



# Special Considerations in People Who Are Immunocompromised

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## Summary Recommendations

### Prevention of COVID-19

- The COVID-19 Treatment Guidelines Panel (the Panel) recommends COVID-19 vaccination for all people who are moderately or severely immunocompromised **(AIII)**.
- All close contacts of people who are immunocompromised are strongly encouraged to be up to date on vaccination against COVID-19 **(AIII)**. Vaccinating household members, close contacts, and health care providers who provide care for patients who are immunocompromised is important to protect these patients from infection.
- The Panel recommends using **tixagevimab plus cilgavimab (Evusheld)** as SARS-CoV-2 pre-exposure prophylaxis (PrEP) for adults and adolescents who do not have SARS-CoV-2 infection or recent exposure to an individual with SARS-CoV-2 infection and who are moderately to severely immunocompromised and may have an inadequate immune response to COVID-19 vaccination **(BIIb)**.
- There is insufficient evidence for the Panel to recommend either for or against the use of SARS-CoV-2 serologic testing to assess for immunity or to guide clinical decisions about using COVID-19 vaccines or anti-SARS-CoV-2 monoclonal antibodies (mAbs) as PrEP in certain people.

### General Management of Patients With COVID-19 Who Are Immunocompromised

- The Panel recommends that decisions regarding stopping or reducing the doses of immunosuppressive drugs in patients with COVID-19 be made in consultation with the appropriate specialists; clinicians should consider factors such as the underlying disease, the specific immunosuppressants being used, the potential for drug-drug interactions, and the severity of COVID-19 **(BIII)**.

### Therapeutic Management of Nonhospitalized Patients With COVID-19 Who Are Immunocompromised

- The Panel recommends prompt treatment with antivirals or anti-SARS-CoV-2 mAbs for nonhospitalized patients with mild to moderate COVID-19 who are immunocompromised **(AIII)**. Specific recommendations are outlined in the text.

### Therapeutic Management of Hospitalized Patients With COVID-19 Who Are Immunocompromised

- For most patients with COVID-19 who are immunocompromised, the Panel recommends using antiviral drugs and immunomodulatory therapies at the doses and durations that are recommended for the general population **(AIII)**.
- In some cases, immunomodulatory drug regimens may need to be adjusted to reduce the risk of drug-drug interactions, overlapping toxicities, and secondary infections.
- There is insufficient evidence to guide clinical recommendations on using combination therapies (e.g., an antiviral drug plus an anti-SARS-CoV-2 mAb) or extending the duration of treatment beyond the duration authorized by the Food and Drug Administration.
- There is insufficient evidence for the Panel to recommend either for or against the use of high-titer COVID-19 convalescent plasma (CCP) in patients with COVID-19 who are immunocompromised. Some clinicians would consider the use of CCP in patients who, in their clinical judgment, have severe or progressive COVID-19 and an inadequate response to therapy. In these cases, clinicians should attempt to administer high-titer CCP from a vaccinated donor who recently recovered from COVID-19 likely caused by a similar SARS-CoV-2 variant as the patient.
- For people who are immunocompromised and have mild to moderate COVID-19 but are hospitalized for reasons other than COVID-19, the Panel recommends promptly initiating treatment with an antiviral drug or an anti-SARS-CoV-2 mAb **(AIII)**.

**Rating of Recommendations:** A = Strong; B = Moderate; C = Weak

**Rating of Evidence:** I = One or more randomized trials without major limitations; IIa = Other randomized trials or subgroup analyses of randomized trials; IIb = Nonrandomized trials or observational cohort studies; III = Expert opinion

Approximately 3% of Americans have immunocompromising conditions.<sup>1</sup> People who are immunocompromised are a heterogeneous population, and the severity of COVID-19 can vary significantly in this group. Some individuals who are immunocompromised may have a higher risk of hospitalization, complications, or death, and some may have outcomes that are comparable to those in the general population.

This section pertains to people who are moderately or severely immunocompromised, which includes, but is not limited to, those who:

- Are receiving active treatment for solid tumor and hematologic malignancies.
- Have hematologic malignancies that are associated with poor responses to COVID-19 vaccines or an increased risk of severe COVID-19 (e.g., acute leukemia, chronic lymphocytic leukemia, non-Hodgkin lymphoma, plasma cell dyscrasias), regardless of the treatment status for the hematologic malignancy.
- Received a solid-organ transplant or an islet transplant and are receiving immunosuppressive therapy.
- Received chimeric antigen receptor T cell (CAR T-cell) therapy or a hematopoietic stem cell transplant (HCT) and are within 2 years of transplantation or are receiving immunosuppressive therapy.
- Have a moderate or severe primary immunodeficiency (e.g., common variable immunodeficiency disease, severe combined immunodeficiency, DiGeorge syndrome, Wiskott-Aldrich syndrome).
- Have advanced or untreated HIV infection (defined as people with HIV and CD4 T lymphocyte [CD4] cell counts  $<200$  cells/mm<sup>3</sup>, a history of an AIDS-defining illness without immune reconstitution, or clinical manifestations of symptomatic HIV).
- Are receiving active treatment with high-dose corticosteroids (i.e.,  $\geq 20$  mg prednisone or equivalent per day when administered for  $\geq 2$  weeks), alkylating agents, antimetabolites, transplant-related immunosuppressive drugs, cancer chemotherapeutic agents classified as severely immunosuppressive, and biologic agents that are immunosuppressive or immunomodulatory.

Data are evolving on the clinical outcomes of COVID-19 in people who are immunocompromised. Analyses have found a higher risk of hospitalization or death from COVID-19 in those with a variety of immunocompromising conditions, including rheumatic diseases, hematological malignancies, solid organ transplants, and HIV.<sup>2-7</sup> Factors that increase the risk of severe COVID-19 in the general population, such as older age, chronic kidney disease, cardiovascular disease, and other comorbidities, are significant drivers of risk in immunocompromised individuals. Moreover, some immunodeficiencies seem to increase the risk above and beyond traditional risk factors. For example, there is evidence that individuals who make autoantibodies to type I interferons, proteins critical to the protective immune response against viral infections, have a higher risk of severe COVID-19.<sup>8</sup> Similarly, certain classes of medications, such as T cell-depleting or T cell-suppressing agents (e.g., antithymocyte globulin, calcineurin inhibitors, mycophenolate mofetil, belatacept) or B cell-depleting agents (e.g., rituximab, ocrelizumab, obinutuzumab), have been associated with more severe COVID-19 outcomes.<sup>9,10</sup>

Prolonged shedding of SARS-CoV-2 has been reported in patients who are immunocompromised. A systematic review found that replication-competent virus could be detected for a median of 20 days in these patients, compared to 11 days in the general population.<sup>11</sup> Prolonged viral shedding may affect SARS-CoV-2 testing strategies and isolation durations for this group of patients.<sup>12</sup> Moreover, case reports suggest that prolonged infections can create evolutionary pressure for the emergence of variants that resist therapies or evade vaccine-induced immunity.<sup>13-15</sup> There is currently insufficient evidence

to guide clinical recommendations on using combinations of antiviral drugs and/or anti-SARS-CoV-2 monoclonal antibodies (mAbs) for the treatment of COVID-19. There are also no data to support extending the duration of COVID-19 therapies beyond the durations authorized or approved by the Food and Drug Administration (FDA).

When there are no logistical or supply constraints, the COVID-19 Treatment Guidelines Panel (the Panel) recommends prescribing therapies for the prevention or treatment of COVID-19 to any eligible individual as recommended in these Guidelines. However, at times during the pandemic, logistical or supply constraints have limited the availability of therapies. In those cases, the Panel recommends prioritizing the treatment of patients with COVID-19 who are at the highest risk of clinical progression (see [Prioritization of Anti-SARS-CoV-2 Therapies for the Treatment and Prevention of COVID-19 When There Are Logistical or Supply Constraints](#)). Providers should use their clinical judgment when prioritizing patients for treatment, including assessing a patient's immunocompromised status, age, and comorbidities.

The sections below outline the Panel's rationale for the recommendations on preventing and managing COVID-19 in people who are immunocompromised. Some of the special considerations for patients who are immunocompromised include the timing of COVID-19 vaccination, the use of pre-exposure prophylaxis (PrEP), the management of immunosuppressive medications, and the strategies for treating COVID-19.

## Prevention of COVID-19

### *Vaccination*

The Panel recommends COVID-19 vaccination for all people who are moderately or severely immunocompromised (**AIII**). Vaccination is the most effective way to prevent serious outcomes and death from SARS-CoV-2 infection, although there are certain special considerations for the timing of vaccination and vaccine responses in people who are immunocompromised. Authorized and approved COVID-19 vaccines in the United States are not live-virus vaccines, and they can be safely administered to patients who are immunocompromised.<sup>16</sup>

The pivotal clinical trials that evaluated the safety and efficacy of the COVID-19 vaccines excluded people who were severely immunocompromised; therefore, the data for this population are less robust.<sup>17,18</sup> Observational data suggest that serological responses to vaccines may be blunted in patients who are immunocompromised.<sup>19,20</sup> Nevertheless, vaccination is still recommended, as it may confer partial protection, including protection from vaccine-induced, cell-mediated immunity.<sup>4</sup> See the Centers for Disease Control and Prevention (CDC) webpage [COVID-19 Vaccines for People Who Are Moderately or Severely Immunocompromised](#) for the current COVID-19 vaccination schedule for this population.

### **Vaccination of Close Contacts**

All close contacts of people who are immunocompromised are strongly encouraged to be up to date on vaccination against COVID-19 (**AIII**). Vaccinating household members, close contacts, and health care workers who provide care to patients who are immunocompromised is important to protect these patients from infection. There is evidence that vaccinated individuals who are infected with SARS-CoV-2 have lower viral loads than unvaccinated individuals, and COVID-19 vaccines are associated with a reduction in the number of SARS-CoV-2 infections not only among vaccinated individuals but also among their household contacts.<sup>21-26</sup>

### **Vaccine Timing and Anti-SARS-CoV-2 Monoclonal Antibodies**

Nonhospitalized patients who are immunocompromised may have received anti-SARS-CoV-2 mAbs for the treatment of COVID-19. Vaccines can be administered at any time after anti-SARS-CoV-2 mAb treatment.<sup>27</sup> When tixagevimab plus cilgavimab (Evusheld) is being used as PrEP, it should not be

administered until at least 2 weeks after vaccination.<sup>27</sup> The use of these anti-SARS-CoV-2 mAbs as PrEP is not a substitute for vaccination.

### **Vaccine Timing and Immunosuppressive Therapies**

If possible, the COVID-19 vaccination series should be completed at least 2 weeks before initiating or resuming immunosuppressive therapies. The timing of the vaccination series should be determined based on the patient's current or planned immunosuppressive therapies, as well as the patient's medical condition and predicted response to the vaccine. Guidance about the timing of COVID-19 vaccination in solid organ transplant, HCT, and cellular immunotherapy candidates can be found in [Special Considerations in Solid Organ Transplant, Hematopoietic Stem Cell Transplant, and Cellular Immunotherapy Candidates, Donors, and Recipients](#). HCT and CAR T-cell recipients who received doses of COVID-19 vaccines prior to or during treatment with an HCT or CAR T-cell therapy should be revaccinated with a primary vaccine series at least 3 months after the transplant or CAR T-cell therapy.<sup>28</sup> The American Society of Hematology and the National Comprehensive Cancer Network have specific guidance about the timing of COVID-19 vaccination around cancer chemotherapy,<sup>28,29</sup> and the American College of Rheumatology also provides guidance for temporarily stopping immunosuppressive regimens during vaccination.<sup>30</sup>

### ***Pre-Exposure Prophylaxis***

The Panel recommends using **tixagevimab plus cilgavimab** as SARS-CoV-2 PrEP for adults and adolescents who do not have SARS-CoV-2 infection or recent exposure to an individual with SARS-CoV-2 infection and who are moderately to severely immunocompromised and may have an inadequate immune response to COVID-19 vaccination (**BIIB**). Information on dosing is available in [Prevention of SARS-CoV-2 Infection](#).

The FDA Emergency Use Authorization (EUA) for tixagevimab plus cilgavimab identifies a broad group of immunocompromised individuals who are eligible for PrEP.<sup>31</sup> Data suggest that some of these individuals are at particularly high risk of inadequate vaccine responses and progression to severe COVID-19 if infected. These individuals include, but are not limited to, those with hematologic malignancies who are receiving active treatment, those who are within 1 year of receiving B cell-depleting agents (e.g., rituximab, ocrelizumab, obinutuzumab, epratuzumab), CAR T-cell therapy recipients, solid organ transplant recipients who are receiving immunosuppressive therapy, those with severe combined immunodeficiencies, and those with HIV and low CD4 counts.<sup>4,9,32-36</sup>

### ***Serologic Testing to Guide Vaccination or Pre-Exposure Prophylaxis Strategies***

There is currently insufficient evidence for the Panel to recommend either for or against the use of SARS-CoV-2 serologic testing to assess for immunity or to guide clinical decisions about using COVID-19 vaccines or anti-SARS-CoV-2 mAbs for PrEP. More than 80 SARS-CoV-2 serologic tests, including quantitative, semiquantitative, neutralizing antibody, and point-of-care tests, have been issued EUAs by the FDA to aid in detecting antibodies to SARS-CoV-2.<sup>37</sup> However, these tests are not currently authorized for routine use in making individual medical decisions, and their ability to assess a person's level of immunity or protection from SARS-CoV-2 infection has not been evaluated.<sup>38</sup> Most of these tests have not been calibrated to a reference standard, limiting the comparability and reproducibility of results from different tests.

## **Management of Patients With COVID-19 Who Are Immunocompromised**

### ***Adjusting Chronic Immunosuppressive Therapies***

The Panel recommends that decisions regarding stopping or reducing the doses of immunosuppressive drugs in patients with COVID-19 be made in consultation with the appropriate specialists; clinicians

should consider factors such as the underlying disease, the specific immunosuppressants being used, the potential for drug-drug interactions, and the severity of COVID-19 (**BIII**).

Early in the clinical course of COVID-19, the disease is primarily driven by the replication of SARS-CoV-2. Immunosuppressive medications can reduce the host immune responses that suppress viral replication, increasing the risk of prolonged viral shedding and infection.<sup>39,40</sup> Clinicians should consider adjusting the doses of immunosuppressive medications or substituting certain immunosuppressive medications, if possible, to improve the patient's immune response to infection. When making decisions about stopping or reducing the dose of immunosuppressive drugs, clinicians should balance the potential benefit of enhancing the patient's immune response to COVID-19 with the risk of exacerbating the underlying condition. They should also consider the role of immunomodulation in the treatment of COVID-19.

Clinicians should be aware that many immunosuppressive drugs, particularly biologic agents, have long half-lives or prolonged periods of biologic activity. Patients may remain immunosuppressed long after the drugs are stopped. Care should be taken to not stop glucocorticoids abruptly, since this may result in adrenal insufficiency. For medications other than glucocorticoids, decisions about dose adjustments should be made on a case-by-case basis. For example, for some autoimmune diseases, temporary cessation of immunosuppression is often possible, and restarting medications 7 to 14 days after symptom resolution may be appropriate.<sup>30,41</sup>

For solid organ transplant recipients, adjustments to immunosuppressive regimens should be individualized based on disease severity, the risk of graft rejection, the specific immunosuppressants being used, the type of transplant, the time since transplantation, the concentration of immunosuppressants, and the potential for drug-drug interactions.<sup>42</sup> See [Special Considerations in Solid Organ Transplant, Hematopoietic Stem Cell Transplant, and Cellular Immunotherapy Candidates, Donors, and Recipients](#) for more information.

### ***Therapeutic Management of Nonhospitalized Patients With COVID-19***

The Panel recommends prompt treatment with antiviral agents or anti-SARS-CoV-2 mAbs for nonhospitalized patients with mild to moderate COVID-19 who are immunocompromised (**AIII**). See [Therapeutic Management of Nonhospitalized Adults With COVID-19](#) to review the Panel's recommendations. Some special considerations for using these therapies in people who are immunocompromised are outlined below.

#### **Ritonavir-Boosted Nirmatrelvir (Paxlovid) and Molnupiravir**

In the EPIC-HR trial, ritonavir-boosted nirmatrelvir, when compared with placebo, reduced the risk of hospitalization or death in nonhospitalized, unvaccinated adults who had laboratory-confirmed SARS-CoV-2 infection and a high risk of progressing to severe COVID-19.<sup>43</sup> However, as the trial enrolled very few participants who were immunocompromised, the efficacy of using this drug in this population is unknown.

Because ritonavir-boosted nirmatrelvir is the only highly effective oral antiviral for the treatment of COVID-19, it should be considered for patients who are immunocompromised if there are no potential drug-drug interactions or if the potential interactions can be safely managed. Clinicians should be aware of drug-drug interactions that may be life- or organ-threatening (see [Drug-Drug Interactions Between Ritonavir-Boosted Nirmatrelvir \[Paxlovid\] and Concomitant Medications](#)).<sup>44</sup> Notably, calcineurin inhibitors (e.g., tacrolimus, cyclosporine A) and mammalian target of rapamycin (mTOR) drugs (e.g., sirolimus, everolimus) have important drug-drug interactions with ritonavir. For this reason, the American Society of Transplantation recommends preferentially using other therapies, such as

anti-SARS CoV-2 mAbs or remdesivir, over ritonavir-boosted nirmatrelvir in people who are taking calcineurin inhibitors or mTOR inhibitors.<sup>45</sup>

Ritonavir can inhibit the metabolism of many cancer-directed therapies and should only be given after consulting with specialty pharmacists and other appropriate specialists. Case reports have described reoccurring COVID-19 symptoms and positive SARS-CoV-2 test results in some patients who have completed treatment with ritonavir-boosted nirmatrelvir.<sup>46</sup> There is currently no evidence to support routinely administering longer courses or a second course of ritonavir-boosted nirmatrelvir. People with COVID-19 who are immunocompromised should not delay or avoid taking ritonavir-boosted nirmatrelvir due to concerns about the rebound of symptoms after treatment completion (see [Ritonavir-Boosted Nirmatrelvir \[Paxlovid\]](#)).

In the MOVE-OUT trial, molnupiravir reduced the rate of hospitalization or death in nonhospitalized patients with COVID-19, when compared with placebo.<sup>47</sup> The MOVE-OUT trial enrolled very few participants who were immunocompromised.<sup>48</sup> Although the different treatment options have not been directly compared in clinical trials, the available evidence suggests that molnupiravir has a lower efficacy than the other options (see [Molnupiravir](#)). Other COVID-19 therapies should be prioritized over molnupiravir in patients who are immunocompromised.

### **Remdesivir**

Remdesivir was studied in nonhospitalized patients with mild to moderate COVID-19 who were at high risk of progressing to severe disease, and it was shown to be highly effective in reducing the risk of hospitalization and death.<sup>49</sup> However, this trial included few participants who were immunocompromised (see [Table 4a](#)). Because remdesivir requires an intravenous infusion for 3 consecutive days, there may be logistical constraints to administering this drug in many settings, but it can be considered for patients who are immunocompromised if other options, such as ritonavir-boosted nirmatrelvir, are not appropriate or available.

### **Anti-SARS-CoV-2 Monoclonal Antibodies**

Clinical trials have demonstrated that anti-SARS-CoV-2 mAb therapy can reduce the risk of hospitalization or death in high-risk patients with COVID-19.<sup>50-53</sup> However, because these trials only enrolled a few patients who were immunocompromised, there is not enough data to determine the efficacy of using anti-SARS-CoV-2 mAbs in this population. Nevertheless, given that a reduced humoral immune response to infection is seen in many patients who are immunocompromised, anti-SARS-CoV-2 mAbs are expected to be effective. Anti-SARS-CoV-2 mAb therapy should be considered for patients who are immunocompromised, especially if significant drug-drug interactions preclude use of ritonavir-boosted nirmatrelvir<sup>42</sup> or logistical constraints prevent the use of remdesivir.

There is insufficient evidence to guide clinical recommendations on using combinations of anti-SARS-CoV-2 mAbs and antiviral drugs. Because the neutralizing activities of some anti-SARS-CoV-2 mAbs may be diminished against certain SARS-CoV-2 variants of concern (VOCs), clinicians should refer to [Anti-SARS-CoV-2 Monoclonal Antibodies](#) for guidance on the use of anti-SARS-CoV-2 mAbs against specific circulating VOCs.

### **COVID-19 Convalescent Plasma**

There is insufficient evidence for the Panel to recommend either for or against the use of high-titer COVID-19 convalescent plasma (CCP) in patients with COVID-19 who are immunocompromised. The FDA has issued an EUA that allows the use of high-titer CCP for the treatment of COVID-19 in outpatients or inpatients who are immunocompromised or who are receiving immunosuppressive treatment.<sup>54</sup> However, the evidence generated from well-designed clinical trials that evaluated the use of CCP for the treatment of nonhospitalized patients is conflicting; these trials enrolled few, if any, patients

who were immunocompromised.<sup>55-58</sup>

Some clinicians would consider using CCP in patients who, in their clinical judgment, have severe or progressive COVID-19 and an inadequate response to therapy. In these cases, to the extent possible, clinicians should attempt to administer high-titer CCP from a vaccinated donor who recently recovered from COVID-19 likely caused by a similar SARS-CoV-2 variant as the patient.

### ***Therapeutic Management of Patients Who Are Hospitalized for COVID-19***

For most patients with COVID-19 who are immunocompromised, the Panel recommends using antiviral drugs and immunomodulatory therapies at the doses and durations that are recommended for the general population (AIII). See [Therapeutic Management of Hospitalized Adults With COVID-19](#) for more information. The optimal management strategies and treatments for COVID-19 in hospitalized patients who are immunocompromised are unknown, since these individuals were either excluded from or poorly represented in major clinical trials. Nevertheless, clinical experience suggests that many patients who are immunocompromised have the expected responses to standard therapies for COVID-19.

#### **Remdesivir**

The optimal duration of treatment with remdesivir in patients who are immunocompromised is unknown. Case reports suggest that the drug can suppress, but does not always eliminate, viral replication in this population.<sup>59,60</sup> Some clinicians may choose to extend the course of antiviral therapy past 5 to 10 days in patients who are immunocompromised, given the risk of prolonged viral replication. Similarly, although remdesivir has not been shown to confer a benefit in patients with more severe respiratory impairment due to COVID-19 (i.e., those who require high-flow nasal cannula [HFNC] oxygen, noninvasive ventilation [NIV], or mechanical ventilation), clinicians may consider using remdesivir along with immunomodulatory therapy in this population of patients who are immunocompromised, given the concerns about prolonged viral replication.

#### **Corticosteroids**

The RECOVERY trial reported a survival benefit for dexamethasone in inpatients with COVID-19 who were receiving oxygen, HFNC oxygen, NIV, or mechanical ventilation; however, specific data regarding the subgroup of patients who were immunocompromised is not available.<sup>61</sup>

Patients who are immunocompromised may experience delayed development of favorable adaptive responses and a prolonged period of viral replication, as discussed above. For patients who are immunocompromised, who are receiving minimal levels of conventional oxygen, and who are earlier in the course of COVID-19 (e.g., those with <10 days of symptoms), the preferred approach may be emphasizing supportive care, using antiviral therapy, and avoiding corticosteroids. This strategy may reduce the duration of viral replication and the risk of secondary infections. Dexamethasone should be added if the patient has escalating oxygen requirements.

For patients who are immunocompromised and who were on chronic corticosteroids prior to hospitalization, the optimal dose of dexamethasone for the treatment of COVID-19 is unknown. The recommended dose of dexamethasone is 6 mg, which is equivalent to 40 mg of prednisone. This is the minimum dose of steroid that should be used. Maintenance doses of corticosteroids should be discontinued while a patient is receiving dexamethasone, and they should be resumed as soon as possible after recovery from COVID-19 or after completion of the course of dexamethasone.

#### **Immunomodulators**

Randomized trials have shown that adding interleukin (IL)-6 inhibitors and Janus Kinase (JAK)

inhibitors to dexamethasone improves clinical outcomes in patients with severe or critical COVID-19. These trials generally excluded patients who were immunocompromised or only included small numbers of these patients.<sup>62-64</sup> The use of these agents may provide a clinical benefit to patients who are immunocompromised that is similar to the benefit seen in the general population. However, it is not clear whether augmenting immunomodulation in this population increases the risk of serious bacterial, invasive fungal, or parasitic infections.

For most patients who are immunocompromised, adding IL-6 or JAK inhibitors to dexamethasone is reasonable for those who are hypoxemic and experiencing clinical progression, which follows the Panel's recommendations for the general population (see [Therapeutic Management of Hospitalized Adults With COVID-19](#)). However, clinicians should consult with the appropriate specialists to ensure that the risks of additional immunosuppression, including the risks of serious infections, do not outweigh the benefits of additional immunosuppression and that the patient is closely monitored for infections.

### **COVID-19 Convalescent Plasma**

There is insufficient evidence for the Panel to recommend either for or against the use of high-titer CCP in hospitalized patients with COVID-19 who are immunocompromised. Three key randomized trials that evaluated the use of CCP for the treatment of COVID-19—RECOVERY, CONCOR-1, and REMAP-CAP—reported no evidence of benefit from CCP in hospitalized patients with COVID-19. However, most of the patients enrolled in these trials were not immunocompromised.<sup>65-67</sup> A prespecified subgroup analysis of 126 critically ill REMAP-CAP participants who were immunocompromised suggested that CCP might offer a potential benefit of improved survival and more organ support-free days in this subgroup, but these results were not statistically significant. Observational data from case reports, case series, and retrospective case-control studies also suggest a potential benefit of CCP in patients who are immunocompromised due to hematologic malignancy, common variable immune deficiency, agammaglobulinemia, or receipt of a solid organ transplant.<sup>68-83</sup>

Some clinicians would consider using CCP in patients who, in their clinical judgment, have severe or progressive COVID-19 and an inadequate response to therapy. In these cases, to the extent possible, clinicians should attempt to administer high-titer CCP from a vaccinated donor who recently recovered from COVID-19 likely caused by a similar SARS-CoV-2 variant as the patient.

### ***Therapeutic Management of Patients Who Are Hospitalized for Reasons Other Than COVID-19***

People who are immunocompromised and have COVID-19 but were hospitalized for conditions other than COVID-19 should receive the same treatments as nonhospitalized patients (BIII). See [Therapeutic Management of Nonhospitalized Adults With COVID-19](#) for more information.

### ***Therapeutic Management of Hospitalized Patients With Prolonged SARS-CoV-2 Viral Replication***

In the absence of evidence, some Panel members would consider using additional treatments in hospitalized patients who are immunocompromised and have ongoing, severe symptoms attributed to viral replication despite the use of other therapies (i.e., remdesivir), because humoral immune responses may be diminished or absent in this population. These treatments may include using anti-SARS-CoV-2 mAbs (under Emergency Investigational New Drug provisions, if available) that have activity against dominant circulating variants or using high-titer CCP collected from vaccinated donors who were infected with SARS-CoV-2 within the past 6 months.

The optimal management of individuals who are immunocompromised, hospitalized with symptomatic COVID-19, and have prolonged periods of significant viral replication despite the receipt of remdesivir



and appropriate immunomodulatory drugs is unknown. Data from the RECOVERY trial of casirivimab plus imdevimab versus placebo suggest that hospitalized patients with COVID-19 who have not developed a humoral immune response (as measured by serologic testing for SARS-CoV-2) received a survival benefit from anti-SARS-CoV-2 mAb therapy.<sup>84</sup>

## Special Considerations for Pregnant Individuals Who Are Immunocompromised

Multiple studies have found that pregnant individuals have an increased risk of severe COVID-19 compared to age-matched controls, with increased rates of intensive care unit admission, mechanical ventilation, extracorporeal membrane oxygenation, and death.<sup>85-87</sup> Although hormonally mediated immunomodulation occurs during pregnancy, pregnancy is not a state of systemic immunosuppression. Changes in the immune response to certain infectious pathogens during pregnancy may increase the severity of respiratory illness in pregnant individuals. Physiologic changes, such as reduced pulmonary residual capacity, may also contribute to respiratory disease severity.<sup>88-91</sup> Pregnant people who have underlying immunocompromising conditions or are receiving immunosuppressive medications likely have an even higher risk of severe disease. This patient group should be prioritized for the prevention and treatment of COVID-19.

### *Prevention*

The Panel recommends administering COVID-19 vaccines to pregnant individuals according to the guidelines from the CDC and the Advisory Committee on Immunization Practices (ACIP) (**AI**). COVID-19 vaccination is strongly recommended for pregnant individuals due to their increased risk for severe disease.<sup>92,93</sup> Vaccination is especially important for pregnant people with concomitant risk factors such as underlying immunocompromising conditions (including those who are receiving immunosuppressive medications), as the risk for severe disease is likely additive.<sup>86</sup> Pregnant individuals who otherwise meet the criteria for PrEP with **tixagevimab plus cilgavimab** should not have this therapy withheld due to their pregnancy status (**AIII**).

### *Treatment*

Although pregnant patients have been excluded from the majority of the clinical trials that evaluated the use of COVID-19 therapeutics, pregnant patients with COVID-19 can be treated the same as nonpregnant patients, with a few exceptions. Pregnant patients who are immunocompromised or who have other risk factors likely have an even higher risk for severe COVID-19 and should be prioritized for treatment. Providers should refer to the Panel's recommendations in [Therapeutic Management of Nonhospitalized Adults With COVID-19](#) and [Therapeutic Management of Hospitalized Adults With COVID-19](#). Pregnant people who are immunocompromised comprise a heterogeneous group of patients, ranging from those who are mildly immunocompromised to those who are severely immunocompromised. The Panel recommends forming a collaborative, multidisciplinary team to make decisions regarding the evaluation and management of pregnant patients, including the involvement of a transplant or specialty provider, an obstetrician or maternal-fetal medicine specialist, a pediatrics or neonatology specialist, and pharmacy services.

## Special Considerations for Children Who Are Immunocompromised

Although the overall risk of critical illness and death related to COVID-19 is lower in children than adults, severe disease does occur, particularly in children with risk factors such as moderate to severe immunocompromising conditions. See [Special Considerations in Children](#) for a discussion of the risk factors for severe COVID-19 in children, and see [Therapeutic Management of Nonhospitalized Children With COVID-19](#) for the Panel's framework for assessing a child's risk of progression to severe COVID-19 based on vaccination status, comorbidities, and age.

## Prevention

The Panel recommends vaccinating all eligible children against COVID-19 as soon as possible according to the guidelines from the CDC and ACIP (AI). In addition, PrEP with **tixagevimab plus cilgavimab** is authorized by the FDA for children aged  $\geq 12$  years and weighing  $\geq 40$  kg and recommended by the Panel for those who do not have SARS-CoV-2 infection or recent exposure to an individual with SARS-CoV-2 infection and who are moderately to severely immunocompromised and may have an inadequate immune response to COVID-19 vaccination (BI**b**).

## Treatment

Most children with mild to moderate COVID-19 will not progress to more severe illness and can be managed with supportive care alone (AIII). Few children, if any, including children aged  $< 18$  years who are immunocompromised, have been enrolled in clinical trials of treatments for COVID-19. Therefore, clinicians should be cautious when applying recommendations based on adult data to children. Clinicians need to consider the potential risks and benefits of therapy, the severity of the patient's disease, and underlying risk factors. See [Therapeutic Management of Hospitalized Children With COVID-19](#) and [Therapeutic Management of Nonhospitalized Children With COVID-19](#) for the Panel's treatment recommendations in these scenarios.

## References

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