BRITISH COLUMBIA
CENTRE *for* EXCELLENCE
in HIV/AIDS

BC-CfE CDET Committee Statement Update on the use of COVID-19 vaccines in Persons Living with HIV

April 2022

OUTLINE

NOTE: The information in this document is current as of April 12th, 2022. Readers are encouraged to refer back to the BC-CfE website (http://bccfe.ca/therapeutic-guidelines/covid-19) for updates.

1) Recommendation

People living with HIV (PLWH) aged 5 years or older should be fully vaccinated for COVID-19, regardless of CD4 count provided that they do not have contraindications to the available age-appropriate vaccines (see below). Although the evidence was mixed in earlier studies, more recently, multiple large studies have indicated that PLWH are at increased risk of serious illness and death due to COVID-19 [1-6]. To date, there appears to be no significant difference in the safety profile of the authorized COVID-19 vaccines in PLWH compared to the general population.

2) Current COVID-19 vaccine usage in BC

a) Vaccine options authorized in Canada

i) **mRNA vaccines** (Pfizer-BioNTech product: *Comirnaty*; or Moderna product: *Spikevax*). COVID-19 vaccine usage in Canada has shifted almost exclusively to one or another of the two mRNA vaccines due to both the higher level of protection against symptomatic infection or severe disease in addition to improved safety profiles compared to the viral vector vaccines [7-9]. Both mRNA vaccines have been approved for adults and adolescents age 12 years and older [10],[11]. For children, the Pfizer-BioNTech vaccine has been approved for those age 5-11 years [12, 13] and the Moderna vaccine at the pediatric dosage of 50 mcg (adult dosage is 100 mcg) has been approved as an alternative to the Pfizer-BioNTech vaccine for those age 6-11 years [14].

ii) **Recombinant protein subunit vaccine** (Novavax product: *Nuvaxovid*). This was approved for use in adults age 18 years and over by Health Canada on February 17th 2022 [15],[16]. The vaccine efficacy for protection against symptomatic COVID-19 illness was 89.7% (95% CI: 80.2-94.6%) in the clinical trial 2019nCoV-302 [15]. However, these data were generated prior to the emergence of the delta and omicron variants.

iii) **Viral vector vaccines** (AstraZeneca product: ChAdOx1 nCOV-19, *Vaxzevria;* or Johnson & Johnson-Janssen product: Ad.COV2.S, *Janssen COVID-19 vaccine*) are approved for those age 18 years and over, using a 2-dose and 1-dose schedule, respectively [7]. These products are only recommended for a primary series of COVID-19 vaccination if there are no specific contraindications to their use, and only when all other authorized COVID-19 vaccines are contraindicated [7]. This NACI recommendation relates to the lower level of protection afforded by the viral vector vaccines in addition to the less favourable adverse effect profile, which includes rare but potentially serious adverse effects, as outlined below [8],[9]. However, there is some preliminary evidence that the immune responses, as measured by peak antibody titres with the Janssen COVID-19 vaccine are initially lower than for mRNA vaccines but remain relatively stable over 8 months [17]. Although there are no randomized controlled trials comparing different COVID-19 vaccines, a recent observational study

suggested that the Janssen COVID-19 vaccine may provide more durable protection against breakthrough infections and hospitalizations [18].

iv) **Recombinant, plant-based virus-like particles (VLP) vaccine** (Medicago product: *COVIFENZ*). This vaccine contains purified, spike protein of SARS-CoV-2 expressed in virus-like particles produced by plant-based technology. In the phase 3 portion of the RCT Study 021, the vaccine efficacy was 71%. The vaccine was approved by Health Canada on February 24, 2022 for individuals 18-64 years of age [19].

b) Recommended primary vaccination series for COVID-19 (see Table [20]).
The recommendations were updated by both the BCCDC and NACI [21]. The recommendation is for a complete series with an mRNA COVID-19 vaccine for those who do not have a contraindication and are age-appropriate for the available vaccine. The Pfizer-BioNTech vaccine dosage for age 5 to 11 years with the pediatric formulation is 10 mcg; for age 12 years and older the dosage is 30 mcg. The Moderna vaccine dose for age 6 to 11 years is 50 mcg and for 12 years of age and over the dose is 100 mcg. The preference in the choice of mRNA vaccine is Moderna for age 30 years and older based upon indirect evidence of higher vaccine efficacy compared to the Pfizer-BioNTech vaccine [7][14]. However, the preference for age 6 to 29 years is the Pfizer-BioNTech vaccine due to its lower incidence of myocarditis in this age group compared to the Moderna vaccine [7][14]. The first and second vaccine doses should be spaced 8 weeks apart [20][21].

Those who are not able or willing to receive an mRNA COVID-19 vaccine should be offered the Novavax COVID-19 vaccine provided there is no contraindication. Although NACI has recommended that such individuals may alternatively be offered the recombinant VLP (Medicago) vaccine as a 2-dose primary vaccination series at least 21 days apart [22], to date this vaccine has not yet been recommended or stated as available in BC according to the BCCDC website. Those individuals who have contraindications to all other authorized COVID-19 vaccinations may be offered one of the viral vector vaccinations after informed consent. This should include discussion regarding the risks of rare but serious complications associated with these vaccines, specifically thrombosis and thrombocytopenia syndrome (TTS) and the need to seek immediate medical care should symptoms develop [7]. The use of **mixed 2-dose vaccine schedules** (e.g., a viral vector vaccine followed by an mRNA vaccine) has been associated with similar high level of protection against COVID-19-related hospitalization which exceeded 90% when at least one dose was an mRNA vaccine [23].

c) 3-dose primary vaccine series (see Table [20]). Multiple studies have demonstrated a suboptimal immune response to different 2-dose COVID-19 vaccine schedules in a substantial proportion of certain populations with immunocompromise or particular comorbidities [24],[25]. In order to address this, the addition of a 3rd dose to the primary vaccination series in transplant and hemodialysis patients has been associated with improved immune responses [25],[26]. This is not considered to be a booster dose since the problem is the absence of a robust immune response to the first 2 doses rather than one of waning immunity. Given these findings, a 3rd dose in the primary vaccine series is now

being recommended for mRNA vaccines in moderately to severely immunocompromised adults and children, rather than the original 2-dose series [21]. However, an additional dose has not been recommended in the primary vaccination series for either of the viral vector vaccines, unless alternative vaccines are contraindicated. Although the Moderna vaccine is considered to be an alternative for those age 6 to 29 years, it should be considered preferentially in immunocompromised children age 6-11 years given the evidence of higher seroconversion rates among immunocompromised Moderna vaccine recipients (versus Pfizer BioNtech recipients) and the much lower incidence of myocarditis in this younger age group in association with mRNA vaccination [14].

Among **PLWH**, this recommendation of a 3-dose primary vaccine series in British Columbia would apply to those with any of the following: a prior AIDS defining illness, or CD4 count $\leq$200/mm^3, or CD4 fraction $\leq$15%; or detectable plasma viral load since January 2021; age $\geq$65 years; or perinatally acquired HIV infection [27]. A recent study among PLWH with a median CD4 of count of 710 (IQR 525-935) cells/mm^3 and receiving antiretroviral therapy demonstrated similar humoral immune responses compared to controls, suggesting that a 3rd vaccine dose in the primary series would not be necessary for most PLWH with viral load suppression and CD4 cell counts above 200 cells/mm^3 [28].

d) COVID-19 booster dose recommendations (see Table [20]).

i) Rationale. The first booster doses may be the 3rd or 4th dose depending upon whether the individual received a primary vaccination series of 2 or 3 doses. Decline in antibody titres and protection from COVID-19 disease have been demonstrated 6 months after completion of a 2-dose primary vaccine series using the initially recommended 21-day interval between doses for the Pfizer-BioNTech vaccine [29],[30],[31],[32]. However, the protection has been restored with the use of a booster dose [33]. Booster doses are now recommended at 6 months after completion of a primary COVID-19 vaccine series, with the booster being an mRNA COVID-19 vaccine even if the primary series was given with a viral vector vaccine. Similar or higher immune responses have been observed with heterologous versus homologous boosting regimens, which included the primary series and booster combinations using one or another of the two mRNA vaccines and the Janssen COVID-19 vaccine [34].

The priority for administration of such booster doses was initially targeting those who are at higher risk of severe disease due to COVID-19 (e.g., older age, immunocompromise, and comorbidities), but has since been broadened to include the general population of age 12 years and older by the BCCDC (see Table [20]). Booster doses are also recommended within 6 months after the last dose in pregnancy or breastfeeding and for any individual who has already received a three-dose primary vaccination series [21]. The only group in the general population for whom a booster dose is not currently recommended is for children less than 12 years of age [21]. A **4th vaccine dose** given within 6 months of the last dose is currently only being recommended as a booster dose in those who were eligible to receive a 3-dose primary immunization series, specifically the moderately to severely immunocompromised (as defined in Appendix A).

Boosters in PLWH. The waning of both humoral and cell-mediated immune response was recently demonstrated among PLWH receiving ART (87% had an HIV RNA <50 c/mL) at a median of 5 months following the second dose of either of the mRNA vaccines, particularly among those with CD4 counts <200 cells/mm^3 [35]. The response to mRNA booster doses at a median of 142 days (132-156) after the second dose was recently evaluated among 216 PLWH receiving ART (93% had HIV RNA <50 c/ml) with a wide range of CD4 counts [36]. A high response rate was observed and a CD4 count of <200 cells/mm^3 was not associated with a risk of failing to elicit a humoral or cell-mediated immune response [36].

Second booster doses are now being recommended by both NACI [37] and BCCDC. Currently in BC, all of the following groups are approved for a second booster dose 6 months after the first booster: people in long term care; assisted living (if age ≥70 yrs, or ≥55 yrs and indigenous); or seniors (if age ≥70 years, or ≥55 years and indigenous).

ii) **Booster preference.** The preference is for the Moderna vaccine for those 30 years of age or older due to higher neutralizing antibody titres and lower rates of breakthrough infection compared to the Pfizer-BioNTech vaccine [38],[39],[40]. However, the rare adverse event of myocarditis, which has been observed predominantly in the age group of 12-29 years occurs more often with the Moderna compared to the Pfizer vaccine, making the latter the preference in this age group.

iii) **Booster alternative.** An alternative booster vaccine option may be offered at ≥6 months after completion of a primary COVID-19 vaccine series to adults age 18 and above with the Novavax vaccine (*Nuvaxovid*) if they are not able or willing to receive an mRNA vaccine booster, provided that they have no contraindication (discretionary NACI recommendation) [16]. Medicago *Covifenz* is not currently authorized for use as a booster dose in Canada [22].

e) **COVID-19 vaccinations for individuals with previous SARS- COV-2 infection and COVID-19 vaccination.** The risk of subsequent SARS-CoV-2 reinfection is significantly reduced by completing a COVID-19 vaccine schedule [41]. Although the optimal time interval between COVID-19 infection and subsequent vaccination is uncertain, BCCDC has recommended that such individuals receive their next scheduled vaccination or booster any time after the resolution of COVID-19 symptoms and up to 3 months after having had a positive COVID-19 test result [42]. However, the recent evidence that a longer interval between COVID-19 infection and vaccination is associated with improved antibody responses supports waiting for 2-3 months before vaccinating [43][44].

f) **Simultaneous administration of COVID-19 vaccines with other vaccinations**. Any of the currently authorized COVID-19 vaccinations may be given simultaneously or at any time before or after a non-COVID-19 vaccine, including either live or non-live vaccines (discretionary NACI recommendation) [16].

3) Vaccine-related adverse events.

a) Very common and common adverse events are defined as those which occur in >10% and 1-9% of vaccine recipients, respectively. **Local reactions** with pain, redness, or swelling at the injection site typically resolve within a few days. Localized axillary lymphadenopathy with swelling or tenderness may also be encountered. **Systemic adverse events** may last a few days with fatigue, headache, muscle pain, chills, or joint pain. Among PLWH, transient HIV RNA viral blips have been detected within 1 month of SARS-CoV-2 vaccination in 8.9% of vaccinees who had been fully suppressed [45]. Similar findings have been previously reported with influenza vaccination.

b) Rare and very rare adverse events. Rare and very rare adverse events occur in 0.01% to <0.1% and <0.01% (< 1:10,000) of vaccine recipients, respectively. Those adverse events which are very rare are unlikely to be identified in clinical trials, highlighting the importance of ongoing surveillance in the vaccinated population.

i) mRNA vaccines.

Severe immediate allergic reactions (e.g., anaphylaxis) occur in approximately 2-10 cases per million doses of vaccine administered. The reactions typically occur within 15-30 minutes and when treated promptly within a supervised vaccine facility complete recovery is expected. So far there have been no fatalities or long-term morbidity associated with allergic reactions to mRNA vaccines reported in Canada [7].

Myocarditis or pericarditis have been associated with both mRNA vaccines, but somewhat more frequently with the Moderna vaccine [46]. This complication is usually noted within a week following vaccination, particularly the 2nd dose. It also occurs mainly in males between the ages of 12-29 years and follows a mild clinical course with quick recovery in most individuals. The rates of myocarditis/pericarditis reported in Canada in association with the Moderna and Pfizer COVID-19 vaccines were 3.0 and 1.9 cases per 100,000 doses, respectively [47]. In the Vaccine Adverse Event Reporting System (VAERS) in the US, among more than 190 million COVID-19 vaccine recipients, 1,626 cases of myocarditis were identified [48] . Among those who developed myocarditis, the median age was 21 years (IQR 16-31 years) and the highest rate was observed in 16-17-year old males (105.9 per million doses). For men aged 18-24 years, the rates were 52.4 and 56.3 cases per million doses of the Pfizer and Moderna vaccines, respectively [48]. Almost all of the cases (96%) were hospitalized, and 87% had resolution of presenting symptoms by the time of hospital discharge.

Bell's palsy. Very rare cases of Bell's palsy have been reported following vaccination with either of the mRNA vaccines [47].

ii) Viral vector vaccines (AstraZeneca and Janssen COVID-19 vaccines).

Thrombosis and thrombocytopenia syndrome (TTS). This is a very rare and serious adverse effect which may involve thrombosis in unusual locations (e.g., cerebral venous sinus thrombosis, splanchnic vein thrombosis or arterial thrombosis) associated with thrombocytopenia. A subgroup of TTS cases test positive for antibodies to platelet factor 4-polyanion complexes (anti-PF4) [49] which is referred to as vaccine-induced immune thrombotic thrombocytopenia (VITT). TTS usually develops between 4-28 days following vaccination. The frequency of TTS with the AstraZeneca vaccine is

between 1:26,000 and 1:100,000 doses. A lower incidence has been observed with the Janssen COVID-19 vaccine at 1:300,000 doses [7]. The incidence of TTS is higher in women than men and higher in younger versus older adults. The case fatality rate is between 20-50% [7].

Guillian-Barre syndrome (GBS). Both viral vector vaccines (but neither of the mRNA vaccines) have been associated with GBS [7]. The onset has occurred between 6 hours and 25 days following vaccination among Canadian cases. Among those individuals with a prior history of GBS, there appears to be no clear indication that COVID-19 vaccination causes recurrent GBS. In a recent cohort study involving 702 patients with a prior history of GBS who received the Pfizer-BioNTech vaccine, there was only one individual identified as having a possible vaccine-related relapse of GBS [50].

Systemic capillary leak syndrome. Very rare reports have described the development of this life-threatening immune disorder, which includes hypoalbuminemia, hypotension, and possibly shock with multi-organ failure. Almost all of the cases described in association with COVID-19 vaccination have involved one of the viral vector vaccines [51].

iii) **Recombinant protein subunit vaccine (Novavax).** The adverse events associated with this vaccine in the licensing clinical trial were local injection site reactions and systemic symptoms (e.g., headache, muscle pain, fatigue), as for the other vaccines. There were 7,020 subjects in the study who received the vaccine and the rate of serious adverse events was 0.5% for both the vaccine and placebo groups [15].

iv) **Recombinant, plant-based virus-like particles vaccine** (Medicago vaccine) [52]. In the phase 3 clinical trial (study 021), there were 4,094 vaccine recipients in the safety subset analysis. Both local and systemic adverse reactions were more frequent in the vaccine group compared to placebo, but these were usually mild to moderate and resolved within a few days. Serious adverse events were observed in 0.4% and 0.3% of the vaccine and placebo groups, respectively.

4) COVID-19 vaccine contraindications and precautions [21]**.**

a) Contraindications:

i) **Thrombosis with thrombocytopenia syndrome (TTS).** Individuals who have experienced TTS following a viral vector vaccination should not receive a subsequent dose. An mRNA vaccination should be recommended instead.

ii) **Capillary leak syndrome (CLS).** Those with a history of capillary leak syndrome (whether or not related to previous vaccination) should not receive a viral vector COVID-19 vaccine. An mRNA vaccine should be recommended instead.

b) Precautions:

i) **Severe immediate allergic reactions** such as anaphylaxis occur ≤4 hours following vaccination may related to a COVID-19 vaccine or a vaccine excipient. Such a reaction should prompt an allergy consultation with risk/benefit consideration prior to a further dose of an mRNA COVID-19 vaccine. Switching to a viral vector vaccine is not the

preferred management. Such reactions are likely not IgE-mediated and have a low likelihood of recurrence after subsequent vaccine doses [7]. Those who agree to receive a subsequent dosage of a COVID-19 vaccine, after informed consent and risk/benefit considerations have been discussed, should also have a longer post-vaccination observation time of 30 minutes instead of 15 minutes. **Excipients** which may be responsible for allergic reactions include: polyethylene glycol (PEG) (found in Pfizer-BioNTech vaccine), tromethamine (in Moderna vaccine), and polysorbates (present in viral vector vaccines) [7]. **Viral vector vaccines** may also be associated with severe allergic reactions. Following such a reaction, any subsequent vaccination should be offered with an mRNA vaccine after informed consent and risk/benefit considerations have been discussed, including an extended 30-minute period of observation following the revaccination.

ii) **Immune thrombocytopenia (ITP).** Individuals with ITP should not receive a viral vector vaccine and instead should be offered an mRNA vaccine. If an mRNA vaccine is contraindicated or inaccessible, then consider hematology assessment prior to vaccination in addition to platelet monitoring following vaccination.

iii) **Thrombosis and thrombocytopenia syndrome (TTS).** For those with a past history of TTS or unusual thrombosis, a viral vector vaccine should only be considered if other vaccines are contraindicated or inaccessible and after appropriate risk assessment. However, a previous history of cerebral venous sinus thrombosis (CVST) with thrombocytopenia unrelated to a viral vector and also those with previous heparin-induced thrombocytopenia (HIT) unrelated to viral vector vaccine do not appear to be at increased risk of VITT after receiving a viral vector vaccine [7].

iv) **Myocarditis and/or pericarditis following mRNA COVID-19 vaccinations.**
Myocarditis. Further doses of an mRNA COVID-19 vaccine should be deferred for people who developed myocarditis within 6 weeks of a previous dose of an mRNA vaccine (e.g., abnormal cardiac evaluation such as electrocardiogram, elevated troponins, echocardiogram or cardiac MRI) [46],[48].
Pericarditis. Those with a history consistent with pericarditis and either no cardiac work up or normal cardiac investigations (i.e., no evidence of myocarditis) can receive a subsequent dose of an mRNA vaccination after they have been symptom-free for at least 90 days following the prior vaccination. Any subsequent dose of an mRNA vaccination in such patients should be with the Pfizer-BioNTech vaccine rather than Moderna, given the lower reported rate of myocarditis and/or pericarditis with the Pfizer product [46],[48].

Table [20]

BC Centre for Disease Control
Provincial Health Services Authority

COVID-19 Vaccine Eligibility

The COVID-19 vaccines authorized for use in Canada include: Pfizer-BioNTech – Adult /Adolescent presentation, Pfizer-BioNTech – Pediatric presentation, Moderna, AstraZeneca, Novavax, and Janssen. Refer to the respective product page for product specific information.

Primary Series	
Eligibility Criteria	**Number of Doses**
Pediatric population – 5 to 11 years of age (inclusive)	2 doses of: • Pfizer: 0.2 mL (10 mcg) – *preferred* • Moderna: 0.25 mL (50 mcg) – only for those 6-11 years of age
General population – 12 years of age and older	2 doses [A] of any: • Pfizer: 0.3 mL (30 mcg) - *preferred for 12-29 year olds* • Moderna: 0.5 mL (100 mcg) • Novavax (≥ 18 years of age): 0.5 mL **OR** 1 dose: Janssen (≥ 18 years of age): 0.5 mL
Moderately to severely immunosuppressed (see Appendix B) – 5 to 11 years of age	3 doses of: • Pfizer: 0.2 mL (10 mcg) • Moderna: 0.25 mL (50 mcg) – only for those 6-11 years of age
Moderately to severely immunosuppressed (see Appendix A) – 12 years of age and older	3 doses [A] of any: • Moderna: 0.5 mL (100 mcg) - *preferred* • Pfizer: 0.3 mL (30 mcg) • Novavax (≥ 18 years of age): 0.5 mL * For individuals who received a single dose of Janssen vaccine, a 2-dose primary series is recommended.
Booster Dose [B]	
Eligibility Criteria	**Number of Doses**
• Residents of long term care (LTC), assisted living and independent living facilities, and alternate level of care clients awaiting placement in LTC • Individuals 70 years of age and older	1 dose [A]– at least 6 months after the primary series: • Pfizer: 0.3 mL (30 mcg) • Moderna: 0.5 mL (100 mcg) - *preferred for those who are moderately to severely immunosuppressed* (see Appendix A)
• Individuals 18-69 years of age	1 dose [A] – at least 6 months after the primary series: • Pfizer: 0.3 mL (30 mcg) - *preferred for 18-29 year olds* • Moderna: 0.25 mL (50 mcg) - *preferred for 18-69 year olds who are moderately to severely immunosuppressed* (see Appendix A) * For individuals who received a 1-dose Janssen primary series, a booster dose is recommended at least 2 months later.
• Individuals 12-17 years of age [C, D]	1 dose – at least 6 months after the primary series: • Pfizer: 0.3 mL (30 mcg) - *preferred* • Moderna: 0.25 mL (50 mcg)
Second Booster Dose	
• Residents of LTC, alternate level of care clients awaiting placement in LTC, individuals 70 years of age and older, and Indigenous persons 55 years of age and older	1 dose – at least 6 months after the first booster dose: • Pfizer: 0.3 mL (30 mcg) • Moderna: 0.25 mL (50 mcg)

[A] mRNA vaccines are the preferred COVID-19 vaccines due to the demonstrated high efficacy and effectiveness with longer term safety data. Novavax COVID-19 vaccine may be offered to individuals for whom COVID-19 mRNA vaccines are contraindicated or have been refused. A viral vector COVID-19 vaccine should only be considered when all other authorized COVID-19 vaccines are contraindicated or refused, due to the reduced effectiveness and the possible adverse effects associated with viral vector vaccines (e.g., Thrombosis with Thrombocytopenia Syndrome)
[B] Pregnant persons may receive a booster dose at least 8 weeks after completion of the primary series.
[C] Includes individuals who are moderately to severely immunosuppressed and received a 3-dose primary series.
[D] A booster dose is particularly recommended for individuals 12-17 years of age who are at higher risk of severe illness due to COVID-19. See the government of B.C. website, under "clinically extremely vulnerable criteria for youth" for further details.

Table, Appendix A and B [20]

BC Centre for Disease Control
Provincial Health Services Authority

COVID-19 Vaccine Eligibility

Appendix A

For those 12 year of age and older, moderately to severely immunosuppressed includes:

- Have had a solid organ transplant (heart, lung, liver, kidney, pancreas or islet cells, bowel or combination organ transplant).
- Since January 2020, have received treatment with any anti-CD20 agents (i.e., rituximab, ocrelizumab, ofatumumab, obinutuzumab, ibritumomab, tositumomab).
- Since January 2020, have been treated with B-cell depleting agents (i.e., epratuzumab, MEDI-551, belimumab, BR3-Fc, AMG-623, atacicept, anti-BR3, alemtuzumab).
- Since October 2020, have received or are receiving radiation therapy for cancer.
- Since March 2020, have received or are receiving systemic therapy for solid tumours as well as hematological cancers (including chemotherapy, molecular therapy, immunotherapy, targeted therapies including CAR-T, monoclonal antibodies, hormonal therapy for cancer).
- Have combined immune deficiencies affecting T-cells, immune dysregulation (particularly familial hemophagocytic lymphohistiocytosis) or type 1 interferon defects (caused by a genetic primary immunodeficiency disorder or secondary to anti-interferon autoantibodies).
- Since September 2019, have had a bone marrow or stem cell transplant or are still taking immunosuppressant medications related to transplant.
- Have a moderate to severe primary immunodeficiency which has been diagnosed by an adult or pediatric immunologist and requires ongoing immunoglobulin replacement therapy (IVIG or SCIG) or the primary immunodeficiency has a confirmed genetic cause (e.g., DiGeorge syndrome, Wiskott-Aldrich syndrome).
- On dialysis (hemodialysis or peritoneal dialysis) or have stage 5 chronic kidney disease (eGFR <15 mL/min) or have glomerulonephritis and receiving steroid treatment.
- Prior AIDS defining illness or CD4 count ≤ 200/mm^3 or CD4 fraction ≤ 15% or detectable plasma viral load since January 2021 or HIV infection and ≥ 65 years old or perinatally acquired HIV infection.
- Have taken significantly immunosuppressing drugs or treatments including at risk biologics, steroids and other agents since December 15, 2020. [E]

Appendix B

For children 5-11 years of age, moderately to severely immunosuppressed includes:

- Have had a solid organ transplant (heart, lung, liver, kidney, pancreas or islet cells, bowel or combination organ transplant).
- In the last year, received systemic treatment for a haematological malignancy, including anti-CD20 or other B-cell depleting therapies.
- In the last 2 years, have had a bone marrow, stem cell transplant, CAR-T, or is still taking immunosuppressant medications.
- In the last 6 months have received anti-cancer systemic therapy for solid tumors (including but not limited to: cytotoxic chemotherapy, molecular targeted therapy, immunotherapy, monoclonal antibodies, bone modifying agents used in the setting of metastatic disease, high dose steroids [e.g. equivalent of > 20 mg/day for more than 1 month but excluding patients only receiving hormonal or bone modifying therapy in the adjuvant setting]).
- In the last 3 months, have received or are receiving radiation therapy for cancer.
- In the past year, have received anti-CD20, B-cell depleting or similar agents. [F]
- In the last 3 months, received immunosuppressing therapies including biologic agents, oral-immune suppressing drugs, steroids (orally or by injection for a period of > 14 days), immune suppressing infusions/injections or intermittent high dose steroids administered as immune suppression prior to intravenous enzyme replacement treatment. [F]
- On dialysis (hemodialysis or peritoneal dialysis) or have stage 5 chronic kidney disease (eGFR <15 mL/min) or have glomerulonephritis and receiving steroid treatment.
- Have a primary immunodeficiency which has been diagnosed by a pediatric immunologist.
- Prior AIDS defining illness or HIV infection with prior CD4 count ≤ 200/mm^3, prior CD4 ≤ 15% or detectable plasma viral load in the last year.

[E] A list of these medications can be found on the government of B.C. website.
[F] A list of these medications can be found on the government of B.C. website.

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Chapter 2: Immunization
Part 4 - Biological Products

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