

# FACT SHEET FOR HEALTHCARE PROVIDERS: INTERIM AUTHORIZATION OF PAXLOVID™

## HIGHLIGHTS OF INTERIM AUTHORIZATION

These highlights do not include all the information needed to use PAXLOVID™ under the interim authorization. See the FULL FACT SHEET FOR HEALTHCARE PROVIDERS for PAXLOVID.

**PAXLOVID (nirmatrelvir tablets; ritonavir tablets), co-packaged for oral use**

## RECENT MAJOR CHANGES

Warnings and Precautions (5.2, 17): revision to hypersensitivity reactions to PAXLOVID including anaphylaxis 09/2022  
Adverse Reactions (6.2): addition of new adverse reactions 09/2022  
Microbiology (12.4): addition of Omicron subvariants, *in vivo*, and resistance data 09/2022  
Drug Interactions (7.3): addition of new drug interactions 08/2022  
Contraindications (4): addition of new contraindicated drugs 06/2022  
Microbiology (12.4): addition of viral RNA rebound 06/2022  
Drug Interactions (7.3, 12.3): addition of new drug interactions 04/2022

## INTERIM AUTHORIZATION OF PAXLOVID

The Health Sciences Authority (HSA) has granted an Interim Authorization to permit the emergency use of the therapeutic product, PAXLOVID, for the treatment of mild-to-moderate coronavirus disease 2019 (COVID-19) in adults with positive results of direct severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) viral testing, and who are at high risk for progression to severe COVID-19, including hospitalization or death (see section 14 Clinical Studies).

## LIMITATIONS OF AUTHORIZED USE

- PAXLOVID is not authorized for initiation of treatment in patients requiring hospitalization due to severe or critical COVID-19.
- PAXLOVID is not authorized for pre-exposure or post-exposure prophylaxis for prevention of COVID-19.
- PAXLOVID is not authorized for use longer than 5 consecutive days.

## DOSAGE AND ADMINISTRATION

PAXLOVID is nirmatrelvir tablets co-packaged with ritonavir tablets. (2.1)

Nirmatrelvir must be co-administered with ritonavir. (2.1)

- Initiate PAXLOVID treatment as soon as possible after diagnosis of COVID-19 and within 5 days of symptom onset. (2.1)
- Administer orally with or without food. (2.1)
- Dosage: 300 mg nirmatrelvir (two 150 mg tablets) with 100 mg ritonavir (one 100 mg tablet), with all three tablets taken together twice daily for 5 days. (2.1)
- **Dose reduction for moderate renal impairment (eGFR  $\geq$ 30 to  $<$ 60 mL/min):** 150 mg nirmatrelvir (one 150 mg tablet) with 100 mg ritonavir (one 100 mg tablet), with both tablets taken together twice daily for 5 days. (2.2)
- PAXLOVID is not recommended in patients with severe renal impairment (eGFR  $<$ 30 mL/min). (2.2, 8.6)
- PAXLOVID is not recommended in patients with severe hepatic impairment (Child-Pugh Class C). (2.3, 8.7)

## DOSAGE FORMS AND STRENGTHS

- Tablets: nirmatrelvir 150 mg (3)
- Tablets: ritonavir 100 mg (3)

## CONTRAINDICATIONS

- History of clinically significant hypersensitivity reactions to the active ingredients (nirmatrelvir or ritonavir) or any other components. (4)
- Co-administration with drugs highly dependent on CYP3A for clearance and for which elevated concentrations are associated with serious and/or life-threatening reactions. (4, 7.3)
- Co-administration with potent CYP3A inducers where significantly reduced nirmatrelvir or ritonavir plasma concentrations may be associated with the potential for loss of virologic response and possible resistance. (4)

## WARNINGS AND PRECAUTIONS

- The concomitant use of PAXLOVID and certain other drugs may result in potentially significant drug interactions. Consult the full prescribing information prior to and during treatment for potential drug interactions. (5.1, 7)
- Hypersensitivity Reactions: Anaphylaxis and other hypersensitivity reactions have been reported with PAXLOVID. If signs and symptoms of a clinically significant hypersensitivity reaction or anaphylaxis occur, immediately discontinue PAXLOVID and initiate appropriate medications and/or supportive care. (5.2)
- Hepatotoxicity: Hepatic transaminase elevations, clinical hepatitis, and jaundice have occurred in patients receiving ritonavir. (5.3)
- HIV-1 Drug Resistance: PAXLOVID use may lead to a risk of HIV-1 developing resistance to HIV protease inhibitors in individuals with uncontrolled or undiagnosed HIV-1 infection. (5.4)

## ADVERSE REACTIONS

Adverse events (incidence  $\geq$ 1% and  $\geq$ 5 subject difference) were dysgeusia, diarrhea, hypertension, and myalgia. (6.1)

## DRUG INTERACTIONS

Co-administration of PAXLOVID can alter the plasma concentrations of other drugs and other drugs may alter the plasma concentrations of PAXLOVID. Consider the potential for drug interactions prior to and during PAXLOVID therapy and review concomitant medications during PAXLOVID therapy. (2.4, 4, 5.1, 7, 12.3)

**See FACT SHEET FOR PATIENTS AND CAREGIVERS.**

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# FULL FACT SHEET FOR HEALTHCARE PROVIDERS

## 1 AUTHORIZED USE

PAXLOVID is authorized for use under an Interim Authorization for the treatment of mild-to-moderate coronavirus disease 2019 (COVID-19) in adults with positive results of direct severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) viral testing, and who are at high risk<sup>1</sup> for progression to severe COVID-19, including hospitalization or death (see section 14 Clinical Studies).

### LIMITATIONS OF AUTHORIZED USE

- PAXLOVID is not authorized for initiation of treatment in patients requiring hospitalization due to severe or critical COVID-19 [see *Dosage and Administration (2.1)*].<sup>2</sup>
- PAXLOVID is not authorized for use as pre-exposure or post-exposure prophylaxis for prevention of COVID-19.
- PAXLOVID is not authorized for use for longer than 5 consecutive days.

### Authority for Issuance of the Interim Authorization

The interim authorization for the abovementioned emergency therapeutic product by the Health Sciences Authority (HSA) of Singapore is made under Regulations 60A(4) and (5)(b) of the Health Product (Therapeutic Products) Regulations.

HSA issued this interim authorization, based on Pfizer's request and submitted data.

For authorized uses, although limited scientific information is available, based on the totality of the scientific evidence available to date, it is reasonable to believe that PAXLOVID may be effective for the treatment of mild-to-moderate coronavirus disease 2019 (COVID-19) in adults with certain risk factors as specified in this Fact Sheet.

For additional information about Interim Authorization, visit HSA at:

<https://www.hsa.gov.sg/therapeutic-products/register/special-access-routes/psar-emergency-therapeutic-product>.

## 2 DOSAGE AND ADMINISTRATION

### 2.1 Dosage

PAXLOVID is nirmatrelvir tablets co-packaged with ritonavir tablets.

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<sup>1</sup> The risk factors included in the clinical study were age  $\geq 60$  years, BMI  $> 25$  kg/m<sup>2</sup>, cigarette smoker, chronic kidney disease, chronic lung disease (including asthma), cardiovascular disease (including hypertension), diabetes, immunosuppression (immunosuppressive disease or prolonged use of immune-weakening medications), sickle cell disease, neurodevelopmental disorders (e.g., cerebral palsy, Down's syndrome) or other conditions that confer medical complexity (e.g., genetic or metabolic syndromes and severe congenital anomalies), active cancer, medical-related technological dependence [e.g., continuous positive airway pressure (CPAP) (not related to COVID-19)].

<sup>2</sup> Patients requiring hospitalization due to severe or critical COVID-19 after starting treatment with PAXLOVID may complete the full 5-day treatment course per the healthcare provider's discretion.

Nirmatrelvir must be co-administered with ritonavir. Failure to correctly co-administer nirmatrelvir with ritonavir may result in plasma levels of nirmatrelvir that are insufficient to achieve the desired therapeutic effect.

The dosage for PAXLOVID is 300 mg nirmatrelvir (two 150 mg tablets) with 100 mg ritonavir (one 100 mg tablet) with all three tablets taken together orally twice daily for 5 days. *Prescriptions should specify the numeric dose of each active ingredient within PAXLOVID.* Completion of the full 5-day treatment course and continued isolation in accordance with public health recommendations are important to maximize viral clearance and minimize transmission of SARS-CoV-2.

The 5-day treatment course of PAXLOVID should be initiated as soon as possible after a diagnosis of COVID-19 has been made, and within 5 days of symptom onset. Should a patient require hospitalization due to severe or critical COVID-19 after starting treatment with PAXLOVID, the patient should complete the full 5-day treatment course per the healthcare provider's discretion.

If the patient misses a dose of PAXLOVID within 8 hours of the time it is usually taken, the patient should take it as soon as possible and resume the normal dosing schedule. If the patient misses a dose by more than 8 hours, the patient should not take the missed dose and instead take the next dose at the regularly scheduled time. The patient should not double the dose to make up for a missed dose.

PAXLOVID (both nirmatrelvir and ritonavir tablets) can be taken with or without food [*see Clinical Pharmacology (12.3)*]. The tablets should be swallowed whole and not chewed, broken, or crushed.

## **2.2 Important Dosing Information in Patients with Renal Impairment**

No dosage adjustment is needed in patients with mild renal impairment (eGFR  $\geq 60$  to  $< 90$  mL/min). In patients with moderate renal impairment (eGFR  $\geq 30$  to  $< 60$  mL/min), the dosage of PAXLOVID is 150 mg nirmatrelvir and 100 mg ritonavir twice daily for 5 days. *Prescriptions should specify the numeric dose of each active ingredient within PAXLOVID.* Providers should counsel patients about renal dosing instructions [*see Patient Counseling Information (17)*].

PAXLOVID is not recommended in patients with severe renal impairment (eGFR  $< 30$  mL/min) until more data are available; the appropriate dosage for patients with severe renal impairment has not been determined [*see Use in Specific Populations (8.6) and Clinical Pharmacology (12.3)*].

## **2.3 Use in Patients with Hepatic Impairment**

No dosage adjustment is needed in patients with mild (Child-Pugh Class A) or moderate (Child-Pugh Class B) hepatic impairment. No pharmacokinetic or safety data are available regarding the use of nirmatrelvir or ritonavir in subjects with severe hepatic impairment (Child-Pugh Class C); therefore, PAXLOVID is not recommended for use in patients with severe hepatic impairment [*see Use in Specific Populations (8.7)*].

## **2.4 Important Drug Interactions with PAXLOVID**

Refer to other sections of the Fact Sheet for important drug interactions with PAXLOVID. Interacting drugs listed in the Fact Sheet are a guide and not considered a comprehensive list of all possible drugs that may interact with PAXLOVID. The healthcare provider should consult other appropriate resources such as the prescribing information for the interacting drug for comprehensive information

on dosing or monitoring with concomitant use of a strong CYP3A inhibitor such as ritonavir. Consider the potential for drug interactions prior to and during PAXLOVID therapy and review concomitant medications during PAXLOVID therapy [see *Contraindications (4)*, *Warnings and Precautions (5.1)*, and *Drug Interactions (7)*].

No dosage adjustment is required when co-administered with other products containing ritonavir or cobicistat.

Patients on ritonavir- or cobicistat-containing HIV or HCV regimens should continue their treatment as indicated.

### **3 DOSAGE FORMS AND STRENGTHS**

PAXLOVID is nirmatrelvir tablets co-packaged with ritonavir tablets.

- Nirmatrelvir is supplied as oval, pink immediate-release, film-coated tablets debossed with “PFE” on one side and “3CL” on the other side. Each tablet contains 150 mg of nirmatrelvir.
- Ritonavir is supplied as white film-coated ovaloid tablets debossed with the "a" logo and the code NK. Each tablet contains 100 mg of ritonavir.

### **4 CONTRAINDICATIONS**

PAXLOVID is contraindicated in patients with a history of clinically significant hypersensitivity reactions [e.g., toxic epidermal necrolysis (TEN) or Stevens-Johnson syndrome] to its active ingredients (nirmatrelvir or ritonavir) or any other components of the product.

Drugs listed in this section are a guide and not considered a comprehensive list of all drugs that may be contraindicated with PAXLOVID. The healthcare provider should consult other appropriate resources such as the prescribing information for the interacting drug for comprehensive information on dosing or monitoring with concomitant use of a strong CYP3A inhibitor such as ritonavir.

PAXLOVID is contraindicated with drugs that are highly dependent on CYP3A for clearance and for which elevated concentrations are associated with serious and/or life-threatening reactions [see *Drug Interactions (7.3)*]:

- Alpha<sub>1</sub>-adrenoreceptor antagonist: alfuzosin
- Antianginal: ranolazine
- Antiarrhythmic: amiodarone, dronedarone, flecainide, propafenone, quinidine
- Anti-gout: colchicine
- Antipsychotics: lurasidone, pimozide
- Benign prostatic hyperplasia agents: silodosin
- Cardiovascular agents: eplerenone, ivabradine
- Ergot derivatives: dihydroergotamine, ergotamine, methylergonovine
- HMG-CoA reductase inhibitors: lovastatin, simvastatin
- Immunosuppressants: voclosporin
- Microsomal triglyceride transfer protein inhibitor: lomitapide
- Migraine medications: eletriptan, ubrogepant
- Mineralocorticoid receptor antagonists: finerenone

- Opioid antagonists: naloxegol
- PDE5 inhibitor: sildenafil (Revatio®) when used for pulmonary arterial hypertension (PAH)
- Sedative/hypnotics: triazolam, oral midazolam
- Serotonin receptor 1A agonist/serotonin receptor 2A antagonist: flibanserin
- Vasopressin receptor antagonists: tolvaptan

PAXLOVID is contraindicated with drugs that are potent CYP3A inducers where significantly reduced nirmatrelvir or ritonavir plasma concentrations may be associated with the potential for loss of virologic response and possible resistance. PAXLOVID cannot be started immediately after discontinuation of any of the following medications due to the delayed offset of the recently discontinued CYP3A inducer [see *Drug Interactions (7.3)*]:

- Anticancer drugs: apalutamide
- Anticonvulsant: carbamazepine, phenobarbital, primidone, phenytoin
- Cystic fibrosis transmembrane conductance regulator potentiators: lumacaftor/ivacaftor
- Antimycobacterials: rifampin
- Herbal products: St. John's Wort (*hypericum perforatum*)

## 5 WARNINGS AND PRECAUTIONS

There are limited clinical data available for PAXLOVID. Serious and unexpected adverse events may occur that have not been previously reported with PAXLOVID use.

### 5.1 Risk of Serious Adverse Reactions Due to Drug Interactions

Initiation of PAXLOVID, a CYP3A inhibitor, in patients receiving medications metabolized by CYP3A or initiation of medications metabolized by CYP3A in patients already receiving PAXLOVID, may increase plasma concentrations of medications metabolized by CYP3A.

Initiation of medications that inhibit or induce CYP3A may increase or decrease concentrations of PAXLOVID, respectively.

These interactions may lead to:

- Clinically significant adverse reactions, potentially leading to severe, life-threatening, or fatal events from greater exposures of concomitant medications.
- Clinically significant adverse reactions from greater exposures of PAXLOVID.
- Loss of therapeutic effect of PAXLOVID and possible development of viral resistance.

See Table 1 for clinically significant drug interactions, including contraindicated drugs. Drugs listed in Table 1 are a guide and not considered a comprehensive list of all possible drugs that may interact with PAXLOVID. Consider the potential for drug interactions prior to and during PAXLOVID therapy; review concomitant medications during PAXLOVID therapy and monitor for the adverse reactions associated with the concomitant medications [see *Contraindications (4)* and *Drug Interactions (7)*].

### 5.2 Hypersensitivity Reactions

Anaphylaxis and other hypersensitivity reactions have been reported with PAXLOVID [see *Adverse Reactions (6.2)*]. Cases of Toxic Epidermal Necrolysis and Stevens-Johnson syndrome have been

reported with ritonavir, a component of PAXLOVID (refer to NORVIR prescribing information). If signs and symptoms of a clinically significant hypersensitivity reaction or anaphylaxis occur, immediately discontinue PAXLOVID and initiate appropriate medications and/or supportive care.

### 5.3 Hepatotoxicity

Hepatic transaminase elevations, clinical hepatitis, and jaundice have occurred in patients receiving ritonavir. Therefore, caution should be exercised when administering PAXLOVID to patients with pre-existing liver diseases, liver enzyme abnormalities, or hepatitis.

### 5.4 Risk of HIV-1 Resistance Development

Because nirmatrelvir is co-administered with ritonavir, there may be a risk of HIV-1 developing resistance to HIV protease inhibitors in individuals with uncontrolled or undiagnosed HIV-1 infection [see *Dosage and Administration (2.4)*, *Contraindications (4)*, and *Drug Interactions (7)*].

## 6 ADVERSE REACTIONS

### 6.1 Adverse Reactions from Clinical Studies

The following adverse reactions have been observed in the clinical studies of PAXLOVID that supported the interim authorization. The adverse reaction rates observed in these clinical studies cannot be directly compared to rates in the clinical studies of another drug and may not reflect the rates observed in clinical practice. Additional adverse events associated with PAXLOVID may become apparent with more widespread use.

The safety of PAXLOVID is based on data from Study C4671005 (EPIC-HR), a Phase 2/3 randomized, placebo-controlled trial in non-hospitalized adult subjects with a laboratory confirmed diagnosis of SARS-CoV-2 infection [see *Clinical Studies (14.1)*]. A total of 2,224 symptomatic adult subjects 18 years of age and older who are at high risk of developing severe COVID-19 illness received at least one dose of either PAXLOVID (n=1,109) or placebo (n=1,115). Adverse events were those reported while subjects were on study medication and through Day 34 after initiating study treatment. PAXLOVID [300 mg nirmatrelvir (two 150 mg tablets) with 100 mg ritonavir] or matching placebo were to be taken twice daily for 5 days.

Adverse events (all grades regardless of causality) in the PAXLOVID group ( $\geq 1\%$ ) that occurred at a greater frequency ( $\geq 5$  subject difference) than in the placebo group were dysgeusia (6% and  $<1\%$ , respectively), diarrhea (3% and 2%), hypertension (1% and  $<1\%$ ), and myalgia (1% and  $<1\%$ ).

The proportions of subjects who discontinued treatment due to an adverse event were 2% in the PAXLOVID group and 4% in the placebo group.

### 6.2 Post-Authorization Experience

The following adverse reactions have been identified during post-authorization use of PAXLOVID. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure.

*Immune System Disorders:* Anaphylaxis, hypersensitivity reactions [see *Warnings and Precautions (5.2)*].

*Gastrointestinal Disorders:* Abdominal pain, nausea  
*General Disorders and Administration Site Conditions:* Malaise

## 6.4 Required Reporting for Serious Adverse Events and Medication Errors

The prescribing healthcare provider and/or the provider's designee is/are responsible for reporting of all serious adverse events\* and medication errors potentially related to PAXLOVID.

\*Serious adverse events are defined as:

- Death;
- A life-threatening adverse event;
- Inpatient hospitalization or prolongation of existing hospitalization;
- A persistent or significant incapacity or substantial disruption of the ability to conduct normal life functions;
- A congenital anomaly/birth defect;
- Other important medical event, which may require a medical or surgical intervention to prevent death, a life-threatening event, hospitalization, disability, or congenital anomaly.

### Other Adverse Event Reporting to Pfizer Singapore

Providers may report all other adverse events, to the extent feasible, to Pfizer Singapore using the contact information below.

Email	Fax number	Telephone number
<a href="mailto:SGP.AEReporting@pfizer.com">SGP.AEReporting@pfizer.com</a>	8001012817 (local toll free)	+65 6403 8888

## 7 DRUG INTERACTIONS

### 7.1 Potential for PAXLOVID to Affect Other Drugs

PAXLOVID (nirmatrelvir co-packaged with ritonavir) is a strong inhibitor of CYP3A and may increase plasma concentrations of drugs that are primarily metabolized by CYP3A. Co-administration of PAXLOVID with drugs highly dependent on CYP3A for clearance and for which elevated plasma concentrations are associated with serious and/or life-threatening events is contraindicated [see *Contraindications (4) and Table 1*]. Co-administration with other CYP3A substrates may require a dose adjustment or additional monitoring as shown in Table 1.

### 7.2 Potential for Other Drugs to Affect PAXLOVID

Nirmatrelvir and ritonavir are CYP3A substrates; therefore, drugs that induce CYP3A may decrease nirmatrelvir and ritonavir plasma concentrations and reduce PAXLOVID therapeutic effect.

### 7.3 Established and Other Potentially Significant Drug Interactions

Table 1 provides a listing of clinically significant drug interactions, including contraindicated drugs [see *Contraindications (4)*]. Drugs listed in Table 1 are a guide and not considered a comprehensive

list of all possible drugs that may interact with PAXLOVID. The healthcare provider should consult other appropriate resources such as the prescribing information for the interacting drug for comprehensive information on dosing or monitoring with concomitant use of a strong CYP3A inhibitor such as ritonavir.

**Table 1: Established and Other Potentially Significant Drug Interactions**

<b>Drug Class</b>	<b>Drugs within Class</b>	<b>Effect on Concentration</b>	<b>Clinical Comments</b>
Alpha 1-adrenoreceptor antagonist	alfuzosin	↑ alfuzosin	Co-administration contraindicated due to potential hypotension [see <i>Contraindications (4)</i> ].
Alpha 1-adrenoreceptor antagonist	tamsulosin	↑ tamsulosin	Avoid concomitant use with PAXLOVID.
Antianginal	ranolazine	↑ ranolazine	Co-administration contraindicated due to potential for serious and/or life-threatening reactions [see <i>Contraindications (4)</i> ].
Antiarrhythmics	amiodarone, dronedarone, flecainide, propafenone, quinidine	↑ antiarrhythmic	Co-administration contraindicated due to potential for cardiac arrhythmias [see <i>Contraindications (4)</i> ].
Antiarrhythmics	lidocaine (systemic), disopyramide	↑ antiarrhythmic	Caution is warranted and therapeutic concentration monitoring is recommended for antiarrhythmics if available.
Anticancer drugs	apalutamide	↓ nirmatrelvir/ritonavir	Co-administration contraindicated due to potential loss of virologic response and possible resistance [see <i>Contraindications (4)</i> ].
Anticancer drugs	abemaciclib, ceritinib, dasatinib, encorafenib, ibrutinib, ivosidenib, neratinib, nilotinib, venetoclax, vinblastine, vincristine	↑ anticancer drug	Avoid co-administration of encorafenib or ivosidenib due to potential risk of serious adverse events such as QT interval prolongation. Avoid use of neratinib, venetoclax or ibrutinib.  Co-administration of vincristine and vinblastine may lead to significant hematologic or gastrointestinal side effects.  For further information, refer to individual product label for anticancer drug.

**Table 1: Established and Other Potentially Significant Drug Interactions**

<b>Drug Class</b>	<b>Drugs within Class</b>	<b>Effect on Concentration</b>	<b>Clinical Comments</b>
Anticoagulants	warfarin	↑↓ warfarin	Closely monitor INR if co-administration with warfarin is necessary.
	rivaroxaban	↑ rivaroxaban	Increased bleeding risk with rivaroxaban. Avoid concomitant use.
	dabigatran <sup>a</sup>	↑ dabigatran	Increased bleeding risk with dabigatran. Depending on dabigatran indication and renal function, reduce dose of dabigatran or avoid concomitant use. Refer to the dabigatran product label for further information.
	apixaban	↑ apixaban	Combined P-gp and strong CYP3A4 inhibitors increase blood levels of apixaban and increase the risk of bleeding. Dosing recommendations for co-administration of apixaban with PAXLOVID depend on the apixaban dose. Refer to the apixaban product label for more information.
Anticonvulsants	carbamazepine <sup>a</sup> , phenobarbital, primidone, phenytoin	↓ nirmatrelvir/ritonavir	Co-administration contraindicated due to potential loss of virologic response and possible resistance [see <i>Contraindications (4)</i> ].
Anticonvulsants	clonazepam	↑ anticonvulsant	A dose decrease may be needed for clonazepam when co-administered with PAXLOVID and clinical monitoring is recommended.
Antidepressants	bupropion	↓ bupropion and active metabolite hydroxy-bupropion	Monitor for an adequate clinical response to bupropion.
	trazodone	↑ trazodone	Adverse reactions of nausea, dizziness, hypotension, and syncope have been observed following co-administration of trazodone and ritonavir. A lower dose of trazodone should be considered. Refer to trazadone product label for further information.

**Table 1: Established and Other Potentially Significant Drug Interactions**

<b>Drug Class</b>	<b>Drugs within Class</b>	<b>Effect on Concentration</b>	<b>Clinical Comments</b>
Antifungals	voriconazole,  ketoconazole, isavuconazonium sulfate, itraconazole <sup>a</sup>	↓ voriconazole  ↑ ketoconazole ↑ isavuconazonium sulfate ↑ itraconazole  ↑ nirmatrelvir/ritonavir	Avoid concomitant use of voriconazole.  Refer to ketoconazole, isavuconazonium sulfate, and itraconazole product labels for further information.
Anti-gout	colchicine	↑ colchicine	Co-administration contraindicated due to potential for serious and/or life-threatening reactions in patients with renal and/or hepatic impairment [see <i>Contraindications (4)</i> ].
Anti-HIV protease inhibitors	atazanavir, darunavir, tipranavir	↑ protease inhibitor	For further information, refer to the respective protease inhibitors' prescribing information.  Patients on ritonavir- or cobicistat-containing HIV regimens should continue their treatment as indicated. Monitor for increased PAXLOVID or protease inhibitor adverse events [see <i>Dosage and Administration (2.4)</i> ].
Anti-HIV	efavirenz, maraviroc, nevirapine, zidovudine, bictegravir/ emtricitabine/ tenofovir	↑ efavirenz ↑ maraviroc ↑ nevirapine ↓ zidovudine ↑ bictegravir ↔ emtricitabine ↑ tenofovir	For further information, refer to the respective anti-HIV drugs prescribing information.
Anti-infective	clarithromycin, erythromycin	↑ clarithromycin ↑ erythromycin	Refer to the respective prescribing information for anti-infective dose adjustment.
Antimycobacterial	rifampin	↓ nirmatrelvir/ritonavir	Co-administration contraindicated due to potential loss of virologic response and possible resistance. Alternate antimycobacterial drugs such as rifabutin should be considered [see <i>Contraindications (4)</i> ].

**Table 1: Established and Other Potentially Significant Drug Interactions**

<b>Drug Class</b>	<b>Drugs within Class</b>	<b>Effect on Concentration</b>	<b>Clinical Comments</b>
Antimycobacterial	bedaquiline	↑ bedaquiline	Refer to the bedaquiline product label for further information.
	rifabutin	↑ rifabutin	Refer to rifabutin product label for further information on rifabutin dose reduction.
	rifapentine	↓ nirmatrelvir/ritonavir	Avoid concomitant use with PAXLOVID.
Antipsychotics	lurasidone, pimozide	↑ lurasidone ↑ pimozide	Co-administration contraindicated due to serious and/or life-threatening reactions such as cardiac arrhythmias [see <i>Contraindications (4)</i> ].
Antipsychotics	quetiapine	↑ quetiapine	If co-administration is necessary, reduce quetiapine dose and monitor for quetiapine-associated adverse reactions. Refer to the quetiapine prescribing information for recommendations.
	clozapine	↑ clozapine	If co-administration is necessary, consider reducing the clozapine dose and monitor for adverse reactions.
Benign prostatic hyperplasia agents	silodosin	↑ silodosin	Co-administration contraindicated due to potential for postural hypotension [see <i>Contraindications (4)</i> ].
Calcium channel blockers	amlodipine, diltiazem, felodipine, nicardipine, nifedipine, verapamil	↑ calcium channel blocker	Caution is warranted and clinical monitoring of patients is recommended. A dose decrease may be needed for these drugs when co-administered with PAXLOVID.  If co-administered, refer to individual product label for calcium channel blocker for further information.
Cardiac glycosides	digoxin	↑ digoxin	Caution should be exercised when co-administering PAXLOVID with digoxin, with appropriate monitoring of serum digoxin levels.  Refer to the digoxin product label for further information.

**Table 1: Established and Other Potentially Significant Drug Interactions**

<b>Drug Class</b>	<b>Drugs within Class</b>	<b>Effect on Concentration</b>	<b>Clinical Comments</b>
Cardiovascular agents	eplerenone	↑ eplerenone	Co-administration with eplerenone is contraindicated due to potential for hyperkalemia [see <i>Contraindications (4)</i> ].
	ivabradine	↑ ivabradine	Co-administration with ivabradine is contraindicated due to potential for bradycardia or conduction disturbances [see <i>Contraindications (4)</i> ].
Cardiovascular agents	aliskiren, ticagrelor, vorapaxar	↑ aliskiren ↑ ticagrelor ↑ vorapaxar	Avoid concomitant use with PAXLOVID.
	clopidogrel	↓ clopidogrel active metabolite	
	cilostazol	↑ cilostazol	Dosage adjustment of cilostazol is recommended. Refer to the cilostazol product label for more information.
Corticosteroids primarily metabolized by CYP3A	betamethasone, budesonide, ciclesonide, dexamethasone, fluticasone, methylprednisolone, mometasone, triamcinolone	↑ corticosteroid	Co-administration with corticosteroids (all routes of administration) of which exposures are significantly increased by strong CYP3A inhibitors can increase the risk for Cushing's syndrome and adrenal suppression. However, the risk of Cushing's syndrome and adrenal suppression associated with short-term use of a strong CYP3A4 inhibitor is low.  Alternative corticosteroids including beclomethasone, prednisone, and prednisolone should be considered.
Cystic fibrosis transmembrane conductance regulator potentiators	lumacaftor/ivacaftor	↓ nirmatrelvir/ritonavir	Co-administration contraindicated due to potential loss of virologic response and possible resistance [see <i>Contraindications (4)</i> ].
Cystic fibrosis transmembrane conductance regulator potentiators	ivacaftor	↑ ivacaftor	Reduce dosage when co-administered with PAXLOVID. Refer to individual product labels for more information.
	elexacaftor/tezacaftor/ivacaftor	↑ elexacaftor/tezacaftor/ivacaftor	
	tezacaftor/ivacaftor	↑ tezacaftor/ivacaftor	

**Table 1: Established and Other Potentially Significant Drug Interactions**

<b>Drug Class</b>	<b>Drugs within Class</b>	<b>Effect on Concentration</b>	<b>Clinical Comments</b>
Dipeptidyl peptidase 4 (DPP4) inhibitors	saxagliptin	↑ saxagliptin	Dosage adjustment of saxagliptin is recommended. Refer to the saxagliptin product label for more information.
Endothelin receptor antagonists	bosentan	↑ bosentan	Discontinue use of bosentan at least 36 hours prior to initiation of PAXLOVID.  Refer to the bosentan product label for further information.
Ergot derivatives	dihydroergotamine, ergotamine, methylergonovine	↑ dihydroergotamine ↑ ergotamine ↑ methylergonovine	Co-administration contraindicated due to potential for acute ergot toxicity characterized by vasospasm and ischemia of the extremities and other tissues including the central nervous system [see <i>Contraindications (4)</i> ].
Hepatitis C direct acting antivirals	elbasvir/grazoprevir, glecaprevir/pibrentasvir  ombitasvir/paritaprevir/ritonavir and dasabuvir  sofosbuvir/velpatasvir/voxilaprevir	↑ antiviral	Increased grazoprevir concentrations can result in ALT elevations.  Avoid concomitant use of glecaprevir/pibrentasvir with PAXLOVID.  Refer to the ombitasvir/paritaprevir/ritonavir and dasabuvir label for further information.  Refer to the sofosbuvir/velpatasvir/voxilaprevir product label for further information.  Patients on ritonavir-containing HCV regimens should continue their treatment as indicated. Monitor for increased PAXLOVID or HCV drug adverse events with concomitant use [see <i>Dosage and Administration (2.4)</i> ].
Herbal products	St. John's Wort ( <i>hypericum perforatum</i> )	↓ nirmatrelvir/ritonavir	Co-administration contraindicated due to potential loss of virologic response and possible resistance [see <i>Contraindications (4)</i> ].

**Table 1: Established and Other Potentially Significant Drug Interactions**

<b>Drug Class</b>	<b>Drugs within Class</b>	<b>Effect on Concentration</b>	<b>Clinical Comments</b>
HMG-CoA reductase inhibitors	lovastatin, simvastatin	↑ lovastatin ↑ simvastatin	Co-administration contraindicated due to potential for myopathy including rhabdomyolysis [see <i>Contraindications (4)</i> ].  Discontinue use of lovastatin and simvastatin at least 12 hours prior to initiation of PAXLOVID, during the 5 days of PAXLOVID treatment and for 5 days after completing PAXLOVID.
HMG-CoA reductase inhibitors	atorvastatin, rosuvastatin	↑ atorvastatin ↑ rosuvastatin	Consider temporary discontinuation of atorvastatin and rosuvastatin during treatment with PAXLOVID. Atorvastatin and rosuvastatin do not need to be withheld prior to or after completing PAXLOVID.
Hormonal contraceptive	ethinyl estradiol	↓ ethinyl estradiol	An additional, non-hormonal method of contraception should be considered during the 5 days of PAXLOVID treatment and until one menstrual cycle after stopping PAXLOVID.
Immunosuppressants	voclosporin	↑ voclosporin	Co-administration contraindicated due to potential for acute and/or chronic nephrotoxicity [see <i>Contraindications (4)</i> ].
Immunosuppressants	cyclosporine, tacrolimus	↑ cyclosporine ↑ tacrolimus	Avoid use of PAXLOVID when close monitoring of immunosuppressant concentrations is not feasible. If co administered, dose adjustment of the immunosuppressant and monitoring for immunosuppressant concentrations and immunosuppressant-associated adverse reactions is recommended. Refer to the individual immunosuppressant product label for further information and obtain expert consultation from the patient's immunosuppressive therapy specialist.
	everolimus, sirolimus	↑ everolimus ↑ sirolimus	Avoid concomitant use of everolimus and sirolimus and PAXLOVID.

**Table 1: Established and Other Potentially Significant Drug Interactions**

<b>Drug Class</b>	<b>Drugs within Class</b>	<b>Effect on Concentration</b>	<b>Clinical Comments</b>
Janus kinase (JAK) inhibitors	tofacitinib	↑ tofacitinib	Dosage adjustment of tofacitinib is recommended. Refer to the tofacitinib product label for more information.
	upadacitinib	↑ upadacitinib	Dosing recommendations for co-administration of upadacitinib with PAXLOVID depends on the upadacitinib indication. Refer to the upadacitinib product label for more information.
Long-acting beta-adrenoceptor agonist	salmeterol	↑ salmeterol	Avoid concomitant use with PAXLOVID. The combination may result in increased risk of cardiovascular adverse events associated with salmeterol, including QT prolongation, palpitations, and sinus tachycardia.
Microsomal triglyceride transfer protein (MTTP) inhibitor	lomitapide	↑ lomitapide	Co-administration contraindicated due to potential for hepatotoxicity and gastrointestinal adverse reactions [see <i>Contraindications (4)</i> ].
Migraine medications	eletriptan	↑ eletriptan	Co-administration of eletriptan within at least 72 hours of PAXLOVID is contraindicated due to potential for serious adverse reactions including cardiovascular and cerebrovascular events [see <i>Contraindications (4)</i> ].
	ubrogepant	↑ ubrogepant	Co-administration of ubrogepant with PAXLOVID is contraindicated due to potential for serious adverse reactions [see <i>Contraindications (4)</i> ].
Migraine medications	rimegepant	↑ rimegepant	Avoid concomitant use with PAXLOVID.
Mineralocorticoid receptor antagonists	finerenone	↑ finerenone	Co-administration contraindicated due to potential for serious adverse reactions including hyperkalemia, hypotension, and hyponatremia [see <i>Contraindications (4)</i> ].
Muscarinic receptor antagonists	darifenacin	↑ darifenacin	The darifenacin daily dose should not exceed 7.5 mg when co-administered with PAXLOVID. Refer to the darifenacin product label for more information.

**Table 1: Established and Other Potentially Significant Drug Interactions**

<b>Drug Class</b>	<b>Drugs within Class</b>	<b>Effect on Concentration</b>	<b>Clinical Comments</b>
Narcotic analgesics	fentanyl, hydrocodone, oxycodone, meperidine	↑ fentanyl ↑ hydrocodone ↑ oxycodone ↑ meperidine	Careful monitoring of therapeutic and adverse effects (including potentially fatal respiratory depression) is recommended when fentanyl, hydrocodone, oxycodone or meperidine is concomitantly administered with PAXLOVID. If concomitant use with PAXLOVID is necessary, consider a dosage reduction of the narcotic analgesic and monitor patients closely at frequent intervals. Refer to the individual product label for more information.
	methadone	↓ methadone	Monitor methadone-maintained patients closely for evidence of withdrawal effects and adjust the methadone dose accordingly.
Neuropsychiatric agents	suvorexant	↑ suvorexant	Avoid concomitant use of suvorexant with PAXLOVID.
	aripiprazole, brexpiprazole, cariprazine, iloperidone, lumateperone, pimavanserin	↑ aripiprazole ↑ brexpiprazole ↑ cariprazine ↑ iloperidone ↑ lumateperone ↑ pimavanserin	Dosage adjustment of aripiprazole, brexpiprazole, cariprazine, iloperidone, lumateperone, and pimavanserin is recommended. Refer to individual product label for more information.
Pulmonary hypertension agents (PDE5 inhibitors)	sildenafil (Revatio®)	↑ sildenafil	Co-administration of sildenafil with PAXLOVID is contraindicated due to the potential for sildenafil associated adverse events, including visual abnormalities, hypotension, prolonged erection, and syncope [see <i>Contraindications (4)</i> ].
Pulmonary hypertension agents (PDE5 inhibitors)	tadalafil (Adcirca®)	↑ tadalafil	Avoid concomitant use of tadalafil with PAXLOVID.
Pulmonary hypertension agents (sGC stimulators)	riociguat	↑ riociguat	Dosage adjustment is recommended for riociguat. Refer to the riociguat product label for more information.

**Table 1: Established and Other Potentially Significant Drug Interactions**

<b>Drug Class</b>	<b>Drugs within Class</b>	<b>Effect on Concentration</b>	<b>Clinical Comments</b>
Erectile dysfunction agents (PDE5 inhibitors)	avanafil  sildenafil, tadalafil, vardenafil	↑ avanafil  ↑ sildenafil ↑ tadalafil ↑ vardenafil	Do not use PAXLOVID with avanafil because a safe and effective avanafil dosage regimen has not been established.  Dosage adjustment is recommended for use of sildenafil, tadalafil or vardenafil with PAXLOVID. Refer to individual product label for more information.
Opioid antagonists	naloxegol	↑ naloxegol	Co-administration contraindicated due to the potential for opioid withdrawal symptoms [see <i>Contraindications (4)</i> ].
Sedative/hypnotics	triazolam, oral midazolam <sup>a</sup>	↑ triazolam ↑ midazolam	Co-administration contraindicated due to potential for extreme sedation and respiratory depression [see <i>Contraindications (4)</i> ].
Sedative/hypnotics	buspirone, clorazepate, diazepam, estazolam, flurazepam, zolpidem  midazolam (administered parenterally)	↑ sedative/hypnotic  ↑ midazolam	A dose decrease may be needed for these drugs when co-administered with PAXLOVID and monitoring for adverse events is recommended.  Co-administration of midazolam (parenteral) should be done in a setting which ensures close clinical monitoring and appropriate medical management in case of respiratory depression and/or prolonged sedation. Dosage reduction for midazolam should be considered, especially if more than a single dose of midazolam is administered. Refer to the midazolam product label for further information.
Serotonin receptor 1A agonist/ serotonin receptor 2A antagonist	flibanserin	↑ flibanserin	Co-administration contraindicated due to potential for hypotension, syncope, and CNS depression [see <i>Contraindications (4)</i> ].
Vasopressin receptor antagonists	tolvaptan	↑ tolvaptan	Co-administration contraindicated due to potential for dehydration, hypovolemia and hyperkalemia [see <i>Contraindications (4)</i> ].

a. See Pharmacokinetics, Drug Interaction Studies Conducted with Nirmatrelvir and Ritonavir (12.3).

## 8 USE IN SPECIFIC POPULATIONS

### 8.1 Pregnancy

#### Risk Summary

There are no available human data on the use of nirmatrelvir during pregnancy to evaluate for a drug-associated risk of major birth defects, miscarriage, or adverse maternal or fetal outcomes. Published observational studies on ritonavir use in pregnant women have not identified an increase in the risk of major birth defects. Published studies with ritonavir are insufficient to identify a drug-associated risk of miscarriage (*see Data*). There are maternal and fetal risks associated with untreated COVID-19 in pregnancy (*see Clinical Considerations*).

In an embryo-fetal development study with nirmatrelvir, reduced fetal body weights following oral administration of nirmatrelvir to pregnant rabbits were observed at systemic exposures (AUC) approximately 10 times higher than clinical exposure at the authorized human dose of PAXLOVID. No other adverse developmental outcomes were observed in animal reproduction studies with nirmatrelvir at systemic exposures (AUC) greater than or equal to 3 times higher than clinical exposure at the authorized human dose of PAXLOVID (*see Data*).

In animal reproduction studies with ritonavir, no evidence of adverse developmental outcomes was observed following oral administration of ritonavir to pregnant rats and rabbits at doses (based on body surface area conversions) or systemic exposures (AUC) greater than or equal to 3 times higher than clinical doses or exposure at the authorized human dose of PAXLOVID (*see Data*).

The estimated background risk of major birth defects and miscarriage for the indicated population is unknown. All pregnancies have a risk of birth defect, loss, or other adverse outcomes. In the U.S. general population, the estimated background risk of major birth defects and miscarriage in clinically recognized pregnancies is 2% to 4% and 15% to 20%, respectively.

#### Clinical Considerations

##### *Disease-associated Maternal and/or Embryo-fetal Risk*

COVID-19 in pregnancy is associated with adverse maternal and fetal outcomes, including preeclampsia, eclampsia, preterm birth, premature rupture of membranes, venous thromboembolic disease, and fetal death.

#### Data

##### *Human Data*

##### Ritonavir

Based on prospective reports to the antiretroviral pregnancy registry of live births following exposure to ritonavir-containing regimens (including over 3,400 live births exposed in the first-trimester and over 3,500 live births exposed in the second and third trimesters), there was no difference in the rate of overall birth defects for ritonavir compared with the background birth defect rate of 2.7% in the U.S. reference population of the Metropolitan Atlanta Congenital Defects Program (MACDP). The prevalence of birth defects in live births was 2.3% (95% confidence interval [CI]: 1.9%-2.9%) following first-trimester exposure to ritonavir-containing regimens and 2.9% (95% CI: 2.4%-3.6%) following second and third trimester exposure to ritonavir-containing regimens. While placental transfer of

ritonavir and fetal ritonavir concentrations are generally low, detectable levels have been observed in cord blood samples and neonate hair.

### *Animal Data*

#### *Nirmatrelvir*

Embryo-fetal developmental (EFD) toxicity studies were conducted in pregnant rats and rabbits administered oral nirmatrelvir doses of up to 1,000 mg/kg/day during organogenesis [on Gestation Days (GD) 6 through 17 in rats and 6 through 19 in rabbits]. No biologically significant developmental effects were observed in the rat EFD study. At the highest dose of 1,000 mg/kg/day, the systemic nirmatrelvir exposure (AUC<sub>24</sub>) in rats was approximately 8 times higher than clinical exposures at the authorized human dose of PAXLOVID. In the rabbit EFD study, lower fetal body weights (9% decrease) were observed at 1,000 mg/kg/day in the absence of significant maternal toxicity findings. At 1,000 mg/kg/day, the systemic exposure (AUC<sub>24</sub>) in rabbits was approximately 10 times higher than clinical exposures at the authorized human dose of PAXLOVID. No other significant developmental toxicities (malformations and embryo-fetal lethality) were observed at up to the highest dose tested, 1,000 mg/kg/day. No developmental effects were observed in rabbits at 300 mg/kg/day resulting in systemic exposure (AUC<sub>24</sub>) approximately 3 times higher than clinical exposures at the authorized human dose of PAXLOVID. A pre- and postnatal developmental (PPND) study in pregnant rats administered oral nirmatrelvir doses of up to 1,000 mg/kg/day from GD 6 through Lactation Day (LD) 20 is ongoing and only interim data through postnatal day (PND) 56 are currently available. Although no difference in body weight was noted at birth when comparing offspring born to nirmatrelvir treated versus control animals, a decrease (8% in males and females) in the body weight of offspring was observed at PND 17. No significant differences in offspring body weight were observed from PND 28 to PND 56. The maternal systemic exposure (AUC<sub>24</sub>) at 1,000 mg/kg/day was approximately 8 times higher than clinical exposures at the authorized human dose of PAXLOVID. No body weight changes in the offspring were noted at 300 mg/kg/day, resulting in systemic exposure (AUC<sub>24</sub>) approximately 5 times higher than clinical exposures at the authorized human dose of PAXLOVID.

#### *Ritonavir*

Ritonavir was administered orally to pregnant rats (at 0, 15, 35, and 75 mg/kg/day) and rabbits (at 0, 25, 50, and 110 mg/kg/day) during organogenesis (on GD 6 through 17 and 6 through 19, respectively). No evidence of teratogenicity due to ritonavir was observed in rats and rabbits at systemic exposures (AUC) approximately 4 times higher than exposure at the authorized human dose of PAXLOVID. Increased incidences of early resorptions, ossification delays, and developmental variations, as well as decreased fetal body weights were observed in rats in the presence of maternal toxicity, at systemic exposures approximately 4 times higher than exposure at the authorized human dose of PAXLOVID. A slight increase in the incidence of cryptorchidism was also noted in rats (at a maternally toxic dose) at an exposure approximately 5 times the exposure at the authorized human dose of PAXLOVID. In rabbits, resorptions, decreased litter size, and decreased fetal weights were observed at maternally toxic doses approximately 11 times higher than the authorized human dose of PAXLOVID, based on a body surface area conversion factor. In a pre- and postnatal development study in rats, administration of 0, 15, 35, and 60 mg/kg/day ritonavir from GD 6 through postnatal day 20 resulted in no developmental toxicity, at ritonavir doses 3 times higher than the authorized human dose of PAXLOVID, based on a body surface area conversion factor.

## 8.2 Lactation

### Risk Summary

There are no available data on the presence of nirmatrelvir in human or animal milk, the effects on the breastfed infant, or the effects on milk production. A transient decrease in body weight was observed in the nursing offspring of rats administered nirmatrelvir (see *Data*). Limited published data reports that ritonavir is present in human milk. There is no information on the effects of ritonavir on the breastfed infant or the effects of the drug on milk production.

### *Data*

In the pre- and postnatal developmental study, body weight decreases (up to 8%) were observed in the offspring of pregnant rats administered nirmatrelvir at maternal systemic exposure (AUC<sub>24</sub>) approximately 8 times higher than clinical exposures at the authorized human dose of PAXLOVID. No body weight changes in the offspring were noted at maternal systemic exposure (AUC<sub>24</sub>) approximately 5 times higher than clinical exposures at the authorized human dose of PAXLOVID.

## 8.3 Females and Males of Reproductive Potential

### Contraception

Use of ritonavir may reduce the efficacy of combined hormonal contraceptives. Advise patients using combined hormonal contraceptives to use an effective alternative contraceptive method or an additional barrier method of contraception [see *Drug Interactions (7.3)*].

## 8.4 Pediatric Use

The safety and efficacy of PAXLOVID in pediatric patients younger than 18 years of age have not yet been established.

## 8.5 Geriatric Use

Clinical studies of PAXLOVID include subjects 65 years of age and older and their data contributes to the overall assessment of safety and efficacy [see *Adverse Reactions (6.1) and Clinical Studies (14.1)*]. Of the total number of subjects in EPIC-HR randomized to receive PAXLOVID (N=1,120), 13% were 65 years of age and older and 3% were 75 years of age and older.

## 8.6 Renal Impairment

Systemic exposure of nirmatrelvir increases in renally impaired patients with increase in the severity of renal impairment [see *Clinical Pharmacology (12.3)*].

No dosage adjustment is needed in patients with mild renal impairment. In patients with moderate renal impairment (eGFR  $\geq 30$  to  $< 60$  mL/min), reduce the dose of PAXLOVID to 150 mg nirmatrelvir and 100 mg ritonavir twice daily for 5 days. *Prescriptions should specify the numeric dose of each active ingredient within PAXLOVID.* Providers should counsel patients about renal dosing instructions [see *Patient Counseling Information (17)*].

PAXLOVID is not recommended in patients with severe renal impairment (eGFR <30 mL/min based on CKD-EPI formula) until more data are available; the appropriate dosage for patients with severe renal impairment has not been determined.

## 8.7 Hepatic Impairment

No dosage adjustment of PAXLOVID is needed for patients with either mild (Child-Pugh Class A) or moderate (Child-Pugh Class B) hepatic impairment. No pharmacokinetic or safety data are available regarding the use of nirmatrelvir or ritonavir in subjects with severe hepatic impairment (Child-Pugh Class C), therefore, PAXLOVID is not recommended for use in patients with severe hepatic impairment [see *Warnings and Precautions (5.3) and Clinical Pharmacology (12.3)*].

## 10 OVERDOSAGE

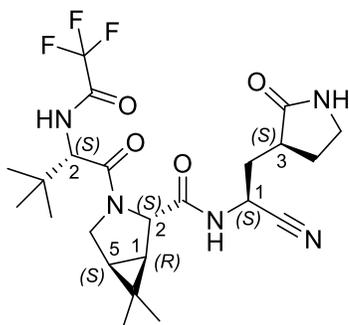
Treatment of overdose with PAXLOVID should consist of general supportive measures including monitoring of vital signs and observation of the clinical status of the patient. There is no specific antidote for overdose with PAXLOVID.

## 11 DESCRIPTION

PAXLOVID is nirmatrelvir tablets co-packaged with ritonavir tablets. Nirmatrelvir is a SARS-CoV-2 main protease (M<sup>pro</sup>) inhibitor, and ritonavir is an HIV-1 protease inhibitor and CYP3A inhibitor.

### Nirmatrelvir

The chemical name of active ingredient of nirmatrelvir is (1*R*,2*S*,5*S*)-*N*-((1*S*)-1-Cyano-2-((3*S*)-2-oxopyrrolidin-3-yl)ethyl)-3-((2*S*)-3,3-dimethyl-2-(2,2,2-trifluoroacetamido)butanoyl)-6,6-dimethyl-3-azabicyclo[3.1.0]hexane-2-carboxamide]. It has a molecular formula of C<sub>23</sub>H<sub>32</sub>F<sub>3</sub>N<sub>5</sub>O<sub>4</sub> and a molecular weight of 499.54. Nirmatrelvir has the following structural formula:

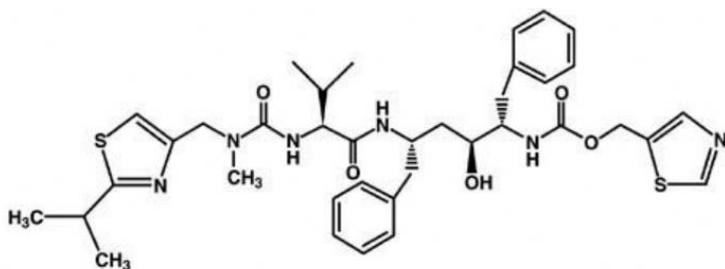


Nirmatrelvir is available as immediate-release, film-coated tablets. Each tablet contains 150 mg nirmatrelvir with the following inactive ingredients: colloidal silicon dioxide, croscarmellose sodium, lactose monohydrate, microcrystalline cellulose, and sodium stearyl fumarate. The following are the ingredients in the film coating: hydroxy propyl methylcellulose, iron oxide red, polyethylene glycol, and titanium dioxide.

### Ritonavir

Ritonavir is chemically designated as 10-Hydroxy-2-methyl-5-(1-methylethyl)-1-[2-(1 methylethyl)-4-thiazolyl]-3,6-dioxo-8,11-bis(phenylmethyl)-2,4,7,12-tetraazatridecan-13-oic acid, 5-thiazolylmethyl

ester, [5S-(5R\*,8R\*,10R\*,11R\*)]. Its molecular formula is C<sub>37</sub>H<sub>48</sub>N<sub>6</sub>O<sub>5</sub>S<sub>2</sub>, and its molecular weight is 720.95. Ritonavir has the following structural formula:



Ritonavir is available as film-coated tablets. Each tablet contains 100 mg ritonavir with the following inactive ingredients: anhydrous dibasic calcium phosphate, colloidal silicon dioxide, copovidone, sodium stearyl fumarate, and sorbitan monolaurate. The following are the ingredients in the film coating: colloidal silicon dioxide, hydroxypropyl cellulose, hypromellose, polyethylene glycol 400, polyethylene glycol 3350, polysorbate 80, talc, and titanium dioxide.

## 12 CLINICAL PHARMACOLOGY

### 12.1 Mechanism of Action

Nirmatrelvir is a peptidomimetic inhibitor of the SARS-CoV-2 main protease (M<sup>Pro</sup>), also referred to as 3C-like protease (3CL<sup>pro</sup>) or nsp5 protease. Inhibition of SARS-CoV-2 M<sup>Pro</sup> renders it incapable of processing polyprotein precursors, preventing viral replication. Nirmatrelvir inhibited the activity of recombinant SARS-CoV-2 M<sup>Pro</sup> in a biochemical assay with a K<sub>i</sub> value of 3.1 nM and an IC<sub>50</sub> value of 19.2 nM. Nirmatrelvir was found to bind directly to the SARS-CoV-2 M<sup>Pro</sup> active site by X-ray crystallography.

Ritonavir is an HIV-1 protease inhibitor but is not active against SARS-CoV-2 M<sup>Pro</sup>. Ritonavir inhibits the CYP3A-mediated metabolism of nirmatrelvir, resulting in increased plasma concentrations of nirmatrelvir.

### 12.2 Pharmacodynamics

#### Effect on Lipids

The changes in lipids in nirmatrelvir/ritonavir treated group were not statistically different than placebo/ritonavir treated group in an exploratory analysis of lipids in multiple ascending dose cohorts in which healthy participants were randomized to receive either escalating doses (75, 250 and 500 mg) of nirmatrelvir (n=4 per cohort) or placebo (n=2 per cohort), enhanced with ritonavir 100 mg, twice a day for 10 days.

In participants receiving placebo/ritonavir twice a day, a modest increase in cholesterol (≤27.2 mg/dL), LDL cholesterol (≤23.2 mg/dL), triglycerides (≤64.3 mg/dL) and decrease in HDL cholesterol (≤4 mg/dL) was observed. The clinical significance of such changes with short-term treatment is unknown.

### 12.3 Pharmacokinetics

The pharmacokinetics of nirmatrelvir/ritonavir have been studied in healthy subjects.

Ritonavir is administered with nirmatrelvir as a pharmacokinetic enhancer resulting in higher systemic concentrations and longer half-life of nirmatrelvir, thereby supporting a twice daily administration regimen.

Upon oral administration of nirmatrelvir/ritonavir, the increase in systemic exposure appears to be less than dose proportional up to 750 mg as a single dose and up to 500 mg twice daily as multiple doses. Twice daily dosing over 10 days achieved steady-state on Day 2 with approximately 2-fold accumulation. The pharmacokinetic properties of nirmatrelvir/ritonavir are displayed in Table 2.

**Table 2: Pharmacokinetic Properties of Nirmatrelvir and Ritonavir in Healthy Subjects**

	<b>Nirmatrelvir (When Given With Ritonavir)</b>	<b>Ritonavir</b>
<b>Absorption</b>		
T <sub>max</sub> (h), median	3.00 <sup>a</sup>	3.98 <sup>a</sup>
<b>Distribution</b>		
% bound to human plasma proteins	69%	98-99%
Blood-to-plasma ratio	0.60	0.14 <sup>c</sup>
V <sub>z</sub> /F (L), mean	104.7 <sup>b</sup>	112.4 <sup>b</sup>
<b>Elimination</b>		
Major route of elimination	Renal elimination <sup>d</sup>	Hepatic metabolism
Half-life (t <sub>1/2</sub> ) (hr), mean	6.05 <sup>a</sup>	6.15 <sup>a</sup>
Oral clearance (L/h) (CL/F), mean	8.99 <sup>b</sup>	13.92 <sup>b</sup>
<b>Metabolism</b>		
Metabolic pathways	Minimal <sup>d</sup>	Major CYP3A4, Minor CYP2D6
<b>Excretion</b>		
% drug-related material in feces	35.3% <sup>e</sup>	86.4% <sup>f</sup>
% drug-related material in urine	49.6% <sup>e</sup>	11.3% <sup>f</sup>

- Represents data after a single dose of 300 mg nirmatrelvir (2 x 150 mg tablet formulation) administered together with 100 mg ritonavir tablet in healthy subjects.
- 300 mg nirmatrelvir (oral suspension formulation) and 100 mg ritonavir (tablet formulation) administered together twice a day for 3 days.
- Red blood cell to plasma ratio.
- Nirmatrelvir is a CYP3A4 substrate but when dosed with ritonavir metabolic clearance is minimal.
- Determined by <sup>19</sup>F-NMR analysis following 300 mg oral suspension enhanced with 100 mg ritonavir at -12 hours, 0 hours, 12 hours, and 24 hours.
- Determined by <sup>14</sup>C analysis following 600 mg <sup>14</sup>C-ritonavir oral solution.

Single dose pharmacokinetic data of PAXLOVID in healthy subjects is depicted below (Table 3).

**Table 3: Single Dose Pharmacokinetics of Nirmatrelvir Following Dosing with 300 mg/100 mg Nirmatrelvir/Ritonavir in Healthy Subjects**

<b>PK Parameter (units)</b>	<b>Nirmatrelvir (N=12)</b>
C <sub>max</sub> (µg/mL)	2.21 (33)
AUC <sub>inf</sub> (µg*hr/mL)	23.01 (23)
T <sub>max</sub> (hr)	3.00 (1.02-6.00)

T <sub>1/2</sub> (hr)	6.05 ± 1.79
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Represents data from 2 x 150 mg tablets of nirmatrelvir. Values are presented as geometric mean (geometric % CV) except median (range) for T<sub>max</sub> and arithmetic mean ± SD for T<sub>1/2</sub>.

### *Effect of Food on Oral Absorption of Nirmatrelvir*

Dosing with a high fat meal modestly increased the exposure of nirmatrelvir (approximately 15% increase in mean C<sub>max</sub> and 1.6% increase in mean AUC<sub>last</sub>) relative to fasting conditions following administration of a suspension formulation of nirmatrelvir co-administered with ritonavir tablets.

### Specific Populations

The pharmacokinetics of nirmatrelvir/ritonavir based on age and gender have not been evaluated.

#### *Pediatric Patients*

The pharmacokinetics of nirmatrelvir/ritonavir in patients less than 18 years of age have not been evaluated.

#### *Racial or Ethnic Groups*

Systemic exposure in Japanese subjects was numerically lower but not clinically meaningfully different than those in Western subjects.

#### *Patients with Renal Impairment*

An open-label study compared nirmatrelvir/ritonavir pharmacokinetics in healthy adult subjects and subjects with mild (eGFR ≥60 to <90 mL/min), moderate (eGFR ≥30 to <60 mL/min), and severe (eGFR <30 mL/min) renal impairment following administration of a single oral dose of nirmatrelvir 100 mg enhanced with ritonavir 100 mg administered at -12, 0, 12, and 24 hours. Compared to healthy controls with no renal impairment, the C<sub>max</sub> and AUC of nirmatrelvir in patients with mild renal impairment was 30% and 24% higher, in patients with moderate renal impairment was 38% and 87% higher, and in patients with severe renal impairment was 48% and 204% higher, respectively (Table 4).

**Table 4: Impact of Renal Impairment on Nirmatrelvir/Ritonavir Pharmacokinetics**

	<b>Normal Renal Function (n=8)</b>	<b>Mild Renal Impairment (n=8)</b>	<b>Moderate Renal Impairment (n=8)</b>	<b>Severe Renal Impairment (n=8)</b>
C <sub>max</sub> (µg/mL)	1.60 (31)	2.08 (29)	2.21 (17)	2.37 (38)
AUC <sub>inf</sub> (µg*hr/mL)	14.46 (20)	17.91 (30)	27.11 (27)	44.04 (33)
T <sub>max</sub> (hr)	2.0 (1.0 - 4.0)	2.0 (1.0 – 3.0)	2.50 (1.0 – 6.0)	3.0 (1.0 - 6.1)
T <sub>1/2</sub> (hr)	7.73 ± 1.82	6.60 ± 1.53	9.95 ± 3.42	13.37 ± 3.32

Values are presented as geometric mean (geometric % CV) except median (range) for T<sub>max</sub> and arithmetic mean ± SD for t<sub>1/2</sub>.

#### *Patients with Hepatic Impairment*

A single oral dose of 100 mg nirmatrelvir enhanced with 100 mg ritonavir at -12 hours, 0 hours, 12 hours and 24 hours in subjects with moderate hepatic impairment resulted in similar exposures compared to subjects with normal hepatic function (Table 5).

**Table 5: Impact of Hepatic Impairment on Nirmatrelvir/Ritonavir Pharmacokinetics**

	<b>Normal Hepatic Function (n=8)</b>	<b>Moderate Hepatic Impairment (n=8)</b>
C <sub>max</sub> (µg/mL)	1.89 (20)	1.92 (48)
AUC <sub>inf</sub> (µg*hr/mL)	15.24 (36)	15.06 (43)

T <sub>max</sub> (hr)	2.0 (0.6 - 2.1)	1.5 (1.0 - 2.0)
T <sub>1/2</sub> (hr)	7.21 ± 2.10	5.45 ± 1.57

Values are presented as geometric mean (geometric % CV) except median (range) for T<sub>max</sub> and arithmetic mean ± SD for t<sub>1/2</sub>.

Nirmatrelvir/ritonavir has not been studied in patients with severe hepatic impairment.

### Drug Interaction Studies Conducted with Nirmatrelvir

*In vitro* data indicates that nirmatrelvir is a substrate for human MDR1 (P-gp) and 3A4, but not a substrate for human BCRP, MATE1, MATE2K, NTCP, OAT1, OAT2, OAT3, OCT1, OCT2, PEPT1, OATPs 1B1, 1B3, 2B1, or 4C1.

Nirmatrelvir does not reversibly inhibit CYP1A2, CYP2B6, CYP2C8, CYP2C9, CYP2C19, or CYP2D6 *in vitro* at clinically relevant concentrations. Nirmatrelvir has the potential to reversibly and time-dependently inhibit CYP3A4 and inhibit MDR1 (P-gp).

Nirmatrelvir does not induce any CYPs at clinically relevant concentrations.

### Drug Interaction Studies Conducted with Ritonavir

*In vitro* studies indicate that ritonavir is mainly a substrate of CYP3A. Ritonavir also appears to be a substrate of CYP2D6 which contributes to the formation of isopropylthiazole oxidation metabolite M-2.

Ritonavir is an inhibitor of CYP3A and to a lesser extent CYP2D6. Ritonavir appears to induce CYP3A, CYP1A2, CYP2C9, CYP2C19, and CYP2B6 as well as other enzymes, including glucuronosyl transferase.

The effects of co-administration of PAXLOVID with itraconazole (CYP3A inhibitor) and carbamazepine (CYP3A inducer) on the nirmatrelvir AUC and C<sub>max</sub> are summarized in Table 6 (effect of other drugs on nirmatrelvir).

**Table 6: Drug Interactions: Pharmacokinetic Parameters for Nirmatrelvir in the Presence of the Co-administered Drugs**

Co-administered Drug	Dose (Schedule)		N	Percent Ratio (in combination with co-administered drug/alone) of Nirmatrelvir Pharmacokinetic Parameters (90% CI); No Effect=100	
	Co-administered Drug	Nirmatrelvir/Ritonavir		C <sub>max</sub>	AUC <sup>a</sup>
Carbamazepine <sup>b</sup>	300 mg twice daily (16 doses)	300 mg/100 mg twice daily (5 doses)	9	56.82 (47.04, 68.62)	44.50 (33.77, 58.65)
Itraconazole	200 mg once daily (8 doses)	300 mg/100 mg twice daily (5 doses)	11	118.57 (112.50, 124.97)	138.82 (129.25, 149.11)

Abbreviations: AUC=area under the plasma concentration-time curve; CI=confidence interval; C<sub>max</sub>=maximum plasma concentrations.

a. For carbamazepine, AUC=AUC<sub>inf</sub>, for itraconazole, AUC=AUC<sub>tau</sub>.

- b. Carbamazepine titrated up to 300 mg twice daily on Day 8 through Day 15 (e.g., 100 mg twice daily on Day 1 through Day 3 and 200 mg twice daily on Day 4 through Day 7).

The effects of co-administration of PAXLOVID with midazolam (CYP3A4 substrate) or dabigatran (P-gp substrate) on the midazolam and dabigatran AUC and  $C_{max}$ , respectively, are summarized in Table 7.

**Table 7: Effect of Nirmatrelvir/Ritonavir on Pharmacokinetics of Co-administered Drug**

Co-administered Drug	Dose (Schedule)		N	Percent Ratio of Test/Reference of Geometric Means (90% CI); No Effect=100	
	Co-administered Drug	Nirmatrelvir/Ritonavir		$C_{max}$	AUC <sup>a</sup>
Midazolam <sup>b</sup>	2 mg (1 dose)	300 mg/100 mg twice daily (9 doses)	10	368.33 (318.91, 425.41)	1430.02 (1204.54, 1697.71)
Dabigatran <sup>b</sup>	75 mg (1 dose)	300 mg/100 mg twice daily (5 doses) <sup>b</sup>	24	233.06 (172.14, 315.54)	194.47 (155.29, 243.55)

Abbreviations: AUC=area under the plasma concentration-time curve; CI=confidence interval;  $C_{max}$ =maximum plasma concentrations.

a. AUC=AUC<sub>inf</sub> for both midazolam and dabigatran.

b. For midazolam, Test=nirmatrelvir/ritonavir plus midazolam, Reference=Midazolam. Midazolam is an index substrate for CYP3A4. For dabigatran, Test=nirmatrelvir/ritonavir plus dabigatran, Reference=Dabigatran. Dabigatran is an index substrate for P-gp.

## 12.4 Microbiology

### Antiviral Activity

Nirmatrelvir exhibited antiviral activity against SARS-CoV-2 (USA-WA1/2020 isolate) infection of differentiated normal human bronchial epithelial (dNHBE) cells, a primary human lung alveolar epithelial cell line (EC<sub>50</sub> value of 62 nM and EC<sub>90</sub> value of 181 nM) after 3 days of drug exposure.

Nirmatrelvir had cell culture antiviral activity (with EC<sub>50</sub> values in the low nanomolar range  $\leq 3$ -fold relative to USA-WA1/2020) against SARS-CoV-2 isolates belonging to the Alpha (B.1.1.7), Gamma (P.1), Delta (B.1.617.2), Lambda (C.37), Mu (B.1.621), and Omicron (B.1.1.529/BA.1, BA.2, BA.2.12.1, and BA.4) variants. The Beta (B.1.351) variant was the least susceptible tested variant with approximately 3.7-fold reduced susceptibility relative to the USA-WA1/2020 isolate.

### Antiviral Activity Against SARS-CoV-2 in Animal Models

Nirmatrelvir showed antiviral activity in BALB/c and 129 mice infected with mouse-adapted SARS-CoV-2. Oral administration of nirmatrelvir at 300 mg/kg or 1,000 mg/kg twice daily initiated 4 hours post-inoculation or 1,000 mg/kg twice daily initiated 12 hours post-inoculation resulted in reduction of lung viral titers and ameliorated indicators of disease (weight loss and lung pathology) compared to placebo-treated animals.

In addition, the antiviral activities of nirmatrelvir alone (300 mg/kg twice daily), ritonavir alone (50 mg/kg twice daily), and nirmatrelvir combined with ritonavir (300 mg/kg + 50 mg/kg twice daily) were evaluated in BALB/c mice infected with mouse-adapted SARS-CoV-2. Dosing was initiated 4 hours post-inoculation. Ritonavir alone did not affect lung viral titers or lung pathology. However, the

combination of nirmatrelvir and ritonavir resulted in reduction of lung virus titers and lung pathology relative to nirmatrelvir alone.

### Antiviral Resistance in Cell Culture and Biochemical Assays

SARS-CoV-2 M<sup>PRO</sup> residues potentially associated with nirmatrelvir resistance have been identified using a variety of methods, including SARS-CoV-2 resistance selection, testing of recombinant SARS-CoV-2 viruses with M<sup>PRO</sup> substitutions, and biochemical assays with recombinant SARS-CoV-2 M<sup>PRO</sup> containing amino acid substitutions. Table 8 indicates M<sup>PRO</sup> substitutions and combinations of M<sup>PRO</sup> substitutions that have been observed in nirmatrelvir-selected SARS-CoV-2 in cell culture. Individual M<sup>PRO</sup> substitutions are listed regardless of whether they occurred alone or in combination with other M<sup>PRO</sup> substitutions. Note that the M<sup>PRO</sup> S301P and T304I substitutions overlap the P6 and P3 positions of the nsp5/nsp6 cleavage site located at the C-terminus of M<sup>PRO</sup>. Substitutions at other M<sup>PRO</sup> cleavage sites have not been associated with nirmatrelvir resistance in cell culture. The clinical significance of these substitutions is unknown.

**Table 8: SARS-CoV-2 M<sup>PRO</sup> Amino Acid Substitutions Selected by Nirmatrelvir in Cell Culture**

Single Substitution (EC <sub>50</sub> value fold change)	T21I (1.1-4.6), L50F (1.4-4.2), P108S (ND), T135I (ND), F140L (ND), S144A (2.2-2.5), C160F (ND), E166A (3.3), E166V (25-267), L167F (ND), T169I (ND), H172Y (ND), A173V (0.9-2.3), V186A (ND), R188G (ND), A191V (ND), A193P (ND), P252L (5.9), S301P (ND), and T304I (2.1-5.5).
≥2 Substitutions (EC <sub>50</sub> value fold change)	T21I+S144A (9.4), T21I+E166V (83), T21I+A173V (3.1), T21I+T304I (3.0-7.9), L50F+E166V (34-163), L50F+T304I (5.9), T135I+T304I (3.8), F140L+A173V (10.1), H172Y+P252L (ND), A173V+T304I (20.2), T21I+L50F+A193P+S301P (28.8), T21I+S144A+T304I (27.8), T21I+C160F+A173V+V186A+T304I (28.5), T21I+A173V+T304I (15), and L50F+F140L+L167F+T304I (54.7).

Abbreviation: ND=no data.

In a biochemical assay using recombinant SARS-CoV-2 M<sup>PRO</sup> containing amino acid substitutions, the following SARS-CoV-2 M<sup>PRO</sup> substitutions led to ≥3-fold reduced activity (fold-change based on K<sub>i</sub> values) of nirmatrelvir: G15S (4.4), Y54A (24.0), T135I (3.2), F140A (39.0), F140L (5.4), S144A (92.0), S144E (470), S144T (160), H164N (6.4), E166A (33.0), E166G (16.0), H172Y (230), A173V (26.0), V186G (13.0), Q189K (65.0), Q192L (28.0), Q192P (33.0), and D248E (3.7). The clinical significance of these substitutions is unknown.

### Antiviral Resistance in Clinical Trials

Among subjects in clinical trial EPIC-HR with sequence analysis data available at both baseline and a post-dose sample (n=361 nirmatrelvir/ritonavir-treated, n=402 placebo treated), the following SARS-CoV-2 M<sup>PRO</sup> or M<sup>PRO</sup> cleavage site amino acid changes were detected as treatment-emergent substitutions that were more common in nirmatrelvir/ritonavir-treated subjects relative to placebo-treated subjects (n=number of nirmatrelvir/ritonavir-treated subjects with emergent substitution); M<sup>PRO</sup> substitutions: A7S/T/V (n=3), L30F (n=3), M82I/R (n=3), G109E/R/V (n=3), P132L/S (n=4), C145F/R/Y (n=3), D153H/Y (n=3), E166V (n=3), T196A/K/M/R (n=4), W207L/S/del (n=5), A260D/T/V (n=8), D263E (n=3), A266P/V (n=3), and V297A/F/del (n=3); M<sup>PRO</sup> ORF1ab cleavage site substitutions: Q5324H/R (n=3), A5328P/S (n=6), and T6449I/P (n=3). In one subject with a baseline M<sup>PRO</sup> L50F substitution, the M<sup>PRO</sup> E166V substitution co-occurred with L50F on Day 5 (included in counts above). The M<sup>PRO</sup> E166V and L50F+E166V substitutions have been associated with nirmatrelvir resistance in cell culture (Table 8). None of these substitutions in M<sup>PRO</sup> or cleavage

sites occurred in nirmatrelvir/ritonavir-treated participants who also experienced hospitalization. Thus, the clinical significance of these substitutions is unknown.

### Viral RNA Rebound

Post-treatment increases in SARS-CoV-2 RNA shedding levels (i.e., viral RNA rebound) in nasopharyngeal samples were observed on Day 10 and/or Day 14 after initiating study treatment in a subset of PAXLOVID and placebo recipients in EPIC-HR, irrespective of COVID-19 symptoms. The frequency of detection of post-treatment viral RNA rebound varied according to analysis parameters but was generally similar among PAXLOVID and placebo recipients, regardless of the rebound definition used. A similar or smaller percentage of placebo recipients compared to PAXLOVID recipients had nasopharyngeal viral RNA results < lower limit of quantitation (LLOQ) at all study timepoints in both the treatment and post-treatment periods.

Post-treatment viral RNA rebound was not associated with the primary clinical outcome of COVID-19-related hospitalization or death from any cause through Day 28, after initiating study treatment. Post-treatment viral RNA rebound also was not associated with drug resistance as measured by M<sup>pro</sup> sequencing. The clinical relevance of post-treatment increases in viral RNA following PAXLOVID or placebo treatment is unknown.

### Cross-Resistance

Cross-resistance is not expected between nirmatrelvir and anti-SARS-CoV-2 monoclonal antibodies, molnupiravir, or remdesivir based on their different mechanisms of action.

## **13 NONCLINICAL TOXICOLOGY**

### **13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility**

#### Nirmatrelvir

Carcinogenicity studies have not been conducted with nirmatrelvir.

Nirmatrelvir was negative for mutagenic or clastogenic activity in a battery of *in vitro* and *in vivo* assays including the Ames bacterial reverse mutation assay using *S. typhimurium* and *E. coli*, the *in vitro* micronucleus assay using human lymphoblastoid TK6 cells, and the *in vivo* rat micronucleus assays.

In a fertility and early embryonic development study, nirmatrelvir was administered orally to male and female rats at doses of 60, 200, or 1,000 mg/kg/day once daily beginning 14 days prior to mating, throughout the mating phase, and continued through GD 6 for females and for a total of 32 doses for males. There were no effects on fertility, reproductive performance, or early embryonic development at doses up to 1,000 mg/kg/day, resulting in systemic exposure (AUC<sub>24</sub>) approximately 4 times higher than exposure at the authorized human dose of PAXLOVID.

#### Ritonavir

Carcinogenicity studies in mice and rats have been conducted on ritonavir. In male mice, at levels of 50, 100, or 200 mg/kg/day, there was a dose dependent increase in the incidence of both adenomas and combined adenomas and carcinomas in the liver. Based on AUC measurements, the exposure at

the high dose was approximately 2 times higher (in males) than the exposure in humans at the authorized human dose of PAXLOVID. There were no carcinogenic effects seen in females at the dosages tested. The exposure at the high dose was approximately 4 times higher (in females) than the exposure in humans at the authorized human dose of PAXLOVID. In rats dosed at levels of 7, 15, or 30 mg/kg/day, there were no carcinogenic effects. In this study, the exposure at the high dose was approximately 36% that of the exposure in humans at the authorized human dose of PAXLOVID.

Ritonavir was found to be negative for mutagenic or clastogenic activity in a battery of *in vitro* and *in vivo* assays including the Ames bacterial reverse mutation assay using *S. typhimurium* and *E. coli*, the mouse lymphoma assay, the mouse micronucleus test and chromosomal aberration assays in human lymphocytes.

Ritonavir produced no effects on fertility in rats at drug exposures approximately 2 (male) and 4 (female) times higher than the exposure in humans at the authorized human dose of PAXLOVID.

### **13.2 Animal Toxicology and/or Pharmacology**

Studies with nirmatrelvir included repeat dose toxicity studies in rats (14 days) and monkeys (15 days). Repeated daily oral dosing in rats at up to 1,000 mg/kg/day resulted in non-adverse hematological, liver, and thyroid effects. All of the hematology and coagulation findings (i.e., increases in PT and APTT) had no clinical or microscopic correlates and all findings completely recovered at the end of the 2-week recovery period. The liver (i.e., minimal to mild periportal hepatocyte hypertrophy and vacuolation) and thyroid gland (i.e., thyroid follicular cell hypertrophy) findings were consistent with secondary adaptive effects related to microsomal enzyme-induced increase in thyroid hormone clearance in the liver, a mechanism that rats are known to be particularly sensitive to relative to humans. All of the findings observed in the liver and thyroid were low severity and occurred in the absence of correlating alterations in clinical pathology parameters, and all of these findings fully recovered. No adverse effects were observed at doses up to 1,000 mg/kg/day, resulting in systemic exposure approximately 4 times higher than exposures at the authorized human dose of PAXLOVID. Nirmatrelvir-related findings following repeat oral dosing in monkeys for 15 days were limited to emesis and increase in fibrinogen. Increased fibrinogen may be attributed to an inflammatory state but lacked a microscopic correlate. At the high dose of 600 mg/kg/day, the systemic exposure in monkeys was about 18 times higher than exposures at the authorized human dose of PAXLOVID.

## **14 CLINICAL STUDIES**

### **14.1 Efficacy in Subjects at High Risk of Progressing to Severe COVID-19 Illness**

The data supporting this interim authorization are based on the analysis of EPIC-HR (NCT04960202), a Phase 2/3, randomized, double-blind, placebo-controlled study in non-hospitalized symptomatic adult subjects with a laboratory confirmed diagnosis of SARS-CoV-2 infection. Eligible subjects were 18 years of age and older with at least 1 of the following risk factors for progression to severe disease: diabetes, overweight (BMI >25), chronic lung disease (including asthma), chronic kidney disease, current smoker, immunosuppressive disease or immunosuppressive treatment, cardiovascular disease, hypertension, sickle cell disease, neurodevelopmental disorders, active cancer, medically-related technological dependence, or were 60 years of age and older regardless of comorbidities. Subjects with COVID-19 symptom onset of ≤5 days were included in the study. Subjects were randomized (1:1) to receive PAXLOVID (nirmatrelvir/ritonavir 300 mg/100 mg) or placebo orally every 12 hours for 5 days. The study excluded individuals with a history of prior

COVID-19 infection or vaccination. The primary efficacy endpoint was the proportion of subjects with COVID-19 related hospitalization or death from any cause through Day 28. The analysis was conducted in the modified intent-to-treat (mITT) analysis set (all treated subjects with onset of symptoms  $\leq 3$  days who at baseline did not receive nor were expected to receive COVID-19 therapeutic mAb treatment), the mITT1 analysis set (all treated subjects with onset of symptoms  $\leq 5$  days who at baseline did not receive nor were expected to receive COVID-19 therapeutic mAb treatment), and the mITT2 analysis set (all treated subjects with onset of symptoms  $\leq 5$  days).

A total of 2,246 subjects were randomized to receive either PAXLOVID or placebo. At baseline, mean age was 46 years; 51% were male; 72% were White, 5% were Black, and 14% were Asian; 45% were Hispanic or Latino; 66% of subjects had onset of symptoms  $\leq 3$  days from initiation of study treatment; 47% of subjects were serological negative at baseline; the mean (SD) baseline viral RNA shedding in nasopharyngeal samples was 4.63  $\log_{10}$  copies/mL (2.87); 26% of subjects had a baseline viral RNA shedding of  $>7 \log_{10}$  copies/mL; 6% of subjects either received or were expected to receive COVID-19 therapeutic monoclonal antibody treatment at the time of randomization and were excluded from the mITT and mITT1 analyses.

The baseline demographic and disease characteristics were balanced between the PAXLOVID and placebo groups.

Table 9 provides results of the primary endpoint in mITT1 analysis population. For the primary endpoint, the relative risk reduction in the mITT1 analysis population for PAXLOVID compared to placebo was 88% (95% CI: 75%, 94%).

**Table 9: Efficacy Results in Non-Hospitalized Adults with COVID-19 Dosed within 5 Days of Symptom Onset who Did Not Receive COVID-19 Monoclonal Antibody Treatment at Baseline (mITT1 Analysis Set)**

	<b>PAXLOVID</b> (N=1,039)	<b>Placebo</b> (N=1,046)
COVID-19 related hospitalization or death from any cause through Day 28		
n (%)	8 (0.8%)	66 (6.3%)
Reduction relative to placebo <sup>a</sup> [95% CI], %	-5.62 (-7.21, -4.03)	
All-cause mortality through Day 28, %	0	12 (1.1%)

Abbreviations: CI=confidence interval.

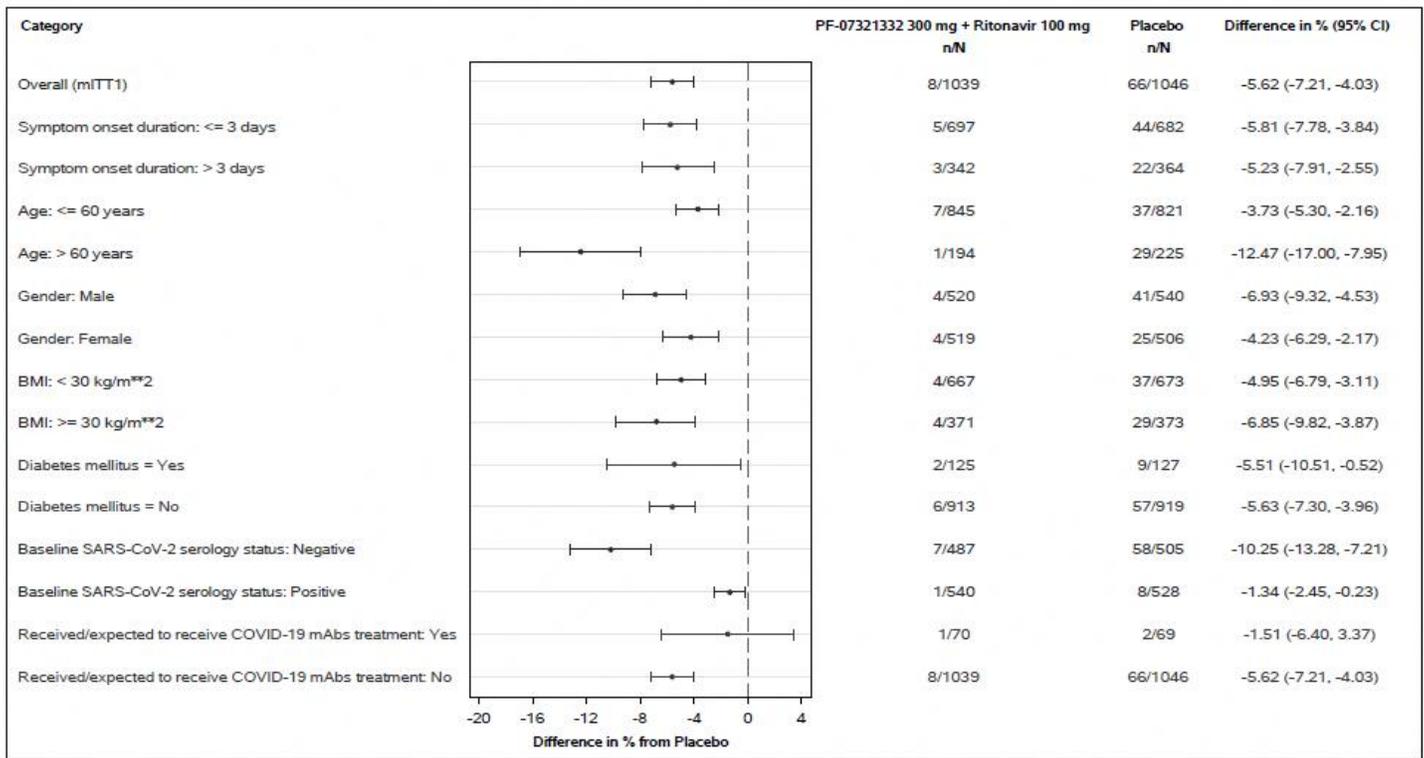
The determination of primary efficacy was based on a planned interim analysis of 780 subjects in mITT population. The estimated risk reduction was -6.3% with a 95% CI of (-9.0%, -3.6%) and 2-sided p-value  $<0.0001$ .

a. The estimated cumulative proportion of participants hospitalized or death by Day 28 was calculated for each treatment group using the Kaplan-Meier method, where subjects without hospitalization and death status through Day 28 were censored at the time of study discontinuation.

Consistent results were observed in the mITT and mITT2 analysis populations. A total of 1,379 subjects were included in the mITT analysis population. The event rates were 5/697 (0.72%) in the PAXLOVID group, and 44/682 (6.45%) in the placebo group. The primary SARS-CoV-2 variant across both treatment arms was Delta (98%), including clades 21J, 21A, and 21I.

Similar trends have been observed across subgroups of subjects (see Figure 1). These subgroup analyses are considered exploratory.

**Figure 1: Adults with COVID-19 Dosed within 5 Days of Symptom Onset with COVID-19-Related Hospitalization or Death from Any Cause Through Day 28 (Protocol C4671005)**



N=number of participants in the category of the analysis set.

All categories are based on mITT1 population except for COVID-19 mAb treatment which is based on mITT2 population.

Seropositivity was defined if results were positive in either Elecsys anti-SARS-CoV-2 S or Elecsys anti-SARS-CoV-2 (N) assay.

The difference of the proportions in the 2 treatment groups and its 95% confidence interval based on Normal approximation of the data are presented.

Relative to placebo, PAXLOVID treatment was associated with an approximately 0.9 log<sub>10</sub> copies/mL greater decline in viral RNA levels in nasopharyngeal samples through Day 5, with similar results observed in the mITT, mITT1, and mITT2 analysis populations.

## 16 HOW SUPPLIED/STORAGE AND HANDLING

### How Supplied

PAXLOVID is nirmatrelvir tablets co-packaged with ritonavir tablets.

- Nirmatrelvir tablets, 150 mg are oval, pink immediate-release, film-coated tablets debossed with “PFE” on one side and “3CL” on the other side.
- Ritonavir tablets, 100 mg are white film-coated ovaloid tablets debossed with the "a" logo and the code NK.

Nirmatrelvir tablets and ritonavir tablets are supplied in separate blister cavities within the same child-resistant blister card.

Each carton contains 30 tablets divided in 5 daily-dose blister cards.

Each daily blister card contains 4 nirmatrelvir tablets (150 mg each) and 2 ritonavir tablets (100 mg each) and indicates which tablets need to be taken in the morning and evening.

### Storage and Handling

Store at or below 25°C.

## **17 PATIENT COUNSELING INFORMATION**

As a healthcare practitioner, you must communicate to the patient and/or caregiver information consistent with the “FACT SHEET FOR PATIENTS AND CAREGIVERS” and provide them with a copy of this Fact Sheet prior to administration of PAXLOVID.

### Hypersensitivity Reactions

Inform patients that anaphylaxis and other hypersensitivity reactions have been reported, even following a single dose of PAXLOVID. Advise them to discontinue the drug and to inform their healthcare provider at the first sign of a skin rash, hives or other skin reactions, difficulty in swallowing or breathing, any swelling suggesting angioedema (for example, swelling of the lips, tongue, face, tightness of the throat, hoarseness), or other symptoms of an allergic reaction [see *Warnings and Precautions (5.2)*].

### Dosage Modification in Patients with Moderate Renal Impairment

To ensure appropriate dosing in patients with moderate renal impairment, instruct such patients that they will be taking one 150 mg nirmatrelvir tablet with one 100 mg ritonavir tablet together twice daily for 5 days.

### Drug Interactions

Inform patients that PAXLOVID may interact with some drugs and is contraindicated for use with some drugs; therefore, patients should be advised to report to their healthcare provider the use of any prescription, non-prescription medication, or herbal products [see *Dosage and Administration (2.4)*, *Contraindications (4)*, *Warnings and Precautions (5.1)*, and *Drug Interactions (7)*].

### Administration Instructions

Inform patients to take PAXLOVID with or without food as instructed. Advise patients to swallow all tablets for PAXLOVID whole and not to chew, break, or crush the tablets. Alert the patient of the importance of completing the full 5-day treatment course and to continuing isolation in accordance with public health recommendations to maximize viral clearance and minimize transmission of SARS-CoV-2. If the patient misses a dose of PAXLOVID within 8 hours of the time it is usually taken, the patient should take it as soon as possible and resume the normal dosing schedule. If the patient misses a dose by more than 8 hours, the patient should not take the missed dose and instead take the next dose at the regularly scheduled time. The patient should not double the dose to make up for a missed dose [see *Dosage and Administration (2.1)*].

## 18 CONTACT INFORMATION

For general questions, visit the website or call the telephone number provided below.

Website	Telephone number
<p data-bbox="240 331 618 363"><a href="http://www.COVID19oralRx.com">www.COVID19oralRx.com</a></p> 	<p data-bbox="997 470 1211 501">+65 6403 8888</p>

### **Medical Information Enquiries – Singapore**

Please submit your medical information enquiries at <https://pmiform.com/HCP/SG>. Alternatively, you may send them to [MedicalInformationSingapore@pfizer.com](mailto:MedicalInformationSingapore@pfizer.com).

### **Product Registrant**

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Reference Label: US LAB-1492-12.0

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