Immunization in adolescents

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Introduction

In recent years, there has been many modifications to the vaccination schedule. For the adolescent, the schedule has been modified in many countries to include universal immunization against hepatitis B and varicella. Because of the problems of vaccine-related cases of poliomyelitis, many countries have discontinued using the live oral poliomyelitis vaccine (OPV) and are now recommending the use of the enhanced inactivated poliomyelitis vaccine (IPV). Hepatitis A vaccine has become available for travellers and other individuals at risk of contracting hepatitis A. In the near future, it is probable that acellular pertussis vaccine will be recommended in adolescents to gain a better control on pertussis in countries where the disease is endemic.

It is a better knowledge of the epidemiology of vaccine-preventable infectious diseases and the desire not only to control but eradicate some infections, that impels public health and infectious diseases authorities to publish new recommendations for immunization of children and adolescents as well. There are newer formulations of vaccines which have fewer side effects or improved clinical efficacy that will replace older vaccines. Therefore, one must find the appropriate place for these vaccines in an already complex immunization schedule.

Table 1 shows the different vaccination schedules for North America, WHO and Europe. Each of the immunization calendars is adapted according to local epidemiology of various infectious diseases. However, vaccination schedules can be adapted to individual circumstances. Table 2 shows the major differences between the immunization schedules of the different provinces and territories of Canada. One must also note that all vaccines are not available in all countries and that the recommendations of use may vary from one country to the other. In the following article, we will discuss the modifications to the immunization schedules, the newer vaccines which have become available and the vaccines which may become available soon. The 5th Edition of the Canadian Immunization Guide will be published in 1998, and should incorporate many more changes to the immunization schedule. However, schedules may still vary according to each province and territory.

Immunization in adolescents

Many American studies report that only 10 to 30% of adolescents coming from a low income family are up to date in their vaccination. Adolescents are a group which has few contacts with the medical system. Approximately 30% of American children from 10 to 18 years of age do not have any contact with a physician in any one year period. Only a small proportion (< 10%) of medical visits concern prevention.

In Canada, the national estimates of vaccination coverage (5 doses of DPT, 4 polio, 2 measles, 1 mumps and rubella and 1 dose for *Haemophilus influenzae* type b) for seven year old children in 1997 were: diphteria (78.7%), pertussis (74.9%), tetanus (76.8%), polio (85.1%), measles – 2 doses (55.9%), mumps (96.7%), rubella (97.2%) and *H. influenzae* type b (86.2%). If we take less strict criteria such as 4 doses of DPT, 3 doses of polio and 1 dose of MMR, the percentages of adequate immunization rates range from 90 to 98%.

Every contact with an adolescent or pre-adolescent is a privileged time to evaluate their health status, to discuss prevention issues, and to evaluate their immunization status. The vaccination schedule for an unvaccinated adolescent is shown in Table 3. The acceptable proof of immunity against measles, mumps and rubella (according to US recommendations of 1998) is shown in Table 5. There are discrepancies between the

American and Canadian recommendations. In Canada, all individuals born before 1970 are considered immune to measles, mumps and rubella, whereas in the US all individuals born before 1957 are considered immune. The immunization of an adolescent is considered adequate if he has received 4 doses of diphteria, tetanus and poliomyelitis vaccines and at least two doses against measles and one dose against rubella and mumps. Depending on the country, the immunization schedule can also include vaccination against hepatitis B and varicella.

Vaccines against diphteria, pertussis and tetanus

The DPT vaccine is not recommended for adolescent because of a higher incidence of adverse events associated with the use of the pertussis component. Td is therefore recommended in children older than 7 years of age. This vaccine contains less diphteria and tetanus anatoxins and has a lower incidence of side effects. It is important to verify that children and adolescents have an adequate immunization against tetanus and diphteria and that they are given their booster dose at 14-16 years of age. The immunization schedule for tetanus prophylaxis after sustaining a laceration or puncture wound is shown in Table 4.

Acellular vaccine against pertussis has been available in Japan since 1981, and has been recommended in the United States since 1992. In Canada, acellular pertussis vaccines are now recommended for initial vaccination and booster doses and are preferred over the old (cellular) vaccine. However, these vaccines are not approved for use in children over 7 years of age. Acellular vaccines contain from two to five antigens of *Bordetella pertussis* and have the major advantage of causing much fewer side effects than the older whole cell pertussis vaccine (which consist of killed *B. pertussis*). World-wide, there are more than 10 different acellular pertussis vaccines available which differ from each other by the antigens included in the vaccine. Even if we do not know which antigen component of the *B. pertussis* induces a durable protection against the disease, the efficacy of the acellular pertussis vaccines appears to be equivalent if not better than that of the older vaccines.
Because adolescents and school-age children represent an important reservoir of *B. pertussis*, the disease could be better controlled by vaccinating these individuals. There is a loss of immunity with time after vaccination against pertussis. Studies have shown that 10 years after vaccination, only 25% of subjects still have detectable serum antibodies. In adolescents and adults, some studies have shown that the acellular pertussis vaccines are safe and immunogenic. To break the transmission of pertussis to young children, it is possible that in the future that the dPaT (diphteria, acellular pertussis, tetanus) vaccine would be recommended every 10 years (or at least one dose at adolescence). This approach has not yet been approved or recommended.

Vaccine against measles

Measles is one of the vaccine-preventable diseases which is very contagious and responsible for 1,4 million deaths per year (WHO), which is three deaths per minute world-wide. Since 1984, there has been an increase in the number of cases in North America with epidemics in 1989 and 1995 in Canada. During the 1989 epidemic in Quebec, a study conducted at Sainte-Justine Hospital in Montreal demonstrated that out of the 484 cases of measles seen, 15% were infants less than 12 months old, 31% less than 2 years old, while 37% were over 10 years of age. Approximately one third of the cases were not immunized, whereas 67% of adolescents older than 10 years of age had a proof of confirmed vaccination and 22% said they had been vaccinated. Following these epidemics, many questions about the efficacy of the vaccine were raised. Approximately 95% of children immunized between the ages of 12 and 15 months develop antibodies

following vaccination. Epidemics can occur because of the presence of the 5% of non responders to the vaccine as well as the pool of non immunized individuals. When non responders are re-immunized, more than 90% of these individuals will produce antibodies. On the other hand, 3 to 5% of individuals lose their antibodies over a 10 to 15 year period after immunization.

A two-dose immunization schedule will allow a second chance to vaccinate those who had not been previously vaccinated and confer protection for the majority of those with a primary vaccine failure resulting in a net increase in the global proportion of the population which is immune to the disease. More than 99% of individuals who have received two doses of measles vaccine will have protective antibodies. The optimal timing for the booster dose of MMR has not been evaluated in a prospective, controlled trial. Some countries will recommend the second dose at 18 months, others at 4 to 6 years of age, and others still at 11 to 12 years of age. In Canada, there are differences between the provinces and territories (Table 2).

It is important to remember that the use of blood products may decrease the immune response to measles and MMR vaccine. Therefore one must respect the minimum intervals between the administration of these products and measles vaccination (Table 6) to ensure an adequate immune response.

In 1996, there were new recommendations concerning egg allergy and MMR vaccine. Egg allergy (even the anaphylactic type) is no longer considered a contra-indication to MMR vaccine. Skin tests are no longer recommended and egg containing vaccines can be administered to these individuals. However, vaccination should be performed in an adequate setting where an anaphylactic reaction can be treated and patients should be kept under observation for a minimum of 30 minutes after immunization. Measles and MMR vaccines are contra-indicated in individuals who have had an anaphylactic reaction to these vaccines in the past.

Vaccines against rubella and mumps

Despite the introduction of these vaccines more than 20 years ago, episodic cases of rubella and mumps still occur. Rubella is generally a benign illness that often is not recognized. The major complication of this disease is the congenital rubella syndrome. When evaluating an adolescent girl, it is imperative to assess her immunization status and vaccinate her if needed. It is also important to immunize women who are post-partum or post-abortion and found to be non immune to rubella. MMR vaccine is the preferred vaccine because many women who are not immune to rubella are also not immune to measles. Also the recommended time interval after which a woman can become pregnant after rubella vaccine has been decreased to one month in Canada (but is still 3 months in the US).

Vaccines against poliomyelitis

With the introduction of the killed polio vaccine (IPV) in 1955 and live polio vaccine in 1962 (OPV), poliomyelitis has disappeared from the Americas. No cases of wild strain poliomyelitis has been reported in the US from more than 10 years and the last reported case in the American continent was reported in Peru in 1991. In developed countries, the majority and often all cases of poliomyelitis are secondary to immunization. Most cases of vaccine-associated poliomyelitis occur after the first dose of the vaccine. The risk to develop a paralytic poliomyelitis in children after the first dose of OPV is estimated to be 1/1.4 million doses and 1/1.9 million doses in the contacts.

Live polio vaccine has the advantage to induce a local immunity and has a long duration of protection. However, an enhanced killed polio vaccine has become available in recent years. This vaccine confers a good immunity but necessitates booster doses every 10 years (including one at 14-16 years of age). In non immunized adolescents, it is preferable to use IPV, because the risk of developing a vaccine associated paralytic poliomyelitis is increased in this age group and in adults. Because the majority of cases of poliomyelitis are now associated with the vaccine, all provinces recommend immunization with IPV. In the United States, there are three recommended immunization schedules for polio: 2 doses of IPV followed by 2 doses of OPV, 4 doses of OPV or 4 doses of IPV. The mixed immunization schedule (2 doses of IPV followed by 2 doses of IPV) would have the theoretical advantage of preventing over half of vaccine-associated poliomyelitis, while keeping the advantages of OPV (intestinal immunity and group immunity). In Canada, only IPV is recommended for immunization against poliomyelitis.

Vaccines against hepatitis B

Despite the introduction of vaccination program against hepatitis B for high risk groups during the 1980's, the incidence of the disease has continued to increase. Among the individuals at risk, there are the infants born of a HBsAg positive mother and the 15 to 35 year-old age group. Hepatitis B virus is transmitted by exposure to blood and biologic fluids. Unprotected sexual contacts (homosexual and heterosexual) and intravenous drug abuse are the most frequent modes of acquisition among adolescents. Much less frequently, the infection can be transmitted by close contact with infected biologic fluids.

To gain better control of hepatitis B virus infections, public health and infectious disease authorities have recommended universal immunization against hepatitis B. Depending on the country, vaccination programs have been established either in the neonatal period or in pre-adolescence (before the individual develops high-risk behavior). Ideally, all pre-adolescent and all adolescents should be immunized. In Quebec province, all adolescents less than 18 years of age can be vaccinated free of charge upon request; the presence of a risk factor is not necessary. For adolescents with high risk behavior it might be preferable to perform hepatitis B serology before immunization. Table 7 shows the different groups at risk who can obtain the hepatitis B vaccine free of charge in Quebec province.

If programs of universal vaccination are not available or are not extensive, the adolescent with the following risk factors should be immunized first: male homosexual contacts, antecedents of sexually transmitted disease, intravenous drug abuser, prostitution and street youth. The vaccination schedule consist of three doses (Table 8). In Quebec province, the hepatitis B vaccination program includes all children in 4th grade, the high risk groups mentioned previously, and all infants born to a HBsAg positive mother. Three provinces have a universal infant vaccination program. All provinces except Manitoba have a school immunization program, but the modalities of administration may vary according to the province (Table 2).
The vaccine against hepatitis B has shown protective efficacy for at least 9 years after immunization. A booster dose is not recommended as the individuals who have had a fall of their anti-HbsAg antibodies below 10 mIU/mL after 6 to 10 years remain protected when exposed to hepatitis B. The two currently available vaccine are(Recombivax-HB® (Merk Frost) and Engerix-B®.

Vaccines against influenza

Vaccination against influenza is frequently forgotten in pediatrics and adolescent medicine. Candidates for vaccination include those at risk to develop a severe infection.

This group would include patients with chronic cardiac or pulmonary disease (including cystic fibrosis and severe asthma), those with chronic diseases such as diabetes and other metabolic disorders, cancer patients, immunodeficient patients (including HIV), those with chronic renal disease or hemoglobinopathy, and those on long term aspirin. The vaccine consists of inactivated viruses and has an estimated efficacy of 70-90% against influenza types A and B. Whole virus vaccine is not recommended in children less than 13 years of age (Table 9). For this age group, the split vaccine has fewer side effects. Influenza vaccine should be given annually at fall time.

Influenza and other respiratory viruses have been associated with exacerbations of asthma both in children and adults. Some physicians have expressed concerns that the influenza vaccine may precipitate an acute exacerbation of asthma or exacerbate the underlying pulmonary dysfunction. However, multiple studies have demonstrated that there are no associations between influenza vaccine and pulmonary deterioration. One must remember that the vaccine is administered at a time when many respiratory virus may cause pulmonary deterioration. Other studies have shown that the vaccine could be administered safely to asthmatic patients who are taking inhaled or systemic corticosteroids.

A live vaccine administered intra-nasally is currently being tested and has had interesting preliminary results. This vaccine is very immunogenic after only one dose and induces both local and systemic immunity.

Vaccines against hepatitis A

Hepatitis A is a relatively benign disease in children. Only 10% of infected children are symptomatic whereas 70-75% of adults become icteric. 10 to 15% of cases are acquired through travel in endemic areas whereas for 50% of patients no known risk factors are identified. The most important risk factor is contact with a case of hepatitis A.

Two hepatitis A vaccines are available in Canada: Havrix® and Vaqta® (Table 10). After vaccination with the Havrix® vaccine, more than 95% of vaccinees develop protective antibody titres against hepatitis A(> 20 mIU/mL). The duration of protection is at least 3 years and probably at least 10 years. For adults, vaccination consist of an initial dose of 1440 U followed 6 to 12 months later by a second dose (1440 or 720 U). For children and adolescents, the vaccination consist of an initial dose of 720 U followed 6 to 12 months later by a second dose of 720 U.

After immunization with the Vaqta® vaccine, from 97 to 100% of children and adolescents have protective antibody titres one month after a dose of 25 U. More than 95% of adults (≥ 18 years) had a seroconversion in the 4 weeks following immunization with a dose of 50 U. After a booster dose, the seroconversion and clinical protection rates were 100%. For children and adolescents, the immunization consist of an initial dose of 25 U followed 6 months later by a second dose of 720 U. For adults, vaccination consist of an initial dose of 50 U followed months later by a second dose of 50 U.

The two vaccines are based on different strains of hepatitis A viruses and their units are not comparable. It is recommended to complete the immunization using the same the vaccine given for the first dose. However, one study has shown that individuals who received the first dose with Havrix® developed protective antibodies after a booster with Vaqta® in 100% of cases.

Candidates for hepatitis A immunization include the communities or groups where hepatitis A is endemic and epidemics are recurrent, long term traveller to an endemic

area, frequent traveller to an endemic area (if the departure is imminent, administer also the immunoglobulins), hemophiliac A and B, and also the employees and residents of institutions for mentally deficient persons and patients with chronic liver diseases. Candidates with a moderate priority to receive the vaccine are those with an increased exposure to the disease: drug abusers, prisoners and male homosexuals. The exact duration of long term protection of these two vaccines is unknown, but probably very long. Presently, hepatitis A vaccines are not recommended for contacts of subjects with acute hepatitis A.

Vaccine against varicella

In the United States, it is estimated that there are approximately 4 million cases of varicella per year with 6500 hospitalizations. Adolescents of 13 years and older are at increased risk of complications. The varicella vaccine (Varivax®) has been approved in the US in March 1995, but has been used in Japan and Korea for universal immunization for more than 20 years. This vaccine is not yet available in Canada, but should be licensed here in 1999. It is a live attenuated vaccine that is administered subcutaneously. The vaccine should be kept frozen until administered. The immune response to the vaccine varies according to age. In children aged from 1 to 12 years, more than 97% develop antibodies after one dose. In adolescents from 13 to 17 years of age, the immune response is smaller with 79% of individuals developing antibodies after one dose. However, the response rate reaches 94% after two doses. Six to eight years after vaccination, 95% of individuals have persisting antibodies, but please note that these studies have been conducted in countries where wild strain of the varicella virus was still present to act as a natural booster.

In children, the vaccine offers a protection of more than 70% after a familial contact of varicella and 90% of severe cases are prevented. In general, vaccine failure result in mild disease. In vaccinated individuals, the yearly incidence of varicella is less than 1% compared to 8% in non immunized individuals. This yearly incidence of varicella among vaccinees remains stable for the first ten years after vaccination. Zoster cases have been described in immunized children and adolescents, but the incidence is similar to the one after natural disease.

Approximately 25% of immunized subjects will develop erythema and tenderness at the injection site. Other adverse events are infrequent, but 5% of children and adolescents will develop a generalized maculopapular or vesicular skin rash (but with fewer than 10 lesions) in the month following vaccination. Transmission of the vaccine strain from a healthy individual to another has not been demonstrated. In the US, universal vaccination of children and adolescents is recommended. The schedule is one dose of vaccine in children aged from 1 to 12 years and two doses at one month interval for adolescents of 13 years of age and older. Adolescents who are non immune to the disease and leukemics (after the end of their chemotherapy) represent the groups who would benefit the most from the vaccine.

Public health authorities will have to evaluate the cost/benefit ratio of empiric vaccination of adolescents with no history of varicella versus doing a serologic evaluation of all individuals with no history of the disease. One study attempted to evaluate this using theoretical data suggested that empiric vaccination is cost-effective for school-age children with no history of varicella, but would not be cost effective for adolescents as this group has more chances of having had the disease previously. Canadian and provincial policy on the use of varicella vaccine has not yet been finalized. A quadrivalent vaccine (MMR-V: mumps, measles, rubella and varicella) is being presently evaluated.

Precautions and contra-indications to vaccination

There are specific contra-indications and precautions when administering vaccines to children and adolescents (Table 11). One of the most frequent adverse events of adolescent immunization is hyperventilation crisis sometimes complicated by transient loss of consciousness. It is very important to establish a favourable climate for vaccination of adolescents, and to take the time to answer their questions and reassure them about the benefits and side effects of vaccines.

Conclusions

The field of immunization is in constant evolution. An increasing number of diseases could be prevented, but this will make the immunization schedule more complex and will increase the risks of adverse events. Prevention is still the best approach to adolescent health. It is essential not to forget to include vaccination evaluation in our contacts with them.

Recommended readings

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It is very important to establish a favourable climate for vaccination of adolescents

It is important to take time to answer question and reassure adolescents.

To gain better control authorities have recommended universal immunization against hepatitis B.

Every contact with an adolescent or pre-adolescent is a privileged time to evaluate their health status and their immunization status.

Table 1. Immunization schedules: North America, WHO and Europe

(See legend p30)

AGE	QUEBEC	UNITED STATES	WHO[1]	EUROPE
< 1 month			BCG, OPV	(BCG)
6 weeks			DTP-OPV	
2 months	DTaP-Hib-IPV	DTP-Hib, polio[2] Or DTaP-Hib, polio[2] Hepatitis B (0-2 mo)		DTP-Hib, polio
10 weeks			DTP-OPV	
14 weeks			DTP-OPV	
4 months	DTaP-Hib-IPV	DTP-Hib, polio[2] Or DTaP-Hib, polio[2] Hepatitis B (2nd dose: 1-4 mo)		DTP-Hib, polio

6 months	DTaP-Hib-IPV	DTP-Hib, polio[2] Or DTaP-Hib, polio[2] Hepatitis B 3rd dose: 6-18 mo)		DTP-Hib, polio
9 months			Measles	
12 months	MMR			
12 to 15 months		MMR Hib		MMR or MR
12 to 18 months		Varicella (1 dose)		
15 to 18 months		DTP, polio[2] Or DTaP, polio[2]		DTP-Hib, polio
18 months	DTaP-Hib-IPV MMR			
Avant 6 years				(BCG)[4]
4 to 6 years	DTaP-IPV	DTP, polio[2] Or DTaP, polio[2] and MMR[3]		DTP, polio
10 years	Hepatitis B (3 doses)			
11 to 12 years		MMR[4] Hepatitis B[8] Td[6] Varicella (1 dose)[7]		MMR or MR (BCG)[4]
14 à 16 years	Td-IPV[5]	Td[6] Varicella (2 doses)		Td (IPV)[5]
Each 10 years	Td-IPV[5]	Td		

Footnote: Table 1

Abbreviations: BCG: antituberculous vaccine; DTP: diphteria, tetanus, pertussis, DTaP: diphteria, tetanus, acellular pertussis; Td : tetanus, diphteria; Hib: *Haemophilus influenzae* type b vaccine; polio: oral polio vaccine (OPV) or inactivated polio vaccine (IPV); MR: vaccine against measles and rubella; MMR: vaccine against mumps, measles and rubella.
1: EPI schedule: WHO Expended Program on Immunization
2: Polio: OPV (oral polio live vaccine) or IPV (inactivated polio vaccine); the third dose of polio can be administered between 6 and 18 months
3: the second dose of MMR is recommended routinely at 4-6 years of age but may be administered during any visit provided at least one month has elapsed since the first dose. Those who have not previously received the second dose should complete the schedule no later than the 11- to 12-year visit
4: if a second dose was not administered previously
5: a booster shot of polio vaccine is indicated only for those vaccinated with IPV
6: the booster dose of diphteria and tetanus can be administered at 14-16 years of age or at 11-12 years at the same time as MMR

7: varicella vaccine: susceptible children may receive varicella vaccine at any visit after the first birthday, and those who lack a reliable history of chickenpox should be immunized during the 11- to 12-year-old visit (one dose of vaccine). For susceptible adolescent ≥ 13 years of age: 2 doses administered at 4-8 weeks interval
8: vaccine against hepatitis B: if not administered previously

Table 2. Immunization schedules: differences between provinces

Province/territoire	Age at Second dose of MMR	School grade of Hepatitis B vaccination
Alberta	4-6 years	5
British Colombia	18 months	6
Prince Edward Island	4-6 years	3*
Manitoba	5 years	none
New Brunswick	18 months	4*
Nova Scotia	4-6 years	4
Newfoundland	18 months	4
Northwest Territories	18 months	4*
Ontario	4-6 years	7
Quebec	18 months	4
Saskatchewan	18 months (MR vaccine)	6
Yukon	18 months	4

* There is also a program for infants vaccination.

Table 3. Immunization schedule for children > 7 years of age, or non immunized adolescents.

Immunization schedule	Vaccines		
First visit	Td	IPV	MMR
2 months after first visit	Td		IPV
12 months after second visit	Td		IPV
Booster every 10 years	Td		IPV[1]

Footnote: Table 3

Abbreviation of vaccines: Td : tetanus, diphteria; MMR: vaccine mumps, measles and rubella; IPV: inactivated polio vaccine. Vaccine against measles and mumps should be administered to all adolescents who are non immune to mumps and measles. Vaccine against rubella should be administered to all female adolescents who are non immune to rubella. Preferably, the vaccines should be administered as MMR vaccine.

Immunization against hepatitis B (3 doses) is performed in fourth grade (3 to 7 according to province) of primary school.

1: Booster of IPV recommended every 10 years in some provinces if patient was previously immunized with IPV

Table 4. Antitetanic prophylaxis for wounds and cuts

Prior vaccination against Tetanus (number of doses)	Clean minor wound		Other wounds	
	Td	**TIG**	**Td**	**TIG**
Unknown or less than 3 doses	Yes[1]	No	Yes[1]	No
Three doses or more	No[2]	No	No[3]	No

Footnote: Table 4

Abbreviations: Td : tetanus; diphtheria, TIG: tetanus hyperimmune globulins.
1: Continue vaccination (if incomplete).
2: Yes, if the last dose was given more than 10 years ago.
3: Yes, if the last dose was given more than 5 years ago

Table 5. Acceptable presumptive evidence of immunity to measles, rubella and mumps*.

Vaccin	Routine	Students at post-high school educational institutions
Measles	(1) documentation of adequate vaccination[1]: - pre-school-aged children and adults not at high risk: 1 dose - school-aged children (grades K-12): 2 doses[2], or (2) laboratory evidence of immunity, or (3) born before 1957 or, (4) documentation of physician-diagnozed measles	(1) documentation administration o 2 doses of live measles vaccine, or (2) laboratory evidence of immunity, or (3) born before 1957 or, (4) documentation of physician-diagnozed measles

Rubella	(1) documentation administration of one dose of live rubella virus vaccine[1] , or (2) laboratory evidence of immunity, or (3) born before 1957 *(except women of childbearing age who could become pregnant[3])*	(1) documentation administration o one dose of live rubella virus vaccine[1] , or (2) laboratory evidence of immunity, or (3) born before 1957 *(except wor of childbearing age who could become pregnant[3])*
Mumps	(1) documented administration of one dose of live mumps virus vaccine[1] , or (2) laboratory evidence of immunity, or (3) born before 1957, or (4) documentation of physician-diagnozed mumps	(1) documented administration of one dose of live mumps virus vaccine[1] , or (2) laboratory evidence of immunity, or (3) born before 1957, or (4) documentation of physician-diagnozed mumps

Footnote: Table 5

1: The first dose should be administered on or after the first birthday; the second dose of measles-containing vaccine should be administered no earlier than one month (i.e., minimum of 28 days) after the first dose. Combined mumps-measles-rubella (MMR) vaccine generally should be used whenever any of its components vaccines is indicated.
2: Timing may vary according to province requirements.
3: Women of childbearing age are adolescents girls and premenopausal women. Birth before 1957 is not an acceptable evidence of rubella immunity for women who could become pregnant.
*According to U.S. recommandations of 1998; in Canada, individuals born before 1970 are considered immune to measles, mumps and rubella (except for women of childbearing age for rubella.

Table 6. Recommended intervals between administration of blood products and vaccination with live measles virus.

Product	Indication	Dose	Interval (months)
Immunoglobulins	Prophylaxis against hepatitis A	0,02 mL/kg 0,06 mL/kg	3 3
	Prophylaxis against measles	0,25 mL/kg 0,5 mL/kg	5 6

Intravenous immunoglobulins	Immune deficit	160 mg/kg 320 mg/kg 640 mg/kg	7 8 9
	Idiopathic thrombocytopenic purpura (ITP)	400 mg/kg 1000 mg/kg	8 10
	Kawasaki syndrome	2 g/kg	11
	Prophylaxis against respiratory syncytial virus infections	750 mg/kg	9
Hyperimmune Immunoglobulins against Hepatitis B (HBIG)	Prophylaxis against hepatitis B	0,06 mL/kg	3
Hyperimmune Immunoglobulins against Rabies (HRIG)	Prophylaxis against rabies	20 IU/kg	4
Hyperimmune Immunoglobulins against tetanus (TIG)	Prophylaxis against tetanus	250 U	3
Hyperimmune Immunoglobulins against Chickenpox (VZIG)	Prophylaxis against chickenpox	125 U/10kg	5
Blood transfusion	Washed red blood cells	10 mL/kg	0
	Whole blood	10 mL/kg	6
	Packed red blood cells	10 mL/kg	6
	Plasma and platelets	10 mL/kg	7

Table 7. Groups of individuals who can get hepatitis B vaccine free of charge in Quebec province.

A. **Contacts of infected individuals**	
Contact of carrier or acute case of hepatitis B	
	Contact of chronic carrier or someone living in the same household

Infant of infected mother
Infant of HBsAg positive mother (acute infection of chronic carrier)

B. Families at high risk, without a known infected individual

Country where hepatitis B is endemic
All children born after January 1st 1995 for whom at least one of his parents was born in an endemic country (Cambodia, China, Hong-Kong, Indonesia, Laos, Malaysia, Mongolia, Philippines, Singapour, Taiwan, Vietnam)

Families at high risk
Child of a family with no known chronic carrier, but where there are high risk habits such as prostitution or IV drug abuse

C. High risk individuals

Male homosexual
Prostitution
IVDU (intravenous drug users)

D. Youth priority

Adolescent without known risk factors who request vaccination
Homeless, street youth (< 25 years)
Youth in custody or under Children's Aid Society
STD or multiple sexual partners (≤ 25 years)

E. Others

Down's syndrome or mental deficiency
Everyone with Down's syndrome. Every child (< 10 years) with mental deficiency who
is susceptible to come in daily contact with chronic carriers of hepatitis B.

Accidental needle stick
Everyone who has accidental needle stick exposure to blood in the community.

Sexual aggression victim

Table 8. Immunization schedule against hepatitis B*

Type of patients	Recombivax-HB*		Engerix-B*	
	Dose (ig)	(mL)	Dose (ig)	(mL)
Infants of HBsAg positive mothers	5,0	0,5	10,0	(
Children =<10 years	2,5	0,25	10,0	(
Children and adolescents of 11-19 years	5,0	0,5	10,0	(
Adults >= 20 years	10,0	1,0	20,0	1
Dialysed or immunocompromised patients	40,0	1,0	40,0	2

Footnote: Table 8

* Immunization schedule consist of 3 doses administered at time 0, 1 and 6 months. Vaccines are administered intramuscularly.
Presentation of Recombivax HB: 5 µg/0.5 mL, 10 µg/1.0 mL, 40 µg/1.0 mL, 3 mL vial (10 µg/mL)
Presentation of Engerix-B: 10 µg/0.5 mL, 20 µg/1.0 mL, 10 mL vial (20 µg/mL)

Table 9. Immunization schedule against influenza.

Age group	Type of vaccine	Dose	Number of doses
6 to 35 months	Split virus vaccine	0,25 mL	1 or 2[1]
3 to 8 months	Split virus vaccine	0,5 mL	1 or 2[1]
9 to 12 years	Split virus vaccine	0,5 mL	1
>= 13 years	Whole or split virus vaccine	0,5 mL	1
Booster	Yearly		

1: Two doses at 4 weeks interval are recommended for children less than 9 years of age, who are receiving the vaccine for the first time.

Table 10. Immunization schedules against hepatitis A.

Vaqta ® (25 U/0,5 mL and 50 U/mL)[1]

Age group	Dose (Units)	Dose (mL)	Number of doses (interval in months)
2 to 17 years	25	0,5	2 (0 , 6)
> 18 years	50	1,0	2 (0 , 6)

Havrix® (720 U/0,5 mL and 1440 U/mL)[1]

Age group	Dose (Units)	Dose (mL)	Number of doses (interval in months)
1 to 18 years	720	0,5	2 (0 , 6-12)
> 19 years	1440 (720 or 1440 for the 2nd dose)	1,0	2 (0 , 6-12)

1. The units of the two vaccines are not comparable.

Table 11. Contra-indications and precautions to vaccination.

- Contra-indications if anaphylactic reaction
  - Eggs:[1] influenza, yellow fever
  - Neomycin: DTP-polio, DTP-polio-Hib, MMR, measles, rubella, OPV, IPV
  - Polimyxin B: DTP-polio, DTP-polio-Hib, Td-polio, rubella, OPV, IPV
  - Streptomycin: Td-polio, measles, OPV, IPV
  - Thimerosal: DTP, DTP-Hib, Td, influenza
  - Aluminium phosphate: DTP, DTP-Hib, DTP-polio, DTP-polio-Hib, Td-polio, Td

- Contra-indications
  - BCG: not to be administered to a patient with immune deficiency
    DTP: age > 7 years, Guillain-Barré syndrome or brachial neuritis at prior vaccination
  - Td: Guillain-Barré syndrome or brachial neuritis at prior vaccination
  - MMR: do not administer to a patient with underlying immune deficiency[2]
  - OPV: do not administer to a patient with underlying immune deficiency or if there is a familial contact with a patient with immune deficiency
  - Varicella: do not administer to a patient with underlying immune deficiency

- Contra-indication in pregnancy
  - Mumps, measles, rubella, oral typhoid, varicella.

- Contra-indication in pregnancy except if exposition is inevitable
  - OPV, yellow fever, plague, rabies (pre-exposition)

- Precautions
  . DTP: progressive neurological disease
  . Td: Arthus phenomenon

. MMR: if patient has received blood products, there is a minimum interval of time between administration of these products and vaccination for measles (Table 6)

Abbreviations: BCG: antituberculous vaccine; DTP: diphteria, pertussis, tetanus; Td: tetanus, diphteria; Hib: *Haemophilus influenzae* type b vaccine; OPV: live oral polio vaccine, IPV: inactivated polio vaccine; MMR: vaccine against mumps, measles and rubella.
1: Egg allergy is not anymore a contra-indication to measles or MMR vaccination. Skin tests are not anymore performed before vaccination. However, the patients should be observed for 30 minutes after vaccination in an appropriate setting to treat possible anaphylactic reactions.
2: Immunization of asymptomatic HIV individual is recommended in the first two years of life. Afterwards, the decision to immunize should be individualized.