Child SOT Recommendations (>18m)

Immunization for Children Expecting Solid Organ Transplant after 18 Months of Age (Catch-up and Ongoing Schedule)

Revision Date: June 24, 2024

Rationale for update:

- Updated to incorporate replacement of Pneu-C13 with Pneu-C20 (Prevnar 20™)

Note: These recommendations do not impose mandatory immunization requirements on transplant candidates and 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*. See also Principles of Immunization for Hematopoietic Stem Cell Transplant and Solid Organ Transplant Recipients.

Inactivated vaccines should be given at least 2 weeks before transplantation and live attenuated vaccines should be given at least 4 weeks prior to transplantation. **Consult with an attending physician before providing live vaccines**.(1)

Routine Immunizations – Before Transplant

1st visit	2nd visit (1 month after 1st visit)	3rd visit (1 month after 2nd visit)	4th visit (1 month after 3rd visit)	5th visit (6 month after 3rd visit)
COVID-19 6 months to less than 5 years of age	Refer to COVID-19 biological pages for current schedule.			
COVID-19 5 years to 17 years of age inclusive	Refer to COVID-19 biological pages for current schedule.			
DTaP-IPV-Hib or Tdap-IPV or Hib	**DTaP-IPV-Hib or Tdap-IPV**	**DTaP-IPV-Hib**		**DTaP-IPV-Hib or Tdap-IPV**
HBV	**HBV**			**HBV**
HPV (9 to 17 years of age)	**HPV (9 to 17 years of age)**			**HPV (9 to 17 years of age)**
INFLUENZA (inactivated)	Children younger than nine years of age who have never received a dose of seasonal influenza vaccine, require two doses.			
MMR		**MMR**		
MenC-ACYW				
PNEU-C20	Age-appropriate number of doses (determined by age and number of previous doses)			
VZ			**VZ**	

See detailed recommendations on the following pages.

COVID-19				
1st visit	**2nd visit** (1 month after 1st visit)	**3rd visit** (1 month after 2nd visit)	**4th visit** (1 month after 3rd visit)	**5th visit** (6 month after 3rd visit)
COVID-19 6 months to less than 5 years of age	Refer to COVID-19 biological pages for current schedule.			
COVID-19 5 years to 17 years of age inclusive	Refer to COVID-19 biological pages for current schedule.			
Refer to Alberta immunization policy | Alberta.ca see COVID-19 vaccine biological products for current schedule.				

DTaP-IPV-Hib or Tdap-IPV or Hib				
After 18 months of age up to and including 6 years of age				
1st visit	**2nd visit** (1 month after 1st visit)	**3rd visit** (1 month after 2nd visit)	**4th visit** (1 month after 3rd visit)	**5th visit** (6 month after 3rd visit)
DTaP-IPV-Hib	**DTaP-IPV-Hib**	**DTaP-IPV-Hib**		**DTaP-IPV-Hib**
DTaP-, IPV- and Hib-containing vaccines - Minimum interval between the first three doses is four weeks.(1) **DTaP-IPV-Hib**: Administer to those younger than seven years of age.				
7 years of age up to and including 17 years of age				
1st visit	**2nd visit** (1 month after 1st visit)	**3rd visit** (1 month after 2nd visit)	**4th visit** (1 month after 3rd visit)	**5th visit** (6 month after 3rd visit)
Tdap-IPV and Hib	**Tdap-IPV**			**Tdap-IPV**
Tdap-IPV: • If polio series is complete, Tdap should be used. **Hib**: • One dose of Hib is recommended for all children five years of age and older regardless of previous Hib immunization (at least one year after any previous dose). Immunity screening after immunization is not recommended.				

HBV				
1st visit	**2nd visit** (1 month after 1st visit)	**3rd visit** (1 month after 2nd visit)	**4th visit** (1 month after 3rd visit)	**5th visit** (6 month after 3rd visit)
HBV	**HBV**			**HBV**
HEPATITIS B • Follow the dosage and schedule for hypo-responsive individuals for Hepatitis B Vaccine. **Laboratory Recommendations** Screen for anti-HBs within 1 – 6 months after completion of series. If antibody levels are less than 10 IU/L, repeat series once and retest anti-HBs within 1 – 6 months after the repeat series. • Periodic screening as recommended by the attending transplant physician taking into account the severity of the immunocompromised state and whether or not the risk of hepatitis B is still present.(1) Ordering serology and interpretation of the results is the responsibility of the transplant physician.				

HPV				
1st visit	**2nd visit** (1 month after 1st visit)	**3rd visit** (1 month after 2nd visit)	**4th visit** (1 month after 3rd visit)	**5th visit** (6 month after 3rd visit)
HPV (9 to 17 years of age)	**HPV** (9 to 17 years of age)			**HPV** (9 to 17 years of age)
The vaccine series includes three doses administered at 0, 1 – 2 months and 6 months after the first dose. Girls and Boys 9 to 17 years of age. Immunity screening after immunization is not recommended.				

INFLUENZA				
1st visit	**2nd visit** (1 month after 1st visit)	**3rd visit** (1 month after 2nd visit)	**4th visit** (1 month after 3rd visit)	**5th visit** (6 month after 3rd visit)
INFLUENZA (inactivated)				
INFLUENZA Administer age-appropriate dose(s) of inactivated influenza vaccine every fall. Influenza vaccine can be administered as early as one month post-transplant at the discretion of the transplant physician.(2) **Note**: • Solid organ transplant recipients: Live attenuated influenza vaccine (LAIV) is contraindicated. Immunity screening after immunization is not recommended.				

MMR				
1st visit	**2nd visit** (1 month after 1st visit)	**3rd visit** (1 month after 2nd visit)	**4th visit** (1 month after 3rd visit)	**5th visit** (6 month after 3rd visit)
MMR		**MMR**		
MMR is to be administered a minimum of four weeks prior to transplant.(1,3) **Laboratory Recommendations** • Routine immunity screening prior to transplant is not recommended because of waning immunity. • Screen for measles and rubella immunity (IgG) 6 weeks after the second dose of vaccine if there is time for two doses pre-transplant.(2) • 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 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. • Annual immunity screening for measles or rubella is not recommended. • Mumps immunity screening is not recommended after immunization. Positive IgG serology following mumps immunization does not necessarily confirm immunity. Ordering serology and interpretation of the results is the responsibility of the transplant physician.				

MenC-ACYW				
1st visit	**2nd visit** (1 month after 1st visit)	**3rd visit** (1 month after 2nd visit)	**4th visit** (1 month after 3rd visit)	**5th visit** (6 month after 3rd visit)
MenC-ACYW		**MenC-ACYW** 2nd dose if high risk and at least 8 weeks apart from 1st dose		

MENINGOCOCCAL

- Menveo® vaccine should be used for children younger than 24 months of age.(1)
- Children who have previously received meningococcal conjugate C (MenC) vaccine only should receive one dose of meningococcal conjugate quadrivalent (MenC-ACYW) separated by at least 4 weeks from any previous dose of MenC vaccine dose.

Note: Children at high risk due to underlying medical conditions should receive two doses of MenC-ACYW at least eight weeks apart and booster doses every 3 – 5 years depending upon their age when immunization was initiated.(1) High-risk underlying medical conditions include functional or anatomic asplenia (including sickle cell disease); congenital complement, properdin, factor D or primary antibody deficiencies; acquired complement deficiency due to eculizumab (Soliris™) and HIV infection.(1)

Immunity screening after immunization is not recommended.

PNEU-C20				
1st visit	**2nd visit** (1 month after 1st visit)	**3rd visit** (1 month after 2nd visit)	**4th visit** (1 month after 3rd visit)	**5th visit** (6 month after 3rd visit)
PNEU-C20				

PNEU-C20

- Age-appropriate number of doses (determined by number of previous doses and age)

Immunity screening after immunization is not recommended.

Notes:

- Children who started a series with Pneu-C13 or Pneu-C15, should complete their series with Pneu-C20. Previous doses will be counted and the series will not be restarted.
- Children 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.(1)
  - 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.(1,5)
-

VZ				
1st visit	**2nd visit** (1 month after 1st visit)	**3rd visit** (1 month after 2nd visit)	**4th visit** (1 month after 3rd visit)	**5th visit** (6 month after 3rd visit)
VZ*			**VZ**	

VARICELLA (chickenpox)

*Administer to susceptible children (evidence of immunity is history of two doses of vaccine after 12 months of age OR laboratory evidence of immunity).

The last dose of varicella vaccine should be administered at least four weeks prior to transplant.(1,3)

Laboratory Recommendations.

- Screen for varicella IgG 4 to 6 weeks after the second dose of vaccine if there is time for two doses pre-transplant.(2)
- It is recommended to provide age appropriate varicella vaccine if time allows pre-transplant.

Note:

If VZ IgG is negative after the second dose, a third dose may be provided at the request of the transplant physician.(2,6–8)

- If a third dose is indicated the interval between doses should be 3 months. If rapid protection is required it can be provided with a minimum interval of four weeks.(2)
- While there are recognized issues with the sensitivity of the assays that are commonly used for varicella serology in clinical labs, varicella seronegativity in SOT recipients is often used clinically as a marker for susceptibility to varicella infection when making decisions about immunization and post-exposure prophylaxis. In certain situations individuals who are VZ IgG negative after the second dose may benefit from a third dose of varicella vaccine.(2,6–8)

Ordering serology and interpretation of the results is the responsibility of the transplant physician.

Non-routine Immunizations – Before and/or After Transplant

Note: Non-routine immunizations may be provided using the same schedule after transplant if not completed prior to transplant. Immunization may resume once immunosuppression has been reduced to maintenance levels, usually 6 to 12 months after transplant,[1,4] and as determined appropriate by the individual's attending physician. **Live vaccines are contraindicated post-transplant.**[1]

Vaccine	Series	Comments
Hepatitis A HAV*	Two doses: Second dose 6 – 12 months after the first dose.	*Only for those considered at high risk (chronic liver disease; liver transplantation; individuals receiving repeated replacement of plasma–derived clotting factors; household or close contacts of children adopted from hepatitis A endemic countries; populations or communities at risk of hepatitis A outbreaks or in which hepatitis A is highly endemic; or those eligible post-exposure.[1] **Note**: Provincially funded vaccine is not available for travellers – refer to local travel health professionals. Immunity screening after HAV immunization is not routinely recommended.[1]
Meningococcal Men-B*	Two doses at least 4 weeks apart.	*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. Schedule and number of doses is age dependent. See Biological Products - Meningococcal B Multicomponent Recombinant Vaccine. May be offered at 6 months post-transplant in a post-exposure situation or travel indication with approval of transplant physician. Immunity screening after immunization is not recommended.
Rabies RAB*	**Pre-exposure**: days 0, 7, 21 or 28 **Post-exposure**: One dose of RIG on day 0 and vaccine on days 0, 3, 7, 14 and 28.	***Pre-exposure**: Should be administered (1.0mL intramuscularly) only to those considered high risk (volunteers working in animal shelters or animal clinics and spelunkers). **Post-exposure**: Rabies prophylaxis can be administered intramuscularly at any time before or after transplant if indicated. **Laboratory Recommendations** **Pre-exposure**: Immunity screening is recommended 7 – 14 days after the third dose and every two years thereafter if risk continues.[1] Provide booster if indicated. **Post-exposure**: Immunity screening is recommended 7 – 14 days after the last dose.[1] If no acceptable antibody response is detected, the individual may need to receive a second rabies vaccine series. Rabies Immune Globulin (RIG) should not be repeated at the initiation of this second course.[1] **Ordering serology and interpretation of the results is the responsibility of the transplant clinician.**
Typhoid TYVI* (inactivated)	1 dose	*Only for those considered at high risk and 24 months of age or older. Individuals at high risk include household or intimate contacts of a typhoid carrier. • Booster every three years if at continued high risk.[1] Immunity screening after immunization is not recommended.

Travel Vaccines		
Hepatitis A HAV (Licensed for 12 months of age and older)	2 doses 6 to 12 months apart	
Japanese Encephalitis (Licensed for 2 months of age and older.)	See product monograph for scheduling	
Men-B (Licensed for 2 months to 25 years.)	See product monograph for scheduling	
Typhoid (Inactivated) TYVI (Licensed for 24 months of age or older.)	One dose	
Twinrix HABV	Not indicated. Require hyporesponsive dose of Hepatitis B vaccine.	
Yellow Fever (Licensed for 9 months of age and older.)	One dose	Contraindicated post-transplant

Travel Vaccines

- Travel vaccines are not provincially funded in Alberta.
- Transplant physicians should be consulted prior to administration of vaccines for travel purpose.
- Inactivated vaccines for travel purposes may be administered at 6 to 12 months post-transplant.
- Yellow fever vaccine is contraindicated post-transplant.
- Clients requesting travel vaccines should be referred to local travel health professionals.

Routine Immunizations – Ongoing Recommendations after Transplant

Note: Immunization may resume once the individual is on baseline immunosuppression, usually 6 to 12 months after transplant.[1] If immunizations were not completed prior to transplant, complete the series for inactivated vaccines as previously indicated. Clearance letters are NOT required for SOT post-transplant.[2]

Live vaccines, such as MMR, VZ and live attenuated influenza vaccine are contraindicated after transplant.[1]

Vaccine	Age	Comments
Covid-19	6 months of age and older	• Refer to COVID-19 biological pages for current schedule.
DTaP-IPV-Hib	Age five years (preschool booster)	• Minimum of 6 months after the fourth dose.[1] • When a fourth dose of DTaP-IPV-Hib is administered at four years of age and older, the pre-school booster is not required.[1] However a dose of Hib would still be required at five years of age.[1] Immunity screening after immunization is not recommended.
Tdap	Grade 9 (14 – 17 years of age)	Not indicated if a reinforcing dose of acellular pertussis-containing vaccine was received at 12 years of age or older. Immunity screening after immunization is not recommended.
Hepatitis A* HAV*	Non-specific age	*Only for those considered at high risk (chronic liver disease; liver transplantation; individuals receiving repeated replacement of plasma–derived clotting factors; household or close contacts of children adopted from hepatitis A endemic countries; populations or communities at risk of hepatitis A outbreaks or in which hepatitis A is highly endemic; or those eligible post-exposure.[1] **Note**: Provincially funded vaccine is not available for travellers – refer to local travel health professionals. Immunity screening after HAV immunization is not routinely recommended.[1]
Hepatitis B HBV	Non-specific age	**Laboratory Recommendations** • Screen for anti-HBs at 1 – 6 months after the initial series. If antibody levels are suboptimal, repeat the series once and retest anti-HBs at 1 – 6 months after the repeat series. Be aware that a positive antibody result for children younger than 12 months can be due to passive immunity from maternal antibodies. • Periodic screening as recommended by the attending transplant physician taking into account the severity of the immunocompromised state and whether or not the risk of hepatitis B is still present.[1] Ordering serology and interpretation of the results is the responsibility of the transplant physician.
Human Papilloma-virus Vaccine HPV	Grade 6 Girls and Boys 9 to 17 years of age	The vaccine series includes three doses administered at 0, 1 – 2 months and 6 months after the first dose. Immunity screening after immunization is not recommended.
Influenza FLU (inactivated)	6 months of age and older - annually	Administer age-appropriate dose(s) of inactivated influenza vaccine every fall. Influenza vaccine can be given as early as three months post-transplant. **Note**: • Solid organ transplant recipients: Live attenuated influenza vaccine (LAIV) is contraindicated. Immunity screening after immunization is not recommended.

Vaccine	Age	Comments
MenC-ACYW	Non-specific age	One dose • Menveo® vaccine should be used for children younger than 24 months of age.(1) • This dose is not needed if a dose has been received at 12 years of age or older. • Children who have previously received meningococcal conjugate C (MenC) vaccine only should receive one dose of meningococcal conjugate quadrivalent (MenC-ACYW) separated by at least 4 weeks from any previous dose of MenC vaccine dose. **Note**: Children at high risk due to underlying medical conditions should receive two doses of MenC-ACYW at least eight weeks apart and booster doses every 3 – 5 years depending upon their age when immunization was initiated.(1) High-risk underlying medical conditions include functional or anatomic asplenia (including sickle cell disease); congenital complement, properdin, factor D or primary antibody deficiencies; acquired complement deficiency due to eculizumab (Soliris™) and HIV infection.(1) Immunity screening after immunization is not recommended.
Men-B*	Non-specific age	**Men-B (Bexsero®):** *Only for children with either anatomical or functional asplenia, acquired complement deficiencies: or congenital complement, properdin, factor D deficiency or primary antibody deficiencies; HIV infection.
VZ	Selected pediatric renal and liver transplant recipients	The use of live univalent varicella vaccine has been shown to be safe and effective in **carefully selected pediatric renal and liver transplant recipients >1 year post-transplant** receiving minimal immune suppression. **In consultation with the transplant team (transplant/infectious disease physician),** univalent varicella vaccine may be administered to select pediatric renal and liver transplant recipients without recent graft rejection and receiving minimal immune suppression **who were not optimally immunized prior to transplant.**(1,2)

References

1. National Advisory Committee on Immunization. Canadian Immunization Guide (Evergreen ed.). Ottawa, Public Health Agency Canada [Internet]. Available from: https://www.canada.ca/en/public-health/services/canadian-immunization-guide.html.
2. Expert opinion of Alberta Solid Organ Transplant Program physicians. (November 2017, November 2019, and November 2023).
3. Rubin LG, Levin MJ, Ljungman P, Davies EG, Avery R, Tomblyn M, et al. 2013 IDSA clinical practice guideline for vaccination of the immunocompromised host. Clin Infect Dis. 2014;58(3).
4. Danziger-Isakov L, Kumar D. Vaccination of solid organ transplant candidates and recipients: Guidelines from the American society of transplantation infectious diseases community of practice. Clin Transplant. 2019;33(9):1–10.
5. Centers for Disease Control and Prevention. Use of 13-Valent Pneumococcal Conjugate Vaccine and 23-Valent Pneumococcal Polysaccharide Vaccine Among Children Aged 6 - 18 Years with Immunocompromising Conditions: Recommendations of the Advisory Committee on Immunization Practices. Morbidity and Mortality Weekly Report 62 (25). 2013.
6. Verolet CM, Pittet LF, Wildhaber BE, McLin VA, Rodriguez M, Grillet S, et al. Long-term Seroprotection of Varicella-zoster Immunization in Pediatric Liver Transplant Recipients. Transplantation. 2019;103(11):E355–64.
7. Pittet LF, Danziger-Isakov L, Allen UD, Ardura MI, Chaudhuri A, Goddard E, et al. Management and prevention of varicella and measles infections in pediatric solid organ transplant candidates and recipients: An IPTA survey of current practice. Pediatr Transplant. 2020;24(8):1–8.
8. Pergam SA, Limaye AP. Varicella zoster virus in solid organ transplantation: Guidelines from the American Society of Transplantation Infectious Diseases Community of Practice. Clin Transplant. 2019;33(9).

Additional resource

Verolet, C., Posfay-Barbe, K (2015, April). Live Virus Vaccines in Transplantation: Friend or Foe? Current Infectious Disease Report, (17:14) https://link.springer.com/article/10.1007/s11908-015-0472-y.

