Immunization Recommendations for Specific Populations

(Immunosuppressed and Chronic Health Conditions)

Revision Date: June 24, 2024

Rationale for Update:

- Updated to incorporate replacement of Pneu-C 13 and Pneumo-P with Pneu-C 20 (Prevnar 20™).

These recommendations do not impose mandatory immunization requirements and are not intended to replace the clinical skill, judgement and decisions of the patient's healthcare team. These recommendations are meant to supplement existing recommendations for routine immunization as outlined in the current Alberta Immunization Policy, and do not replace the skill, judgement and decisions of the individual's healthcare team.

Health Conditions Requiring Special Considerations for Immunization

Immunization Recommendations for Transplant Candidates and/or Recipients. See:

- Principles of Immunization for HSCT and SOT Recipients
- Child HSCT
- Adult HSCT
- Child SOT (Before 18 Months of Age)
- Child SOT (After 18 Months of Age)
- Adult SOT

General Principles

1. Maximize benefit while minimizing harm.[1]
2. The safety and effectiveness of vaccines in immunocompromised individuals are determined by the type of immunodeficiency and the degree of immunosuppression.[1] The relative degree of immunodeficiency is variable depending on the underlying condition and can vary over time in many individuals.[1]
3. Case-by-case medical consultation with the individual's attending physician is recommended in order to determine the individual's degree of immunosuppression or immunodeficiency and whether or not immunization is appropriate for the individual. In complex cases, referral to a physician with expertise in immunization and/or immunodeficiency is advised.[1]
4. There may not be complete protection even when there is a history of childhood infection or previous immunization.[1] Monitor vaccines carefully and boost aggressively. The magnitude and duration of vaccine-induced immunity are often reduced/suboptimal in immunocompromised individuals. The individual may remain susceptible despite appropriate immunization.
5. The decision to recommend for or against any particular vaccine will depend upon a careful analysis of the risks and benefits. There is potential for serious illness and death if immunocompromised individuals are under-immunized and every effort should be made to ensure adequate protection through immunization; however, the inappropriate use of live vaccines can cause serious adverse events in some immunocompromised individuals as a result of the uncontrolled replication of the vaccine virus or bacterium.[1]
6. Immunize at the time when maximum immune response can be anticipated.
   - Immunize early, before immunodeficiency begins, if possible.
   - Delay immunization if the immunodeficiency is transient (if this can be done safely).
   - Stop or reduce immunosuppression to permit better vaccine response, if appropriate.
7. If possible, administer immunization at least two weeks (inactivated vaccines) or four weeks (live vaccines) before planned immunosuppression due to treatment or medications.[1]
8. Live vaccines are not generally recommended due to the risk of disease caused by the vaccine strains.[1] However, in some less severely immunocompromised individuals, the benefits of live vaccines may outweigh the risks.[1] Approval from the individual's attending physician must be obtained before proceeding with live vaccines.
   - **Children with a known or suspected family history of congenital or hereditary immunodeficiency that is a contraindication to immunization with live vaccines should not receive a live vaccine until their immune competence has been established**.[1] (Refer to section in this document on *Congenital Immunodeficiency States*.)
   - If the child has other than first-degree relatives with congenital immunodeficiency conditions or if multiple neonatal or infant deaths occurred within the child's immediate family, the provider should seek a medical consultation before proceeding with the administration of a live vaccine.
9. If serologic testing is available and there is a clear antibody correlate of protection, post-immunization antibody titres to determine the immune response and guide re-immunization and post-exposure management should be considered.[1] See Biological Products for specific vaccine recommendations.
10. Consider the immunization environment broadly. Immunize household/close contacts when appropriate. Strongly encourage up-to-date immunization, including annual influenza vaccine, for all health care workers (HCW) providing care to immunocompromised individuals.

    Household contacts of immunocompromised individuals should receive all routine immunization as appropriate, including measles, mumps, rubella, rotavirus and varicella vaccines, if susceptible, as well as annual influenza immunization.

ADDITIONAL Notes:

- All biologic products listed are provincially funded.
- Shingrix® (Herpes Zoster Non-Live Recombinant Vaccine) may be considered in immunocompromised adults ≥50 years of age on a case-by-case basis (not Zostavax® - Live Attenuated Zoster Vaccine).[1] However, Shingrix® is only provincially funded for candidates/recipients of solid organ transplant and HSCT recipients.

Immunocompromising Conditions

Acquired Complement Deficiency	
• Individuals receiving terminal complement inhibitor (e.g. eculizumab [Soliris®] or other C5 complement inhibitors) should receive inactivated and live vaccines following routine immunization schedules as well as meningococcal (meningococcal conjugate ACYW and meningococcal B), pneumococcal conjugate and *Haemophilus influenzae* type b vaccines. • Immunize at least 2 weeks prior to first dose of eculizumab (Soliris®) if possible.[(1)] • Individuals who remain on eculizumab (Soliris®) should receive a booster of meningococcal conjugate ACYW and meningococcal B every 3 to 5 years. **Note**: **Medical consultation is recommended before proceeding with immunization**.	
See Biological Products – for specific vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Not routinely recommended
HBV	Recommended as per age eligibility and schedule.
Hib	Recommended due to condition
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Recommended due to condition.
MenC-ACYW	Recommended due to condition
PNEU-C15	Not routinely recommended
PNEU-C20	Recommended due to condition.
Live Vaccines	
Rotavirus	Recommended as per age eligibility and routine schedule. Contraindicated if on immunosuppressive therapy.
MMR-Var	Contraindicated
MMR	Recommended as per age eligibility and routine schedule. Contraindicated if on immunosuppressive therapy.
VZ	Recommended as per age eligibility and routine schedule. Contraindicated if on immunosuppressive therapy.

CAR T-cell therapy (Chimeric Antigen Receptor T-cell Therapy)
Individuals receiving Chimeric Antigen Receptor T (CAR) T-cell therapy are to be reimmunized as per allogeneic HSCT guidelines. CAR-T involves using the patient's own chimeric antigen receptor T cells that have been manipulated to target their cancer. Research into immunity post CAR-T is evolving and in the interim, patients will be immunized using the standard allogeneic HSCT schedule.). See: • Principles of Immunization for HSCT and SOT Recipients • Child HSCT • Adult HSCT

Congenital Immunodeficiency States (Inborn Errors of Immunity – Primary Immunodeficiency)

The following are broad categories of congenital immunodeficiency conditions (Inborn Errors of Immunity) for which specific immunization recommendations apply.[1,2]

1. **Predominantly antibody (B cell) deficiencies**
2. **Combined T and B cell immunodeficiencies (with or without associated /syndromic features) and Immune dysregulation**
3. **Phagocytic and neutrophil disorders**
4. **Complement deficiencies**
5. **Defects of innate immunity**

Notes:

- **Immunology or hematology medical consultation is strongly recommended before proceeding with immunization. If there is uncertainty about the nature of an immune deficiency, do not proceed without seeking expert medical opinion.**
- If the child has other than first-degree relatives with congenital immunodeficiency conditions (Inborn Errors of Immunity) or if multiple neonatal or infant deaths occurred within the child's immediate family, the provider should seek a medical consultation before proceeding with the administration of a live vaccine.

Predominantly antibody (B cell) deficiencies[1,2]

Severe – X-linked agammaglobulinemia (XLA), common variable immunodeficiency (CVID)

- Most patients with severe defects of antibody production, such as XLA or CVID are not able to mount a significant humoral response. While administration of inactivated vaccines is not harmful, it may be futile.
- As a general rule, people with severe antibody defects can be protected from many of the vaccine preventable infections with the use of replacement immunoglobulin (IG) therapy or pathogen-specific Ig preparations; however, the level of antibody to specific pathogens in these products may be variable.

Less severe – selective immunoglobulin A (IgA) deficiency and specific polysaccharide antibody deficiency (SPAD).

- For those with less severe antibody deficiency and expected ability to mount some antibody response, especially selective IgA deficiency, immunization may be recommended to increase the level of protection.

See Biological Products – for specific vaccines.

	Severe antibody (B cell) deficiencies	**Less Severe antibody (B cell) deficiencies**
Inactivated Vaccines		
COVID-19	Routinely recommended	Routinely recommended
Influenza	Routinely recommended	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Consult with physician	Recommended as per age eligibility and schedule
HBV	Consult with physician	Recommended as per age eligibility and schedule. Recommended due to condition. See hyporesponsive dosing and schedule.
Hib	Consult with physician	Recommended as per age eligibility and schedule
HPV	Consult with physician	Recommended as per age eligibility and schedule
Men-B	Consult with physician.	Consult with physician
MenC-ACYW	Consult with physician	Recommended as per age eligibility and schedule. (For adults – consult with physician)
PNEU-C15	Consult with physician	Recommended as per age eligibility and schedule. This population should be offered Pneu-C15 vaccine. Recommendation for Pneu-C20 vaccine will be provided by specialist during the diagnostic process.
PNEU-C20	Not recommended	For adults – consult with physician
Live Vaccines		
Rotavirus	Contraindicated	Generally contraindicated *See notes below
MMR-Var	Contraindicated	Contraindicated
MMR	Contraindicated	Recommended as per age eligibility and schedule - *See notes below
VZ	Contraindicated	Recommended as per age eligibility and schedule - *See notes below

*Notes: Individuals with:

- Partial B cell defects and known intact T cell immunity (and some ability to produce antibody) who are not receiving IG should receive MMR and univalent varicella vaccines as appropriate for age. MMRV has not been evaluated in immunodeficiency. All other live vaccines are contraindicated.
- Selective IgA deficiency who have no concomitant defects in T cell function can receive most live vaccines.
- Documented IgG subclass deficiency with intact T cell function who are not receiving regular IG replacement therapy can receive routine live vaccines although response may be suboptimal.
- Isolated specific polysaccharide antibody deficiency (SPAD) may receive all live vaccines.

Combined T and B cell immunodeficiencies (with or without associated /syndromic features) and Immune dysregulation[1,2]

- Individuals with mixed (combined immunodeficiency) and T cell defects are particularly susceptible to virtually all viruses and some bacteria.[1]

Severe – T cell defects may be severe e.g., severe combined immunodeficiency (SCID), complete DiGeorge syndrome

- Those with severe defects will not respond to any vaccines.
- For individuals with severe combined immunodeficiency, administration of inactivated vaccines will not provide protection and is not recommended. The majority of these infants are managed with immunoglobulin replacement to provide passive immunity.
- All live vaccines are contraindicated
- Alberta screens all infants for Severe Combined Immune Deficiency (SCID) and metabolic screen results can be reviewed if there is a concern.
    - However, the screening for SCID does not pick up all cases of significant combined immune deficiencies, therefore if there is a concern due to family history or symptoms, review by immunology should be pursued prior to giving live vaccines.[3]

Partial – e.g., DiGeorge syndrome, Wiskott-Aldrich syndrome, ataxia telangiectasia, hyper IgM syndrome, STAT3 deficiency, X-linked lymphoproliferative disease, familial predisposition to hemophagocytic lymphohistiocytosis)

- Those with partial defects may have some response to vaccines.
- Live vaccines are also generally contraindicated for Wiskott-Aldrich syndrome, ataxia telangiectasia, X-linked lymphoproliferative disease, or familial predisposition to hemophagocytic lymphohistiocytosis.
- Live vaccines may be considered for partial T cell defects after assessment of immune competence.

	Severe Combined immunodeficiencies	**Partial Combined immunodeficiencies**
Inactivated Vaccines		
COVID-19	Consult with physician	Routinely recommended
Influenza	Consult with physician	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Not recommended	Consult with physician
HBV	Not recommended	Consult with physician
Hib	Not recommended	Consult with physician
HPV	Not recommended	Consult with physician
Men-B	Not recommended	Consult with physician
MenC-ACYW	Not recommended	Consult with physician
PNEU-C15	Not recommended	Consult with physician
PNEU-C20	Not recommended	Consult with physician
Live Vaccines		
Rotavirus	Contraindicated	Consult with physician before proceeding with immunization
MMR-Var	Contraindicated	Contraindicated
MMR	Contraindicated	Consult with physician before proceeding with immunization
VZ	Contraindicated	Consult with physician before proceeding with immunization

Phagocytic and neutrophil disorders.[1,2]

Individuals with phagocytic and neutrophil disorders (e.g., congenital neutropenia, cyclic neutropenia, leukocyte adhesion and migration defects, chronic granulomatous disease (CGD), myeloperoxidase deficiency and Chediak-Higashi syndrome) are at increased risk for bacterial infections.

- Inactivated vaccines should be given.

Live vaccines

- Live vaccines (rotavirus, MMR, varicella, MMRV) should be given according to routine schedules to persons with neutropenia or CGD,
- All live vaccines are contraindicated with leukocyte adhesion defect (LAD), Chediak-Higashi syndrome and other defects in cytotoxic granule release, and in any other undefined phagocytic cell defect.

Inactivated Vaccines		
COVID-19	Routinely recommended	
Influenza	Routinely recommended	
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule	
HBV	Recommended as per age eligibility and schedule	
Hib	Recommended as per age eligibility and schedule. Recommended due to condition	
HPV	Recommended as per age eligibility and schedule	
Men-B	Not routinely recommended	
MenC-ACYW	Recommended as per age eligibility and schedule	
PNEU-C15	Not routinely recommended	
PNEU-C20	Recommended due to condition	
Live Vaccines		
	• Neutropenia • Chronic granulomatous disease	• Leukocyte adhesion defect • Chediak-Higashi syndrome • Other defects in cytotoxic granule release, and • Any other undefined phagocytic cell defect
Rotavirus	Recommended as per age eligibility and schedule	Contraindicated
MMR-Var	Contraindicated	Contraindicated
MMR	Recommended as per age eligibility and schedule	Contraindicated
VZ	Recommended as per age eligibility and schedule	Contraindicated

Complement deficiencies[1,2]	
For complement subunits, properdin, factor D or B or mannan-binding lectin deficiency • These individuals are particularly susceptible to infections with *N. meningitidis* but also susceptible to other encapsulated bacteria such as *S. pneumoniae* and *Haemophilus influenzae* • In general, response to vaccines is expected to be normal and there are no contraindications. • Should receive all routine live vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Influenza	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule, Hib recommended due to condition.
HBV	Recommended due to condition. See hyporesponsive dosing and schedule. Recommended as per age eligibility and schedule
Hib	Recommended due to condition
HPV	Recommended as per age eligibility and schedule
Men-B	Recommended due to condition.
MenC-ACYW	Recommended due to condition
PNEU-C15	Not routinely recommended
PNEU-C20	Recommended due to condition
Live Vaccines	
Rotavirus	Recommended as per age eligibility and schedule
MMR-Var	Recommended as per age eligibility and schedule
MMR	Recommended as per age eligibility and schedule.
VZ	Recommended as per age eligibility and schedule.

Defects of innate immunity[1,2]

For innate immune defects of cytokine generation or cellular activation, such as defects of the interferon-gamma/interleukin-12 axis, toll-like receptor signaling pathway deficiencies (e.g., IRAK4 and MyD88 deficiency).

- All routine inactivated vaccines should be given.
- A specialist should be consulted before giving live vaccines to persons with innate immune defects of cytokine generation or response or cellular activation defects
- Live vaccines are contraindicated in patients with defects in alpha/beta or gamma interferon production and in nuclear factor kappa B pathway defects.

Inactivated Vaccines		
COVID-19	Routinely recommended	
Influenza	Routinely recommended	
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule	
HBV	Recommended as per age eligibility and schedule	
Hib	Recommended as per age eligibility and schedule	
HPV	Recommended as per age eligibility and schedule	
Men-B	Not routinely recommended	
MenC-ACYW	Recommended as per age eligibility and schedule	
PNEU-C15	Not routinely recommended	
PNEU-C20	Recommended due to condition	
Live Vaccines		
	• Innate immune defects of cytokine generation or response or • Cellular activation defects	• Defects in alpha/beta or gamma interferon production and in nuclear factor kappa B pathway defects.
Rotavirus	Consult with physician	Contraindicated
MMR-Var	Consult with physician	Contraindicated
MMR	Consult with physician	Contraindicated
VZ	Consult with physician	Contraindicated

HIV Infection

- **Medical consultation is recommended before proceeding with any immunization.** Timing of immunization is important in order for the individual to receive an optimal response to the vaccines.[3]
- Screening for HIV infection is not necessary prior to immunization.[1]
- The degree of immune suppression varies widely among HIV-infected individuals, reflecting disease stage and response to antiretroviral therapy. Immune suppression is approximately predicted by a recent CD4 count and CD4 percentage. Having lower CD4 counts and elevated viral loads may diminish the effectiveness of some vaccines although this is not a reason to delay immunization.
- There is no contraindication to the use of inactivated vaccines at any time.[1,3]
- HIV positive individuals may be considered for routine age-appropriate immunization with inactivated vaccines as well as pneumococcal conjugate , meningococcal (meningococcal conjugate ACYW and meningococcal B), *Haemophilus influenzae type b* and hepatitis B vaccines. Hepatitis A and other inactivated vaccines may also be recommended based on risk factors. See Biological Products for vaccine-specific information.
- There are no contraindications to the use of some live vaccines (MMR, VZ, rotavirus, and Mpox) if immune function is normal.[1] MMRV, BCG, small pox, and oral live typhoid vaccines are contraindicated and LAIV is not recommended.[1] If immune suppression is already advanced at diagnosis, live vaccines should be deferred pending potential immune recovery with treatment. Consensus thresholds based on immunologic categories have been determined for the use of MMR and univalent varicella as follows[1]:
  - Measles-mumps-rubella vaccine (MMR)
    - Asymptomatic HIV-infected children 12 months of age and older without severe immunosuppression, (that is, CD4 ≥ 15% and CD4 cell count ≥ 500 × 106/L for at least 6 months in children 1 through 5 years old and ≥ 15% and CD4 cell count ≥ 200 × 106/L for at least 6 months in those 6 through 13 years of age), may receive two doses of MMR vaccine 3 – 6 months apart.[1]
    - For susceptible HIV-infected adolescents and adults with CD4 cell count ≥200 x 10^6/L and CD4 percentage ≥15%, immunization with two doses of MMR vaccine administered three months apart may be considered.[1]
    - MMR vaccine is contraindicated in persons with advanced HIV/AIDS.[1]
  - Univalent varicella vaccine
    - Asymptomatic HIV-infected children 12 months of age and older without severe immunosuppression, (that is, CD4 ≥ 15% and CD4 cell count ≥ 500 × 106/L for at least 6 months in children 1 through 5 years old and ≥ 15% and CD4 cell count ≥ 200 × 106/L for at least 6 months in those 6 through 13 years of age), may receive two doses of univalent varicella vaccine 3 – 6 months apart.[1]
    - For susceptible HIV-infected adolescents and adults there are no published data on the use of varicella vaccine in. Based on expert opinion, immunization with two doses of univalent varicella vaccine administered three months apart may be considered for HIV-infected adolescents and adults without evidence of immunity with CD4 cell count ≥200 x 10^6/. (Evidence of immunity includes: two documented doses varicella containing vaccine, lab evidence of varicella immunity, or lab confirmation of varicella disease).[1]
    - Varicella vaccine is contraindicated in persons with advanced HIV/AIDS.[1]
  - Individuals with symptomatic HIV/AIDS sometimes receive intramuscular immune globulin as prophylaxis against infection. The immune globulin may interfere with their antibody response to live vaccines.
  - Individuals with symptomatic HIV infection (i.e. low CD4 count or presence of opportunistic infection) should receive immune globulin if exposed to measles, even if they have received MMR vaccine. The immune globulin may interfere with their antibody response to live vaccines.[1] Consult with physician for immune globulin when measles IgG positive and HIV symptomatic.[3]

○ Rotavirus vaccine: Infants born to HIV positive mothers can safely receive rotavirus vaccine and should receive rotavirus vaccine according to the routine schedule. The majority (>99%) of these infants will not be infected with HIV. If they become infected, they do not become significantly immunocompromised until later in infancy (after rotavirus vaccine has been administered).[1,4,5] ○ If the infant is known to have severe immunodeficiency, consultation with a specialist is still recommended.[1]	
See Biological Products – for specific vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Not routinely recommended
HBV	Recommended due to condition. See hyporesponsive dosing and schedule. Recommended as per age eligibility and schedule
Hib	Recommended due to condition
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Recommended due to condition
MenC-ACYW	Recommended due to condition
PNEU-C15	Not routinely recommended
PNEU-C20	Recommended due to condition.
Live Vaccines	
Rotavirus	Recommended as per age eligibility and routine schedule if not significantly immunocompromised.[1]
MMR-Var	Contraindicated
MMR	Usually recommended only if within acceptable clinical and immunologic categories. Recommended as per age eligibility and routine schedule.
VZ	Usually recommended only if within acceptable clinical and immunologic categories. Recommended as per age eligibility and routine schedule.

Immunosuppressive Therapy

- **Medical consultation with the individual's physician(s) is recommended regarding the appropriateness of immunization for individuals whose immune status may be suppressed** within the past three months **by immunosuppressive therapy** (such as, long-term high-dose steroids, cancer chemotherapy, radiation therapy, cytotoxic drugs, and calcineurin inhibitors.[1.]
- The following corticosteroid therapies do not generally result in immunosuppression that would contraindicate immunization:
  - Short-term therapy (less than 14 days)[(1)]
  - Low to moderate dose of prednisone or equivalent (less than 2 mg/kg/day) or less than 20 mg/day if weight is greater than 10 kg.[(1)]
  - Maintenance physiologic replacement therapy.[(1)]
  - Administered topically, inhaled, or locally injected (e.g., joint injection).[(1)]
- Long-term immunosuppressive therapy is used for organ transplantation and a range of chronic infections and inflammatory conditions (e.g., inflammatory bowel disease, psoriasis, systemic lupus erythematosus).[(1)] These therapies have their greatest impact on cell-mediated immunity, although T-cell dependent antibody production can also be adversely affected.[(1)]
- Immunization status should be reviewed prior to the initiation of immunosuppressive therapy and any age-appropriate vaccines recommended should be administered prior to the initiation of immunosuppressive therapy so that optimal immunity is achieved.[(1)]
- Inactivated vaccines:
  - Inactivated vaccines should be administered at least 14 days before the initiation of immunosuppressive therapy, when possible, to optimize immunogenicity or delayed until at least three months after immunosuppressive medications have stopped. Although they can be administered safely at any time before, during or after immunosuppression every effort should be made to time immunization so that optimal immunogenicity will be achieved.[(1)]
  - Routine immunization is recommended as well as pneumococcal conjugate vaccine.
  - Vaccines may be administered four weeks after discontinuation of high-dose systemic steroids. If needed for post-exposure or outbreak management consultation with physician is recommended before proceeding with immunization.[(1)]
- Live vaccines:
  - Live vaccines should be administered at least four weeks before immunosuppressive therapy begins to reduce the risk of disease caused by the vaccine strain.[(1)] Live vaccines are generally contraindicated during and for at least three months after the immunosuppressive drugs have been discontinued.[(1)]
  - Generally only high-dose systemic steroids (e.g., 2 mg/kg or more per day for a child or 20 mg or more of prednisone or its equivalent per day for an adult) can interfere with vaccine-induced immune responses.[(1)]
  - Vaccines may be administered four weeks after discontinuation of high-dose systemic steroids.[(1)] If needed for post-exposure or outbreak management consultation with physician is recommended before proceeding with immunization.[(1)]
- Hepatitis B vaccine should be offered to individuals with inflammatory bowel disease anticipating the initiation of long-term immunosuppressive therapies.[(3)]

Summary Table for Immunizations when on Biologics[3,6]

"Biologics" in this context refer to biological modifying agents, that target specific pathways in the immune system for immunosuppression.[3]

	Infant whose mother was on anti-TNF alpha therapy *Infliximab, Adalimumab, Golimumab Certolizumab pegol, Etanercept* **during pregnancy**	**Infant whose mother was on *Rituximab* or any other biologic(s) agents during pregnancy**	**Infant who is being breast fed and their mother is on biologic(s)**	**Individual is on biologic(s)**
All Inactivated vaccines	Recommended as appropriate for age and eligibility	Recommended as appropriate for age and eligibility	Recommended as appropriate for age and eligibility	Recommended as appropriate for age and eligibility
Live vaccines: Rotavirus	Recommend as appropriate for age and eligibility	Consult with MOH or Special Immunization Clinic for immunologic testing[1]	Recommended as appropriate for age and eligibility	Contraindicated
Live vaccines: MMR, Varicella, MMR-V (12 months of age or older)	Recommended as appropriate for age and eligibility	Generally not applicable as maternal biologics only persist for 6 months in the infant *if MMR is required/recommended for travel under 1 year of age consult with MOH	Recommended as appropriate for age and eligibility	Contraindicated

[1]Rotavirus can be given if immunologic testing suggests no abnormalities.

Monoclonal antibodies

- Are laboratory-produced substances that can bind to specific molecules with the purpose of modulating or inhibiting immune responses.
- As with other immunosuppressive therapy, immunization should be administered prior to beginning the therapy or delayed until at least 3 months after the therapy has ended.[1] Consultation with physician is recommended.
- Infants, who have been exposed to rituximab, during pregnancy, should have a medical consultation with child's physician prior to immunization.
- Immune responses to live vaccine that are administered after one year of age (e.g. MMR or MMRV vaccine) are not considered to be affected by utero exposure to monoclonal antibodies.
- Infants exposed to monoclonal antibodies in utero should receive all inactivated vaccines according to routine schedule.

  NOTES from CIG:
  - Rituximab taken during pregnancy is associated with B cell depletion in both mother and fetus. A longer interval of 6-12 months should be observed following rituximab therapy.
  - Palivizumab which is specific for the prevention of respiratory syncytial virus (RSV) infection; will not interfere with the response to a live vaccine.
- Monoclonal antibodies administered to the mother during breastfeeding are thought to have very little or no impact on the infant. Transfer of monoclonal antibodies through breast milk is limited, and the minimal quantities that are ingested are likely to be broken down in the infant's gastrointestinal tract. Infants of breastfeeding women receiving monoclonal antibody treatment should therefore be immunized with both live and inactivated vaccines according to routine schedules.[1]

See Biological Products – for specific vaccines.

Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Not routinely recommended
HBV	Recommended as per age eligibility and schedule. See hyporesponsive dosing and schedule.
Hib	Not routinely recommended
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Not routinely recommended
MenC-ACYW	Not routinely recommended
PNEU-C15	Not routinely recommended
PNEU-C20	Recommended due to condition.
Live Vaccines	
Rotavirus	Generally contraindicated. Consultation with physician is recommended.
MMR-Var	Contraindicated
MMR	Generally contraindicated. Consultation with physician is recommended.
VZ	Generally contraindicated. Consultation with physician is recommended.

Malignant Hematological Disorders (e.g., leukemia, lymphomas, or other malignant neoplasms affecting the bone marrow or lymphatic systems)	
• **Medical consultation is recommended before proceeding with immunization**. • During active chemotherapy and shortly thereafter, antibody responses are impaired; therefore, ensure that at least three months have passed since the completion of chemotherapy before immunizing. If individuals have received rituximab it is recommended to wait at least 6 months before immunizing.[3] • In addition to routine inactivated vaccines, pneumococcal conjugate) and Hib vaccines are also recommended.[1] If asplenic, meningococcal vaccines (meningococcal conjugate ACYW and meningococcal B) are recommended. • Live vaccines are contraindicated for individuals with severe immunodeficiency due to blood dyscrasias, lymphomas, leukemias of any type or other malignant neoplasms affecting the bone marrow or lymphatic systems and those undergoing immunosuppressive treatment for malignancy.[1] • Children with Acute Lymphocytic Leukemia (ALL) in remission for at least 12 months may be considered for MMR vaccine and/or varicella vaccine. Consultation with physician is recommended. • Generally, individuals who are more than 3 years post therapy and no longer on immunosuppressive medications would be considered healthy and should be assessed for immunizations as per the general population.[3]	
See Biological Products – for specific vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Not routinely recommended
HBV	Recommended as per age eligibility and schedule See hyporesponsive dosing and schedule.
Hib	Recommended due to condition
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Not routinely recommended
MenC-ACYW	Not routinely recommended
PNEU-C15	Not routinely recommended
PNEU-C20	Recommended due to condition.
Live Vaccines	
Rotavirus	Generally contraindicated. Consultation with physician is recommended.
MMR-Var	Contraindicated
MMR	Generally contraindicated. Consultation with physician is recommended.
VZ	Generally contraindicated. Consultation with physician is recommended.

Malignant Solid Tumors (and on immunosuppressive therapy)	
• Inactivated vaccines according to routine immunization schedules should be administered. Pneumococcal conjugate vaccine is recommended before individuals begin immunosuppressive therapies.(1) • Live vaccines are contraindicated in people undergoing immunosuppressive treatment for any malignant solid tumors. • In general, if an individual is 3 months post-chemotherapy and the cancer is in remission, the person is no longer considered immunocompromised.(1) • Medical consultation is advised.	
See Biological Products – for specific vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Not routinely recommended
HBV	Recommended as per age eligibility and schedule. See hyporesponsive dosing and schedule.
Hib	Not routinely recommended
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Not routinely recommended
MenC-ACYW	Not routinely recommended
PNEU-C15	Not routinely recommended
PNEU-C20	Recommended due to condition
Live Vaccines	
Rotavirus	Contraindicated
MMR-Var	Contraindicated
MMR	Contraindicated
VZ	Contraindicated

Other Chronic Health Conditions

Asplenia or Hyposplenia	
• Asplenia or hyposplenism may be congenital, surgical or functional. A number of conditions can lead to functional asplenia (e.g., sickle-cell anemia, thalassemia major/intermedia or hemoglobin H disease).[1,3] (Note thalassemia carrier and thalassemia trait does not lead to functional asplenia.)[3] • Individuals with asplenia/hyposplenia are at increased risk of fulminant bacterial infection which is associated with a high mortality rate. Risk is highest in the first 2 years following splenectomy but remains elevated for life. When emergency splenectomies are performed, vaccines are best administered two weeks following surgery for optimal response. Particular attention should be paid to ensuring optimal protection against encapsulated bacteria (*Neisseria meningitidis*, *Streptococcus pneumoniae*, *Haemophilus influenzae* type b) to which these individuals are highly susceptible.[1] • Immunization status review is critical when an elective surgical splenectomy is planned so that all the necessary vaccines can be administered at least two weeks prior to surgery.[1] • Individuals who are asplenic/hyposplenic should receive all routine immunization. Two doses of varicella vaccine if needed should be administered with an interval of at least three months between doses instead of six weeks apart as routinely recommended for adolescents and adults.[1] In addition, it is important that they receive Hib, meningococcal (meningococcal conjugate ACYW and meningococcal B) and pneumococcal conjugate vaccines according to recommended schedules.[1] See Biological Products for information on the specific vaccines. Some individuals receiving repeated blood transfusions should receive hepatitis B vaccine. • Parents of children with asplenia and adults with asplenia should be aware that all febrile illnesses are potentially serious and that they should seek immediate medical attention for all febrile events.[7]	
See Biological Products – for specific vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Not routinely recommended
HBV	Recommended due to condition if receiving repeated blood products. Recommended as per age eligibility and schedule
Hib	Recommended due to condition
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Recommended due to condition
MenC-ACYW	Recommended due to condition
PNEU-C15	Not routinely recommended
PNEU-C20	Recommended due to condition
Live Vaccines	
Rotavirus	Recommended as per age eligibility and schedule
MMR-Var	Recommended as per age eligibility and schedule
MMR	Recommended as per age eligibility and routine schedule
VZ	Recommended as per age eligibility and routine schedule

Cardiac Disease (Chronic)	
• Individuals with chronic heart disease should receive pneumococcal conjugate vaccine as well as routinely recommended vaccines.[1]	
See Biological Products – for specific vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Not routinely recommended
HBV	Recommended as per age eligibility and schedule
Hib	Not routinely recommended
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Not routinely recommended
MenC-ACYW	Not routinely recommended
PNEU-C15	Not routinely recommended
PNEU-C20	Recommended due to condition
Live Vaccines	
Rotavirus	Recommended as per age eligibility and schedule
MMR-Var	Recommended as per age eligibility and schedule
MMR	Recommended as per age eligibility and schedule
VZ	Recommended as per age eligibility and schedule

Chronic Inflammatory Disease (Autoimmune Conditions)

- Includes individuals with inflammatory arthropathies (e.g. systemic lupus erythematosus [SLE], rheumatoid of juvenile arthritis etc.) inflammatory dermatological conditions (such as psoriasis, severe atopic dermatitis and eczema); and inflammatory bowel disease (Crohn's disease, ulcerative colitis).
- Individuals with chronic inflammatory diseases not being treated with immunosuppressive drugs are not considered significantly immunocompromised and can receive all recommended routine immunization. (Rheumatic disease modifying agents, such as hydroxychloroquine, sulfasalazine, or auranofin are not generally identified as immunosuppressive).[(1)]
- If being treated with immunosuppressive therapy, should ensure routine immunizations are up-to date. Refer to section in this document on *Immunosuppressive therapy* for recommendations and immunization indications.
- If possible, individuals should receive all routinely recommended vaccines and pneumococcal conjugate vaccine prior to starting immunosuppressive therapy.
    - Live vaccines are generally contraindicated for individuals on immunosuppressive therapy. Live vaccines should be administered at least 4 weeks prior to initiation of immunosuppressive therapy to reduce the risk of disease caused by the vaccine strain. Consult with individual's physician prior to giving live vaccines when immunosuppressive therapy is planned.
- Inactivated vaccines should be given at least 14 days prior to the start of immunosuppressive therapy so that optimal immunogenicity is achieved. However, when this is not possible inactivated vaccines can be safely administered at any time before, during or after immunosuppression.

See Biological Products – for specific vaccines.

Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Not routinely recommended
HBV	Recommended as per age eligibility and schedule
Hib	Not routinely recommended
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Not routinely recommended
MenC-ACYW	Not routinely recommended
PNEU-C15	Recommended as per age eligibility and schedule for those not receiving, and not anticipated to receive, immunosuppressive therapy
PNEU-C20	Recommended due to condition for those prior to immunosuppressive therapy or receiving immunosuppressive therapy.
Live Vaccines	
Rotavirus	Generally contraindicated if on immunosuppressive therapy.
MMR-Var	Generally contraindicated if on immunosuppressive therapy.
MMR	Generally contraindicated if on immunosuppressive therapy.
VZ	Generally contraindicated if on immunosuppressive therapy.

Cochlear Implant Candidates and Recipients	
• Individuals approved for cochlear implant surgery as well as past implant recipients should be considered at risk for bacterial meningitis. They should receive all routine immunizations and Hib and pneumococcal conjugate vaccines.[1]	
See Biological Products – for specific vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Not routinely recommended
HBV	Recommended as per age eligibility and schedule
Hib	Recommended due to condition
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Not routinely recommended
MenC-ACYW	Not routinely recommended
PNEU-C15	Not routinely recommended
PNEU-C20	Recommended due to condition
Live Vaccines	
Rotavirus	Recommended as per age eligibility and routine schedule.
MMR-Var	Recommended as per age eligibility and routine schedule.
MMR	Recommended as per age eligibility and routine schedule.
VZ	Recommended as per age eligibility and routine schedule.

Endocrine and Metabolic Diseases	
• Individuals with diabetes should receive all routine vaccines and pneumococcal conjugate vaccine.	
See Biological Products – for specific vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Not routinely recommended
HBV	Recommended as per age eligibility and schedule
Hib	Recommended as per age eligibility and schedule
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Not routinely recommended
MenC-ACYW	Not routinely recommended
PNEU-C15	Not routinely recommended
PNEU-C20	Recommended due to condition
Live Vaccines	
Rotavirus	Recommended as per age eligibility and routine schedule.
MMR-Var	Recommended as per age eligibility and routine schedule.
MMR	Recommended as per age eligibility and routine schedule.
VZ	Recommended as per age eligibility and routine schedule.

Liver Disease (Chronic)	
• Individuals with chronic liver disease, including hepatitis B carriers, anti-HCV positive individuals biliary atresia, fatty liver, hepatic cirrhosis and those with chronic liver graft versus host disease, should receive hepatitis A vaccine, hepatitis B vaccine and pneumococcal conjugate vaccines.	
See Biological Products – for specific vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Recommended due to condition.
HBV	Recommended due to condition. Recommended as per age eligibility and schedule
Hib	Not routinely recommended
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Not routinely recommended
MenC-ACYW	Not routinely recommended
PNEU-C15	Not routinely recommended
PNEU-C20	Recommended due to condition
Live Vaccines	
Rotavirus	Recommended as per age eligibility and routine schedule.
MMR-Var	Recommended as per age eligibility and routine schedule.
MMR	Recommended as per age eligibility and routine schedule.
VZ	Recommended as per age eligibility and routine schedule.

Neurologic Conditions	
• Individuals with pre-existing neurological disorders should receive all routinely recommended immunizations with the exception of repeat doses of any vaccine administered within six weeks of the onset of GBS.(1) • Individuals with chronic cerebrospinal fluid (CSF) leak and with neurologic conditions that may impair clearance of oral secretions should receive all routine immunizations and pneumococcal conjugate vaccine..(1) • Immunization should be deferred for 24 hours following significant head injury to avoid confusion between head trauma symptoms and adverse effects following immunization. .	
See Biological Products – for specific vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Not routinely recommended
HBV	Recommended as per age eligibility and schedule
Hib	Not routinely recommended
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Not routinely recommended
MenC-ACYW	Not routinely recommended
PNEU-C15	Recommended as per age eligibility and schedule for those with neurological conditions except for CSF leak and neurologic conditions impairing oral secretions
PNEU-C20	Recommended for individuals with a CSF leak and those with neurologic conditions impairing oral secretions.
Live Vaccines	
Rotavirus	Recommended as per age eligibility and routine schedule.
MMR-Var	Recommended as per age eligibility and routine schedule.
MMR	Recommended as per age eligibility and routine schedule.
VZ	Recommended as per age eligibility and routine schedule.

Non-malignant Hematologic Disorders (anemia, hemoglobinopathy, and bleeding disorders)	
• If a bleeding disorder is present, it should be optimally managed prior to immunization to minimize the risk of bleeding. For example, hemophiliacs may receive clotting factor concentrates to optimize their clotting factor level before they receive a parenteral vaccine or a passive immunizing agent.[1] • In addition to routine immunization, they should receive hepatitis A and hepatitis B vaccines. Intramuscular vaccines should be administered with a small gauge needle (23 gauge or smaller) with firm pressure applied to the injection site for 5 – 10 minutes following the injection.[1] **Notes**: ○ Anemia due to sickle cell disease see Asplenia/hyposplenia. ○ Individuals receiving long-term anticoagulation therapy with warfarin or heparin are not considered to be at higher risk of bleeding complications following immunization.[1]	
See Biological Products – for specific vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Recommended for individuals with hemophilia A or B receiving plasma-derived clotting factors.
HBV	Recommended due to condition if receiving repeated blood products. Recommended as per age eligibility and schedule
Hib	Not routinely recommended
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Not routinely recommended
MenC-ACYW	Not routinely recommended
PNEU-C15	Recommended as per age eligibility and schedule for those with non-malignant hematologic disorders except for hemoglobinopathy.
PNEU-C20	Recommended for individuals with hemoglobinopathy.
Live Vaccines	
Rotavirus	Recommended as per age eligibility and routine schedule.
MMR-Var	Recommended as per age eligibility and routine schedule.
MMR	Recommended as per age eligibility and routine schedule.
VZ	Recommended as per age eligibility and routine schedule.

Pulmonary Disease (chronic)	
• Individuals with chronic lung diseases such as asthma, chronic obstructive pulmonary diseases (COPD) or cystic fibrosis are at increased risk of complications from influenza and invasive pneumococcal disease. As well as routine immunizations, these individuals should receive pneumococcal conjugate vaccine. • Individuals with cystic fibrosis are at increased risk of complications from varicella infection. [1]	
See Biological Products – for specific vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Not routinely recommended
HBV	Recommended as per age eligibility and schedule
Hib	Not routinely recommended
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Not routinely recommended
MenC-ACYW	Not routinely recommended
PNEU-C15	Not routinely recommended
PNEU-C20	Recommended due to condition
Live Vaccines	
Rotavirus	Recommended as per age eligibility and routine schedule.
MMR-Var	Recommended as per age eligibility and routine schedule.
MMR	Recommended as per age eligibility and routine schedule.
VZ	Recommended as per age eligibility and routine schedule.

Renal disease (chronic)	
• Bacterial and viral infections are a major cause of morbidity and mortality in individuals with renal disease, nephrotic syndrome, those on dialysis (hemodialysis or peritoneal dialysis), or undergoing renal transplant.[1] In addition to routine immunization, hepatitis B (higher dose) and pneumococcal conjugate vaccines are recommended. . • Susceptible individuals 12 months and older should receive two doses of univalent varicella vaccine with an interval of at least three months between doses.[1]	
See Biological Products – for specific vaccines.	
Inactivated Vaccines	
COVID-19	Routinely recommended
Tdap/ Td/Tdap-IPV/ DTaP-IPV-Hib	Recommended as per age eligibility and schedule
HAV	Not routinely recommended
HBV	Recommended due to condition. See hyporesponsive dosing and schedule. Recommended as per age eligibility and schedule
Hib	Not routinely recommended
HPV	Recommended as per age eligibility and schedule
Influenza	Routinely recommended
Men-B	Not routinely recommended
MenC-ACYW	Not routinely recommended
PNEU-C15	Not routinely recommended
PNEU-C20	Recommended due to condition
Live Vaccines	
Rotavirus	Recommended as per age eligibility and routine schedule.
MMR-Var	Recommended as per age eligibility and routine schedule.
MMR	Recommended as per age eligibility and routine schedule.
VZ	Recommended as per age eligibility and routine schedule.

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