-	17	12	16	22	26	28	34	40	50	45	40	38
Cholera	0	0	0	0	0	0	1	3	2	1	4	1	1
Rabies	1	0	0	0	0	0	0	0	0	0	0	0	0
Typhoid	5	7	3	2	5	7	11	11	24	20	16	26	23
RATES PER 100,000													
Hepatitis A	8.0	5.2	5.3	17.8	23.3	16.8	12.6	29.4	13.4	7.7	10.9	12.8	9.2
Meningococcal disease (invasive)	-	0.6	0.4	0.5	0.7	0.8	0.8	1.0	1.1	1.4	1.2	1.0	1.0
Cholera	0.0	0.0	0.0	0.0	0.0	0.0	<0.1	0.1	0.1	<0.1	0.1	<0.1	<0.1
Rabies	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Typhoid	0.2	0.2	0.1	0.1	0.2	0.2	0.3	0.3	0.7	0.5	0.4	0.7	0.6
8 DEATHS													
Diphtheria, all ages	0	0	0	0	0	0	1	0	0	0	0	0	0
Hib deaths, age 0-4	5	4	2	0	1	0	0	1	1	0	0	0	0
Measles, all ages	0	1	0	0	0	0	0	0	0	0	0	0	*
Pertussis, all ages	0	0	0	0	2	0	0	0	0	0	0	2	0
9 ICU ADMISSIONS - PERTUSSIS													
Cases admitted to intensive care units	7	6	3	7	6	4	3	4	9	6	7	2	3
Days of stay	115	43	28	34	36	15	24	17	44	15	25	19	12
Average length of stay (days)	16.4	7.2	9.3	4.9	6.0	3.8	8.0	4.3	4.9	2.5	3.6	9.5	4.0

Notes and Sources

7. Number of reported cases and rates per 100,000 total population. Source: Epidemiology Services, B.C. Centre for Disease Control Society. Unpublished tables, February 1999.

8. Number of deaths due to diphtheria, Haemophilus influenzae type b (Hib), measles, and pertussis. Hib: haemophilus meningitis (ICD9 320.0) and acute epiglottitis (ICD9 464.3). Source: B.C. Vital Statistics Agency. Unpublished tables.
* Deaths due to measles in 1997 to be confirmed.

9. Cases admitted to intensive care units for pertussis (ICD9 033), days of stay in hospital associated with those cases, and average days of stay in hospital per case. All cases were children age 0-4 except for one case in 1988/89 and one case in 1994/95. Figures are for fiscal years ("1997" is fiscal year 1997/98). Source: Canadian Institute for Health Information (CIHI) data for acute and rehabilitation care by principal diagnosis. Unpublished tables. Prepared by Information and Analysis Branch, B.C. Ministry of Health. File 1998-397. B.C. residents treated out-of-province are included in figures for 1991/92 through 1997/98 only.

Reported Cases of Diphtheria, Measles, and Pertussis, British Columbia, 1924-1997

	Number of Cases			Rate (per 100,000 population)		
Year	Diphtheria	Measles	Pertussis	Diphtheria	Measles	Pertussis
1924	642	1,458	115	112.4	255.3	20.1
1925	312	61	473	53.1	10.4	80.4
1926	384	2,095	641	63.4	345.7	105.8
1927	442	5,667	641	70.9	909.6	102.9
1928	906	343	253	141.3	53.5	39.5
1929	815	5,036	388	123.7	764.2	58.9
1930	380	860	2,516	56.2	127.2	372.2
1931	299	456	1,210	43.1	65.7	174.4
1932	83	8,861	822	11.7	1,253.3	116.3
1933	33	397	937	4.6	55.4	130.7
1934	40	192	1,004	5.5	26.4	138.1
1935	27	3,918	1,552	3.7	532.3	210.9
1936	31	5,939	1,415	4.2	797.2	189.9
1937	26	13,158	797	3.4	1,733.6	105.0
1938	17	1,708	2,143	2.2	220.4	276.5
1939	9	625	1,888	1.1	78.9	238.4
1940	10	3,217	957	1.2	399.6	118.9
1941	23	15,562	1,264	2.8	1,902.4	154.5
1942	60	720	1,753	6.9	82.8	201.5
1943	28	8,207	1,753	3.1	911.9	194.8
1944	17	1,493	1,474	1.8	160.2	158.2
1945	36	9,021	522	3.8	950.6	55.0
1946	63	2,546	167	6.3	253.8	16.7
1947	34	9,324	1,581	3.3	893.1	151.4
1948	35	4,137	385	3.2	382.3	35.6
1949	12	10,765	214	1.1	966.3	19.2
1950	63	5,648	1,740	5.5	496.7	153.0
1951	5	6,269	1,134	0.4	538.0	97.3
1952	11	8,225	976	0.9	682.6	81.0
1953	8	7,641	716	0.6	612.3	57.4
1954	7	6,531	1,088	0.5	504.3	84.0
1955	8	8,160	1,623	0.6	608.0	120.9
1956	1	5,616	987	0.1	401.6	70.6
1957	5	11,807	941	0.3	796.7	63.5
1958	0	3,534	1,427	0.0	229.8	92.8
1959	0	*	681	0.0	*	43.5
1960	0	*	961	0.0	*	60.0

	Number of Cases			Rate (per 100,000 population)		
Year	Diphtheria	Measles	Pertussis	Diphtheria	Measles	Pertussis
1961	1	*	212	0.1	*	13.0
1962	3	*	456	0.2	*	27.5
1963	0	*	711	0.0	*	41.8
1964	0	*	181	0.0	*	10.4
1965	0	*	230	0.0	*	12.8
1966	0	*	311	0.0	*	16.6
1967	1	*	264	0.1	*	13.6
1968	8	*	133	0.4	*	6.6
1969	14	*	62	0.7	*	3.0
1970	9	*	155	0.4	*	7.3
1971	11	200	91	0.5	9.2	4.2
1972	11	97	102	0.5	4.3	4.6
1973	51	158	102	2.2	6.9	4.4
1974	69	573	66	2.9	24.1	2.8
1975	22	1,149	49	0.9	47.2	2.0
1976	11	181	77	0.4	7.3	3.1
1977	17	310	45	0.7	12.4	1.8
1978	17	130	103	0.7	5.1	4.1
1979	9	1,801	286	0.4	70.0	11.1
1980	10	228	534	0.4	8.6	20.2
1981	2	48	255	0.1	1.7	9.3
1982	1	57	222	<0.1	2.0	8.0
1983	0	69	90	0.0	2.5	3.2
1984	1	1,136	32	<0.1	39.9	1.1
1985	2	1,756	89	0.1	58.7	3.0
1986	1	7,148	89	<0.1	236.7	2.9
1987	2	116	63	0.1	3.8	2.1
1988	1	131	81	<0.1	4.2	2.6
1989	2	146	193	0.1	4.5	6.0
1990	2	107	197	0.1	3.2	6.0
1991	0	68	121	0.0	2.0	3.6
1992	0	45	266	0.0	1.3	7.7
1993	2	20	537	0.1	0.6	15.1
1994	0	36	433	0.0	1.0	11.8
1995	1	15	452	<0.1	0.4	12.0
1996	0	41	979	0.0	1.1	25.5
1997	0	275	730	0.0	7.0	18.6

Notes and Sources

Number of reported cases and rates per 100,000 total population.

Diphtheria: Diphtheria toxoid vaccine licensed in Canada in 1926. B.C. immunization program began in 1929.

Measles: Measles (rubeola) vaccine introduced in Canada in 1963. B.C. immunization program began in December 1969.
*** Measles was not reportable during these years.**

Pertussis (whooping cough): Pertussis vaccine licensed in Canada in 1943. B.C. immunization program began in 1948.

Source: Epidemiology Services, B.C. Centre for Disease Control Society. Unpublished tables, January 1999.

Deaths Due to Selected Vaccine-Preventable Diseases, British Columbia, 1890-1997

Year	Cholera	Diph-theria	Pneu/ Infl	Measles	Per-tussis	Polio	Typhoid
1890	8	40	18	0	3	0	15
1891	15	35	32	1	3	0	22
1892	15	27	21	5	4	0	12
1893	47	29	31	0	0	0	26
1894	14	22	38	1	1	0	24
1895	17	7	30	4	1	0	18
1896	37	9	62	2	3	0	28
1897	16	10	78	0	13	0	31
1898	40	18	140	43	3	0	61
1899	21	17	140	4	5	0	56
1900	25	17	105	1	6	0	74
1901	25	17	115	0	0	0	31
1902	21	33	161	6	6	0	29
1903	15	24	126	1	12	0	22
1904	37	22	110	1	3	0	42
1905	39	14	107	1	4	0	31
1906	43	16	112	2	4	0	37
1907	36	26	243	10	26	0	62
1908	18	31	190	6	9	0	70
1909	40	18	209	1	18	0	55
1910	42	25	223	7	20	15	101
1911	0	68	332	11	23	9	92
1912	0	36	392	13	15	5	99
1913	0	35	272	11	27	2	85
1914	0	11	260	0	23	2	40
1915	0	8	393	14	9	6	29
1916	0	18	404	12	37	7	23
1917	0	19	333	4	21	5	24
1918	0	16	2,323	19	26	2	15
1919	0	34	1,095	7	8	2	8
1920	0	32	731	17	26	1	8
1921	0	27	405	14	6	1	20
1922	0	23	589	2	12	nk	11
1923	0	23	428	24	27	nk	12
1924	0	55	349	90	19	nk	15
1925	0	28	383	4	32	nk	13
1926	0	33	538	10	38	1	15
1927	0	22	652	38	46	37	13
1928	0	40	500	7	13	20	10
1929	0	38	599	68	9	15	10
1930	0	15	496	9	32	8	17
1931	0	18	498	1	28	11	7
1932	0	3	466	26	19	1	7
1933	0	5	443	1	10	2	10
1934	0	6	457	1	5	3	9
1935	0	8	517	8	9	4	8
1936	0	5	614	19	17	7	6
1937	0	2	825	173	29	0	10
1938	0	4	563	11	31	4	8
1939	0	0	470	1	17	3	4
1940	0	2	576	4	10	2	8
1941	0	2	468	11	8	1	3
1942	0	2	424	14	13	0	3
1943	0	5	646	22	16	1	3
1944	0	1	573	4	10	2	5
1945	0	2	436	21	8	1	3
1946	0	5	523	2	5	1	15
1947	0	4	463	17	17	12	6
1948	0	7	560	3	4	5	1
1949	0	5	529	22	1	3	1
1950	0	3	453	17	10	7	2
1951	0	0	578	6	8	7	1
1952	0	1	482	12	5	40	3
1953	0	2	470	17	7	24	1
1954	0	0	541	10	0	6	1
1955	0	0	582	5	3	7	0
1956	0	0	660	11	1	2	3
1957	0	1	752	9	11	1	5
1958	0	0	706	0	6	3	4
1959	0	0	680	2	0	14	3
1960	0	0	671	5	0	14	1
1961	0	0	614	1	0	0	4
1962	0	2	747	7	1	0	1
1963	0	0	657	2	0	0	1
1964	0	0	778	8	1	0	1
1965	0	0	678	1	0	0	1
1966	0	0	877	4	1	0	6
1967	0	1	676	3	1	0	1
1968	0	2	846	0	0	0	1
1969	0	3	993	1	0	0	0
1970	0	2	762	6	1	0	0
1971	0	1	889	1	1	0	0
1972	0	0	719	2	0	0	0
1973	0	1	590	2	2	0	0
1974	0	4	645	2	1	0	0
1975	0	1	709	0	0	0	0
1976	0	3	614	0	0	0	0
1977	0	1	411	1	0	0	0
1978	0	1	389	3	0	0	1
1979	0	3	265	4	0	0	0
1980	0	0	350	0	0	0	0
1981	0	0	363	0	0	0	0
1982	0	0	836	1	0	0	0
1983	0	0	753	0	0	0	0
1984	0	0	797	0	0	0	0
1985	0	0	905	0	0	0	0
1986	0	0	845	1	0	0	0
1987	0	0	893	0	0	0	0
1988	0	0	952	0	0	0	0
1989	0	0	994	0	2	0	0
1990	0	0	987	0	0	0	0
1991	0	1	1,017	0	0	1	0
1992	0	0	1,142	0	0	0	0
1993	1	0	1,217	0	0	0	0
1994	0	0	1,111	0	0	0	0
1995	0	0	1,164	0	0	0	0
1996	0	0	1,229	0	2	0	0
1997	0	0	1,294	*	0	0	0

Notes and Sources

Diphtheria: Croup included with diphtheria deaths for years 1890 to 1910.

Pneu/Infl (Pneumonia and Influenza): Many cases, but not all cases, are vaccine-preventable. See "Pneumococcal Disease and Influenza", pages 45-47.

Measles: * Deaths due to measles in 1997 to be confirmed.

Polio: Deaths due to acute poliomyelitis. An average of two deaths per year occur due to late effects of polio, in persons who contracted the disease prior to the introduction of immunization programs in the mid to late 1950s.

Source: B.C. Vital Statistics Agency, B.C. Ministry of Health. Data for years 1980-1990 from *The Nineteen Eighties A Statistical Resource for a Decade of Vital Events in British Columbia*, 1994. Data for years 1991-1997 from unpublished tables.

Hospitalizations Due to Vaccine-Preventable Diseases - CASES
British Columbia Residents, 1985/86-1997/98

Principal Diagnosis		Number of Hospitalized Cases (acute and rehab care)												
Disease	ICD9	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98
Diphtheria	032	0	4	0	0	0	0	0	0	0	0	1	2	1
Hepatitis B	070.3	52	72	86	95	77	61	61	75	66	65	60	45	59
Hib meningiti	320.0, 464.3													
Ages 0-4		139	106	101	92	55	50	34	25	20	12	7	7	5
Ages 5 and older		41	40	42	49	35	31	56	58	31	58	47	64	61
Total - all ages		180	146	143	141	90	81	90	83	51	70	54	71	66
Influenza	487	1,062	778	859	838	957	638	686	733	489	415	406	557	590
Measles	055	166	80	6	8	7	5	2	3	1	2	1	16	2
Mumps	072	5	7	5	3	6	5	10	3	2	1	3	2	5
Pertussis	033	65	92	57	98	118	109	96	145	134	83	112	123	75
Pneumococc	481	754	707	711	707	729	736	948	786	803	822	872	1,127	1,057
Polio	045	1	3	1	2	0	1	1	1	0	0	0	1	0
Rubella	056	36	27	11	15	13	10	4	8	7	4	3	5	4
Congenital ru	771.0	7	2	1	1	0	2	0	0	1	0	0	2	1
Tetanus	037	4	2	4	1	4	4	1	3	1	1	3	1	3
Diseases that are less commonly reported and/or for which universal immunization is not recommended at this time.														
Chickenpox	052	60	67	73	110	81	86	94	99	92	95	80	65	92
Cholera	001	0	0	2	2	0	0	4	0	2	1	0	0	0
Hepatitis A	070.1	39	32	34	106	77	56	66	107	39	39	47	36	26
Meningococ	036	36	40	37	41	31	35	52	29	61	65	44	34	40
Plague	020	1	1	2	0	1	1	0	1	0	2	1	1	0
Rabies	071	1	0	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	010-018	304	292	259	239	209	205	211	237	253	231	223	184	219
Typhoid	002.0	8	12	11	10	7	10	13	12	12	16	9	12	11
Yellow fever	060	1	0	0	0	0	0	0	0	0	0	0	0	0
Total cases - all above diseases		2,782	2,364	2,302	2,417	2,407	2,045	2,339	2,325	2,014	1,912	1,919	2,284	2,251

Notes and Sources

Source: Canadian Institute for Health Information (CIHI) data for acute and rehabilitation care by principal diagnosis. Prepared for the Provincial Health Officer's Annual Report by Information and Analysis Branch, B.C. Ministry of Health. File 1998-397. Figures are for fiscal years ("97/98" data are for period April 1, 1997 to March 31, 1998). B.C. residents treated out-of-province are included in figures for 1991/92 through 1997/98 only.

Hospitalizations Due to Vaccine-Preventable Diseases - DAYS
British Columbia Residents, 1985/86-1997/98

Principal Diagnosis		Number of Hospital-Days (days of stay, acute & rehab care)												
Disease	ICD9	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98
Diphtheria	032	0	21	0	0	0	0	0	0	0	0	7	24	11
Hepatitis B	070.3	617	654	829	650	656	519	508	489	465	529	517	295	476
Hib meningitis/acute epiglottitis	320.0, 464.3													
Ages 0-4		1,548	1,042	902	630	484	374	277	173	121	48	17	17	30
Ages 5 and older		309	290	216	213	142	417	429	174	97	180	171	199	185
Total - all ages		1,857	1,332	1,118	843	626	791	706	347	218	228	188	216	215
Influenza	487	5,919	3,520	3,765	3,562	4,648	2,410	2,812	3,005	2,000	1,388	1,493	2,191	2,637
Measles	055	549	309	21	30	32	19	5	4	6	8	3	49	6
Mumps	072	17	22	16	11	17	20	111	7	7	4	10	5	14
Pertussis	033	474	556	311	540	653	544	558	745	650	373	431	613	382
Pneumococcal pneumonia	481	6,963	6,243	6,047	6,454	5,889	6,236	7,810	6,392	6,273	6,169	6,121	8,170	7,594
Polio	045	1	104	3	17	0	1	79	24	0	0	0	9	0
Rubella	056	131	91	30	41	48	34	15	25	16	7	6	14	8
Congenital rubella syndrome	771.0	41	60	18	3	0	9	0	0	6	0	0	73	4
Tetanus	037	92	14	36	2	68	6	63	38	1	5	42	12	3
Diseases that are less commonly reported and/or for which universal immunization is not recommended at this time.														
Chickenpox	052	232	318	307	457	328	404	370	386	364	435	297	244	403
Cholera	001	0	0	21	17	0	0	11	0	6	3	0	0	0
Hepatitis A	070.1	272	202	301	684	413	341	337	593	153	122	197	216	134
Meningococcal disease	036	424	326	457	365	210	326	505	267	476	731	379	478	290
Plague	020	16	1	11	0	3	8	0	14	0	60	7	2	0
Rabies	071	27	0	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	010-018	8,802	7,923	8,426	7,724	6,632	5,210	5,469	6,831	6,155	5,392	5,337	4,961	5,528
Typhoid	002.0	96	139	151	112	60	109	97	144	87	101	53	63	54
Yellow fever	060	1	0	0	0	0	0	0	0	0	0	0	0	0
Total days - all above diseases		26,531	21,835	21,868	21,512	20,283	16,987	19,456	19,311	16,883	15,555	15,088	17,635	17,759

Notes and Sources

Source: Canadian Institute for Health Information (CIHI) data for acute and rehabilitation care by principal diagnosis. Prepared for the Provincial Health Officer's Annual Report by Information and Analysis Branch, B.C. Ministry of Health. File 1998-397. Figures are for fiscal years ("97/98" data are for period April 1, 1997 to March 31, 1998). B.C. residents treated out-of-province are included in figures for 1991/92 through 1997/98 only.

Appendix F

Immunization Indicators – Regional Data

Note:

Where data permit, the following appendix provides indicator data for 20 geographic regions, for the most recent year available. Some additional graphs are also provided. A map showing the names and boundaries of the regions may be found in Appendix G.

Much of this data can be accessed from the website of the Ministry of Health's Health Data Warehouse. The Warehouse is available to health stakeholders in British Columbia. This includes Ministry of Health and related staff in Health Authorities and Ministry for Children and Families. Users must register at http://admin.moh.hnet.bc.ca/hdw/ prior to accessing the website. For further information, please contact the Information and Analysis Branch, B.C. Ministry of Health, 250-952-3179.

These graphs portray regional data for some of the immunization rates discussed in Chapter 4 of this report. See in particular Table 9 (page 32) and Table 12 (page 40). Numerical data for these graphs may be found on page F-6.

Figure 1 Immunization Rates for Children 24 Months of Age, Diphtheria, Tetanus, Polio (DTP, 4 doses), B.C., 1998

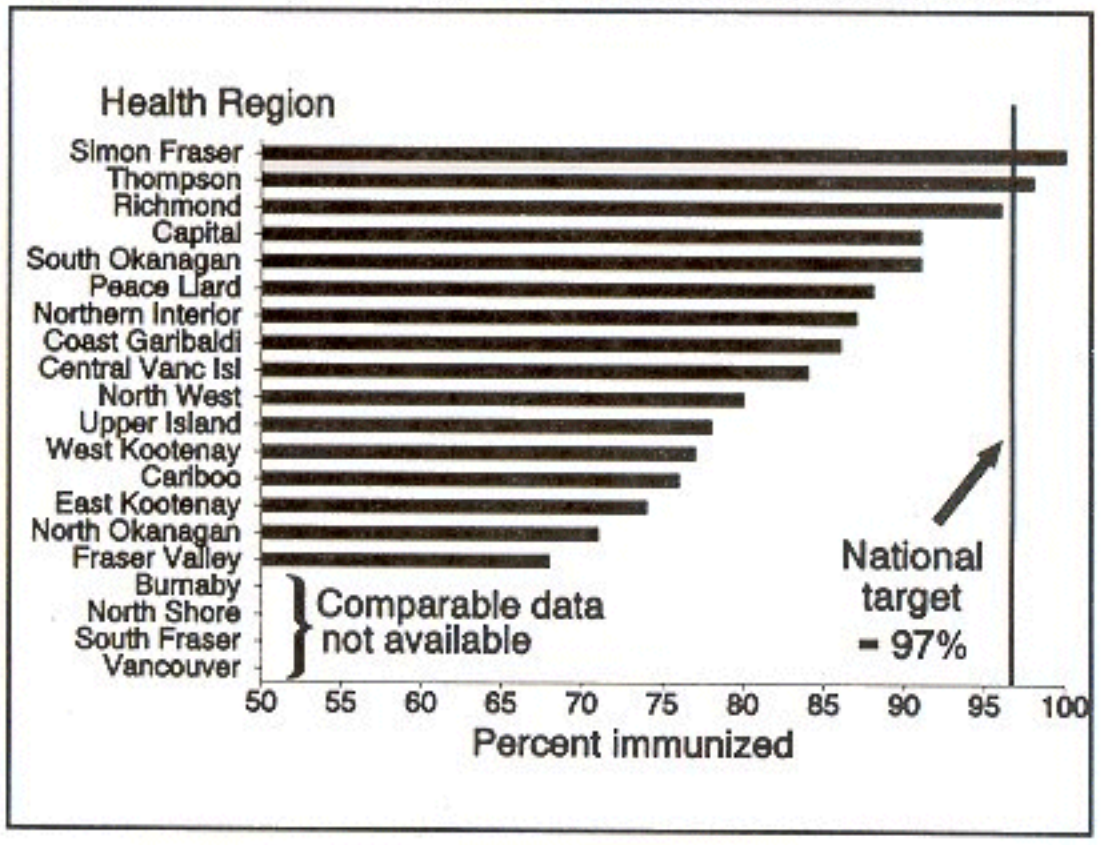
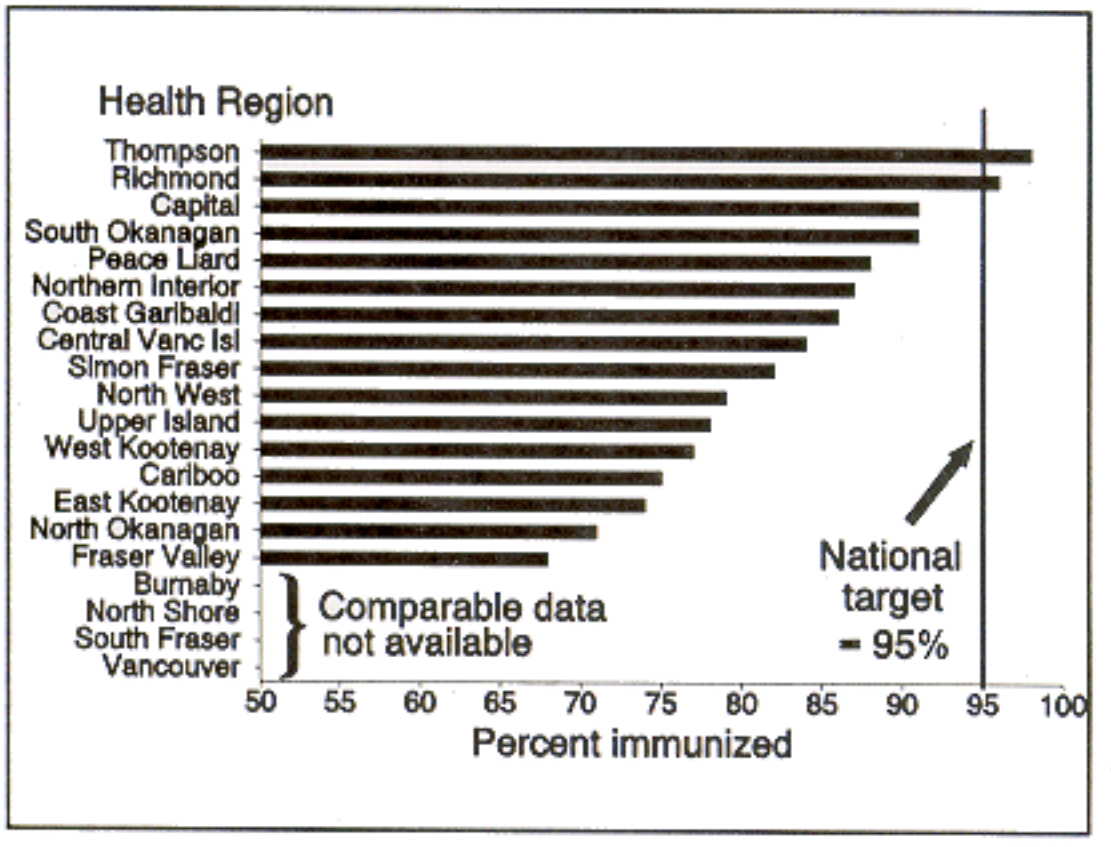


Figure 2 Immunization Rates for Children 24 Months of Age, Pertussis (4 doses), B.C., 1998



Source: Immunization Status of Children Age 2. B.C. Ministry of Health Administrative Circular No. 98:014. Note: Data are based on a one-month sample of children who were two years old in April 1998 and for whom Child Health Records were available.

Figure 3 Immunization Rates for Children 24 Months of Age, Measles, Mumps, Rubella (MMR, 2 doses), B.C., 1998

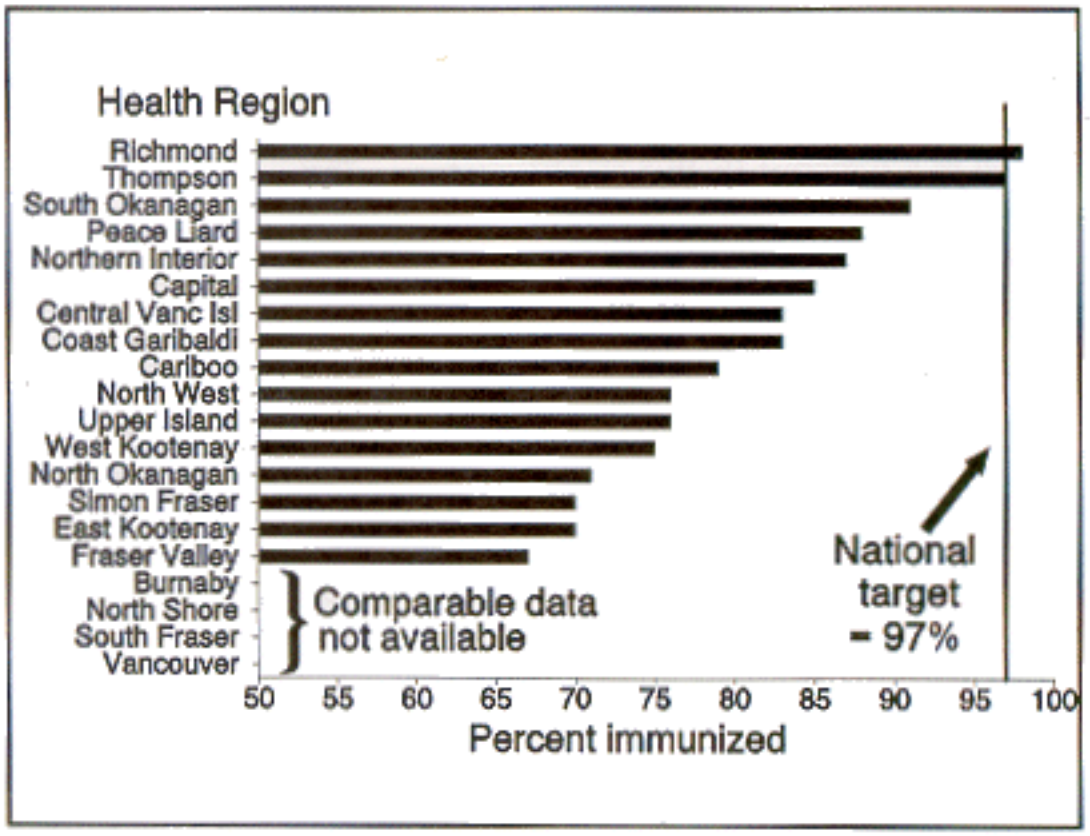
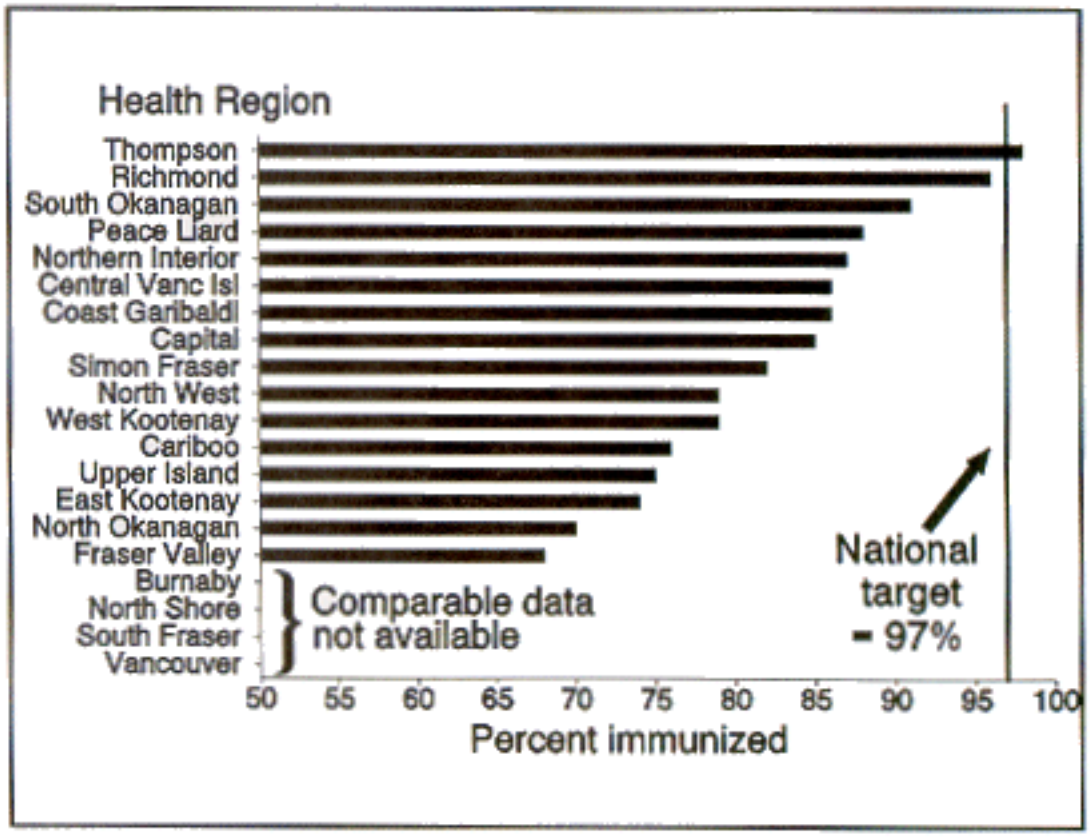


Figure 4 Immunization Rates for Children 24 Months of Age, Hib (4 doses), B.C., 1998



Source: Immunization Status of Children Age 2. B.C. Ministry of Health Administrative Circular No. 98:014. Data are based on a one-month sample of children who were two years old in April 1998 and for whom Child Health Records were available.

Figure 5 Immunization Rates, Kindergarten Children, B.C., 1998

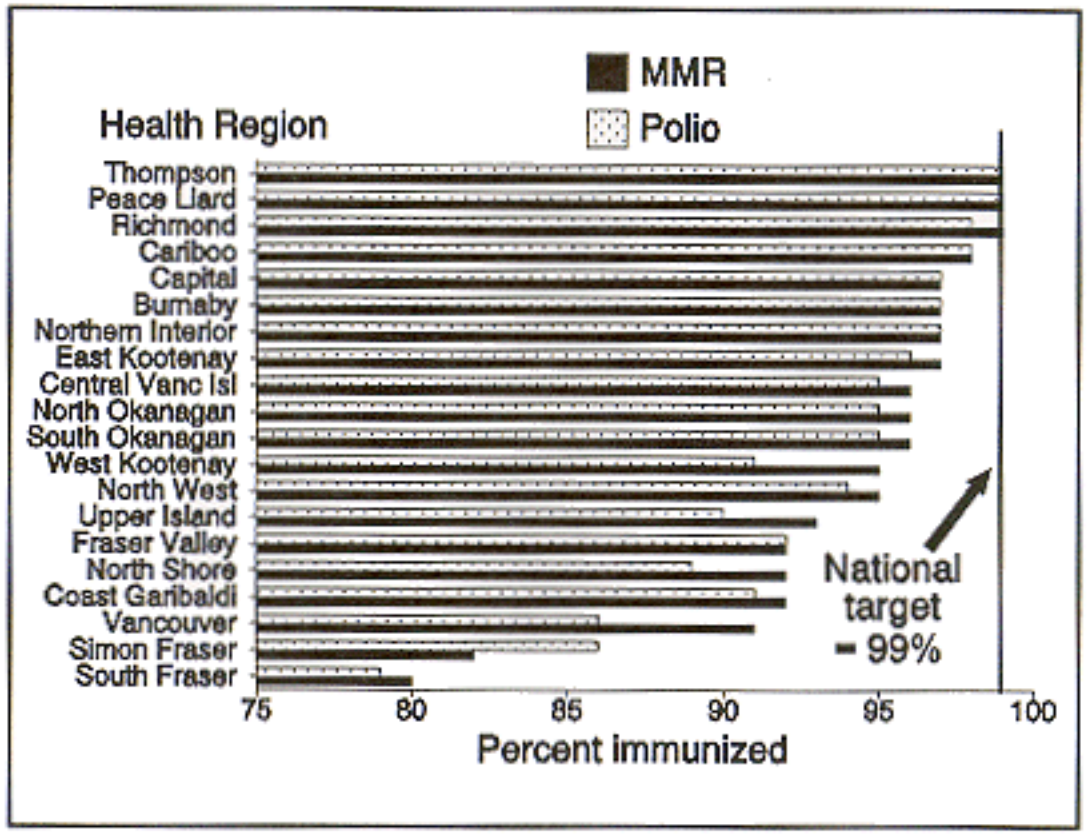
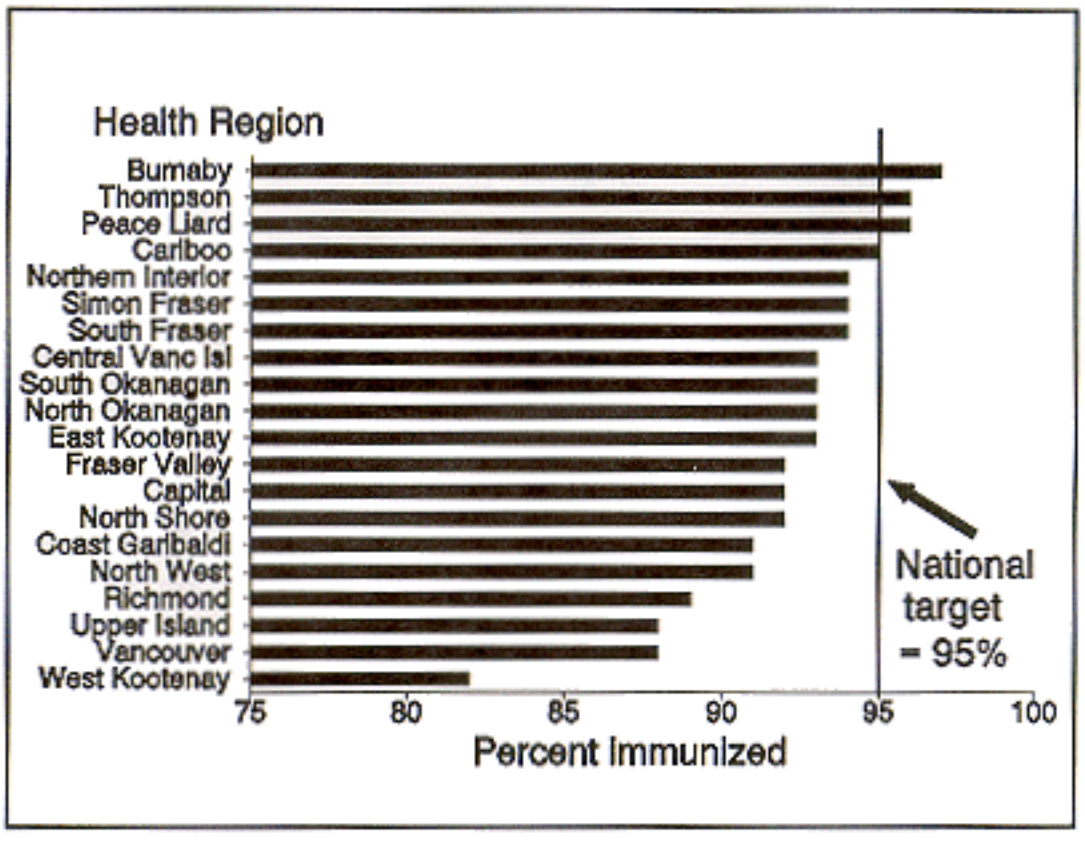


Figure 6 Hepatitis B Immunization Rates, Grade 6 Students, B.C., 1998



Percent of children who, by the end of the school year, have received the appropriate number of vaccine doses. Source: British Columbia School Immunization Rates 1997/98. B.C. Ministry of Health Administrative Circular No. 98:016.

IMMUNIZATION INDICATORS - REGIONAL DATA

	HEALTH REGION (See map, Appendix G, for region names and locations)																						
	Okanagan-Kootenay					Fraser Valley			Island-Coast			North				Lower Mainland				CRD			
Indicator	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		Best	Worst
	EK	WK	NO	SO	TH	FV	SFV	SF	CG	CVI	UI	CA	NW	PL	NI	VA	BU	NS	RI	CAP	BC	Rate	Rate
1 Immunization, two year olds																							
Diphtheria/Tetanus/Polio	74%	77%	71%	91%	98%	68%	N/A	100%	86%	84%	78%	76%	80%	88%	87%	N/A	N/A	N/A	96%	91%	83%	####	68%
Pertussis	74%	77%	71%	91%	98%	68%	N/A	82%	86%	84%	78%	75%	79%	88%	87%	N/A	N/A	N/A	96%	91%	82%	98%	68%
Hib	74%	79%	70%	91%	98%	68%	N/A	82%	86%	86%	75%	76%	79%	88%	87%	N/A	N/A	N/A	96%	85%	82%	98%	68%
Measles/Mumps/Rubella	70%	75%	71%	91%	97%	67%	N/A	70%	83%	83%	76%	79%	76%	88%	87%	N/A	N/A	N/A	98%	85%	81%	98%	67%
2 Immunization, kindergarten																							
Diphtheria/Pertussis/Tetanus	95%	92%	95%	94%	98%	90%	78%	85%	89%	95%	90%	98%	94%	98%	96%	91%	97%	88%	98%	96%	90%	98%	78%
Polio	96%	91%	95%	95%	99%	92%	79%	86%	91%	95%	90%	98%	94%	99%	97%	86%	97%	89%	98%	97%	90%	99%	79%
Measles/Mumps/Rubella	97%	95%	96%	96%	99%	92%	80%	82%	92%	96%	93%	98%	95%	99%	97%	91%	97%	92%	99%	97%	91%	99%	80%
3 Immunization, grade 6																							
Hepatitis B	93%	82%	93%	93%	96%	92%	94%	94%	91%	93%	88%	95%	91%	96%	94%	88%	97%	92%	89%	92%	92%	97%	82%
4 Immunization, influenza																							
B.C. population age 65+	59%	49%	48%	50%	58%	47%	59%	47%	52%	57%	54%	52%	50%	51%	55%	N/A	47%	50%	59%	N/A	53%	59%	47%
Residents of care facilities	85%	76%	82%	83%	87%	83%	80%	85%	80%	89%	91%	88%	92%	78%	89%	81%	85%	65%	86%	87%	83%	92%	65%
Staff of care facilities (NOTE)	23%	21%	18%	37%	61%	29%	30%	19%	26%	33%	52%	36%	24%	20%	27%	N/A	19%	20%	26%	24%	28%	61%	18%
5 Immunization, pneumococcal																							
Residents of care facilities	83%	73%	49%	62%	95%	79%	77%	84%	74%	74%	88%	78%	90%	78%	79%	78%	84%	56%	87%	68%	75%	95%	49%
6 Immunizations: % public hlth																							
Routine childhood series	####	98%	95%	100%	100%	98%	23%	39%	95%	100%	90%	100%	100%	100%	97%	20%	20%	7%	30%	70%	59%		
Kindergarten booster	####	100%	100%	100%	100%	98%	30%	66%	90%	100%	97%	100%	100%	100%	####	50%	66%	15%	65%	90%	73%		
School-age	####	100%	100%	100%	100%	100%	####	100%	100%	100%	100%	100%	100%	100%	####	75%	####	####	90%	100%	97%		
Influenza	80%	95%	95%	85%	80%	60%	14%	20%	80%	30%	65%	100%	100%	80%	50%	6%	20%	17%	20%	13%	38%		

Notes and Sources

1. Percent of children who, by their second birthday, have completed the primary series for immunization, according to the Provincial Immunization Schedule. Rates are based on a one-month sample of children who were two years old in April of 1998 and for whom child health records (HLTH 182s) were available. Source: *Immunization Status of Children Age 2*. B.C. Ministry of Health Administrative Circular No. 98:014. Diphtheria/Tetanus/Polio: 4 doses. Pertussis: 4 doses. Measles/Mumps/ Rubella (MMR): 2 doses. Haemophilus influenzae type b (Hib): 4 doses.
N/A: Comparable data not available for South Fraser, Vancouver, Burnaby, and North Shore regions.

2. Percent of children who, by the end of their school entry (kindergarten) year, have received the appropriate number of vaccine doses, according to the Provincial Immunization Schedule. Figures are for the school year ending June 1998. Source: *British Columbia School Immunization Rates 1997/98*. B.C. Ministry of Health Administrative Circular No. 98:016. Note: "Diphtheria/Tetanus" figures are for Diphtheria/Pertussis/Tetanus or Diphtheria/Tetanus; coverage for pertussis is not tracked separately.

3. Percent of children who, by the end of grade six, have received three doses of hepatitis B vaccine during in-school immunization. Figures are for the school year ending June 1998. Source: *British Columbia School Immunization Rates 1997/98*. B.C. Ministry of Health Administrative Circular No. 98:016.

4. Percent immunized against influenza, B.C. population age 65 and older and residents/staff of care facilities, 1997/98.
- Data for population age 65+ are from Epidemiology Services, B.C. Centre for Disease Control Society. **N/A: Data not available for Vancouver and Capital health regions.**
- Data for residents/staff of care facilities are from *Report of Pneumococcal and Influenza Immunization in Care Facilities 1997*, B.C. Ministry of Health Administrative Circular No. 98:13. "SF" and "BU" figures are for Simon Fraser and Burnaby combined. **NOTE: Data on facility staff immunized are incomplete. Staff immunization data not available for Vancouver (45 facilities) and for a total of 46 facilities in other regions.**

5. Percent immunized against pneumococcal disease, of care facility residents eligible to receive pneumococcal vaccine. Source: *Report of Pneumococcal and Influenza Immunization in Care Facilities 1997*, B.C. Ministry of Health Administrative Circular No. 98:13. "SF" and "BU" figures are for Simon Fraser and Burnaby combined.

6. Estimated percentage of immunizations given by public health departments. In British Columbia, most immunizations not provided by public health departments are given by private physicians; other providers include hospitals, long-term care facilities, Medical Services Branch (Health Canada), and First Nations health agencies. Percentage provided by public health is an estimate based on a 1998 survey of public health nursing administrators. Data compiled by Public Health Nursing, B.C. Ministry of Health.

VACCINE-PREVENTABLE DISEASES - REGIONAL DATA

	HEALTH REGION (See map, Appendix G, for region names and locations)																						
	Okanagan-Kootenay					Fraser Valley			Island-Coast			North				Lower Mainland				CRD			
Indicator	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		Best	Worst
	EK	WK	NO	SO	TH	FV	SFV	SF	CG	CVI	UI	CA	NW	PL	NI	VA	BU	NS	RI	CAP	BC	Rate	Rate
7 REPORTED CASES (all ages)																							
Pertussis	1	65	2	29	8	9	157	87	94	37	12	4	21	11	7	50	38	78	18	2	730		
Measles	2	0	7	4	0	6	129	33	1	0	0	0	0	0	0	23	45	6	18	1	275		
Mumps	0	0	0	8	2	4	11	11	2	33	5	1	0	0	2	42	8	10	0	2	141		
Rubella	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	5		
Hib	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	1	0	4		
Hepatitis B - acute/undeter	2	6	22	15	7	19	43	45	7	26	2	4	6	2	2	156	38	59	276	37	774		
Hepatitis B - carrier/chronic	1	1	14	13	13	45	168	190	1	23	16	0	1	4	3	1390	247	23	193	42	2,388		
Hepatitis B - total	3	7	36	28	20	64	211	235	8	49	18	4	7	6	5	1546	285	82	469	79	3,162		
Hepatitis A	1	3	13	8	6	18	45	30	14	5	4	2	4	1	3	150	17	17	10	9	362		
Meningococcal (invasive)	1	1	1	2	1	5	6	2	0	2	2	0	0	1	2	3	1	2	4	2	38		
Typhoid	0	0	0	0	0	5	8	0	0	0	0	0	0	0	0	8	0	0	1	1	23		
RATES PER 100,000																							
Pertussis	1.3	####	1.7	12.9	6.1	3.8	28.5	28.4	124.9	15.6	10.0	5.3	23.1	16.9	5.4	9.1	20.3	44.1	11.5	0.6	18.6	0.6	124.9
Measles	2.5	0.0	6.1	1.8	0.0	2.6	23.4	10.8	1.3	0.0	0.0	0.0	0.0	0.0	0.0	4.2	24.0	3.4	11.5	0.3	7.0	0.0	24.0
Mumps	0.0	0.0	0.0	3.6	1.5	1.7	2.0	3.6	2.7	13.9	4.2	1.3	0.0	0.0	1.5	7.6	4.3	5.7	0.0	0.6	3.6	0.0	13.9
Rubella	1.3	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.1	0.0	1.3
Haemophilus influenza b (Hib)	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.6	0.0	0.1	0.0	1.5
Hepatitis B - acute/undeter	2.5	7.4	19.0	6.7	5.3	8.1	7.8	14.7	9.3	10.9	1.7	5.3	6.6	3.1	1.5	28.3	20.3	33.4	175.7	11.1	19.7	1.5	175.7
Hepatitis B - carrier/chronic	1.3	1.2	12.1	5.8	9.9	19.2	30.5	62.0	1.3	9.7	13.3	0.0	1.1	6.1	2.3	252.1	131.8	13.0	122.9	12.7	60.9	0.0	252.1
Hepatitis B - total	3.8	8.6	31.1	12.5	15.2	27.4	38.3	76.7	10.6	20.6	15.0	5.3	7.7	9.2	3.8	280.4	152.1	46.4	298.6	23.8	80.6	3.8	298.6
Hepatitis A	1.3	3.7	11.2	3.6	4.5	7.7	8.2	9.8	18.6	2.1	3.3	2.7	4.4	1.5	2.3	27.2	9.1	9.6	6.4	2.7	9.2	1.3	27.2
Meningococcal (invasive)	1.3	1.2	0.9	0.9	0.8	2.1	1.1	0.7	0.0	0.8	1.7	0.0	0.0	1.5	1.5	0.5	0.5	1.1	2.5	0.6	1.0	0.0	2.5
Typhoid	0.0	0.0	0.0	0.0	0.0	2.1	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.6	0.3	0.6	0.0	2.1

Notes and Sources

7. Number of reported cases and rates per 100,000 population, 1997. Source: Epidemiology Services, B.C. Centre for Disease Control Society. Unpublished tables, February 1999. Hepatitis B: Acute cases are persons recently infected. Undetermined cases are persons in whom it could not be determined on the basis of the bloodwork at hand whether they were acute or chronically infected; some of these undetermined cases will ultimately be classified as chronic.

NOTE: For many diseases, the number of reported cases does not represent all the cases that occur. There were other cases that were not recognized or that were not reported.

VACCINE-PREVENTABLE DISEASES - REGIONAL DATA

		HEALTH REGION (See map, Appendix G, for region names and locations)																					
		Okanagan-Kootenay					Fraser Valley			Island-Coast			North				Lower Mainland				CRD			
	Indicator	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		Best	Worst
		EK	WK	NO	SO	TH	FV	SFV	SF	CG	CVI	UI	CA	NW	PL	NI	VA	BU	NS	RI	CAP	BC	Rate	Rate
8	Hib deaths, age 0-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9	Pertussis ICU admissions																							
	Cases	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	3		
	Days	0	0	0	0	0	1	0	0	0	0	0	0	0	0	11	0	0	0	0	0	12		
10	Hospital cases																							
	Diphtheria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1		
	Hepatitis B	0	0	1	1	1	7	3	4	2	3	1	1	0	1	0	16	6	6	4	2	59		
	Hib																							
	Ages 0-4	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	5		
	Ages 5 and older	2	1	0	5	0	5	10	5	1	6	2	0	0	1	1	6	2	4	3	7	61		
	Total - all ages	3	2	0	5	0	5	10	5	1	6	2	1	0	1	1	6	2	4	3	9	66		
	Influenza	26	66	18	87	18	30	66	29	13	23	31	49	15	10	14	29	14	5	6	38	590		
	Measles	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2		
	Mumps	1	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	5		
	Pertussis	1	1	4	2	1	10	14	1	0	11	2	0	3	0	5	6	2	5	2	5	75		
	Pneumococcal pneumonia	35	24	53	70	41	273	59	30	29	27	44	18	29	6	47	89	36	12	52	78	1057		
	Rubella	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	4		
	Congenital rubella syndrome	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1		
	Tetanus	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3		
	Chickenpox	0	3	2	9	6	8	9	7	2	7	6	3	4	2	5	1	2	0	2	14	92		
	Hepatitis A	0	0	1	0	1	1	4	0	1	1	0	0	0	2	0	12	1	1	1	0	26		
	Meningococcal disease	1	1	3	2	1	4	6	1	0	6	3	0	0	1	0	4	2	0	5	0	40		
	Tuberculosis	0	0	2	3	1	16	31	5	3	5	5	1	2	1	19	82	15	2	14	8	219		
	Typhoid	0	0	0	0	0	1	4	0	0	1	0	0	1	0	0	2	1	0	1	0	11		
	Total cases	67	97	86	181	72	355	206	83	51	91	96	73	54	24	91	250	83	35	90	154	2251		

Notes and Sources

8. Number of deaths age 0-4 due to haemophilus meningitis (ICD9 320.0) and acute epiglottitis (ICD9 464.3), 1997. Source: B.C. Vital Statistics Agency, B.C. Ministry of Health. Unpublished tables.

9. Number of cases admitted to intensive care units for pertussis (ICD9 033) and days of stay associated with those cases, fiscal year 1997/98. Source: Canadian Institute for Health Information (CIHI) data for acute and rehabilitation care by principal diagnosis. Prepared for the Provincial Health Officer's Annual Report by Information and Analysis Branch, B.C. Ministry of Health. File 1998-397.

10. Number of hospitalizations due to vaccine-preventable diseases, fiscal year 1997/98. "Hib" includes Hib meningitis (ICD9 320.0) and acute epiglottitis (ICD9 464.3). B.C. residents treated out-of-province are included. For some diseases, B.C. total includes cases of unknown health region. Source: Canadian Institute for Health Information (CIHI) data for acute and rehabilitation care by principal diagnosis. Prepared for the Provincial Health Officer's Annual Report by Information and Analysis Branch, B.C. Ministry of Health. File 1998-397.

Appendix G

Map of Health Regions

Health Regions in British Columbia

Under British Columbia's new regionalized health system, introduced in 1997/98, responsibility for the direct delivery and management of most health services has been transferred from the Ministry of Health to local health authorities: 11 regional health boards, 34 community health councils, and 7 community health services societies. Regionalization has involved some boundary changes, a process that always creates a number of data conversion issues.

Over time, health information systems will be modified to reflect the names, numbers, and boundaries of the local health authorities. At the time this annual report was prepared, however, most information systems produced data based on 20 health analysis areas known as "Health Regions". The 20 health regions are aggregations of Local Health Areas (LHAs) and are roughly equivalent to the areas served by the former 20 provincial health units/health departments.

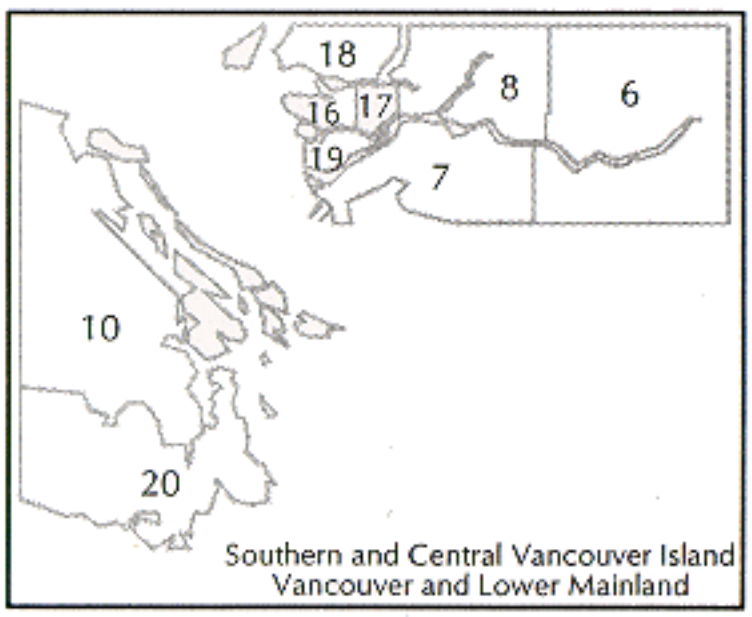
The 20 geographic regions used in this year's annual report are identical to those used in previous Provincial Health Officer's annual reports and in Vital Statistics Annual Reports for 1995 through 1998.

Names, abbreviations, and numbers are as follows:

Health Region Names, Abbreviations, and Numbers

Health Region/Health Analysis Area		Health Unit/Health Department	
01 EK	East Kootenay	01 EK	East Kootenay
02 WK	West Kootenay-Boundary	02 CK	Central Kootenay
03 NO	North Okanagan	04 NO	North Okanagan
04 SO	South Okanagan Similkameen	05 SO	South Okanagan
05 TH	Thompson	06 SC	South Central
06 FV	Fraser Valley	07 UFV	Upper Fraser Valley
07 SFV	South Fraser Valley	09 BO	Boundary
08 SF	Simon Fraser	10 SF	Simon Fraser
09 CG	Coast Garibaldi	11 CG	Coast Garibaldi
10 CVI	Central Vancouver Island	13 CVI	Central Vancouver Island
11 UI	Upper Island/Central Coast	14 UI	Upper Island
12 CA	Cariboo	15 CA	Cariboo
13 NW	North West	16 SK	Skeena
14 PL	Peace Liard	17 PR	Peace River
15 NI	Northern Interior	18 NI	Northern Interior
16 VA	Vancouver	20 VA	Vancouver
17 BU	Burnaby	30 BU	Burnaby
18 NS	North Shore	40 NS	North Shore
19 RI	Richmond	50 RI	Richmond
20 CAP	Capital	60 CRD	Capital Regional District

British Columbia
Health Regions



HEALTH REGIONS

1. East Kootenay
2. West Kootenay-Boundary
3. North Okanagan
4. South Okanagan Similkameen
5. Thompson
6. Fraser Valley
7. South Fraser Valley
8. Simon Fraser
9. Coast Garibaldi
10. Central Vancouver Island
11. Upper Island/Central Coast
12. Cariboo
13. North West
14. Peace Liard
15. Northern Interior
16. Vancouver
17. Burnaby
18. North Shore
19. Richmond
20. Capital

Prepared by: Planning & Evaluation Division, Ministry of Health and Ministry Responsible for Seniors
Boundary Source: BC STATS, Ministry of Finance and Corporate Relations

SEP97