

Child HSCT Recipients

Immunization for Child Hematopoietic Stem Cell Transplant (HSCT) Recipients

Revision Date: November 1, 2018

Rationale for Update:

- Updated dosing and scheduling of hepatitis B vaccine for hyporesponsive individuals.
- MMR-Var vaccine no longer contraindicated for HSCT recipients as per CIG.

Note: This guide is meant to supplement existing recommendations for routine immunization as outlined in the current *Alberta Immunization Policy*. Consult with an attending transplant physician before providing live vaccines. See [Principles of Immunization in Hematopoietic Stem Cell Transplant Recipients and Solid Organ Transplant Recipients](#).

Routine Immunizations

	6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT	
Influenza (Inactivated)	X	Live influenza vaccine is contraindicated for HSCT patients less than 24 months post-HSCT and until deemed immunocompetent by the transplant physician.							
Pneu-C 13 ^{1,2,3}	X	X	X						
DTaP-IPV-Hib				X	X	X		TAT serology. If low, give a booster dose	
MenC-ACYW				X					
Hepatitis B				X	X	X		Serology for anti-HBs	
HPV				X	X	X			
Hepatitis A				X		X			
Pneumo-P					X	X			
MMR and Varicella OR						X	X At least 3 months after 1st dose ¹	IgG for measles and rubella	
MMR-Var						X	X At least 3 months after 1st dose ¹	IgG for measles and rubella	

See detailed recommendations on following pages.

INFLUENZA (Inactivated)									
	6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT	
Influenza (Inactivated)	X ^(a)	Live influenza vaccine is contraindicated for HSCT patients less than 24 months post-HSCT and until deemed immunocompetent by the transplant physician.							

INFLUENZA
Annual seasonal administration starting before HSCT. Inactivated influenza vaccine must be administered at least two weeks prior to transplant conditioning or mobilization chemotherapy.³

(a) Inactivated Influenza vaccine may be administered as early as four months post-transplant in outbreak situations³ with approval of transplant physician.⁴ If administered less than six months post-transplant (i.e., 4 – 6 months), a 2nd dose may be administered four weeks later if there is ongoing circulation of virus in the community.²

Children younger than nine years of age receiving influenza vaccine for the first time post-transplantation require two doses administered at least four weeks apart.^{3,5}

Live influenza vaccine may be administered to children 24 months post-HSCT provided that active chronic GVHD is not present, all immunosuppressive drugs have been discontinued for at least three months and the child is deemed to be immunocompetent by the transplant physician. Children on maintenance chemotherapy or immunomodulator therapy should not receive live vaccines.⁴

Annual influenza vaccine is strongly recommended for close contacts of pre- and post-transplant recipients (e.g., family members, household contacts, etc.). Either inactivated or live influenza vaccines may be administered to close contacts.

Note: Individuals who have received FluMist® should avoid close association with individuals with severe immunocompromising conditions (e.g., bone marrow transplants recipients requiring protective isolation) for at least two weeks following immunization.^{6,7}

Immunity screening after immunization is not recommended.

PNEUMOCOCCAL								
	6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT
Pneu-C 13 ^{1,2,3}	X	X	X					
Pneumo-P					X	X		

PNEUMOCOCCAL
The minimum interval between Pneu-C13 doses is four weeks¹ and the minimum interval between the Pneu-C13 and the Pneumo-P is six months.¹ The minimum interval between Pneumo-P doses is six months.⁴

Pneu-C13 may be offered at 3 months post transplant at request of transplant physician.^{1,4}

Pneumo-P may be offered at 12 months post transplant respecting the interval between Pneu-C 13 and Pneumo-P.^{1,4}

Children must be 24 months of age or older to receive Pneumo-P.¹

Immunity screening after immunization is not recommended at this time.

DTaP-IPV-HIB								
	6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT
DTaP-IPV-Hib				X	X ^(a)	X		TAT serology. If low, give a booster dose ^(b)
<p>DTaP-IPV-HIB</p> <p>(a) Children younger than seven years of age should receive a 3rd dose 4 – 8 weeks following the 2nd dose and a 4th dose at 24 months after HSCT. The minimum interval between each of the first three doses is four weeks and between the 3rd and 4th dose is six months¹</p> <p>May offer at 6 months post transplant in the event of an outbreak at request of transplant physician.^{1,4}</p> <p>Screen for tetanus antitoxin (TAT) after immunization at three years post-transplant. If the patient is on intravenous immune globulin (IVIG), serology should be delayed until three months after the completion of IVIG therapy.</p> <p>(b) If TAT results indicate not immune for tetanus, administer a booster dose of DTaP-IPV/Hib.</p> <p>Immunity screening for diphtheria, pertussis, polio and Hib is not recommended.</p> <p>Ordering serology and booster (if needed) is the responsibility of the transplant physician (allograft recipients) or the primary physician (autograft recipients).</p> <p>Notes:</p> <ul style="list-style-type: none"> • Only inactivated polio vaccine is used in North America. • Off-license use of DTaP-IPV/Hib – see Biological Products. <p>The immunization recommendations for the general population should be followed long term (i.e., after the TAT assessment and recommendations at three years).</p>								

MENINGOCOCCAL								
	6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT
MenC-ACYW				X				
<p>MENINGOCOCCAL</p> <p>Children younger than two years of age should receive Menveo® (not Menactra® or Nimenrix®) vaccine.</p> <p>May offer at 6 months post transplant at request of transplant physician.^{1,4}</p> <p>Immunity screening after immunization is not recommended.</p> <p>Immunity screening immunization is not recommended.</p>								

Hepatitis B (HBVD)																				
	6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT												
Hepatitis B				X	X	X		Serology for anti-HBs ^(a)												
<p>HEPATITIS B Administer higher dose levels of vaccine¹:</p> <ul style="list-style-type: none"> Children 0 – 15 years of age: <ul style="list-style-type: none"> Follow the dosage and schedule for hypo-responsive individuals for Hepatitis B Vaccine. Children 16 – 19 years of age: <ul style="list-style-type: none"> Recombivax HB® - follow the dosage and schedule for hypo-responsive individuals for Hepatitis B Vaccine. <ul style="list-style-type: none"> Minimal spacing between doses: Four weeks between dose 1 and dose 2; at least two months between dose 2 and 3 and four months between dose 1 and dose 3.¹ If Recombivax HB® is unavailable, use double µg dose of Engerix®-B. The hypo-responsive series for Engerix®-B is four doses with the following schedule.⁶ <table border="1"> <thead> <tr> <th></th> <th>12 months after HSCT</th> <th>13 months after HSCT</th> <th>14 months after HSCT</th> <th>24 months after HSCT</th> <th>36 months after HSCT</th> </tr> </thead> <tbody> <tr> <td>Engerix®-B (double µg)</td> <td>X</td> <td>X</td> <td>X</td> <td>X</td> <td>Serology for anti-HBs^(a)</td> </tr> </tbody> </table> <p>May offer at 6 months post transplant at request of transplant physician.^{1,4}</p> <p>(a) If patient is on IVIG, serology should be delayed until three months after the completion of IVIG therapy.</p> <p>*If antibody levels are suboptimal, a repeat HBV series is indicated.¹</p> <p>Ordering serology and recommending the 2nd series is the responsibility of the transplant physician (allograft recipients) or the primary physician (autograft recipients).</p>										12 months after HSCT	13 months after HSCT	14 months after HSCT	24 months after HSCT	36 months after HSCT	Engerix®-B (double µg)	X	X	X	X	Serology for anti-HBs ^(a)
	12 months after HSCT	13 months after HSCT	14 months after HSCT	24 months after HSCT	36 months after HSCT															
Engerix®-B (double µg)	X	X	X	X	Serology for anti-HBs ^(a)															

HPV								
	6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT
HPV				X	X	X		
<p>HUMAN PAPILOMAVIRUS – Girls and Boys 9 to 17 years of age</p> <p>The minimum interval between dose 1 and dose 2 is four weeks and between dose 2 and dose 3 is twelve weeks.¹</p> <p>Immunity screening after immunization is not recommended.</p>								

Hepatitis A								
	6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT
Hepatitis A				X		X		

HEPATITIS A
 Only for those considered high risk (i.e., chronic liver disease; liver transplantation and liver chronic GVHD following HSCT) The minimum interval between 1st dose and 2nd dose is six months.
 May be offered at 6 months post transplant in a post-exposure situation or travel indication with approval of transplant physician.^{1,4}
 Hepatitis A vaccine is not provided for travellers: refer to local travel clinics.
 Immunity screening after HAV immunization is not routinely recommended.¹

MEASLES, MUMPS, RUBELLA								
	6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT
MMR						X ^(a)	X ^(a) At least 3 months after 1st dose ¹	IgG for measles and rubella after 2 nd dose

MEASLES, MUMPS, RUBELLA
(a) If active chronic GVHD, live vaccines are contraindicated. A live vaccine may be administered after all immunosuppressive drugs have been discontinued for at least three months and the child is deemed immunocompetent by the transplant physician.^{1,5} Children on maintenance chemotherapy or immunomodulator therapy should not receive live vaccines.⁴
 IVIG: Interval between IVIG and a live vaccine is dependent upon the dose of IVIG used and ranges between eight and eleven months.^{1,3} Refer to the *Canadian Immunization Guide* www.phac-aspc.gc.ca/publicat/cig-gci/p01-10-eng.php
 Measles and rubella IgG level at 36 months (in case of delayed immunization with live vaccines, IgG level should be determined at least one month after the 2nd MMR or MMR-Var dose).

- If after two doses of MMR or MMR-Var vaccine, measles IgG is negative or indeterminate consider non-immune to measles – no further doses of vaccine should be administered. If patient is exposed to measles in the future, prophylactic IG within six days of exposure should be provided.

 Ordering serology and booster dose (if needed) is the responsibility of the transplant physician (allograft recipients) or the primary physician (autograft recipients).

MEASLES, MUMPS, RUBELLA, AND VARICELLA (MMR-VAR)								
	6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT
MMR-Var						X ^(a)	X ^(a) At least 3 months after 1st dose ¹	IgG for measles and rubella after 2 nd dose

MEASLES, MUMPS, RUBELLA, AND VARICELLA (MMR-VAR)
(a) If active chronic GVHD, live vaccines are contraindicated. A live vaccine may be administered after all immunosuppressive drugs have been discontinued for at least three months and the child is deemed immunocompetent by the transplant physician.^{1,5} Children on maintenance chemotherapy or immunomodulator therapy should not receive live vaccines.⁴

IVIG: Interval between IVIG and a live vaccine is dependent upon the dose of IVIG used and ranges between eight and eleven months.^{1,3} Refer to the *Canadian Immunization Guide* www.phac-aspc.gc.ca/publicat/cig-gci/p01-10-eng.php

Measles and rubella IgG level at 36 months (in case of delayed immunization with live vaccines, IgG level should be determined at least one month after the 2nd MMR or MMR-Var dose).

- If after two doses of MMR or MMR-Var vaccine, measles IgG is negative or indeterminate consider non-immune to measles – no further doses of vaccine should be administered. If patient is exposed to measles in the future, prophylactic IG within six days of exposure should be provided.

Ordering serology and booster dose (if needed) is the responsibility of the transplant physician (allograft recipients) or the primary physician (autograft recipients).

Varicella								
	6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT
Varicella						X ^(a)	X ^(a) At least 3 months after 1st dose ¹	

VARICELLA (Chickenpox)
(a) If active chronic GVHD, live vaccines are contraindicated. A live vaccine may be administered only after all immunosuppressive drugs have been discontinued for at least three months and the child is deemed immunocompetent by the transplant physician.^{1,6} Children on maintenance chemotherapy or immunomodulator therapy should not receive live vaccines.⁴

Even if the patient has previously developed shingles or chickenpox (pre or post transplant), varicella vaccine should be administered.^{2,4}

All individuals with HSCT should be considered susceptible in case of exposure to VZV and should be offered VZIG.¹

Intravenous IG: Interval between IVIG and a live vaccine is dependent upon the dose of IVIG used and ranges between eight and eleven months. Refer to the *Canadian Immunization Guide* www.phac-aspc.gc.ca/publicat/cig-gci/p01-10-eng.php

Antiviral medications should be discontinued at least 24 hours before receipt of varicella-containing vaccines¹ and should not be restarted.

Immunity screening after immunization is not recommended.

Non-routine Immunizations

	6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT
Hepatitis A				X		X		
Rabies				X pre-exposure: 3 doses post-exposure: 5 doses				
Typhoid				X TYVI (inactivated)				
Travel Vaccines								

Hepatitis A							
6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT
			X		X		
<p>HEPATITIS A Only for those considered high risk (i.e., chronic liver disease; liver transplantation and liver chronic GVHD following HSCT) The minimum interval between 1st dose and 2nd dose is six months. May be offered at 6 months post transplant in a post-exposure situation or travel indication with approval of transplant physician.^{1,4} Hepatitis A vaccine is not provided for travellers: refer to local travel clinics. Immunity screening after HAV immunization is not routinely recommended.¹</p>							

Rabies							
6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT
			X (a), (b), (c)				
<p>RABIES (a) Pre-exposure: Should be delayed 12 – 24 months after HSCT¹ and administered only to those considered high-risk (e.g., workers caring for animals including veterinarians, veterinary health technicians, veterinary assistants; SPCA workers and volunteers; animal research workers; animal control workers; wildlife workers and spelunkers (cavers) in Alberta). (b) Pre-exposure series must be administered intramuscularly: 1.0 mL (days 0, 7, 21 or 28).¹ Immunity screening is recommended 7 – 14 days after the third dose of vaccine and then every two years if risk continues.¹ Provide booster if indicated. (c) Post-exposure: Rabies post-exposure prophylaxis (rabies immune globulin/RIG and rabies vaccine) may be administered at any time following transplant if indicated (i.e., if bitten by potentially rabid animal). Post-exposure vaccine schedule: RIG – day 0 and vaccine - days 0, 3, 7, 14, 28 administered IM.¹ Immunity screening is recommended 7 – 14 days after the last dose of vaccine.¹ May be offered at 6 months post transplant for pre-exposure with approval of transplant physician and as needed in post-exposure situation.^{1,4} Ordering serology and booster dose (if needed) is the responsibility of the transplant physician (allograft recipients) or the primary physician (autograft recipients).</p>							

Typhoid							
6 months after HSCT	7 months after HSCT	8 months after HSCT	12 months after HSCT	14 months after HSCT	24 months after HSCT	27 months after HSCT	36 months after HSCT
			X TYVI (inactivated)				
<p>TYPHOID</p> <p>Only for those considered high-risk (i.e., household or intimate contacts of typhoid carriers; laboratory workers who regularly manipulate the salmonella typhi organism).</p> <p>May be offered at 6 months post transplant in the event of an exposure or travel indication with approval of transplant physician.^{1,4}</p> <p>Children must be 24 months of age or older to receive Typhoid vaccine.¹</p> <p>Booster every three years if risk continues.¹</p> <p>Immunity screening after immunization is not recommended.</p>							

Travel Vaccines
<p>Travel Vaccines</p> <p>Travel vaccines are not publicly funded in Alberta. Clients requesting travel vaccines should be referred to one of Alberta Health Services Travel Clinics (in Edmonton or Calgary). For more detailed information and clinic locations, please go to: www.albertahealthservices.ca/services.asp?pid=service&rid=7568.</p> <p>Travel vaccines, if needed, should be administered at two years post-transplant or later, as long as the client has been off of immunosuppressive drugs for at least three months. This is an absolute requirement for live vaccines. Non-live vaccines may be administered at 6 – 12 months; however immunogenicity is limited, so waiting until 24 months or later is preferred. Live vaccines (e.g., yellow fever) are contraindicated in the first two years post-transplant. After that, live vaccines may be administered if the client does not have a relapse or chronic GVHD and if the client is off all immunosuppressive drugs.</p>

References

- ¹ National Advisory Committee on Immunization. (Evergreen). *Canadian Immunization Guide* (Evergreen ed.). Ottawa, On: Public Health Agency of Canada www.canada.ca/en/public-health/services/canadian-immunization-guide.html
- ² Ljungman, P., Cordonnier, C., Einsele, H., Englund, J., Macbado, C.M., Storek, J., Small, T. (2009) Vaccination of HCT recipients. In Guidelines for preventing infectious complications among hematopoietic cell transplantation recipients: a global perspective. *Biology of Blood and Marrow Transplant*, 15, 1143 –1238.
- ³ Rubin, L. G., et all. (2014, February). 2013 IDSA clinical practice guidelines for vaccination of the immunocompromised host. *Clinical Infectious Diseases*, 58(3), 309-318
- ⁴ Expert opinion of Alberta HSCT physicians. (April 2014 and October 2017).
- ⁵ National Advisory Committee on Immunization. Statement on seasonal influenza vaccine for 2017-2018.
- ⁶ Hilgendorf, I., et all. (2011, February 18). Vaccination of allogeneic haematopoietic stem cell transplant recipients: Report from the International Consensus Conference on Clinical Practice in chronic GVHD. *Vaccine* (2011). Doi: 10.1016/Journal of Vaccine
- ⁷ Verolet, C., Posfay-Barbe, K (2015, April). Live Virus Vaccines in Transplantation: Friend or Foe? *Current Infectious Disease Report*, (17:14)
- ⁸ Alberta Advisory Committee on Immunization. (2011, May 31). Record of decisions (unpublished).