Table 4d. Characteristics of Antiviral Agents

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- 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 5c.
- The sections on Chloroquine or Hydroxychloroquine and/or Azithromycin, Lopinavir/Ritonavir and Other HIV Protease Inhibitors, and Nitazoxanide have been archived. The Panel will no longer be updating the information on these therapies. 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.

Dosing Regimens	Adverse Events	Monitoring Parameters	Drug-Drug Interaction Potential	Comments and Links to Clinical Trials
Ritonavir-Boosted Nirmatrelvir (Paxlovid) *Authorized under FDA EUA for the treatment of mild to moderate COVID-19 in high-risk individuals aged ≥12 years and weighing ≥40 kg.*				
FDA EUA Doses for COVID-19[1] *eGFR ≥60 mL/min:* • Nirmatrelvir 300 mg (two 150-mg tablets) with RTV 100 mg (one 100-mg tablet) twice daily for 5 days *eGFR ≥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	• Dysgeusia • Diarrhea • HTN • Myalgia	• Monitor for potential AEs due to drug-drug interactions with concomitant medications. • Use with caution in patients with pre-existing liver diseases, liver enzyme abnormalities, or hepatitis. • Consider checking renal function in patients	• RTV-boosted nirmatrelvir has significant drug-drug interactions. Before prescribing RTV-boosted nirmatrelvir, **carefully review concomitant medications**, including OTC medicines, herbal supplements, and recreational drugs. • See Drug-Drug Interactions	• Both nirmatrelvir and RTV tablets can be taken with or without food. • A list of clinical trials is available: Ritonavir-Boosted Nirmatrelvir

Dosing Regimens	Adverse Events	Monitoring Parameters	Drug-Drug Interaction Potential	Comments and Links to Clinical Trials
Ritonavir-Boosted Nirmatrelvir (Paxlovid), continued				
eGFR <30 mL/min: • **Not recommended** *Severe Hepatic Impairment (Child-Pugh Class C):* • **Not recommended**		with suspected renal impairment.	Between Ritonavir-Boosted Nirmatrelvir (Paxlovid) and Concomitant Medications for additional guidance and resources to assist with identifying drug-drug interactions.	
Remdesivir *Approved by the FDA for the treatment of COVID-19 in individuals aged ≥28 days and weighing ≥3 kg.*				
Dose for Adults and Children Weighing ≥40 kg: • RDV 200 mg IV on Day 1, then RDV 100 mg IV once daily from Day 2 **Dose for Children Aged ≥28 Days and Weighing 3 kg to <40 kg:** • RDV 5 mg/kg IV on Day 1, then RDV 2.5 mg/kg IV once daily from Day 2 **Total Treatment Duration:** *Nonhospitalized Patients:* • 3 days *Hospitalized Patients:* • 5 days or until hospital discharge	• Nausea • ALT and AST elevations • Hypersensitivity • Increases in prothrombin time • Drug vehicle is SBECD, which has been associated with renal and liver toxicity. SBECD accumulation may occur in patients with moderate or severe renal impairment. • Each 100 mg vial of RDV lyophilized powder contains 3 g of SBECD, and each 100 mg/20 mL vial of RDV solution contains 6 g of SBECD. • Clinicians may consider preferentially using the lyophilized powder formulation (which contains less SBECD) in patients with renal impairment.	• Monitor patients for infusion reactions during the infusion and observe them for ≥1 hour after the infusion as clinically appropriate. • Monitor renal function, hepatic function and prothrombin time as clinically indicated. • The FDA does not recommend using RDV when eGFR is <30 mL/min. See Remdesivir for information on using RDV in people with renal insufficiency.	• Clinical drug-drug interaction studies of RDV have not been conducted. • 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]	• 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. • A list of clinical trials is available: Remdesivir

Dosing Regimens	Adverse Events	Monitoring Parameters	Drug-Drug Interaction Potential	Comments and Links to Clinical Trials
Molnupiravir *Authorized under FDA EUA for the treatment of mild to moderate COVID-19 in high-risk individuals aged ≥18 years.*				
Dose Recommended in FDA EUA: • MOV 800 mg (4 200-mg capsules) PO every 12 hours for 5 days	• Diarrhea • Nausea • Dizziness • Per the FDA, the 5-day course of MOV has a low risk for genotoxicity.[3] See Molnupiravir for details.	• Before initiating MOV, assess pregnancy status as clinically indicated. • Monitor for potential AEs.	• Clinical drug-drug interaction studies of MOV have not been conducted. • Drug-drug interactions related to hepatic metabolism are not expected.	• MOV can be taken with or without food. • Sexually active individuals of reproductive potential should use effective contraception during and following treatment with MOV. See Molnupiravir for details. • 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 offered the opportunity to participate in the pregnancy surveillance program. • During MOV treatment and for 4 days after the final dose, lactating people **should not breastfeed** their infants. • MOV is not authorized for use in children aged <18 years due to potential effects on bone and cartilage growth. • A list of clinical trials is available: Molnupiravir

Dosing Regimens	Adverse Events	Monitoring Parameters	Drug-Drug Interaction Potential	Comments and Links to Clinical Trials
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.	• AEs associated with inhaled therapy (e.g., throat irritation, cough, bronchospasm) • Minimal systemic effects expected	• Respiratory symptoms after inhalation	• Low potential for drug-drug interactions	• 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: Interferon Alfa **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	• Flu-like symptoms (e.g., fever, fatigue, myalgia) • Leukopenia, neutropenia, thrombocytopenia, lymphopenia • Liver function abnormalities (ALT > AST) • Injection site reactions • Headache • Hypertonia • Pain • Rash • Worsening depression • Induction of autoimmunity	• CBC with differential • Liver enzymes • Worsening CHF • Depression, suicidal ideation	• Low potential for drug-drug interactions • **Use with caution** with other hepatotoxic agents. • Reduce dose if ALT >5 times ULN.	• A list of clinical trials is available: Interferon Beta **Availability** *Brand Names of IFN Beta-1a Products:* • Avonex, Plegridy, Rebif *Brand Names of IFN Beta-1b Products:* • Betaseron, Extavia

Dosing Regimens	Adverse Events	Monitoring Parameters	Drug-Drug Interaction Potential	Comments and Links to Clinical Trials
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 **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.[4] • A list of clinical trials is available: Ivermectin

Key: AE = adverse event; ALT = alanine transaminase; AST = aspartate aminotransferase; CBC = complete blood count; CHF = congestive heart failure; CYP = cytochrome P450; eGFR = estimated glomerular filtration rate; EUA = Emergency Use Authorization; FDA = Food and Drug Administration; GI = gastrointestinal; HSR = hypersensitivity reaction; HTN = hypertension; IFN = interferon; IV = intravenous; IVM = ivermectin; mAb = monoclonal antibody; MATE = multidrug and toxin extrusion protein; MOV = molnupiravir; 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; SBECD = sulfobutylether-beta-cyclodextrin; SUBQ = subcutaneous; ULN = upper limit of normal

References

1. Food and Drug Administration. Fact sheet for healthcare providers: emergency use authorization for Paxlovid. 2022. Available at: https://www.fda.gov/media/155050/download.
2. Remdesivir (Veklury) [package insert]. Food and Drug Administration. 2020. Available at: https://www.accessdata.fda.gov/drugsatfda_docs/label/2020/214787Orig1s000lbl.pdf.
3. Food and Drug Administration. Fact sheet for healthcare providers: emergency use authorization for molnupiravir. 2022. Available at:

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4. Ivermectin (Stromectol) [package insert]. Food and Drug Administration. 2009. Available at: https://www.accessdata.fda.gov/drugsatfda_docs/label/2009/050742s024s025lbl.pdf.