Clinical Guidance on COVID-19 Vaccines for people with hematological malignancy at any stage of treatment and/or who have undergone hematopoietic stem cell transplant or CAR-T cell therapy in the past 6 months

This guidance is intended for healthcare providers and is based on known evidence as of November 16, 2021.

This document relates to people with hematological malignancies and those who have undergone hematopoietic stem cell transplant or CAR-T cell therapy. Please refer to other guidance document for people with solid cancers. For general information, please refer to BCCDC Guidance and information on COVID-19 vaccines for providers.

Background and Context

Hematologic malignancies (blood cancers such as leukemias, myelodysplastic syndromes, myeloproliferative neoplasms, lymphomas and multiple myeloma) can be treated with chemotherapy, hematopoietic stem cell transplant (HSCT) or chimeric antigen receptor T-cell (CAR-T) therapies with either a curative intent or to prolong survival. The hematologic malignancy itself or the anti-cancer therapies can result in long-lasting immunodeficiency, and COVID-19 infection in this population is associated with a significantly higher risk of hospitalization and death.[1]

This guidance is based on a review of the vaccines approved by Health Canada for the prevention of COVID-19 disease caused by the SARS-CoV-2 virus:

- **mRNA vaccines:** Pfizer-BioNTech (BNT162b2),[2] Moderna (mRNA-1273)[3]
- **Replication-defective adenoviral vector vaccine:** AstraZeneca/COVISHIELD (ChADOx1-S),[4,5] Janssen/Johnson & Johnson (Ad26.COV2.S)[6]

Currently, anyone in British Columbia who is 12 years and older (i.e., born in 2009 or earlier) is eligible for COVID-19 immunization. Both of the mRNA vaccines, Pfizer-BioNTech[2] and Moderna[3], are authorized for youth aged 12-17. Studies of the COVID-19 vaccines in younger children are ongoing.

- If you receive the mRNA vaccine (Pfizer or Moderna) for your first dose, you will usually be offered the same vaccine for your second dose. However, you may be offered the other mRNA vaccine as the vaccines are very similar. No data currently exist on the interchangeability of the COVID-19 mRNA vaccines. However, there is no reason to believe that mRNA vaccine series completion with a different authorized mRNA vaccine product will

result in any additional safety issues or deficiency in protection.[7] You should not receive an AstraZeneca/COVISHIELD vaccine for your second dose.[8]

Third doses:

To date, people who are moderately to severely immunocompromised have been observed to have generally lower antibody responses and lower vaccine effectiveness from COVID-19 vaccines compared to the general population. The National Advisory Committee on Immunization[9] has reviewed this evidence and recent studies that demonstrate that some people who are immunocompromised develop an improved antibody response after a third dose of vaccine.

As such, as of September 15, 2021, people who are severely immunocompromised in B.C. are eligible to receive a third dose of an mRNA COVID-19 vaccine. People who are moderately immunocompromised will be eligible for a third dose of an mRNA COVID-19 vaccine in the weeks following.

A minimum interval of 28 days between dose 2 and dose 3 is recommended for those eligible for a third dose. As per the BC Immunization Manual, Moderna COVID-19 vaccine is preferred for the third dose. However if Moderna is unavailable (or if the individual prefers), the Pfizer-BioNtech COVID-19 vaccine may be provided.[10]

Specifics on current eligibility for a third dose may be reviewed here: www2.gov.bc.ca/gov/content/covid-19/vaccine/register#immunocompromised

Other vaccines:

The AstraZeneca/COVISHIELD COVID-19 vaccine program has been stopped in B.C. for first doses, unless there is a contraindication to the mRNA vaccines, or as advised by the Medical Health Officer or an allergist,[7] due to infrequent (1:50,000) but serious Vaccine-Induced Thrombotic Thrombocytopenia (VITT) blood clotting events after the first dose.[11] The risk of VITT is more than six times lower for the second dose (1:600,000). People who had the AstraZeneca/COVISHIELD vaccine for their first dose have the option of receiving AstraZeneca for their second dose, or, receiving an mRNA vaccine as their second dose. Receiving a mixed vaccine series (AstraZeneca/COVISHIELD for first dose and an mRNA vaccine for the second dose) is permitted based on small studies that suggest that this is likely safe and likely as effective and may be even more effective, but not enough is known to make firm conclusions and data collection is ongoing. There may also be heightened side effects experienced with a mixed vaccine series.

The BCCDC has prepared two information sheets to help navigate that choice:

- For health care professionals: Updated recommendations for AstraZeneca and COVISHIELD vaccines letter for physicians (www.bccdc.ca/health-professionals/clinical-resources/covid-19-care/covid-19-vaccinations/toolkit-for-health-professionals)
- For patients: 2nd dose choice for people who received AstraZeneca/COVISHIELD (www.bccdc.ca/Health-Info-Site/Documents/COVID-19_vaccine/AstraZeneca_2ndDose.pdf)

The Janssen/Johnson & Johnson (Ad26.COV2.S)[6] one-dose viral vector vaccine is now available in limited supply in B.C. However, mRNA vaccines are preferred over viral vector vaccines due to better effectiveness and immunogenicity of mRNA vaccines and the possible adverse effects specifically associated with viral vector vaccines (e.g., Thromobosis and Thrombocytopenia Syndrome [TTS]).

As well, another emerging vaccine candidate developed by Novavax may also be approved by Health Canada in the coming months. This vaccine works differently than the approved vaccines in Canada. This guidance will be updated as more information becomes available.

There is still uncertainty as to whether the currently available COVID-19 vaccines are efficacious in adults and children with cancer or undergoing therapy for their cancer (cytotoxic chemotherapy, endocrine therapy, targeted therapy, immunotherapy) and/or radiation therapy (external-beam, brachytherapy, or systemic), as well as to the timing of immunization in relation to their cancer treatments.

Is the COVID-19 vaccine recommended for people with hematologic malignancies and HSCT and/or CAR-T recipients?

The risk of mortality from COVID-19 disease is higher in patients with cancer, including patients with hematologic malignancies and HSCT recipients.[12-15] One study found that more severe forms of COVID-19 disease, including those requiring ICU admission, were more frequent in patients with hematologic malignancies hospitalized with COVID-19, and led to mortality nearly four times higher than that of the general population with COVID-19 and 41 times higher than that of hematologic malignancy patients without COVID-19.[1]

COVID-19 vaccine vaccines are not contraindicated and should be encouraged for people with hematologic malignancies and HSCT and/or CAR-T recipients and as per BC Public Health recommendation for age eligibility. This recommendation is based on the following:

- The National Advisory Committee on Immunization (NACI) recommends that immunosuppressed individuals be offered the vaccine if the benefits of vaccines outweigh the potential risks.[7]
- Patients with blood cancer have an increased risk of death related to COVID-19 infection.[1,12-15]
- The United Kingdom, the United States, France, and Australia have prioritized patients with cancer for COVID-19 vaccinations, highlighting the high COVID-19 risk faced by these patients.[16]

Is the COVID-19 vaccine efficacious and safe in people with hematologic malignancy patients and HSCT and/or CAR-T recipients?

There is still uncertainty about the efficacy of COVID-19 vaccines in patients with blood cancer and/or have undergone HSCT or CAR-T cell therapy in the last six months. As with most vaccines, there is a potential for diminished immune response in individuals who are immunocompromised due to their disease or treatment. In addition, patients with active cancer or undergoing active cancer treatment seemed to be generally excluded from the COVID-19 vaccine trials. However, in the Pfizer-BioNTech vaccine trial, 3.9% of enrolled participants had a malignancy.[16]

There are currently no known factors that would predispose these individuals to adverse events associated with the vaccines.[2-5] At the time of authorization, there are no known serious warnings or precautions related to the vaccines in patients with cancer.[2-5]

Small exploratory studies have shown lower antibody responses in patients with advanced cancer and haematological malignancies[17] following vaccination compared to controls. However, it is unclear how much antibody is needed for protection and/or the role of other immunological responses.

There are currently no data on the actual efficacy or effectiveness of a third dose with any of the COVID-19 vaccines in immunocompromised individuals. Small studies on third doses of the mRNA COVID-19 vaccines have shown that immunogenicity (immunity measured in the blood) may increase with a third dose. The safety of a third dose is unknown at this time, but in these small studies reactions were found to be similar to that of prior doses. The impact of additional doses on the worsening of underlying disease or on rare adverse events, including the risk of myocarditis and/or pericarditis, is unknown at this time.[8]

The frequency and severity of adverse events following vaccination with an mRNA COVID-19 vaccine in these populations were comparable to that of non-immunosuppressed individuals in these studies and what was reported in clinical trials. Safety data in these populations following vaccination with a viral vector vaccine is not available.[7]

Informed consent should include discussion about the possibility that individuals who are immunosuppressed may have a diminished immune response to any of the authorized COVID-19 vaccines.[7]

Observed short-term adverse effects with the mRNA-based COVID-19 vaccines have been similar to those seen with seasonal influenza vaccination. Still, they may be more pronounced after the second COVID-19 vaccine dose (e.g. injection site pain/erythema, fever, headache, fatigue, and myalgia/arthralgia).[2-6, 19] Safety results in the allogeneic HSCT patient population seem comparable.[18] Any long-term side effects of COVID-19 vaccines are not yet known, but Health Canada continues to monitor any adverse events following vaccination through their post-authorization surveillance process.

Immunocompromised patient populations are diverse and the relative degree of immunodeficiency will depend on the underlying condition, the progression of the disease, and the type and timing of treatment received. Therefore, the balance of potential benefit and risk associated with COVID-19 vaccination should be assessed on an individual basis (Table 1).

Are there any specific contraindications or exceptions for those within the hematologic malignancy, HSCT and/or CAR-T recipient patient populations?

Blood counts

Patients with blood cancer and HSCT or CAR-T recipients may experience low blood counts, either due to their disease or treatment, which could impact individual decision-making around receipt of COVID-19 vaccinations and timing of

vaccinations relative to their treatments. COVID-19 vaccination should be deferred in patients unwell with neutropenia until well,[2,3] but may be considered in well patients with disease-related chronic neutropenia where neutrophil recovery is not expected.[19]

Allergy

The above noted COVID-19 vaccines are contraindicated in individuals with a history of severe allergic reaction to any component of the vaccines, including non-medicinal ingredients such as polyethylene glycol (PEG) or polysorbate-80, or a history of anaphylaxis after administration of a previous dose of COVID-19 vaccine using a similar platform (mRNA or viral vector).[7] People with a history of anaphylaxis without known or obvious cause, and those with suspected hypersensitivity or non-anaphylactic allergy to COVID-19 vaccine components, are advised to consult with an allergist prior to immunization. Patients who have experienced a serious allergic reaction to another vaccine, medicine or food should be observed longer after vaccine administration to monitor for development of any allergic reaction.[7]

For a list of components in the vaccine and packaging consult the respective COVID-19 vaccine product monographs found at:

- Pfizer BioNTech: https://covid-vaccine.canada.ca/info/pdf/pfizer-biontech-covid-19-vaccine-pm1-en.pdf
- Moderna: https://covid-vaccine.canada.ca/info/pdf/covid-19-vaccine-moderna-pm-en.pdf
- AstraZeneca: https://covid-vaccine.canada.ca/info/pdf/astrazeneca-covid-19-vaccine-pm-en.pdf
- COVISHIELD: https://covid-vaccine.canada.ca/info/pdf/covishield-pm-en.pdf

Health Canada continues to monitor any adverse events following immunization through their post-authorization surveillance process.

Other vaccines

Currently, it is recommended that COVID-19 vaccines can be given concomitantly with, or any time before or after any other indicated vaccine.[20,21] This is a change from the previous recommendation for a 14-day interval before or after receipt of a COVID-19 vaccine. The original advice against co-administration was based on a cautionary approach, as specific studies of co-administration with other vaccines have not been performed. However, substantial data have now been collected regarding the safety of COVID-19 vaccines currently authorized by Health Canada. Extensive experience with non-COVID-19 vaccines has demonstrated that immunogenicity and adverse event profiles are generally similar when vaccines are administered simultaneously as when they are administered alone.

Are there specific recommendations or considerations for safe and/or most effective administration?

1. Blood counts

Patients with blood cancer and HSCT or CAR-T recipients may have lowered blood counts related to the underlying disease or therapy. If blood counts (platelet count and neutrophil count) are low due to therapy and timing of recovery can be anticipated, e.g. 1 week prior to the next cyclical chemotherapy or maintenance cycle, the timing of vaccination should be scheduled accordingly (please see Table 1). However, where the timing of blood count recovery is unclear or not anticipated, e.g. marrow failure syndromes, then vaccination should not be delayed solely for this reason.

There is no consensus on an adequate platelet count for IM injections. Still, practical suggestions include using a platelet threshold of >20 x 10^9/L, administering the vaccine after platelet transfusion if receiving regular transfusions, and applying firm pressure at the injection site for at least 5 minutes.[22]

2. Anti-coagulant therapy

As per Thrombosis Canada recommendations,[23] anti-coagulation should not be a barrier for administering COVID-19 vaccination to patients on warfarin (INR monitoring not required prior to vaccination), novel oral anticoagulants (apixaban, dabigatran, edoxaban, rivaroxaban) or antiplatelet agents (aspirin, clopidogrel, ticagrelor). Patients on therapeutic dose low-molecular weight heparin (dalteparin, tinzaparin, enoxaparin, nadroparin) or fondaparinux may consider delaying their anti-coagulant dose on the day of vaccination until after the IM injection. For patients on any of the above, applying pressure to the injection site for 3 to 5 minutes post vaccination is recommended to reduce bruising.

3. Special considerations for immunotherapy

a. Therapies targeting B-cells including anti-CD20, CD19, CD22 targeting antibodies, or BiTEs: Patients receiving these agents may have a reduced immune response to vaccines in general that can extend to up to 6 months following treatment completion. If possible, patients should receive both doses of vaccine prior to starting these therapies. If patients are on, or have recently been treated with these agents, when they received the first 2 doses of vaccine, a 3rd dose is recommended to be administered at least 28 days after the 2nd dose.

b. Checkpoint inhibitors:

Previous studies have not signalled an increased risk of complications of COVID-19 for patients on checkpoint inhibitors such as CTLA-4 inhibitors (e.g., ipilimumab), PD-1 inhibitors (e.g., nivolumab, pembrolizumab) and PD-L1 inhibitors (e.g., atezolizumab, durvalumab). There have been theoretical concerns of an enhanced immune reaction, particularly with CTLA-4 inhibitors. However, given the seriousness of COVID-19 infection, vaccination is still recommended in this group even if a four-week window cannot be confirmed.

4. Timing of COVID-19 vaccines in relation to therapy

There are no known studies regarding the timing of COVID-19 vaccination in relation to therapy for blood cancer. The Pfizer-BioNTech, Moderna and AstraZeneca/COVISHIELD vaccines are given as two injections with optimal protection assumed after the second dose for the general population.[2-5] The efficacy and duration of immunity after one dose are

continuously being evaluated and recommendations are evolving rapidly. Therefore, patients should follow current BCCDC guidance for the recommended number of and interval between COVID-19 vaccine doses.

In general, it is preferred that patients complete their two dose COVID-19 vaccination series ideally 14 days prior to starting immunosuppressive therapy.[24]

***However, life-saving or prolonging therapy should not be delayed solely to complete vaccination.**

Recommendations for timing of COVID-19 vaccination for patients with hematologic malignancies (either completed, starting or already receiving treatment) and patients who have undergone HSCT or CAR-T cell therapy in the past 6 months are described in Table 1 below.

Any other timing should involve a case-by-case assessment based on:

a. Risk of morbidity related to COVID-19 infection (including local incidence of the pandemic, cancer type, comorbidities that confer higher risk categories in general population, etc.),
b. Cancer-related morbidity due to delay of active treatment, and
c. Suboptimal immunity due to insufficient time window between vaccination and immunosuppressive therapy.

Table 1. Suggested timing of COVID-19 vaccination in patients with hematologic malignancies[24,26-28]

Therapy	**Suggested timing of COVID-19 vaccine**
Cyclical chemotherapy – *prior to starting* (including hypomethylating agents)	1) Ideally complete vaccination at least 2 weeks prior to starting* 2) Alternatively, complete vaccination between cycles of therapy if clinically not appropriate to wait to complete vaccination
Cyclical chemotherapy – *between cycles* (including hypomethylating agents)	Give vaccine dose(s) between cycles: • Upon count recovery (*if anticipated to recover)*** about 1 week prior to starting subsequent cycle *Note: Avoid on same day as treatment*
Single agent small molecule inhibitors (e.g. kinase inhibitors or continuous oral chemotherapy, BTK inhibitors)	No specific timing
Immunomodulatory agents	Avoid on same day as treatment
Proteasome inhibitors (e.g. bortezomib)	Avoid on same day as treatment
Check point inhibitors	Avoid on same day as treatment

Therapy	**Suggested timing of COVID-19 vaccine**
CD19, CD20, CD22 targeted therapy (e.g. monoclonal antibodies)	No specific timing †
Other monoclonal antibodies	No specific timing
Systemic Corticosteroids	Cyclical corticosteroids as part of chemotherapy regimens – ideally vaccinate on days when not receiving corticosteroids Continuous corticosteroids – no specific timing ***
Autologous HSCT § ¥	Pre-HSCT: ≥ 2 weeks prior to starting conditioning chemotherapy Post-HSCT: > 3 months post-HSCT
Allogeneic HSCT § ¥	Pre-HSCT: ≥ 2 weeks prior to starting conditioning chemotherapy Post-HSCT: > 3 months post-HSCT †
CAR-T cell therapy §	Pre-CAR-T cell therapy: ≥ 2 weeks prior to starting lymphodepleting chemotherapy Post-CAR-T cell therapy: > 3 months post-CAR-T cell therapy
Aplastic Anemia	Not on therapy or completed therapy with counts in acceptable range: No specific timing required Post-therapy: > 3 months post-initiation of cyclosporine/ATG †
Intravenous immunoglobulin (IVIG) - Not COVID-19 specific	No specific timing
Under Observation - Not scheduled for therapy *OR* completed planned therapy	No specific timing

* In general, it is preferable to complete vaccination before starting immunosuppressive therapy if possible (based on timing of therapy and vaccine availability). However, life-saving or prolonging therapy should not be delayed solely to complete vaccination. Some immunity may be achieved following the first dose of the vaccine.

** Some patients may not have adequate counts either prior to or between cycles of therapy. The benefit likely outweighs the risk, and these patients should proceed to vaccination regardless of neutrophil count and with platelet transfusion support if required.

*** Ideally high dose systemic corticosteroids (> 0.5 mg/kg/day prednisone or equivalent) should be avoided or completed 28 days prior to vaccination; if this is not possible, proceed with vaccination.

† Due to likelihood of impaired immune response to vaccination within 3 months of receiving B-cell directed monoclonal antibodies and ATG, consider delaying to 3 months post-therapy.

§ Rationale for consideration of delaying COVID-19 vaccination for > 3 months after HSCT and CAR-T cell therapy includes:

- Vaccine response is expected to be sub-optimal;
- Antibody testing cannot be evaluated as standard of practice;
- Revaccination post-HSCT and CAR-T cell therapy is recommended. The attestation form for "Revaccination following Hematopoietic Stem Cell Transplant" can be obtained from transplant physicians.

¥ If local COVID-19 transmission rates are high, consider prioritization of COVID-19 vaccination. Routine post-HSCT vaccinations may be given at the same time as the COVID-19 vaccines but may be delayed at the discretion of the patient or medical professional.[26]

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