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Communicable Disease Control Manual

Chapter 2: Immunization

Part 1 - Immunization Schedules

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Vaccine Abbreviations and Vaccines

The table below provides a list of the abbreviations used in this section and the vaccines to which they refer. For information on specific vaccines and their use see Part 4 – Biological Products.

Abbreviation	Vaccine
DTaP-HB-IPV-Hib	Diphtheria and tetanus toxoids, acellular pertussis, hepatitis B, inactivated polio and *Haemophilus influenzae* type b vaccine
DTaP-IPV-Hib	Diphtheria and tetanus toxoids, acellular pertussis, inactivated polio and *Haemophilus influenzae* type b vaccine
HA	Hepatitis A vaccine
HB	Hepatitis B vaccine – available on its own or in combination format as DTaP-HB-IPV-Hib as INFANRIX hexa®
Hib	*Haemophilus influenzae* type b vaccine – available on its own or in combination format as DTaP-HB-IPV-Hib or DTaP-IPV-Hib vaccines
HPV9	Human papillomavirus vaccine (nonavalent, HPV types 6, 11, 16, 18, 31, 33, 45, 52, and 58)
Flu	Influenza vaccine
IPV	Inactivated polio vaccine – available on its own or in combination format as DTaP-HB-IPV-Hib, DTaP-IPV-Hib, Td/IPV or Tdap-IPV vaccines
Men-C-C	Meningococcal serogroup C conjugate vaccine
Men-C-ACYW-135	Meningococcal quadrivalent conjugate vaccines (serogroups A, C, Y, W-135)
MMR	Measles, mumps and rubella vaccine
MMRV	Measles, mumps, rubella and varicella vaccine
PCV13	Pneumococcal conjugate vaccine, 13-valent vaccine
PPV23	Pneumococcal polysaccharide vaccine, 23-valent
Rota	Rotavirus vaccine: monovalent (ROTARIX®) or pentavalent (RotaTeq®)
Td	Tetanus and diphtheria toxoids vaccine
Tdap	Tetanus and diphtheria toxoids and acellular pertussis vaccine
Tdap-IPV	Tetanus and diphtheria toxoids, acellular pertussis and inactivated polio vaccine
Td/IPV	Tetanus and diphtheria toxoids and inactivated polio vaccine
Var	Varicella vaccine

1. Guidelines for Immunization Schedules

Optimal response to a vaccine depends on many factors, including the nature of the vaccine and the age and immune status of the recipient.

Adhere as closely as possible to recommended vaccine schedules. Recommendations for the age at which vaccines are administered are influenced by age-specific risks for disease, age-specific risks for complications, ability of persons of a certain age to respond to the vaccine, and in infancy, potential interference with the immune response by passively transferred maternal antibody.

Recommended ages and intervals between doses of vaccines and toxoids provide optimal protection or have the best evidence of efficacy. Recommended ages and intervals may differ from those contained in the product monographs and are based on research and expert opinion.

For premature infants, chronological age based on actual birth date should be used as opposed to corrected age. There is no minimum weight for commencing immunization.

Use each client contact as an opportunity to review immunization status and administer all vaccines for which the client is eligible. Clients should also be informed of the availability of other vaccines that are recommended by the National Advisory Committee on Immunization but are not currently publicly funded.

Determine vaccine eligibility by assessing the client's:

- Age
- Health status and underlying medical conditions
- Lifestyle or occupational risk factors
- Contact with individuals at risk of vaccine preventable disease
- Local disease epidemiology.

In general, individuals who missed being immunized on the routine schedule remain eligible for indicated vaccines and these should be offered at opportune encounters with an immunization service provider. In some instances, these vaccines will no longer be indicated beyond a certain age. In other instances, the individual remains eligible for the vaccine, however the recommended product may change depending on the individual's age. See Part 4 – Biological Products for vaccine eligibility and recommended product/schedule.

The number of doses required to complete a series may be reduced for some vaccines as children age out of infancy or early childhood. When an individual presents, assess any previously received doses against the schedule for their current age and complete the series according to the schedule appropriate for their age.

Interruption of a recommended series does not require starting the series over again, regardless of the interval elapsed (with the exception of oral typhoid vaccine). A longer than recommended interval between vaccine doses does not reduce final antibody concentrations, although protection might not be attained until the recommended number of doses has been administered.

By contrast, doses given at less than the minimum interval or minimum age may result in less than optimal antibody response and should generally not be counted as part of the series.

The full recommended vaccine dose volume should be administered. The recommended dosages of biological products are derived from clinical trials and post-marketing research. Administration of amounts smaller than those recommended and administration of divided doses such as half doses given over two visits is likely to result in inadequate protection. If a partial dose has been given it should be considered invalid and a full dose given subsequently.

Exceeding the recommended dosage volume is not necessary to achieve protection and may result in an increase in adverse events, especially local reactions, due to excessive concentrations of antigens.

Certain vaccines (e.g., Td) produce increased rates of local or systemic reactions in some recipients when administered too frequently. Such reactions may be the result of the formation of antigen-antibody complexes and are not allergic reactions.

1.1 Consideration of Immunization History

A verbal history of immunization is not considered proof of immunity. When a client presents without written documentation of immunization, a thorough assessment of the reliability of the verbal immunization history as well as risk factors for vaccine preventable diseases should be undertaken. At minimum, a verbal history should include date (day/month/year) and sufficient information to identify the product administered (i.e., the generic name or product name). If the provider determines that the history is unreliable or the risk of disease acquisition is assessed to be high, the client should be considered unimmunized and should be offered immunization according to the schedule for their current age. Written documentation may include that recorded in the Child Health Passport, on the CANImmunize app, or other client-held records. A verbal history of a vaccine preventable disease is generally not sufficient proof of immunity against that disease but varies by disease and by age.

1.2 Considerations for Clients Initiating or Resuming Immunization at 7 Years of Age and Older

When developing a schedule for an unimmunized or incompletely immunized client, it is important to consider several factors including age at presentation, health status, lifestyle or occupational risk factors, local epidemiology of vaccine preventable diseases, and for children, future opportunities to participate in school-based immunization programs (grades 6 and 9). Since each situation is different, the client may be best served by developing a personalized schedule. The recommendations in subsections 2.3 and 2.4 (schedules C and D) will guide the development of the schedule for routine immunization of children, adolescents and adults, and should be used in combination with the relevant Biological Product pages (see Part 4 – Biological Products and 3.1 Minimum Intervals Between Vaccine Doses Table). For guidance in developing schedules for medically fragile clients and other special populations, see Part 2 – Immunization of Special Populations.

2. Routine Schedules

2.1 Schedule A: Basic Immunization for Children Starting Series at 2 Months of Age

The following recommendations will guide the development of the schedule for healthy children and adolescents, and should be used in combination with the relevant Biological Product pages (see Part 4 – Biological Products). Children with specific health conditions and/or risk factors should be immunized according to principles outlined in Part 2 – Immunization of Special Populations.

Age	Vaccine
2 months	DTaP-HB-IPV-Hib (or DTaP-IPV-Hib and HB) [A] PCV13 Men-C-C [B] Rota [C]
4 months	DTaP-HB-IPV-Hib (or DTaP-IPV-Hib and HB) PCV13 [D] Rota [C]
6 months	DTaP-HB-IPV-Hib (or DTaP-IPV-Hib and HB) Rota [C] HA (Aboriginal infants only) Flu [E]
On or after 1st birthday	MMR Var PCV13 Men-C-C
18 months	DTaP-IPV-Hib HA (Aboriginal infants only)
School Entry (4-6 years of age)	Tdap-IPV MMRV [F]
Grade 6	HPV9 (2 doses 6 months apart) Var (not required if 2 doses already received)
Grade 9	Men-C-ACYW-135 Tdap [G]

[A] The primary series of 3 doses of DTaP-containing vaccine should be completed with the same product.
[B] For high risk infants, Men-C-ACYW-135 (Menveo®) should be given in place of Men-C-C and administered at 2, 4 and 12 months of age
[C] Give 1st dose of rotavirus vaccine no later than 20 weeks less 1 day of age. All doses should be administered by 8 months plus 0 days. If any dose in the series is RotaTeq® or the product is unknown, a total of 3 doses of vaccine should be administered.
[D] For high risk infants, an additional dose of PCV13 should be given at 6 months of age, followed by the dose at 12 months of age. High risk children should be given a dose of PPV23 at 2 years of age or older.
[E] Annual influenza immunization is recommended for infants and children during the influenza season with 2 doses in the first year of vaccine receipt for children less than 9 years of age and 1 dose in subsequent years.
[F] Separate MMR and varicella vaccine may be recommended for select special populations, see Part 2 – Immunization of Special Populations.
[G] If a booster dose of Tdap is given after 10 years of age, the adolescent dose of Tdap given at 14-16 years of age is not needed, and subsequent Td booster doses are recommended every 10 years.

2.2 Schedule B: Children 1 to 6 Years of Age (Inclusive) When Starting or Resuming Immunization

Timing of visits and need for specific vaccines will require adjustment based on the age at which the child starts the schedule. The following recommendations will guide the development of the schedule for healthy children and adolescents, and should be used in combination with the relevant Biological Product pages (see Part 4 – Biological Products). Children with specific health conditions and/or risk factors should be immunized according to principles outlined in Part 2 – Immunization of Special Populations.

Visit	Vaccine
1st	DTaP-HB-IPV-Hib (or DTaP-IPV-Hib and HB) [A] MMR [B] PCV13 [C] Var (if susceptible) [B, D] Men-C-C [E] HA (Aboriginal children only) Flu [F]
2nd (4 weeks after 1st visit)	DTaP-HB-IPV-Hib (or DTaP-IPV-Hib and HB) [A]
3rd (8 weeks after 1st PCV13)	PCV13
4th (16 weeks after 1st visit and at least 8 weeks after 2nd dose of HB)	DTaP-HB-IPV-Hib (or DTaP-IPV-Hib and HB) [A]
5th (6 months after 1st visit)	HA (Aboriginal children only)
6th (6 months after 3rd dose of DTaP-containing vaccine)	DTaP-IPV-Hib (or Tdap-IPV) [G]
School Entry (4-6 years of age)	Tdap-IPV [H] MMRV [I]
Grade 6	HPV9 (2 doses 6 months apart) Var (not required if 2 doses already received)
Grade 9	Men-C-ACYW-135 Tdap [J]

[A] The primary series of 3 doses of DTaP-containing vaccine should be completed with the same product. If child is unable to complete the primary series before the 7th birthday, separate DTaP-IPV-Hib and HB vaccines to be used.
[B] If child is 4 years of age or older, MMR and varicella should be given as MMRV.
[C] See Part 4 – Biological Products, Completing a Pneumococcal Conjugate Vaccine Series when the basic schedule has been delayed. High risk children should receive a dose of PPV23 at 2 years of age or older, and at least 8 weeks after their final dose of PCV13.
[D] As of June 2018, a varicella susceptible person is one without a history of lab confirmed varicella or herpes zoster after 12 months of age and without a history of age appropriate varicella immunization. Individuals with a documented exemption in the immunization registry prior to this date due to previous disease will be considered immune. A self-reported history of varicella or physician diagnosed varicella is adequate only if disease occurred before 2004.
[E] For high risk children, Men-C-ACYW-135 should be given in place of Men-C-C and administered according to age at presentation (see Part 4 – Biological Products, Meningococcal Quadrivalent Conjugate Vaccines).
[F] Yearly influenza immunization is recommended for infants and children during the influenza season with 2 doses in the first year of vaccine receipt for children less than 9 years of age and 1 dose in subsequent years.
[G] This booster dose can be provided as DTaP-IPV-Hib to children up to 5 years of age who require Hib, as well as children less than 4 years of age who are complete for Hib. For children 4 years of age and older who do not require Hib, this booster dose is given as Tdap-IPV.
[H] Not required if the 4th dose of diphtheria, tetanus, pertussis and polio-containing vaccine was given after the 4th birthday.
[I] Separate MMR and varicella vaccines may be recommended for select special populations, see Part 2 – Immunization of Special Populations.
[J] If a booster dose of Tdap is given after 10 years of age, the adolescent dose of Tdap given at 14-16 years of age is not needed, and subsequent Td booster doses are recommended every 10 years.

2.3 Schedule C: Children and Adolescents 7 to 17 Years of Age (Inclusive) When Starting or Resuming Immunization

The following recommendations will guide the development of the schedule for healthy children and adolescents, and should be used in combination with the relevant Biological Product pages (see Part 4 – Biological Products). Children and adolescents with specific health conditions and/or risk factors should be immunized according to principles outlined in Part 2 – Immunization of Special Populations.

Vaccine	Scheduling Guidelines
HA	• Aboriginal children only: 2 doses given 6 months apart.
HB	• Children 11-15 years of age (inclusive): 2 doses (1.0 mL each) given at 0 and 6 months. These doses may be administered in the school-based grade 6 program for children aged approximately 11 years of age. • Children under 11 years of age and adolescents aged 16 and 17 years: 3 doses (0.5 mL each) given at 0, 1, and 6 months.
HPV9	• Children in grade 6 and eligible individuals initiating vaccine series at 9-14 years of age (inclusive): 2 doses given at 0 and 6 months. • Eligible individuals initiating vaccine series at 15 years of age and older: 3 doses given at 0, 2, and 6 months.
Men-C-C	• Children born prior to January 1, 2002: at least 1 dose at 10 years of age or older. • Children born on or after January 1, 2002 **and** younger than grade 9: at least 1 dose at 12 months of age or older.
Men-C-ACYW-135	• Adolescents born on or after January 1, 2002 **and** who are in grade 9 or older: 1 dose.
MMR	• 2 doses given at least 4 weeks apart (may be given as 2 doses of MMRV 12 weeks apart in those eligible for varicella vaccine if under 13 years of age).
Tdap or Tdap-IPV (if polio vaccine is also required)	• 3 doses given at: 0 and 1 month, followed by a 3rd dose 6-12 months after the 2nd dose. • For children resuming immunization, if the first dose of DTaP-containing vaccine was administered before the 1st birthday, administer additional dose(s) in order to complete a 4-dose primary series. (See Part 4 – Biological Products). • If the series is completed before the 10th birthday, give a booster in grade 9.
Var	• As of June 2018, a varicella susceptible person is one without a history of lab confirmed varicella or herpes zoster after 12 months of age and without a history of age appropriate varicella immunization. Individuals with a documented exemption in the immunization registry prior to this date due to previous disease will be considered immune. A self-reported history of varicella or physician diagnosed varicella is adequate only if disease occurred before 2004. • Susceptible children under 13 years of age: 2 doses given 12 weeks apart (may be given as MMRV in those also eligible for MMR vaccine). • Susceptible adolescents 13 years of age and older: 2 doses given 6 weeks apart.

The following worksheet may assist the immunizer to develop an appropriate schedule for the client.

			Date:		
			YYYY/MM/DD		
Personalized Schedule Worksheet for Children and Adolescents, aged 7-17 years (inclusive)					
CLIENT INFORMATION					
Name:					
	Last		*First*		
DOB:			PHN:		
	YYYY/MM/DD				
	1st visit	2nd visit	3rd visit	4th visit	5th visit
Date *(YYYY/MM/DD)*					
HA					
HB					
HPV9					
Men-C-C					
Men-C-ACYW-135					
MMR					
MMRV					
Tdap					
Tdap-IPV					
Varicella					

2.4 Schedule D: Adults Age 18 and Older When Starting or Resuming Immunization

The following vaccines are routinely offered to eligible adults in BC; this schedule should be used in combination with the relevant Biological Product pages (see Part 4 – Biological Products). Additional vaccines may be recommended due to risk factors i.e., occupation, travel, lifestyle, health status. Refer to Part 2 – Immunization of Special Populations.

Vaccine	Scheduling Guidelines and Routine Eligibility Criteria
HA	• Aboriginal adults 18 years of age only: 2 doses given at 0 and 6 months.
HB	• Individuals 18 and 19 years of age: 3 doses (0.5 mL each) given at 0, 1 and 6 months. • Individuals 20 years of age and older born in 1980 or later: 3 doses (1.0 mL each) given at 0, 1, and 6 months
HPV9	• Women born in 1994 or later and high risk males, up to 26 years of age (inclusive): 3 doses given at 0, 2, and 6 months. NOTE: Individuals who initiated the vaccine series prior to their 15th birthday should be immunized using a 2-dose series.
Men-C-C	• Adults up to 24 years of age (inclusive): 1 dose.
MMR	• **Measles Protection:** up to 2 doses of MMR are recommended for all individuals born on or after January 1, 1970 (1957 for health care workers) who do not have a history of lab confirmed measles infection, lab evidence of immunity, or documentation of 2 doses of a live measles-containing vaccine at 12 months of age or older and given at least 4 weeks apart. • **Mumps Protection:** up to 2 doses of MMR are recommended for all individuals born on or after January 1, 1970 (1957 for health care workers) who do not have a history of lab confirmed mumps infection, or documentation of 2 doses of a live mumps-containing vaccine at 12 months of age and older and given at least 4 weeks apart. • **Rubella protection:** 1 dose of MMR is recommended for all individuals born on or after January 1, 1957 who have not received 1 dose of a rubella-containing vaccine or who do not have serologic evidence of rubella immunity. • If 2 doses of MMR vaccine are required, give at least 4 weeks apart.
IPV	• Routine primary immunization against polio of adults living in Canada is not considered necessary. Primary immunization with polio vaccine is recommended only for unimmunized adults who are at higher risk of exposure to wild polioviruses: refer to Part 4 – Biological Products, Polio Vaccine. • 3 doses given at 0 and 1 month, followed by a 3rd dose 6-12 months after the 2nd dose. • If IPV is indicated, for those also requiring protection against tetanus, diphtheria or pertussis, combination products can be used (i.e., Tdap-IPV and Td/IPV).
Td/Tdap	• Adults receiving a primary immunization series should receive 1 dose of Tdap (to provide protection against pertussis) followed by 2 doses of Td. This series should be given at 0 and 1 month, followed by a 3rd dose 6-12 months after the 2nd dose. • For adults resuming an interrupted immunization series, provide additional doses of vaccine to ensure that the client has received at least 3 doses of a diphtheria and tetanus containing vaccine with at least one dose after the 4th birthday. • Individuals born in 1989 or later who missed their adolescent Tdap booster are eligible for 1 dose of Tdap.
Var	• As of June 2018, a varicella susceptible person is one without a history of lab confirmed varicella or herpes zoster after 12 months of age and without a history of age appropriate varicella immunization. Individuals with a documented exemption in the immunization registry prior to this date due to previous disease will be considered immune. A self-reported history of varicella or physician diagnosed varicella is adequate only if disease occurred before 2004. • If susceptible, give 2 doses 6 weeks apart.

The following worksheet may assist the immunizer to develop an appropriate schedule for the client.

	Date:
	YYYY/MM/DD

Personalized Schedule Worksheet for Adults 18 Years of Age or Older					
CLIENT INFORMATION					
Name:					
	Last		*First*		
DOB:			PHN:		
	YYYY/MM/DD				
	1st visit	2nd visit	3rd visit	4th visit	5th visit
Date *(YYYY/MM/DD)*					
HA					
HB					
HPV9					
IPV					
Men-C-C					
MMR					
Td					
Tdap					
Tdap-IPV					
Td/IPV					
Varicella					

2.5 Schedule E: Routine Immunizations for Adults Who Have Completed a Primary Series of Childhood Vaccines

For unimmunized adults see 2.4 Schedule D.

The following vaccines are routinely offered to eligible adults in BC; this schedule should be used in combination with the relevant Biological Product pages (see Part 4 – Biological Products). Additional vaccines may be recommended due to risk factors i.e., occupation, travel, lifestyle, health status. Refer to Part 2 – Immunization of Special Populations.

Vaccine	Group	Frequency of Immunization
Td	Any adult. Adults with a tetanus prone wound.	Every 10 years. Refer to Part 4 – Biological Products, Tetanus Prophylaxis in Wound Management.
MMR	All susceptible adults.	1 or 2 doses as needed.
Flu	All individuals 65 years of age and older and those eligible for publicly funded influenza vaccine. For a complete list of indications refer to Part 4 – Biological Products, Seasonal Influenza Vaccine Indications.	Annually.
PPV23	All individuals 65 years of age and older. Individuals with specific medical conditions. For a complete list of indications refer to Part 4 – Biological Products, Pneumococcal Polysaccharide Vaccine.	Once only revaccination, 5 years after initial dose, as required for specific medical conditions. See Part 4 – Biological Products, Pneumococcal Polysaccharide Vaccine.
Var	As of June 2018, a varicella susceptible person is one without a history of lab confirmed varicella or herpes zoster after 12 months of age and without a history of age appropriate varicella immunization. Individuals with a documented exemption in the immunization registry prior to this date due to previous disease will be considered immune. A self-reported history of varicella or physician diagnosed varicella is adequate only if disease occurred before 2004. For susceptible adults give 2 doses 6 weeks apart.	1 or 2 doses as needed.

3. Minimum Intervals Between Vaccine Doses

A “minimum interval” is the shortest time between two doses of a vaccine in a multi-dose series in which a protective response to the subsequent dose could be expected. For optimal response, immunizers should observe recommended ages and intervals as much as possible, however, doses given earlier than recommended may still be considered valid and need not be repeated if minimum intervals/ages are observed.

Minimum intervals are primarily relevant in assessing the validity of an immunization series that has already been administered to ensure that there has been sufficient time between doses to generate a protective immune response. Doses given prior to the minimum age or at less than the minimum interval are considered ‘invalid’ and should generally be repeated. If there is doubt as to whether a dose should be repeated, or whether the dose given too soon can be considered valid, consult with the Medical Health Officer.

In certain circumstances, it may be appropriate to administer doses of a multi-dose series at shorter than the routinely recommended intervals.

Consider using minimum intervals if:

1. Protection is required more quickly for an individual at high risk of exposure, e.g., during an outbreak or when traveling overseas.
2. An individual is significantly delayed starting their series and is at high risk of morbidity if exposed.

In these circumstances, minimum intervals may be used for the initial priming doses, however, maintaining the recommended interval to the final dose is generally correlated with higher levels of protective antibody and duration of protection.

Refer to 3.1 Minimum Intervals Between Vaccine Doses Table for information specific to each vaccine.

3.1 Minimum Intervals Between Vaccine Doses Table

Vaccine (Dose 1 minimum age)	Minimum Spacing Between Doses [A]			
	Dose 1 to Dose 2	Dose 2 to Dose 3	Dose 3 to Dose 4	Dose 4 to Dose 5
DTaP-IPV-Hib (6 weeks)	4 weeks	4 weeks	24 weeks [B]	24 weeks AND minimum age for this dose is 4 years [C]
DTaP-HB-IPV-Hib INFANRIX hexa® (6 weeks)	4 weeks	16 weeks after dose 1 AND 8 weeks after dose 2 AND minimum age for dose 3 is 24 weeks		
Haemophilus influenzae type b (Hib) **4 doses** (6 weeks) [D]	4 weeks	4 weeks	8 weeks AND minimum age of 12 months	
Hepatitis A (24 weeks)	24 weeks			
Hepatitis B grade 6 program Recombivax HB® **2 doses** (11 years) [E]	16 weeks			
Hepatitis B grade 6 program Engerix®-B **2 doses** (11 years) [E]	24 weeks			
Hepatitis B **3 doses** [F]	4 weeks	16 weeks after dose 1 AND 8 weeks after dose 2 AND minimum age for dose 3 is 24 weeks		
HPV (Gardasil®9 and Cervarix®) **3 doses** (9 years)	4 weeks	12 weeks after dose 2 AND 24 weeks after dose 1		
HPV (Gardasil®9 and Cervarix®) **2 doses** (9 years) [G]	24 weeks			
Meningococcal C conjugate NeisVac-C® (8 weeks)	8 weeks [H]			
Meningococcal quadrivalent conjugate Menveo® (8 weeks) [I]	8 weeks	8 weeks		
Meningococcal quadrivalent conjugate Menactra® & Nimenrix® (2 years) [I]	8 weeks			
MMR (12 months) [J]	4 weeks			
MMRV (4 years)	12 weeks			
Pneumococcal conjugate **4 doses** (6 weeks) [K]	4 weeks	4 weeks	8 weeks [L]	
Pneumococcal conjugate **3 doses** (8 weeks) [K]	4 weeks	8 weeks [L]		
Rotavirus **2 doses** (Rotarix®) (6 weeks) [M]	4 weeks [M]			
Rotavirus **3 doses** (RotaTeq®) (6 weeks) [M]	4 weeks [M]	4 weeks [M]		
Td/Tdap (7 years) [N]	4 weeks	24 weeks		
Varicella (12 months)	12 weeks or 6 weeks [O]			

A Minimum intervals are typically calculated in weeks.

B If DTaP-IPV-Hib 4th dose is given before 12 months of age, another dose of Hib is required, at ≥ 12 months of age.

C Minimum age for dose 5 is 4 years, and is given as Tdap-IPV.

D Based on age of presentation, fewer doses may be recommended (see Part 4 – Biological Products, Haemophilus b conjugate vaccine), with a minimum interval between doses in the primary series of 4 weeks. The booster dose recommended at 18 months of age can be given as early as 12 months of age provided there is an 8 week interval following the previous dose.

E Engerix®-B and Recombivax HB® are interchangeable at any dose. In a 2 dose series, if either dose is given as Engerix®-B, there must be a minimum of 24 weeks between doses.

F This change to the minimum intervals was effective as of June 2007. Prior to this date the minimum interval was 4 weeks between each dose.

G This schedule applies only to those starting a series prior to their 15th birthday. The minimum interval between doses in a 2 dose HPV schedule is 24 weeks. However, if an interval as short as 5 months (150 days) was used, the dose does not need to be repeated. If an interval of less than 5 months (150 days) was used, a 3rd dose should be given at least 24 weeks after the 1st dose and 12 weeks after the 2nd dose (WHO, 2015).

H Administer second dose of NeisVac-C® vaccine on or after 12 months of age and at least eight weeks after the previous dose. NeisVac-C® is the recommended and supplied product for the primary infant series. Any meningococcal C conjugate vaccine may be used for doses given at 18 months of age or older.

I The recommended interval between any meningococcal C conjugate vaccine and meningococcal quadrivalent conjugate vaccine is 4 weeks (regardless of which vaccine is given first).

J A dose may be given as early as 6 months of age in infants who are traveling to endemic areas or who are identified as contacts of a measles case. If MMR is given before 12 months of age, the child will require two doses of MMR after 12 months of age.

K When a series of pneumococcal conjugate vaccine is delayed or interrupted, refer to Part 4 – Biological Products, Completing a Pneumococcal Conjugate Vaccine Series.

L The final dose of pneumococcal conjugate vaccine in a three or four dose series should be given no sooner than 12 months of age, and at least 8 weeks after the previous dose.

M The **maximum** age for dose 1 is 20 weeks less 1 day of age. All doses should be administered by 8 months plus 0 days of age. If any dose in the series is RotaTeq® or the product is unknown, a total of 3 doses of vaccine should be administered. The minimum interval between any 2 doses of rotavirus vaccine is 4 weeks.

N There is no minimum interval between a dose of Td and Tdap when Tdap is being given for pertussis protection.

O For those 12 years of age and under, the recommended interval between two doses of varicella is 12 weeks; this is also the minimum interval to be used when scheduling a 2nd dose. However, if an interval as short as 4 weeks was used, the dose does not need to be repeated. For those 13 years of age and older, the recommended interval between two doses of varicella is 6 weeks; this is also the minimum interval to be used when scheduling a 2nd dose. However, if an interval as short as 4 weeks was used, the dose does not need to be repeated.

4. Timing and Spacing of Biological Products

Administration of all vaccines for which a person is eligible, at the same clinic visit, is critical to increasing the probability that a client will be fully vaccinated, and therefore, fully protected at the earliest opportunity. Generally, adverse event profiles, immunogenicity, and parental compliance are similar to when vaccines are given at separate visits. Exceptions may apply, including giving multiple live attenuated vaccines to immune compromised individuals, see Part 2 – Immunization of Special Populations.

4.1 Timing and Spacing of Inactivated Vaccines

Inactivated vaccines are **not** affected by the presence of circulating antibody and can therefore be administered before, after, or at the same time as a passive immunizing agent.

An inactivated vaccine can be administered concurrently or at any time before or after the administration of another inactivated vaccine or a live vaccine. The exceptions to this are the specific timing considerations between conjugate and polysaccharide presentations of the same antigen (e.g., PCV13 and PPV23 vaccines).

Inactivated vaccines almost always require multiple doses to generate lasting immunity. The first dose primes the immune system and a lasting protective immune response generally develops after one or more subsequent doses.

Immunity from many vaccines tends to wane over time, and for some inactivated vaccines may wane below protective levels, resulting in the need for periodic booster doses of the vaccine (e.g., tetanus/diphtheria toxoid vaccine).

Pure polysaccharide vaccines such as pneumococcal polysaccharide vaccine elicit a T-cell-independent response. As such, these vaccines are not usually effective in children under 2 years of age because they do not ‘prime’ the immune system, and repeat doses do not produce a sustained increase in antibody titres.

4.2 Timing and Spacing of Live Attenuated Vaccines

Live attenuated vaccines must replicate in order to elicit an immune response. Agents that interfere with viral replication may affect the immune response. Examples include: interferon, antiviral medications, and circulating antibodies from maternal immunity or passive immunization. Issues related to the presence of circulating antibodies are discussed in section 4.3 Spacing of Vaccines and Antibody-Containing Products.

In the first 14 days after the administration of a live attenuated vaccine, interferon is produced which would interfere with the immune response to another live vaccine when not administered concurrently. The interferon can prevent cells from becoming infected with the vaccine virus by killing the vaccine virus. For this reason, one live parenteral vaccine may interfere with the effectiveness of another if they are not given concurrently. They may also interfere with the effectiveness of intranasal vaccines, such as the live attenuated influenza vaccine (LAIV).

To minimize the possibility of vaccine interference, two or more live parenteral vaccines or a live parenteral vaccine and the live attenuated influenza vaccine (LAIV) should be administered either on the same day or

be separated by an interval of at least 28 days. The exception to this is the administration of varicella vaccine and another live vaccine to high risk/immunocompromised clients. For some of these clients, varicella vaccine should be administered 4 weeks apart from the administration of another live vaccine. Refer to Part 2 – Immunization of Special Populations, Specific Immunocompromising Conditions.

If two live parenteral vaccines or a live parenteral vaccine and live intranasal influenza vaccine are not given on the same day and are given less than four weeks apart, the vaccine that was given second should be repeated 28 days after it was given.

Live vaccines given by the parenteral or intranasal route are not believed to have an effect on live vaccines given orally. Live oral vaccines can be given at any time before or after live vaccines administered parenterally or intranasally.

Antiviral medications also impact the ability of live attenuated vaccine viruses to replicate. For example, antivirals active against varicella zoster virus (VZV), such as acyclovir, famciclovir, and valacyclovir, taken less than 2 days before or within 14 days after immunization may decrease vaccine effectiveness.

Live attenuated virus vaccines administered parenterally (e.g., MMR and varicella) usually produce prolonged immunity, even if antibody titres decline over time. Subsequent exposure to viruses usually does not lead to viremia but to a rapid anamnestic response.

For live attenuated parenteral vaccines, the first dose administered at the recommended age usually provides protection. A second dose is given to ensure seroconversion for those persons who fail to respond to the first dose.

4.3 Spacing of Vaccines and Antibody-Containing Products

Live attenuated vaccines must replicate in order to elicit an immune response. For this reason they are more sensitive to the presence of circulating antibody, including maternal antibodies and those present in passive immunizing agents. Circulating antibody against injected live vaccines can inhibit their ability to replicate, thereby inhibiting the immune response.

Antibody containing products include immune globulin (Ig) and blood products (e.g., whole blood, packed red blood cells, and plasma).

Ig preparations or blood products will not interfere with the antibody response when given simultaneously with, or at any interval before or after administration of any inactivated vaccine.

Ig preparations or blood products can interfere with the immune response to a measles, mumps, rubella or varicella-containing vaccine. For measles (routinely given as MMR or MMRV) and varicella vaccines, the recommended interval between Ig or blood product administration and subsequent vaccination varies, depending on the specific product and the dose given.

The length of time that interference with live parenteral vaccines occurs after administration of an antibody-containing product is directly related to the amount of antigen-specific antibody contained in the product. Live vaccines should be delayed until the antibody-containing product has degraded. For recommended intervals between antibody-containing products and MMR or varicella vaccine administration, refer to Part 4 – Biological Products, Immune Globulin Preparations or Blood: Timing Intervals For Vaccines Containing Live Measles, Mumps, Rubella, or Varicella Virus.

After immunization with parenteral or intranasal live attenuated virus vaccine, virus replication and stimulation of immunity occur in about 7 to 14 days. If the Ig preparation or blood product is given more than 14 days after parenteral or intranasal live attenuated virus vaccines, the immunization does not have to be repeated. If Ig or a blood product is administered less than 14 days post immunization with MMR or varicella vaccine, immunization should be repeated at an interval indicated in Part 4 – Biological Products, Immune Globulin Preparations or Blood: Timing Intervals For Vaccines Containing Live Measles, Mumps, Rubella, or Varicella Virus.

There are no data to indicate Ig preparations interfere with the immune response to other live vaccines (e.g., yellow fever and typhoid). This is probably because Ig and blood products available in Canada are unlikely to contain substantial amounts of antibodies to these antigens.

Respiratory syncytial virus monoclonal antibody preparation (palivizumab--Synagis®) and washed red blood cells will not interfere with the immune response to any currently available live or inactivated vaccines.

Rh immune globulin (RhIg) may theoretically interfere with the response to MMR and varicella vaccines. Women who receive RhIg postpartum and are eligible for MMR and/or varicella vaccine should generally wait 3 months before being vaccinated with these vaccines. However, if there is a risk of exposure to measles, mumps, rubella, or varicella, a risk of pregnancy in the 3-month postpartum period, or a risk that vaccines may not be given later, MMR and/or varicella vaccines may be given prior to discharge with a second dose at the recommended interval if indicated. If MMR or varicella vaccine is given within 3 months of receipt of RhIg, serologic testing for rubella or varicella should be done 3 months postpartum and at least 1 month after the final dose. Women who have not mounted an antibody response should be revaccinated.

4.4 Spacing of Vaccines and Blood Donation

If an individual reports that they are planning to donate blood, inform them that there may be an interval recommended between vaccine receipt and blood donation. Information on deferral periods between vaccinations and blood donation can be found at Canadian Blood Services.

4.5 Vaccination Following Vaccine Administration Errors

4.5.1 Vaccine or Antigen Given at Less than the Minimum Interval

Consider a vaccine or vaccine-component dose given at less than the minimum interval to be an **invalid** dose and repeat the dose. The repeat dose should be spaced after the invalid dose by the recommended minimum interval (see also 4.5.3 Live Vaccines Given Less than 4 Weeks Apart).

- If some of the components of a combination vaccine are valid, repeat only the component(s) that are invalid if the appropriate product is available (e.g., if only the hepatitis B component of an INFANRIX hexa® dose is invalid, repeat only the hepatitis B component using hepatitis B vaccine).
- Refer to 3.1 Minimum Intervals Between Vaccine Doses Table.

4.5.2 Vaccine Given at Less than the Minimum Age

Consider a vaccine dose given at less than the minimum age to be an **invalid** dose and repeat the dose.

- Live vaccine (e.g., MMR or varicella): Repeat the dose when the child reaches the minimum age **and** at least 4 weeks after the dose that was given too early.
- Inactivated vaccine (e.g., INFANRIX hexa®): Repeat the dose when the child reaches the minimum age.

4.5.3 Live Vaccines Given Less than 4 Weeks Apart

If two live vaccines are not given on the same day and are given less than 4 weeks apart, consider the vaccine that was given second to be **invalid**.

- Repeat the vaccine that was given second a minimum of 28 days after it was given.
- Exceptions to this are:
    - Rotavirus vaccine may be given any time before or after another live vaccine. The only scenario where this would occur, however, is MMR given between 6 months and less than or equal to 8 months of age for post-exposure prophylaxis or travel indications.
    - If LAIV is given less than 28 days after a live vaccine (such as MMR), and protection against influenza is required promptly, an injectable influenza vaccine should be administered.

4.5.4 Expired Vaccine

If an expired product is given inadvertently, the dose must be repeated.

- If it is a live vaccine, give on the same day the expired vaccine was given. If the error is discovered after that, repeat the dose of live vaccine 28 days later.
- If an expired dose of an inactivated product is given, give another dose as soon as possible.

4.6 Tuberculin Testing

Tuberculin skin tests can be administered at the same time, or at any time after most vaccines. However, live virus vaccines (e.g., MMR or varicella vaccine) may interfere with the test and produce a false negative response if the vaccine was given in the 4 weeks before the tuberculin skin test. If possible, delay the tuberculin skin test until at least 4 weeks following date of immunization with a live vaccine. If the test cannot be delayed, it is acceptable to do the test and discuss any negative results with TB Services. The test may have to be repeated or a chest X-ray completed.

Live virus vaccines will not interfere with the tuberculin test if given on the same day as test.

No data exist for the potential degree of tuberculin skin test suppression that might be associated with other live vaccines (e.g., yellow fever vaccine) but it would be prudent to follow the guidelines for MMR

vaccine. An exception to this is rotavirus vaccine, the administration of which can occur at any time before or after a tuberculin skin test.

5. References

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