Public Health

Educate. Protect. Vaccinate.

A Resource to Address Parents' Concerns About Childhood Vaccines

When it comes to vaccines, the biggest risk is misinformation.

Health care providers are the most important source of information and advice for parents on immunizations. This reference will help you in your discussions with parents who struggle with making their decision.

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Introduction

Vaccination has saved more lives in Canada in the last 50 years than any other intervention. (Canadian Public Health Association, 2001)

Overview

Some vaccine programs are victims of their own success. High immunization rates have eradicated or decreased once-common childhood illnesses. Because there are fewer cases of vaccine preventable diseases in the community, many parents have not seen the ravages of these deadly diseases and learned to fear them.

As a result, some parents are wary of vaccines and question the need to give a healthy child an injection. Concerns about vaccines can potentially erode public support for immunization. This leads to decreased immunization rates and increased vaccine preventable disease in the community.

Purpose of Flipbook

Anti-immunization campaigns often base their messages on information that is emotional and personal. These types of messages have a greater influence on parents than statistical arguments. The media also tend to present the benefits and risks of immunization with similar time and treatment as if they have equal scientific validity.

Health care providers are the most important source of information and advice for parents on immunizations. This reference will help you in your discussions with parents who struggle with making their decision.

Sources:

Gellin, Bruce G. "Do Parents Understand Immunizations? A National Telephone Survey." *Pediatrics* Vol. 106, No.5 (November 2000), pp. 1097-1102.

Halperin, Scott A. "How to Manage Parents Unsure About Immunization." *Canadian Journal of CME* Vol. 12, No. 1 (January 2000), pp.62-75.

Offit, Paul A. "The Power of 'Box A'." *Expert Rev. Vaccines*, 2(1), (2003), pp. 89-91.

Immunization concerns: Discussion tips

1. Listen, Evaluate, Categorize

- Determine specific concerns of parents so you can provide more effective information, reasons, and arguments.
- Dedicate enough time to make the discussion effective.
- Assess if the parent is truly seeking advice. Avoid wasted time and effort with those who are not.

Parents with immunization concerns can generally be divided into five categories:

Category	Characteristics	Chance of positive outcome (immunization)
Uninformed but educatable	Told by others not to immunize, but seek information to counter argument.	High
Misinformed but correctable	Gathered info from media; haven't heard the other side of the story.	May slowly change their position and frequently consent to immunization at a later date.
Well-read and open-minded	Aware of anti-immunization info and have done reading on the subject. Need help prioritizing each argument and pointing out false logic.	Need to be prepared for discussion with client, but often ultimately agree to immunize. May start with certain antigens and agree to others over time.
Convinced and content	Convinced that immunization is bad and content with decision not to immunize. In your office because someone has "badgered" them to discuss it with their physician.	Success is unusual, but discussion may lead them to re-examine their position in the future. Extensive discussion is seldom productive.
Committed and missionary	Staunch anti-immunization position. At your office to convince you to stop immunization of all patients.	Patients in this category have strongly held beliefs and do not appreciate the value of immunization; extensive discussion is non-productive.

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Immunization concerns: Discussion tips (continued)

2. Recognize Legitimate Concerns

- Acknowledge that adverse events can be associated with vaccines, and that concerns are legitimate.
- Emphasize that most adverse-events are mild and self-limiting (e.g. soreness at injection site). Discuss the less common, more severe adverse-events and stress that most have no lasting effect (e.g. febrile seizure). Do not ignore the rare severe adverse-events such as anaphylaxis.

3. Provide Context

- Provide parents with the comparative risks associated with the vaccine and with the disease. (e.g. The risk of a severe adverse-event is similar to that of dying from being struck by lightening or a tornado).
- Discuss the likelihood of becoming infected in the absence of immunization.
- Review what has happened in countries where immunization rates have fallen and vaccine preventable diseases have re-emerged.

4. Refute Misinformation

- Know the claims made by anti-immunization groups. Be able to clarify fallacies.
- Visit anti-immunization websites and examine the tactics they use.
- Research parents' specific issues. Provide information from reputable sources.

5. Provide Valid Information

- Respond to incorrect information and provide reliable data on elimination of disease, decreased mortality, and the effects of an interrupted vaccine program. Don't be defensive.
- Offer parents the handout from Public Health that lists valid references and internet sites.

6. Recognize That Immunization Is the Parents' Decision

- Immunization is not compulsory, but logic may convince parents to immunize.

7. Educate About Potential Consequences

- Ensure parents understand the consequences of contracting the disease and related risks. They are often concerned about vaccination risks and ignore the risk of not immunizing.

8. Make a Clear Recommendation

- Make clear your opinion and any recommendations.

Source:

Halperin, Scott A. "How to Manage Parents Unsure About Immunization." *Canadian Journal of CME* Vol. 12, No. 1 (January 2000), pp.62-75.

How vaccines work

The Immune System

Every day, the body is bombarded with bacteria, viruses, and other antigens. When a person is infected with a disease-causing antigen, the immune system defends against it. In the process, the body produces substances known as antibodies against that specific antigen. The antibodies eliminate the antigen from the body. The next time the person encounters the antigen, the circulating antibodies quickly recognize and eliminate it before signs of disease develop. This is immunity.

1. Passive Immunity

- Usually lasts only a few weeks or months.
- Often provides effective protection for the short term.

Examples of passive immunity are:

- Immunity infants receive from their mothers during the last two months of pregnancy when antibodies are transferred across the placenta from mother to child.
- Injection of blood products such as immunoglobulins used for post-exposure prophylaxis for several diseases including hepatitis A and B, rabies, tetanus and varicella.

Note: Breastfeeding has numerous benefits for infants and is known to enhance the immune response to certain vaccines. It does not provide complete protection against specific vaccine preventable disease.

2. Active Immunity

- Usually lasts for many years, often for a lifetime.
- The immune system is stimulated to produce antigen-specific humoral (antibodies) and cellular immunity.

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How vaccines work (continued)

Active immunity can be achieved in two ways:

Natural Disease	Vaccine-Induced
Bacteria or virus is acquired naturally from the environment	Bacteria or virus is inserted into the body via vaccine serum
The germ or invader is live and active and reproducing	The invading germ from a vaccine may be live, inactivated, or contain only part of the bacteria or virus
The individual may or may not become sick from the invader depending on how well the body's immune system responds	The vaccinated person cannot become sick unless a live vaccine such as MMR or varicella is given, in which case they could possibly experience a much milder form of the disease post-vaccination.

Vaccines interact with the immune system to produce a response similar to one produced by natural infection—but without the risks or potential complications of the disease.

Two Types of Vaccines:

The more similar the vaccine and the reaction are to the natural disease, the more effective the immune response will be.

Live Attenuated

- Produced in a laboratory by modifying a disease-producing bacteria or virus.
- Able to replicate and produce immunity, but usually does not cause illness, e.g. MMR, yellow fever, and varicella vaccines.

Inactivated

- Inactivated vaccines are composed of either whole bacteria or viruses, or a fraction of either with a protein or polysaccharide base.
- Protein-based vaccines contain toxoids (inactivated bacterial toxins) such as tetanus.
- Polysaccharide-based vaccines are composed of pure cell-wall from a bacteria.
- Conjugate polysaccharide vaccines (chemically linked to a protein) are more potent.

Sources:

Atkinson, W., et al. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. Washington D.C.: Public Health Foundation, 2006.
Lars, A. Hanson. *Immunobiology of Human Milk: How Breastfeeding Protects Babies*. 2004. pp.139

Multiple and combination immunizations – Are they safe?

Many parents worry that it is not safe to give so many injections at once or that multiple vaccines will overwhelm the immune system.

Scientific data shows that multiple and combination vaccinations have no adverse effect on the normal childhood immune system.

Vaccines use only a small part of immune system capabilities to protect children during the vulnerable early months of their lives.

From before birth, an infant's immune system can recognize and respond to hundreds of thousands of different organisms. Newborn babies may be temporarily immune to some diseases because they have antibodies from their mothers. However, this immunity lasts only a short time and there are many diseases for which maternal immunity is not provided. Unimmunized children may be unable to fight effectively against diseases to which they are exposed.

Multiple Vaccines:

Extensive testing ensures that only vaccines that are safe and effective when given together are administered at the same time.

Studies show that vaccines are as effective in combination as they are individually, and that combinations have no greater risk for side effects. Children may receive several vaccines separately or in combination doses during the same clinic visit. Examples of combination vaccines currently in use in Canada are: MMR (measles, mumps and rubella) and Pentacel (tetanus, diphtheria, acellular pertussis, inactivated polio and haemophilus influenzae type b).

Combination Vaccines:

Combination vaccines are helpful and practical.

When children receive several vaccines at one time, they are protected earlier against many diseases. Combination vaccines:

- reduce the number of clinic visits needed
- decrease the number of injections given
- minimize exposure to preservatives in vaccines
- reduce discomfort and anxiety experienced by children and their parents
- decrease the potential for schedule errors or omissions.

Sources:

Canada. Health Canada. *Canadian Immunization Guide*. Ottawa: Ontario Medical Association, 2002.

Offit P., et al. "Addressing Parents' Concerns: Do Vaccines Weaken or Overwhelm the Infant's Immune System? *Pediatrics*. Vol. 109 (2002), pp.124-129.

Thimerosal and mercury

What is thimerosal?

Thimerosal is a very effective preservative used in vaccines. It is found in certain multi-dose vials of vaccines in order to:

- prevent the growth of bacteria and fungi, and
- stabilize the vaccine so that it remains effective over time.

Thimerosal contains about 49% of a type of mercury called ethyl mercury.

What is ethyl mercury?

Mercury is a metal that occurs naturally in the earth's crust, air, soil, and water. Two types of mercury–ethyl and methyl–are processed differently in the human body. Ethyl mercury is broken down and excreted much more rapidly than methyl mercury. Therefore, it is much less likely than methyl mercury to accumulate in the body and cause harm.

Is thimerosal in all vaccines?

No. Most vaccines used in Ontario do not contain thimerosal. Since 1994, all routine childhood vaccines have not contained thimerosal. It is not added to single-dose vaccines.

The exceptions are the **influenza** and **hepatitis B** vaccines that are marketed in multi-dose vials.

How much thimerosal is added to multi-dose vaccines?

Vaccines for influenza and hepatitis B contain trace amounts of thimerosal – up to 25 micrograms per adult dose. (A microgram is one millionth of a gram).

Can thimerosal in vaccines cause neuro-developmental problems or brain damage?

No. The best available scientific studies show there is no link between the minute quantities of thimerosal in vaccines and neuro-developmental diseases or brain damage.

Recently the National Advisory Committee on Immunization (NACI) reviewed the scientific evidence on the use of vaccines containing thimerosal. NACI is Canada's national committee of recognized experts in the fields of paediatrics, infectious diseases, immunology, medical microbiology, internal medicine, and public health, and provides evidence-based recommendations on immunization and vaccines.

International Scientific Conclusion

NACI concluded that there is no legitimate safety concern that warrants avoiding the use of thimerosal-containing vaccines. This opinion is shared by international bodies such as the World Health Organization, the U.S. Food and Drug Administration, and the Institute of Medicine in the U.S.

Sources:

Centers for Disease Control and Prevention. *Mercury & Thimerosal*. www.cdc.gov/nip/vacsafe/concerns/thimerosal/faqs-mercury.htm

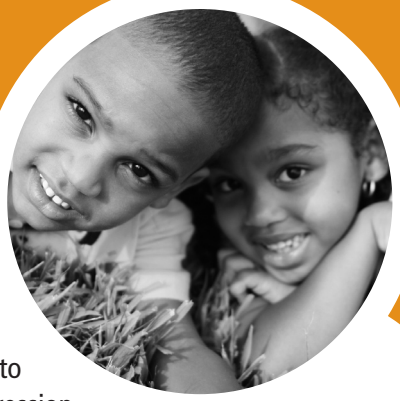
National Advisory Committee on Immunization (NACI). Statement on Thimerosal. CCDR 2003:29(ACS-1):1-10.

National Advisory Committee on Immunization (NACI). *Updated Recommendations on the use of thimerosal-containing vaccines in Canada*. CCDR 2005:31(ACS-12):1-4.

Offit, Paul A and R.K. Jew. "Addressing Parents' Concerns: Do Vaccines Contain Harmful Preservatives, Adjuvants, Additives, or Residuals?" *Pediatrics* Vol. 112, No. 6 (2003), pp. 1394-1401.

Vaccine Education Center. The Children's Hospital of Philadelphia. *Q&A Thimerosal: What You Should Know.* Philadelphia: Spring 2006.

MMR vaccine and autism



Why is there concern about the MMR vaccine causing autism?

In 1998, a study was published by Dr. Andrew Wakefield and his colleagues in England. The researchers had reviewed reports of children with bowel disease and regressive developmental disorders, mostly autism. The study suggested that MMR vaccination led to intestinal abnormalities, resulting in impaired intestinal function and developmental regression.

This hypothesis was based on only 12 children and had many limitations. Ten of the thirteen authors of the Wakefield study later retracted the findings, stating that data were insufficient to establish a causal link between MMR vaccine and autism. As a result of publicity though, parents were left with the impression that there was a link.

Parents of an autistic child typically start to notice the signs when their child is one to two years old. Since both MMR doses are given at this age, it is easy to understand why some parents suspect a link.

Does the MMR vaccine cause autism?

The vast majority of medical and scientific evidence now strongly refutes a link between MMR vaccine and developmental disorders such as autism.

Current research is now focusing on a genetic link to autism.

MMR Vaccine Facts

- The MMR vaccine protects against three different diseases (measles, mumps, and rubella) in one shot. It is given twice during childhood to provide lifelong protection, with the first dose given on or after the first birthday.
- MMR vaccine has been around for nearly 30 years, is used in over 100 countries, and more than 500 million doses have been given.
- Measles alone caused over a million deaths in children around the world last year, mainly in countries without widespread immunization programs.
- Studies from around the world have shown MMR vaccine to be a highly effective vaccine, with an excellent safety record.

Sources:

Fitzpatrick, Michael. *MMR and Autism: What Parents Need to Know*. England: Routledge, 2004.

Immunization Action Coalition. (n.d.). *Vaccines and Autism*. Retrieved January 16, 2007, from http://www.immunize.org/catg.d/p2065.htm.

Institute of Medicine. (n.d.). *Frequently Asked Questions*. Retrieved January 15, 2007, from http://www.iom.edu.

Autism Society of Canada. http://www.autismsocietycanada.ca/index_e.html

Vaccine development and licensing in Canada

The requirements for licensing vaccines in Canada are held to the highest standard of safety. Access to vaccines in Canada is a process that involves many steps to ensure safety to the public:

- Health Canada is authorized by the Food and Drug Act and Regulations to regulate the safety, efficacy and quality of vaccines in Canada.
- Health Canada's Health Products and Food Branch are responsible for the review process of any new vaccine sold in Canada.
- This process is on a spectrum from Pre-Market to Post-Market and involves the following steps:

- The Biologics and Genetic Therapies Directorate (BGTD) of Health Canada regulate vaccines used in Canada.
- The BGTD follows an approval process for vaccines with three main steps; Production, Safety & Potency.
- A vaccine can only be considered for approval once sufficient scientific evidence has been collected to show that it is safe, effective and of suitable quality.

The Precautionary Principle

In response to a growing anti-immunization movement, regulatory authorities now operate under the Precautionary Principle. This principle strives to eliminate all risks – real or perceived.

> *The precautionary principle essentially states that where there is uncertainty as to the existence or extent of risks to human health, the (regulatory) institutions may take protective measures without having to wait until the reality and seriousness of those risks become apparent.*

An example of this is the removal of thimerosal from vaccines. In order to increase parental confidence, thimerosal was removed from single-dose vaccines, even though scientific data indicated that this policy change was unnecessary. The irony, of course, is that this change of attitude is occurring at a time when vaccines have never been safer, given the stringent regulatory demands and compliance involved in vaccine manufacturing.

Sources:

Canada. Public Health Agency of Canada. *Misconceptions About Vaccines and Facts*. Ottawa: Internet, December 8, 2006.

Canada. Health Canada. *Biologics, Radiopharmaceuticals and Genetic Therapies*. Ottawa, 2006.

Gold, Ronald. *Your Child's Best Shot. A Parent's Guide to Vaccination*. Canadian Paediatric Society, 2006, pp. 13-18.

Health Canada. Health Products and Food Branch. *Access to Therapeutic Products. The Regulatory Process in Canada*. Ottawa, 2006.

Quadros, Cira A. *Vaccines. Preventing Disease Protecting Health*. Pan American Health Organization, 2004.

Reporting and monitoring adverse events following immunization

Healthcare Professionals in Ontario have a duty to report Adverse Vaccine Reactions as per the Health Promotion and Protection Act, Section 38 (3):

"A physician, a member of the College of Nurses of Ontario or a member of the Ontario College of Pharmacists who, while providing professional services to a person, recognizes the presence of a reportable event and forms the opinion that it may be related to the administration of an immunizing agent shall, within seven days after recognizing the reportable event, report thereon to the medical officer of health of the health unit where the professional services are provided. R.S.O. 1990, c. H.7, s. 38 (3); 1998, c. 18, Sched. G, s. 55 (4)."

Process of Reporting of Adverse Events Following Immunization (AEFI)

Adverse Event Following Immunization	Local Public Health Office	Provincial/Territorial Health Department	Public Health Agency of Canada (PHAC) entry into the Canadian Adverse Events Following Immunization Surveillance System (CAEFISS) database

Post-Marketing Surveillance of Vaccines

In Canada there are advanced systems in place to monitor Adverse Events Following Immunization (AEFI).

- There is active surveillance by The Advisory Committee of Causality Assessment which is responsible to review all cases of serious Adverse Events resulting in hospitalization, permanent damage or death that occur following vaccination.
- Investigative surveillance is maintained by the Immunization Monitoring Program-ACTive (IMPACT) which actively reviews hospital admissions due to reactions to vaccine administration.
- There is a national system for reporting adverse events following immunization that is maintained by The Canadian Adverse Events Following Immunization Surveillance System database.

In the past 10 years, infants have received a higher number and complexity of vaccines. Yet the number of AEFI reports has declined. The removal of the whole cell pertussis vaccine and introduction of acellular pertussis vaccine in 1997 revealed a marked drop in AEFI reports for children with fever 39 degrees Celcius or greater and screaming/persistent crying. Data collection by IMPACT has also confirmed that severe neurological illness occurring after vaccination is extremely rare.

The Federal government is responsible for pulling from the market any lot of vaccine that is reported as having serious adverse events.

Sources:

Canada. Public Health Agency of Canada. *Canadian National Report on Immunization*. Ottawa: November 2006.

Canada. Public Health Agency of Canada. Vaccine Safety. Misconceptions about Vaccines and Facts. Retrieved from Internet, 2006-12-21.

Canada. Public Health Agency of Canada. *Vaccine Safety Canadian Adverse Events following Immunization Surveillance System*. Retrieved from Internet, 2005-10-19.

Gold, Ronald. *Your Child's Best Shot. A Parent's Guide to Vaccination*. Canadian Paediatric Society, 2006, pp. 13-18.

Alternatives to vaccines

Some natural or homeopathic treatments claim to be alternatives to vaccines.

- Herbs, vitamins, or other natural substances can boost the immune system. But they do not protect people from a specific bacteria or virus. A person must have been naturally infected or vaccinated with that specific disease in order to be protected.
- **Vaccines undergo extensive testing to determine their efficacy and side effects. They are bound to the laws of scientific approach. But many alternative immunizations are used without being tested and follow no production guidelines.**
- Vaccines are monitored for their concentration and strength. But natural alternatives, such as nosodes, can be a different strength every time they are prepared.
- While testimonies from users of alternatives to vaccines are valuable, a decision should not be based solely on their claims. Instead, these claims should be used as a starting point for further research.
- Although some chiropractors and homeopathic physicians are against vaccination, the policy of the Faculty of Homeopathy at the Royal London Homeopathic Hospital is as follows: "Where there is no medical contraindication, immunization should be carried out in the normal way using conventional tested and approved vaccines." The Canadian College of Chiropractic also recommends that all children should receive routine immunization.

  In 2004, the College of Chiropractors of Ontario established a Standard of Practice in relation to immunization: "Chiropractors may not, in their professional capacity, express views about immunization/vaccination as it is outside their scope of practice."

Help parents make an educated decision

If parents decide against using science-based vaccines, they must understand that alternatives may not be safe or effective.

Sources:

Neustaedter, R. , and OMD, Lac. "Risks and Benefits for Children and Adults." *The Vaccine Guide*.

Smith, G. 1997. *Common Questions about Science and "Alternative" Health Methods*. Retrieved Jan 9, 2007 from http://www.quackwatch.org/.

Gold, Ronald. *Your Child's Best Shot. A Parents' Guide to Vaccination*. Canadian Paediatric Society, 2006 pp. 316-317.

Recommended websites

Many parents go to the Internet looking for up-to-date information about immunization. Although trustworthy immunization information is available on Internet sites, parents need to know that:

- Anyone can create a website.
- Information may not be scientifically valid.
- It's important to check with a reliable source.

How to Evaluate Information

Check the website's ownership, purpose, authors, and organizations that support it.

If the website address ends in .edu, it is a school, college or university. Some other common endings are:

.gc.ca	Canadian government	**.ca**	Canadian-based sites
.gov	U.S. government	**.org**	non-profit organizations
.int	international organizations	**.com**	commercial sites

Check that information is based on sound scientific study. A trustworthy website will clearly state the name of an author whose work appears on the site and will provide information based on sound scientific research, not on opinion. References and links should be provided to support statements.

Questions to consider:

- Does the website claim seem too good– or too bad– to be true? If so, it likely is.
- Are the claims based on the idea of a conspiracy? Does the website say it has discovered "the hidden truth" about vaccines? If so, avoid it.
- Is the information based on emotion rather than scientific fact? Stories about children who became sick or died are difficult to read objectively. Be aware that there is no substitute for scientific study in assessing the causes of illness and death.

Adapted from the Canadian Coalition for Immunization Awareness and Promotion, **www.immunize.cpha.ca**

Recommended Websites

www.immunize.cpha.ca Coalition for Immunization Awareness and Promotion

www.caringforkids.cps.ca Canadian Paediatric Society

www.phac-aspc.gc.ca Public Health Agency of Canada

www.cdc.gov Centers for Disease Control and Prevention (U.S.)

www.immunizationinfo.org National Network for Immunization Information (U.S.)

www.immunize.org Immunization Action Coalition (U.S.)

www.chop.edu The Children's Hospital of Philadelphia (U.S.)

www.who.int/vaccines World Health Organization

Common vaccine components

Below is a list of common vaccine components. Parents should be reassured:

- the amounts are extremely small (usually measured in micrograms, one-millionth of a gram), and
- every batch of vaccine is tested for safety and quality in Canada before it is released for public use.

To find out what components are in specific vaccines and their amounts, please refer to the vaccine product monograph.

Vaccine Components	Function
Preservatives	Prevent bacterial or fungal contamination (e.g. phenol, 2-phenoxyethanol, thimerosal [refer to section on **thimerosal and mercury**]).
Adjuvants	Stimulate production of antibodies to fight off diseases and aid other vaccine components in their action. For example, adjuvants may be added to help promote an earlier response, more potent response, or more persistent immune response to disease (e.g. aluminum salts, aluminum hydroxide, aluminum phosphate, potassium aluminum sulphate [alum]).
Additives	Stabilize vaccine from adverse conditions such as freeze-drying, heat, light, acidity, and humidity. Help prevent immunogens from adhering to the side of the vial (e.g. sugars [sucrose, lactose], amino acids [glycine, monosodium salt of glutamic acid], and proteins [gelatin or human serum albumin]).
Inactivating Agents	Separate a pathogen's immunogenicity from its virulence by eliminating the harmful effects of bacterial toxins or removing the ability of the virus to replicate (e.g. formaldehyde, beta-propiolactone, glutaraldehyde).
Antibiotics	Prevent bacterial contamination during manufacturing process (e.g. neomycin, streptomycin, polymixin B, chlortetracycline, amphotericin B).
Cellular Residuals	**Egg Proteins** – residual amounts found in vaccines made in egg (influenza, yellow fever vaccine) or propagated in chick embryos (MMR vaccines). **Yeast Proteins** – residual amounts found in hepatitis B vaccines which are made by transfecting baker's yeast cells with the gene that encodes the hepatitis B surface antigen.

Source:

Offit, P.A., and R.K. Jew, "Addressing Parents' Concerns: Do Vaccines Contain Harmful Preservatives, Adjuvants, Additives or Residuals?" *Pediatrics*, Vol. 112, No. 6 (December 2003). pp. 1394-1401

Comparison of effects of diseases and vaccines

Disease	Cases in Canada in Peak Year, Before Routine Immunization	Cases in 2004	Effects of Disease	Side Effects of Vaccine
Diphtheria	9000	1	5-10% case fatality rate Toxin may lead to myocardial and neurological complications	DTap vaccine – about 20% have local discomfort or inflammation, 5% have fever. A transient nodule may develop at the injection site, lasting a few weeks. Up to 70% at the 4-6yr booster develops redness and swelling.
Tetanus	Average 40-50 deaths/ yr.	3	10% case fatality rate Risk is greatest for very young or old	See DTap vaccine side effects above. Local erythema and swelling not uncommon with adult boosters, and increasing with age. Peripheral neuropathies rarely reported.
Pertussis (Whooping Cough)	25,000	3120	About 1% case fatality in children under six months, from pneumonia or fatal encephalopathy (usually hypoxic) Several deaths still occur every year, particularly in unimmunized infants	See DTap vaccine side effects above. Rate of reaction to acellular pertussis vaccine is less than with whole cell.
Polio	20,000	0	1% of infections have clinical symptoms 1 in 20 of those hospitalized die 50% of survivors remain paralysed	IPV is now routinely used in Canada, so vaccine-associated polio is no longer a risk (although rare with OPV). Local discomfort or inflammation in 5% of recipients. See side effects of DTap for combination use.
Haemophilus influenzae b (Hib)	2000	81	5% case fatality from meningitis 10-15% of survivors have permanent neurologic sequelae 15-20% of survivors have deafness	5% have discomfort or local inflammation, 2% have fever
Measles	300,000-400,000	8	10% of cases have complications such as broncho-pneumonia and otitis media 1/1,000 cases develop encephalitis of these 10% are fatal, 25% suffer permanent sequelae 1/25,000 develops Subacute Sclerosing Panencephalitis (SSPE)	5-10% have discomfort, local inflammation or fever with or without a non-infectious rash 1/1 million recipients develop encephalitis About 1/24,000 develop transient thrombocytopenia
Mumps	30,000	16	1/200 cases develop encephalitis 20-30% of cases that occur in post-pubertal males develop orchitis 5% of cases that occur in females develop oophoritis	Fever and mild skin rash occasionally occurs 1% of recipients may develop parotitis 1 in 3 million recipients may develop aseptic meningitis
Rubella	69,000	10	50% develop a rash and adenopathy 50% of adolescents and adults have acute arthralgias or arthritis 1/6,000 cases develop an encephalopathy Infections in the first 10 weeks of pregnancy have an 85% risk of congenital rubella syndrome (deafness, cataracts, neurological deficits)	About 10% have discomfort, local inflammation or fever About 5% have swollen glands, stiff neck or joint pains About 1% develop a non-infectious rash Transient arthralgias or arthritis may occur, more in post-pubertal females

Sources:

Canadian Immunization Guide, Public Health Agency of Canada, 2006. Adapted and reproduced with the permission of the Minister of Public Works and Government Services Canada, 2007.

Canadian National Report on Immunization, 1996, Volume:23S4-May 1997, Public Health Agency of Canada

Canadian National Report on Immunization, 2006, Volume:32S3-November 2006, Public Health Agency of Canada