Table 2f. Characteristics of Antiviral Agents

Last Updated: May 31, 2022

- RDV is the only antiviral drug that is approved by the FDA for the treatment of COVID-19.
- RTV-boosted nirmatrelvir, MOV, and certain anti-SARS-CoV-2 mAbs have received EUAs from the FDA for the treatment of COVID-19.
- Other medications that are currently being evaluated in clinical trials for the treatment of COVID-19 are also included in this table. The inclusion of these drugs does not imply that the Panel recommends their use.
- This table focuses on small-molecule antiviral drugs. For more information regarding anti-SARS-CoV-2 mAbs, please see Table 3c.
- Information on CQ, HCQ, and LPV/RTV are available in archived versions of the Guidelines. The Panel recommends against using these agents to treat COVID-19.
- For many of these antiviral drugs, there are limited or no data on dose modifications for patients with organ failure or those who require extracorporeal devices. Please refer to product labels or EUAs, when available.
- For drug interaction information, please refer to product labels, EUA fact sheets, and the Liverpool COVID-19 Drug Interactions website.
- For the Panel’s recommendations on using the drugs listed in this table, please refer to the individual drug sections, Therapeutic Management of Nonhospitalized Adults With COVID-19, Therapeutic Management of Hospitalized Adults With COVID-19, or Antiviral Therapy Summary Recommendations.

<table>
<thead>
<tr>
<th>Dosing Regimens</th>
<th>Adverse Events</th>
<th>Monitoring Parameters</th>
<th>Drug-Drug Interaction Potential</th>
<th>Comments and Links to Clinical Trials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ritonavir-Boosted Nirmatrelvir (Paxlovid)</td>
<td>Dysgeusia, Diarrhea, HTN, Myalgia</td>
<td>Monitor for potential AEs due to drug-drug interactions with concomitant medications.</td>
<td>RTV-boosted nirmatrelvir has significant and complex drug-drug interactions. Before prescribing RTV-boosted nirmatrelvir, carefully review concomitant medications, including OTC medicines, herbal supplements, and recreational drugs.</td>
<td>Both nirmatrelvir and RTV tablets can be taken with or without food. A list of clinical trials is available: Ritonavir-Boosted Nirmatrelvir</td>
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<tr>
<td>Authorized under FDA EUA for the treatment of mild to moderate COVID-19 in high-risk individuals aged ≥12 years and weighing ≥40 kg.</td>
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<td>FDA EUA Doses for COVID-19</td>
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<tr>
<td>≥60 mL/min: nirmatrelvir 300 mg (two, 150-mg tablets) with RTV 100 mg (one, 100-mg tablet) twice daily for 5 days</td>
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<tr>
<td>≥30 to 60 mL/min: nirmatrelvir 150 mg (one, 150-mg tablet) with RTV 100 mg (one, 100-mg tablet) twice daily for 5 days</td>
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<tr>
<td>&lt;30 mL/min: not recommended</td>
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COVID-19 Treatment Guidelines

Downloaded from https://www.covid19treatmentguidelines.nih.gov/ on 7/13/2022
<table>
<thead>
<tr>
<th><strong>Ritonavir-Boosted Nirmatrelvir (Paxlovid), continued</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Dosing for Patients with Severe Hepatic Impairment (Child-Pugh Class C):</strong></td>
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<tr>
<td>• Not recommended</td>
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**Remdesivir**  
*Approved by the FDA for the treatment of COVID-19 in individuals aged ≥28 days and weighing ≥3 kg.*

<table>
<thead>
<tr>
<th><strong>Dose for Adults and Children Weighing ≥40 kg:</strong></th>
<th><strong>Adverse Events</strong></th>
<th><strong>Monitoring Parameters</strong></th>
<th><strong>Drug-Drug Interaction Potential</strong></th>
<th><strong>Comments and Links to Clinical Trials</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• RDV 200 mg IV on Day 1, then RDV 100 mg IV once daily from Day 2</td>
<td>• Nausea&lt;br&gt;• ALT and AST elevations&lt;br&gt;• Hypersensitivity&lt;br&gt;• Increases in prothrombin time&lt;br&gt;• Drug vehicle is SBEC, which has been associated with renal and liver toxicity. SBEC accumulation may occur in patients with moderate or severe renal impairment.&lt;br&gt;• Each 100 mg vial of RDV lyophilized powder contains 3 g of SBEC, and each 100 mg/20 mL vial of RDV solution contains 6 g of SBEC.&lt;br&gt;• Clinicians may consider preferentially using the lyophilized powder formulation (which contains less SBEC) in patients with renal impairment.</td>
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<tr>
<td><strong>Dose for Children Aged ≥28 Days Weighing 3 kg to &lt;40 kg:</strong></td>
<td>• Monitor patients for infusion reactions during the infusion and observe them for ≥1 hour after the infusion as clinically appropriate.&lt;br&gt;• Monitor renal function, hepatic function and prothrombin time as clinically indicated.&lt;br&gt;• The FDA does not recommend using RDV when eGFR is &lt;30 mL/min. See <a href="https://www.covid19treatmentguidelines.nih.gov/">Remdesivir</a> for information on using RDV in people with renal insufficiency.</td>
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<tr>
<td>• RDV 5 mg/kg IV on Day 1, then RDV 2.5 mg/kg IV once daily from Day 2</td>
<td>• Clinical drug-drug interaction studies of RDV have not been conducted.&lt;br&gt;• In vitro, RDV is a minor substrate of CYP3A4, a substrate of OATP1B1 and P-gp, and an inhibitor of CYP3A4, OATP1B1, OATP1B3, and MATE1.²</td>
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<tr>
<td><strong>Total Treatment Duration:</strong></td>
<td>• RDV should be administered in settings in which health care providers have immediate access to medications to treat severe infusion-related reactions or HSRs, such as anaphylaxis, and the ability to activate the emergency medical system.&lt;br&gt;• A list of clinical trials is available: <a href="https://www.covid19treatmentguidelines.nih.gov/">Remdesivir</a></td>
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<tr>
<td>• Nonhospitalized patients: 3 days&lt;br&gt;• Hospitalized patients: 5 days or until hospital discharge</td>
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² Clinicians should have access to a list of clinical trials before using RDV in people with renal insufficiency.
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<tr>
<td><strong>Molnupiravir</strong>&lt;br&gt;Authorized under FDA EUA for the treatment of mild to moderate COVID-19 in high-risk individuals aged ≥18 years.</td>
<td>• Diarrhea&lt;br&gt;• Nausea&lt;br&gt;• Dizziness&lt;br&gt;• Per the FDA, the 5-day course of MOV has a low risk for genotoxicity. See Molnupiravir for details.</td>
<td>• Before initiating MOV, assess pregnancy status as clinically indicated.&lt;br&gt;• Monitor for potential AEs.</td>
<td>• Clinical drug-drug interaction studies of MOV have not been conducted.&lt;br&gt;• Drug-drug interactions related to hepatic metabolism are not expected.</td>
<td>• MOV can be taken with or without food.&lt;br&gt;• Sexually active individuals of reproductive potential should use effective contraception during and following treatment with MOV. See Molnupiravir for details.&lt;br&gt;• If MOV is prescribed for a pregnant individual, the prescribing clinician should document that the risks and benefits were discussed and that the patient chose this therapy. Pregnant patients should also be informed of the pregnancy surveillance program and, if they agree to participate, be enrolled in the program. See Molnupiravir for details.&lt;br&gt;• During MOV treatment and for 4 days after the final dose, lactating people <strong>should not breastfeed</strong> their infants.&lt;br&gt;• MOV is not authorized for use in children aged &lt;18 years due to potential effects on bone and cartilage growth.&lt;br&gt;• A list of clinical trials is available: Molnupiravir</td>
</tr>
</tbody>
</table>

**Dose Recommended in FDA EUA:**<br>• MOV 800 mg (four, 200-mg capsules) PO every 12 hours for 5 days
Interferon Alfa
Not approved by the FDA and not recommended by the Panel for the treatment of COVID-19. Currently under investigation in clinical trials.

IFN Alfa-2b
Dose for COVID-19 in Clinical Trials:
• Nebulized IFN alfa-2b 5 million international units twice daily; the optimal duration of treatment is unclear.

<table>
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<tr>
<td>• AEs associated with inhaled therapy (e.g., throat irritation, cough, bronchospasm) • Minimal systemic effects expected</td>
<td>• Respiratory symptoms after inhalation</td>
<td>• Low potential for drug-drug interactions</td>
<td>• The nebulized formulation of IFN alfa has been the formulation most used in clinical trials for the treatment of COVID-19. IFN alfa is usually included as part of a combination regimen. • A list of clinical trials is available: <a href="#">Interferon Alfa</a></td>
</tr>
</tbody>
</table>

Availability:
• Nebulized IFN alfa-2b is not approved by the FDA for use in the United States.

Interferon Beta
Not approved by the FDA and not recommended by the Panel for the treatment of COVID-19. Currently under investigation in clinical trials.

IFN Beta-1a
Dose for COVID-19 in Clinical Trials:
• IFN beta-1a 44 µg SUBQ or IV every other day for up to 3 or 4 doses

IFN Beta-1b
Dose for COVID-19 in Clinical Trials:
• IFN beta-1b 8 million international units SUBQ every other day for up to 7 days total

<table>
<thead>
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<tr>
<td>• Flu-like symptoms (e.g., fever, fatigue, myalgia) • Leukopenia, neutropenia, thrombocytopenia, lymphopenia • Liver function abnormalities (ALT &gt; AST) • Injection site reactions • Headache • Hypertonia • Pain • Rash • Worsening depression • Induction of autoimmunity</td>
<td>• CBC with differential • Liver enzymes • Worsening CHF • Depression, suicidal ideation</td>
<td>• Low potential for drug-drug interactions • Use with caution with other hepatotoxic agents. • Reduce dose if ALT &gt;5 times ULN.</td>
<td>• A list of clinical trials is available: <a href="#">Interferon Beta</a></td>
</tr>
</tbody>
</table>

Availability
Brand Names of IFN Beta-1a Products:
• Avonex, Plegridy, Rebif

Brand Names of IFN Beta-1b Products:
• Betaseron, Extavia
<table>
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<tr>
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| **Interferon Lambda**  
*Not approved by the FDA and not recommended by the Panel for the treatment of COVID-19. Currently under investigation in clinical trials.* |  |  |  |  |
| **PEG-IFN Lambda-1a**  
*Dose for COVID-19 in Clinical Trials:*  
• Single dose of PEG-IFN lambda-1a 180 µg SUBQ | • Liver function abnormalities  
• Injection site reactions | • CBC with differential  
• Liver enzymes  
• Monitor for potential AEs. | • Low potential for drug-drug interactions  
• Use with caution with other hepatotoxic agents. | • A list of clinical trials is available: [Interferon Lambda](https://www.covid19treatmentguidelines.nih.gov/)  
**Availability:**  
• PEG-IFN lambda-1a is not approved by the FDA for use in the United States. |
| **Ivermectin**  
*Not approved by the FDA and not recommended by the Panel for the treatment of COVID-19. Currently under investigation in clinical trials.* |  |  |  |  |
| **Dose for COVID-19 in Clinical Trials:**  
• IVM 200–600 µg/kg PO as a single dose or a once-daily dose for up to 5 days | • Dizziness  
• Pruritis  
• GI effects (e.g., nausea, diarrhea)  
• Neurological AEs have been reported when IVM has been used to treat parasitic diseases, but it is not clear whether these AEs were caused by IVM or the underlying conditions. | • Monitor for potential AEs. | • Minor CYP3A4 substrate  
• P-gp substrate | • Generally given on an empty stomach with water; however, administering IVM with food increases its bioavailability.  
• A list of clinical trials is available: [Ivermectin](https://www.covid19treatmentguidelines.nih.gov/) |
| **Nitazoxanide**  
*Not approved by the FDA and not recommended by the Panel for the treatment of COVID-19. Currently under investigation in clinical trials.* |  |  |  |  |
| **Doses for Adults:**  
• Doses studied for COVID-19 range from NTZ 500 mg PO 3 times daily to 4 times daily.  
• Higher doses are being studied.  
• Doses used for antiprotozoal indications range from NTZ 500 mg–1 g PO twice daily. | • Abdominal pain  
• Diarrhea  
• Headache  
• Nausea  
• Vomiting  
• Urine discoloration  
• Ocular discoloration (rare) | • Monitor for potential AEs. | • Drug-drug interactions may occur if NTZ is administered concurrently with other highly plasma protein-bound drugs due to competition for binding sites.  
• If NTZ is coadministered with other highly protein-bound drugs with narrow therapeutic indices, monitor the patient for AEs.  
• NTZ should be taken with food.  
• The oral suspension is not bioequivalent to the tablet formulation.  
• A list of clinical trials is available: [Nitazoxanide](https://www.covid19treatmentguidelines.nih.gov/) |  |
Key: AE = adverse event; ALT = alanine transaminase; AST = aspartate aminotransferase; CBC = complete blood count; CHF = congestive heart failure; CQ = chloroquine; CYP = cytochrome P450; eGFR = estimated glomerular filtration rate; EUA = Emergency Use Authorization; FDA = Food and Drug Administration; GI = gastrointestinal; HCQ = hydroxychloroquine; HSR = hypersensitivity reaction; HTN = hypertension; IFN = interferon; IV = intravenous; IVM = ivermectin; LPV/RTV = lopinavir/ritonavir; mAb = monoclonal antibody; MATE = multidrug and toxin extrusion protein; MOV = molnupiravir; NTZ = nitazoxanide; OATP = organic anion transporting polypeptide; OTC = over the counter; the Panel = the COVID-19 Treatment Guidelines Panel; PEG-IFN = pegylated interferon; P-gp = P-glycoprotein; PO = orally; RDV = remdesivir; RTV = ritonavir; SBECID = sulfobutylether-beta-cyclodextrin; SUBQ = subcutaneous; ULN = upper limit of normal

References


