Adult HSCT Recommendations

Immunization for Adult Hematopoietic Stem Cell Transplant (HSCT) Recipients

Revision Date: June 24, 2024

Rationale for update:

- Updated to incorporate replacement of Pneu-C13 and Pneumo-P with Pneu-C20 (Prevnar 20™).

Notes:

- These recommendations do not impose mandatory immunization requirements on transplant recipients, and are not intended to replace the clinical skill, judgement and decisions of the individual's transplant healthcare team. These recommendations are meant to supplement existing recommendations for routine immunization as outlined in the current *Alberta Immunization Policy*.
- Individuals receiving CAR T-cell therapy are to be reimmunized as per Allogeneic HSCT guidelines.
- For further information, see Principles of Immunization for Hematopoietic Stem Cell Transplant and Solid Organ Transplant Recipients.

Routine Immunizations

	6 mos. after HSCT	7 mos. after HSCT	8 mos. after HSCT	9 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
COVID-19	X	*Refer to COVID-19 biological pages for current schedule.*							
Influenza (Inactivated)	X	*Live influenza vaccine is contraindicated for HSCT patients less than 24 months post-HSCT and not recommended in the later transplant phase (25-36 months).*[1]							
Pneu-C20[1–3]	X	X	X			X			
DTaP-IPV-Hib					X	X	X		TAT serology. If low, give a booster dose
MenC-ACYW[1,2,] **(Adults 18 to 24 years of age inclusive)**					X				
Hepatitis B (HBVD)					X	X	X		Serology for anti-HBs
HPV (18 to 45 years of age inclusive)					X	X	X		
MMR							X	X At least 3 months after 1st dose	IgG for measles and rubella after second dose
Varicella							X	X At least 3 months after 1st dose	
Varicella (Herpes) Zoster (Shingrix®)	See detailed recommendations for Varicella (Herpes) Zoster.								

See detailed recommendations on following pages.

COVID-19									
	6 mos. after HSCT*	7 mos. after HSCT	8 mos. after HSCT	9 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
COVID-19	**X**	Refer to COVID-19 biological pages for current schedule.							

COVID-19

*May be administered as early as 3 months after HSCT at the discretion of the transplant physician.[1]

Refer to Alberta immunization policy | Alberta.ca see COVID-19 vaccine biological products for current schedule.

COVID-19 vaccine may be administered a minimum of two weeks **prior to** transplant conditioning or mobilization chemotherapy, if feasible.

Consulting with the transplant physician prior to immunizing with COVID-19 vaccine is not necessary as long as the initial clearance letter has been received to proceed with inactivated vaccines.

Note: Regardless of pre-transplant immunization status, immunization is re-started post-transplant.[2]

INFLUENZA (Inactivated)								
	6 mos. after HSCT*	7 mos. after HSCT	8 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
Influenza (Inactivated)	**X**	Live influenza vaccine is contraindicated for HSCT patients less than 24 months post-HSCT and not recommended in the later transplant phase.						

INFLUENZA (INACTIVATED)

*Inactivated Influenza vaccine may be administered as early as three months at the discretion of the transplant physician during the influenza season.[1]

Annual seasonal administration starting before HSCT. Inactivated influenza vaccine is to be administered a minimum of two weeks prior to transplant conditioning or mobilization chemotherapy.[3]

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.

Live influenza vaccine is contraindicated for HSCT patients less than 24 months post-HSCT and not recommended in the later transplant phase. It may be considered on a case by case basis in the later transplant period (greater than 2 years post transplant).

Note: Individuals who have received live influenza vaccine (LAIV) 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.[4]

Immunity screening after immunization is not recommended.

PNEUMOCOCCAL								
	6 mos. after HSCT	7 mos. after HSCT	8 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
Pneu-C20[2,3,5]	X	X	X		X			

PNEUMOCOCCAL

The minimum interval between Pneu-C20 doses 1, 2, and 3 is four weeks and at least 6 months between doses 3 and 4.[2]

Pneu-C20 may be offered as early as 3 months post transplant at request of transplant physician.[1,2]

Immunity screening after immunization is not recommended at this time.

Notes:

- Individuals who started a series with Pneu-C13 or Pneu-C15, should complete their series with Pneu-C20.[2] Previous doses will be counted and the series will not be restarted.
- Individuals who previously completed a series with another pneumococcal conjugate vaccine and/or received the recommended doses of Pneumo-P vaccine are eligible for one dose of Pneu-C20 if they have not received Pneu-C20 vaccine.
    - It is recommended that this dose be given at least 8 weeks after the last pneumococcal conjugate vaccine and at least one year after the last Pneumo-P vaccine.[2]
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DTaP-IPV-HIB								
	6 mos. after HSCT	7 mos. after HSCT	8 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
DTaP-IPV-Hib				X	X[a]	X		TAT serology. If low, give a booster dose[b]

(a) Minimum interval between dose 1 and dose 2 is four weeks and between dose 2 and dose 3 is six months.

May offer at 6 months post-transplant at request of transplant physician.[1,2]

Screen for tetanus antitoxin (TAT) 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.

(b) If TAT results indicate not immune for tetanus, a booster dose of DTaP-IPV/Hib is recommended.

Immunity screening for diphtheria, pertussis, polio and Hib is not recommended.

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

Notes:

- Only inactivated polio vaccine is used in North America.
- Off-license use of DTaP-IPV/Hib vaccine.

After the TAT assessment and recommendations indicated above are complete, immunization recommendations for the general population should be followed.

MENINGOCOCCAL								
	6 mos. after HSCT	7 mos. after HSCT	8 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
MenC-ACYW **(Adults 18 to 24 years of age inclusive)**				X				

MENINGOCOCCAL

May offer at 6 months post transplant at the request of the transplant physician.[1,2]

Notes:

- Adults (18 years of age and older) at higher risk due to underlying medical conditions (i.e., functional or anatomic asplenia including sickle cell disease; congenital complement, properdin, factor D or primary antibody deficiencies; acquired complement deficiencies e.g., those receiving eculizumab [Soliris®]; HIV infection) should receive two doses of MenC-ACYW eight weeks apart and booster doses every five years.[2]
- Laboratory workers routinely exposed to *Neisseria meningitidis*[2] should receive one dose of MenC-ACYW with booster doses every five years as long as the risk of exposure is present.

Immunity screening after immunization is not recommended.

Hepatitis B (HBVD)								
	6 mos. after HSCT	7 mos. after HSCT	8 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
Hepatitis B				X	X	X		Serology for anti-HBs[(a)]

HEPATITIS B

Administer dialysis strength[2] (Recombivax®) dose. If Recombivax® is unavailable, use double µg dose of available product (e.g., Engerix®-B).

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® is unavailable, use double µg dose of available product (e.g., Engerix®-B). The hypo-responsive series for Engerix®-B is four doses with the following schedule.[2]

	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)]

May offer at 6 months post-transplant at request of transplant physician.[1,2]

[(a)] If patient is on IVIG, serology should be delayed until three months after the completion of IVIG therapy.

*If antibody levels are less than 10 IU/L[2]

individuals **should receive a second series**, followed by serology one month later.

If GVHD defer second series until GVHD has resolved.[1]

Ordering serology and recommending the second series is the responsibility of the transplant physician (allograft recipients) or the primary physician (autograft recipients).

HPV								
	6 mos. after HSCT	7 mos. after HSCT	8 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
HPV[1,2] **(18 – 45 years of age inclusive)**[1,6–9]				X	X	X		

HPV

The minimum interval between dose one and dose two is 4 weeks, the minimum interval between the second and third doses of vaccine is 12 weeks, and the minimum interval between the first and last doses is 24 weeks.[2]

May offer at 6 months post-transplant at request of transplant physician.[1,2]

Immunity screening after immunization is not recommended.

MEASLES, MUMPS, RUBELLA								
	6 mos. after HSCT	7 mos. after HSCT	8 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
MMR						X[(a)]	X[(a)] At least 3 months after 1st dose[1]	IgG for measles and rubella after 2nd 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 individual is deemed immunocompetent by the transplant physician.[2,6]

- Clients on maintenance chemotherapy should not receive live vaccines.
- Clients on immunomodulator therapy generally should not receive live vaccines, however, those on immunomodulators such as lenalidomide or on bortezomb as maintenance therapies may receive live vaccines if cleared by their physician to do so.

IVIG: Interval between IVIG and a live vaccine is dependent upon the dose of IVIG used and ranges between eight and eleven months.[2–4] 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 dose).

- If after two doses of MMR 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.
- If after two doses of MMR vaccine, **rubella** IgG is negative or indeterminate consider non-immune to rubella. A third dose of MMR vaccine is not indicated.

Mumps immunity screening is not recommended after immunization.

Ordering serology is the responsibility of the transplant physician (allograft recipients) or the primary physician (autograft recipients).

NOTE:

Early clearance may be provided (clearance letter) at physician discretion based on the patient's risk profile and anticipated travel/exposures.[1]

Rationale: Early MMR may be indicated in rare circumstances. There are a reasonable amount of data to suggest that it is safe to pursue MMR immunization at 1 year post-transplant, if the patient is not on immunosuppression or maintenance chemotherapy (apart from lenalidomide), and does not have active GVHD.[1]

Varicella (live vaccine)								
	6 mos. after HSCT	**7 mos. after HSCT**	**8 mos. after HSCT**	**12 mos. after HSCT**	**14 mos. after HSCT**	**24 mos. after HSCT**	**27 mos. after HSCT**	**36 mos. after HSCT**
Varicella						**Allogeneic and CAR T-cell therapy only** **X[(a)]**	**Allogeneic and CAR T-cell therapy only** **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 individual is deemed immunocompetent by the transplant physician.[(2,6)]

- Clients on maintenance chemotherapy should not receive live vaccines.[(1)]
- Clients on immunomodulator therapy generally should not receive live vaccines, however, those on immunomodulators such as lenalidomide or on bortezomb as maintenance therapies may receive live vaccines if cleared by their physician to do so.[(1)]

Autologous
(From the same person - the donor and the recipient are the same individual)

Prior to immunization and not on antiviral medication, all individuals with HSCT should be considered susceptible in case of exposure to VZV and should be offered VZIG.[(2)]

Varicella vaccine is not needed and is not recommended for post autologous recipients who receive Shingrix® vaccine.[(1,7)]

See Varicella (Herpes) Zoster Vaccine (Shingles) for immunization recommendations.

NOTE: For autologous individuals who have received one dose of varicella vaccine post HSCT, a second dose of varicella vaccine should be given at least three months after the first dose.[(1)]

Allogeneic and CAR T-cell therapy
(Allogeneic involves two people: one donor and one recipient)

Even if the patient has previously developed shingles or chickenpox (pre or post-transplant), varicella vaccine is recommended.[(1)]

Prior to immunization and not on antiviral medication, all individuals with HSCT should be considered susceptible in case of exposure to VZV and should be offered VZIG[(2)] until they have received 2 doses of appropriately spaced varicella vaccine. Those who have received 2 doses generally would not be considered susceptible.[(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 vaccines[(2)] and should not be restarted.

Immunity screening after immunization is not indicated. May be considered at physician discretion. However two doses of varicella vaccine are still recommended.[(1)]

Varicella (Herpes) Zoster Vaccine (Shingles) – non-live vaccine								
	6 mos. After HSCT	**7 mos. After HSCT**	**8 mos. After HSCT**	**12 mos. After HSCT**	**14 mos. After HSCT**	**24 mos. After HSCT**	**27 mos. After HSCT**	**36 mos. After HSCT***
Varicella (Herpes) Zoster (Shingrix®)	Autologous only **X** 18 years of age and older		Autologous only **X** 18 years of age and older					Allogeneic and CAR T-cell therapy **X** 50 years of age and older
Requires 2 doses spaced 2 to 6 months apart.								

Autologous
(from the same person – the donor and the recipient are the same individual)

Shingrix® is recommended 6 months post-autologous transplant for individuals 18 years of age and older regardless of varicella disease history.[1]

Shingrix may be given while an individual is receiving antiviral medication.

The randomized trial of Shingrix® after autologous transplant demonstrated sustained protection, eliminating the need for varicella vaccine.[1,10]

Shingrix® is available through the provincially funded immunization program for post-autologous recipients starting at 6 months post-transplant.

NOTE: For autologous individuals who have received one dose of varicella vaccine post HSCT, a second dose of varicella vaccine should be given at least three months after the first dose.

- For these individuals Shingrix® is recommended as per the general immunocompetent population at 50 years of age and older, 36 months post-autologous HSCT.[1]
- For these individuals Shingrix® **may be purchased at pharmacies and administered by physicians or pharmacists.**

Allogeneic and CAR T-cell therapy
(Allogeneic involves two people: one donor and one recipient)

Post-allogeneic and CAR T-cell therapy recipients are recommended to receive both varicella vaccine and Shingrix®.[1]

Shingrix® is recommended for adults 50 years of age and older at 36 months post-allogeneic transplant and post CAR T-cell therapy.[1]

Minimum spacing between varicella vaccine and Shingrix® is 8 weeks when varicella vaccine is administered first.[11]
There is no data on spacing between Shingrix® and varicella vaccine when Shingrix® is administered first. Consult with attending transplant physician.

***Shingrix® is not available through the provincially funded immunization program for** post-allogeneic and CAR T-cell therapy recipients**.**

- Shingrix® is not effective early post-allogeneic transplant (3-6 months).[1,12]
- Providing varicella vaccine starting at 24 months post-transplant has been effective.
- Shingrix® at 36 months is recommended when HSCT individuals are immunized as per the general immunocompetent population.

Shingrix® **may be purchased at pharmacies and administered by physicians or pharmacists.**

Non-routine Immunizations

	6 mos. after HSCT	7 mos. after HSCT	8 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
Hepatitis A				X		X		
Men-B				X	X			
Rabies				X pre-exposure: 3 doses post-exposure: 5 doses				
RSV vaccine Arexvy®								
Typhoid (Inactivated)				X TYVI				
Travel Vaccines								

See detailed recommendations below.

Hepatitis A*								
	6 mos. after HSCT	**7 mos. after HSCT**	**8 mos. after HSCT**	**12 mos. after HSCT**	**14 mos. after HSCT**	**24 mos. after HSCT**	**27 mos. after HSCT**	**36 mos. after HSCT**
				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.[1,2]

Hepatitis A vaccine is not provided for travellers: refer to local travel health professionals.

Immunity screening after HAV immunization is not routinely recommended.[1]

Men-B*								
	6 mos. after HSCT	**7 mos. after HSCT**	**8 mos. after HSCT**	**12 mos. after HSCT**	**14 mos. after HSCT**	**24 mos. after HSCT**	**27 mos. after HSCT**	**36 mos. after HSCT**
				X	X			

MEN-B

*Only for those considered at high risk of meningococcal disease (i.e., asplenia; acquired complement deficiencies; or congenital complement, properdin, factor D deficiency or primary antibody deficiencies; HIV infection.

Requires 2 doses at least 4 weeks apart.

May be offered at 6 months post-transplant with approval of transplant physician.

Immunity screening after immunization is not recommended.

Rabies								
	6 mos. after HSCT	7 mos. after HSCT	8 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
				X [a],[b],[c]				

RABIES

[a] **Pre-exposure**: Should be delayed 12 – 24 months after HSCT[2] and administered only to those considered high-risk (e.g., workers routinely 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 is to be administered by the intramuscular route only: 1.0 mL (days 0, 7, 21 or 28).[2] Immunity screening is recommended 7 – 14 days after the third dose of vaccine and then every two years if risk continues.[2] 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.[2] Immunity screening is recommended 7 – 14 days after the last dose of vaccine.[2]

May be offered at 6 months post-transplant for pre-exposure with approval of transplant physician and as needed in post-exposure situation.[1,2]

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

RSV vaccine Arexvy® (Respiratory Syncytial virus)								
	6 mos. after HSCT	7 mos. after HSCT	8 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
								X

Arexvy® (RSV vaccine).

Licensed for 60 years and older

Individuals should discuss the vaccine with their transplant physician.[1]

Immunity screening after immunization is not recommended.

Arexvy® may be administered at the same time as other vaccines.

See AREXVY English Product Monograph (gsk.com) for additional information.

Arexvy® **is not available** through the provincially funded immunization program. It is available by prescription and may be purchased at pharmacies and administered by physicians or pharmacists.

Typhoid* (Inactivated)								
	6 mos. after HSCT	7 mos. after HSCT	8 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
TYPHOID TYVI				X				

TYPHOID

*Only for those considered high-risk (i.e., household or intimate contacts of typhoid carriers; laboratory workers who regularly manipulate the salmonella typhi organism).

May be offered at 6 months post-transplant in the event of an exposure or travel indication with approval of transplant physician.[1,2]

Booster every three years if risk continues.[2]

Immunity screening after immunization is not recommended.

Travel Vaccines								
	6 mos. after HSCT	7 mos. after HSCT	8 mos. after HSCT	12 mos. after HSCT	14 mos. after HSCT	24 mos. after HSCT	27 mos. after HSCT	36 mos. after HSCT
Hepatitis A HAV (Licensed for 12 months of age and older)				X		X		
Japanese Encephalitis (Licensed for 2 months of age and older.)				X See product monograph for scheduling				
Men-B (Licensed for 2 months to 25 years.)				X See product monograph for scheduling				
Typhoid TYVI (Inactivated) (Licensed for 24 months of age or older.)				X				
Twinrix HABV	Not indicated. Require hyporesponsive dose of Hepatitis B vaccine.							
Yellow Fever (Licensed for 9 months of age and older.)						X		

Travel Vaccines

- Travel vaccines are not provincially funded in Alberta.
- Transplant physicians should be consulted prior to administration of vaccines for travel purpose.
- 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
- Clients requesting travel vaccines should be referred to local travel health professionals.

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