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COVID-19 Antivirals Utilization: Geographic and Demographic Patterns of Treatment in 2022

Utilization of oral antiviral medications to treat COVID-19 increased sharply in the spring and summer of 2022, with treatment rates higher among older adults and those in long-term care settings.

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KEY POINTS

- Using IQVIA prescription drug data from January to September 2022, which captures approximately 93% of U.S. community prescriptions and 72% of nursing home prescriptions (projected to represent the full U.S. market) we analyzed monthly patterns of utilization of the new COVID-19 oral antiviral medications Paxlovid and Lagevrio by age group, gender, and state.
- Utilization of both Paxlovid and Lagevrio rose sharply in the spring of 2022, rising more than tenfold for all age groups between March and July 2022.
- For both Paxlovid and Lagevrio, the absolute level of utilization per 100,000 people increased steadily with older age. The exception to this pattern is that, for Paxlovid, the 85 and older cohort had a lower rate of utilization than the 75-84 cohort — but still higher than that of the 65-74 cohort.
- Paxlovid utilization rates per 100,000 people were highest for those in long-term care (LTC) settings, exceeding any population-based age group in retail settings. Lagevrio usage was even more concentrated in LTC settings, where residents may more frequently have contraindications to Paxlovid.
- Paxlovid represented roughly 90% of overall antiviral prescriptions in September 2022, with Lagevrio representing the other 10%. Lagevrio's utilization share increases with age, ranging from approximately 7% of prescriptions for adults 18-24, up to 17% in the 85 and older cohort. After combining prescriptions for the two antivirals, total antiviral utilization in the 85 and older cohort remain slightly lower than those for the 75–84-year-olds.
- We find significant heterogeneity in antiviral utilization by state. Monthly per capita rates of antiviral use in recent months varied by a factor of 4 for Paxlovid and 18 for Lagevrio. As expected, utilization increased in association with higher statewide COVID-19 case rates. For May - September, we estimate that 34.7% of confirmed cases received Paxlovid, and 3.5% received Lagevrio.
- Paxlovid utilization (but not Lagevrio) was also statistically significantly higher in states with higher vaccination rates. The fact that states with lower vaccine uptake are also utilizing antivirals at lower rates indicates the need for additional efforts to increase awareness and uptake of treatment in these areas, where the risk of severe COVID-19 outcomes may be highest.

BACKGROUND

New COVID-19 oral antiviral treatments – Paxlovid (ritonavir-boosted nirmatrelvir)[1] and Lagevrio (molnupiravir)[2] – were first made available at the end of 2021 through the FDA's Emergency Use Authorization (EUA), providing important new outpatient treatment options for preventing severe disease in patients with mild-to-moderate COVID-19.* Studies demonstrate that Paxlovid has an effectiveness of nearly 90 percent in preventing hospitalizations and deaths for patients at high risk of progression to severe COVID-19.[3, 4] Moreover, real-world effectiveness has been demonstrated as well showing that among U.S. adults diagnosed with COVID-19, persons who were prescribed Paxlovid within 5 days of diagnosis had a 51% lower hospitalization rate within 30 days after diagnosis than those who were not prescribed Paxlovid.[5] Based on these findings, Paxlovid is the recommended first-line treatment in such cases. However, Paxlovid is not recommended in patients with severe renal or liver disease, and it has numerous drug-drug interactions; Lagevrio is instead recommended for patients for whom Paxlovid or other FDA approved or authorized treatments are not accessible or clinically appropriate.[6, 7] Studies indicate Lagevrio is effective with a 30% relative risk reduction in all-cause hospitalization or death among people with predefined risk factors, and a 89% relative risk reduction in death.[8, 9, 10] One potential concern is that uptake of oral antivirals by older patients and those with comorbid conditions could therefore be lower due to potential contraindications for use of Paxlovid and lower prescribing of Lagevrio due to lower efficacy in preventing hospitalization relative to Paxlovid.

Efforts to ensure timely access to COVID-19 oral antiviral medications include the federal Test-to-Treat initiative, beginning in March 2022, which leveraged pharmacy-based clinics for patients to test for COVID-19 and prescribe treatment from a qualified health care provider in the same location.[11] In May 2022, the program was expanded to include federally-supported[12] Test-to-Treat sites to support the program's reach to vulnerable communities, including 200 federally qualified health centers and Indian Health Service (IHS) facilities.[13] Furthermore, the program opened direct ordering of oral antivirals to long-term care (LTC) pharmacies to facilitate increased access for LTC residents who are at increased risk for developing severe COVID-19.[14] The Department of Veterans Affairs (VA) has also been connecting veterans who test positive at VA medical centers directly to treatment. In July 2022, FDA further revised the EUA for Paxlovid to allow state-licensed pharmacists to prescribe Paxlovid to eligible individuals to support timely access to treatments.[15] However pharmacists are advised to refer patients for evaluation by a clinician if there is insufficient information on renal or hepatic function and current patient medications, or the need for modifications to other medications.

The purpose of this analysis is to assess utilization of COVID-19 oral antivirals in 2022 by age group, LTC setting, and state of residence, to help support policy efforts to ensure access to these life-saving oral treatments for patients with mild-to-moderate COVID-19. This analysis may also help inform federal efforts to ensure equitable distribution and access to COVID-19 oral antiviral medications.

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* Prior to these new oral antiviral treatments, Veklury (remdesivir) was the only COVID-19 antiviral treatment available but was limited to those hospitalized with COVID-19 at that time. (See: https://www.fda.gov/news-events/press-announcements/fda-approves-first-treatment-covid-19; last accessed November 2, 2022). Other available COVID-19 treatments included monoclonal antibodies, but changes in activity against the viral variants circulating in 2022 led to changes in EUA availability of monoclonal antibodies. (See: https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-limits-use-certain-monoclonal-antibodies-treat-covid-19-due-omicron). These oral antiviral medications therefore represent a new tool in combatting the severe health consequences of COVID-19 through secondary prevention.

METHODS AND DATA

To examine statistical trends and patterns in antiviral utilization broken out along different dimensions such as by time, age, gender or geographic distribution, this report utilizes several data sources measuring prescription drug utilization, population size, insurance coverage rates, state-level income, COVID-19 case and death rates, and COVID-19 related vaccination rates. This section provides an overview of our analytic methodologies with details of each of the datasets used.

Our analysis begins by examining prescription utilization rates of Paxlovid and Lagevrio by age and time at the national level. The prescription drug utilization data employed here are predominantly derived from IQVIA Total Patient Tracker covering retail pharmacies from January 2022 through September 2022. This dataset comes at the age cohort-by-month level for each drug, where age is broken out into nine groupings. We pair these data with age-level population counts from the US Census,[16] which gives population counts disaggregated by each individual age-year. This allows us to create an appropriate estimated population size that corresponds to each age group that the IQVIA prescription drug data use in order to create drug utilization rates per 100,000 persons.

Since IQVIA Total Patient Tracker only covers retail pharmacy prescriptions, we supplement this dataset with IQVIA National Prescription Audit (NPA) data on prescription use in the long-term care (LTC) channel over the same time period.† The NPA database does not break out prescription utilization by age group, so our first analysis treats LTC as a separate independent category of utilization. To create a comparable utilization rate for this separate LTC demographic, we use an estimate of the LTC population of 2,159,100 which is based on information from the National Center for Health Statistics (NCHS).‡ We then provide a further analysis that imputes this LTC prescription utilization to our age groups based on the NCHS data, by allocating prescriptions in the LTC channel proportionately to the age distribution of the LTC demographic, attributing approximately 13%, 15%, 28%, and 44% of the prescriptions to the age groups 55-64, 65-74, 75-84, and 85+, respectively.

Our analysis next examines prescription utilization rates of Paxlovid and Lagevrio by gender and age. This analysis relies only on IQVIA Total Patient Tracker from January 2022 through September 2022 using the same age cohorts as before.

Finally, we analyze geographic heterogeneity in the use of Paxlovid and Lagevrio, using data from the IQVIA Total Patient Tracker disaggregated by state and month. We restrict the sample period for this analysis between May and September 2022 to remove the earlier months during which both Paxlovid and Lagevrio were still scaling up their distribution. We calculate an average monthly rate of utilization per 100,000 persons over this period for each drug based on this data in combination with the US Census state-level population estimates.[17] As part of this analysis, we employ a regression framework to examine the statistical correlates of Paxlovid and Lagevrio utilization rates, with the following explanatory variables: monthly COVID-19 case and death rates,[18] cumulative COVID-19 vaccinations administered by the start of the month,[19] state-level per capita income,[20] the share of the state population covered by Medicaid, the share of the state population covered by Medicare, and the share of the population that is uninsured.[21] Our regression models use data on COVID-19 case, death and cumulative vaccination rates at the state-by-month level, but only have state-level average personal income, and insurance coverage share data; all four regression models use month-level fixed effects, with standard errors clustered at the state level.

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† IQVIA describes this data source as tracking "prescriptions dispensed through pharmacies that service nursing home residential care facilities, institutional providers, chain nursing home providers, and nursing home pharmacies," but does not include VA nursing homes.

‡ We took as an estimate the population in nursing homes and residential care communities, from: https://acrobat.adobe.com/link/review?uri=urn:aaid:scds:US:56456bb6-163e-3930-aeb8-f26d86806f7e

FINDINGS

UTILIZATION RATES BY AGE GROUP OVER TIME

We begin by analyzing trends in the utilization rates per 100,000 persons for each of Paxlovid and Lagevrio prescriptions from the US retail channel separated by nine age groups. We also provide estimates for the LTC channel treating it as its own group. We present our results below in Table 1 and Table 2, showing the estimated prescription utilization rate for Paxlovid (Table 1) or Lagevrio (Table 2) from US retail pharmacies, and by age group (including LTC as a standalone group) from January through September 2022. Additionally, Figure 1 and Figure 2 visualize the distribution of the prescription use rates for Paxlovid and Lagevrio, respectively, using the same approach as in Table 1 and Table 2.

Table 1 and Figure 1 show that by August 2022 the relative utilization rate of Paxlovid was highest for LTC populations, surpassing all community-dwelling age groups receiving medication from the retail channel; before that point, LTC utilization was similar to that of 65-74 year-olds and slightly lower than 75-84 year-olds. While this relative pattern continued into September, future data will be helpful in assessing whether the LTC increase seen first in August will persist.

Moreover, examining the differential utilization rates among only the age brackets receiving medication through the retail channel, we find that there is a general pattern of increasing utilization rates across the age spectrum. This pattern is as expected, since older age is a strong predictor of risk from COVID-19 and an indication for antiviral treatment. However, there is one exception to this general pattern, which is that the 85+ cohort uses Paxlovid at only the third highest rate among our age cohorts; falling above that of 55-64 year-olds but below both 65-74 year-olds and 75-84 year-olds. We discuss likely reasons for this in the Discussion section.

Table 1. Paxlovid Utilization in Retail Channel by Age Group (and LTC Segment)

Age Group	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22
0 - 17	0.8	0.3	0.3	1.3	7.6	8.5	14.1	16.3	8.8
18 - 24	4.1	1.8	2.3	12.3	58.6	85.8	131.9	104.6	55.1
25 - 34	6.0	2.8	4.0	25.6	111.6	157.2	220.3	168.8	91.1
35 - 44	13.2	6.0	7.4	45.8	206.8	275.1	385.5	298.2	166.1
45 - 54	19.0	8.8	10.7	65.4	291.9	386.7	553.1	431.0	252.2
55 - 64	22.1	11.8	14.7	87.9	366.4	484.4	706.6	565.4	351.3
65 - 74	29.3	18.0	24.0	138.2	520.0	695.9	1,032.7	830.2	546.7
75 - 84	36.0	22.3	26.8	158.9	563.8	754.3	1,135.9	926.3	621.2
85+	40.4	24.3	21.9	133.3	441.3	550.2	842.2	681.9	454.5
Long-Term Care	73.9	66.0	34.4	160.3	567.5	647.6	1,002.9	1,037.7	710.2

Table 2. Lagevrio Utilization in Retail Channel by Age Group (and LTC Segment)

Age Group	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22
0 - 17	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
18 - 24	3.3	1.2	0.5	1.0	3.1	6.1	9.7	7.6	3.8
25 - 34	6.2	1.9	0.7	2.0	6.1	10.4	16.0	12.8	6.7
35 - 44	13.6	4.2	1.4	3.6	11.6	18.6	28.6	23.9	13.8
45 - 54	22.0	7.1	2.3	5.9	18.9	29.8	47.3	41.9	24.2
55 - 64	25.9	9.7	3.0	8.8	25.8	40.9	66.6	58.5	37.1
65 - 74	33.9	13.5	4.9	14.5	41.3	65.4	107.2	96.5	66.4
75 - 84	42.7	18.6	6.6	21.0	56.8	87.4	144.9	137.1	98.5
85+	46.8	21.9	6.5	21.9	56.0	76.3	128.3	118.3	87.3
Long-Term Care	67.4	80.5	22.7	54.7	131.4	178.6	247.3	264.7	204.1

In the case of Lagevrio, Table 2 and Figure 2 show that utilization is highest within LTC settings, compared to each of the age cohorts receiving medication within retail settings, and that pattern holds in each month of the sample by a significant margin. Moreover, examining the differential utilization rates within the age cohorts receiving medication from retail pharmacies, we find that there is again a clear pattern of increasing utilization rates across the age spectrum, as was the case for Paxlovid. The only exception to this general pattern is that the 85+ cohort uses Lagevrio at the second highest rate, only slightly lower than the rate of the 75-84 cohort. In the next section, we allocate the LTC utilization by age group, which changes this pattern somewhat.

Finally, we note that despite Paxlovid's significantly higher per capita utilization rate, both Paxlovid and Lagevrio have similar relative time trends by age across the sample period—where utilization declined modestly in the first quarter of the year and then dramatically increased in the second quarter and tapered modestly in the third quarter.

Figure 1. Paxlovid Utilization in Retail Channel by Age Group (and LTC Population)

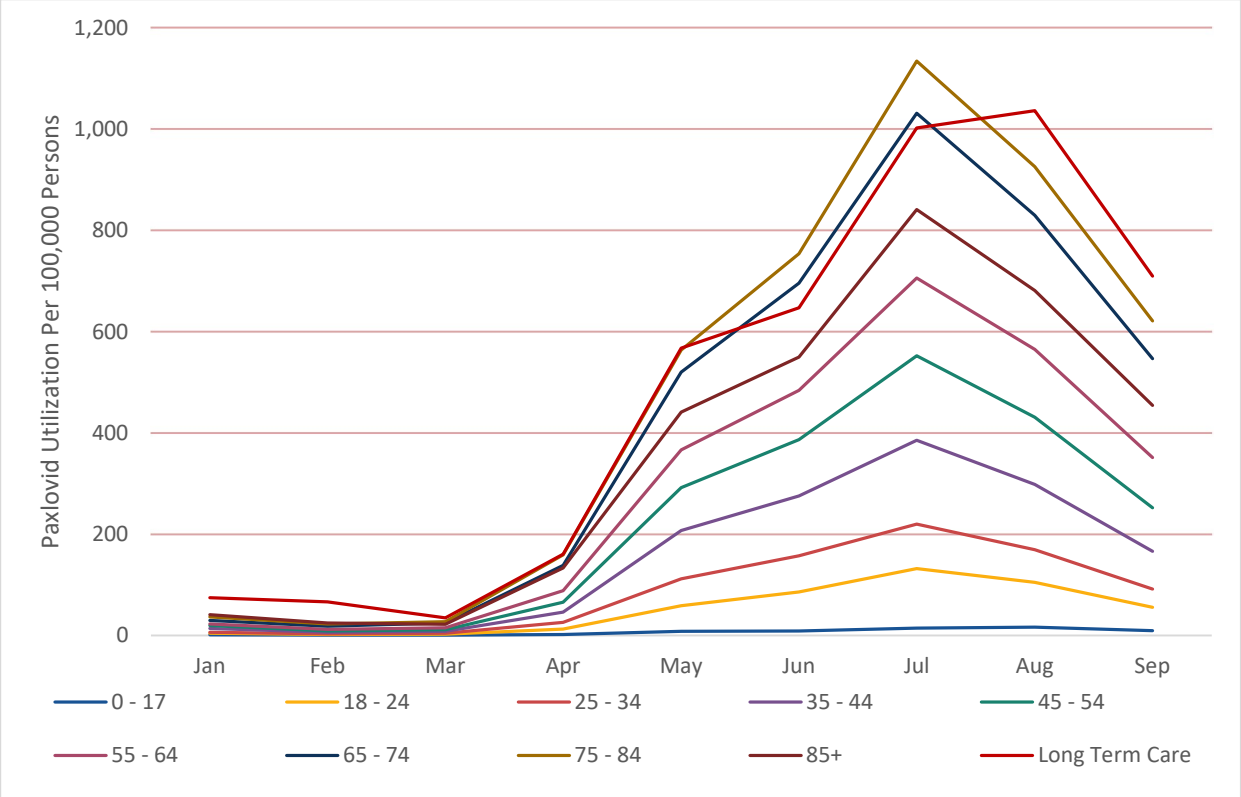
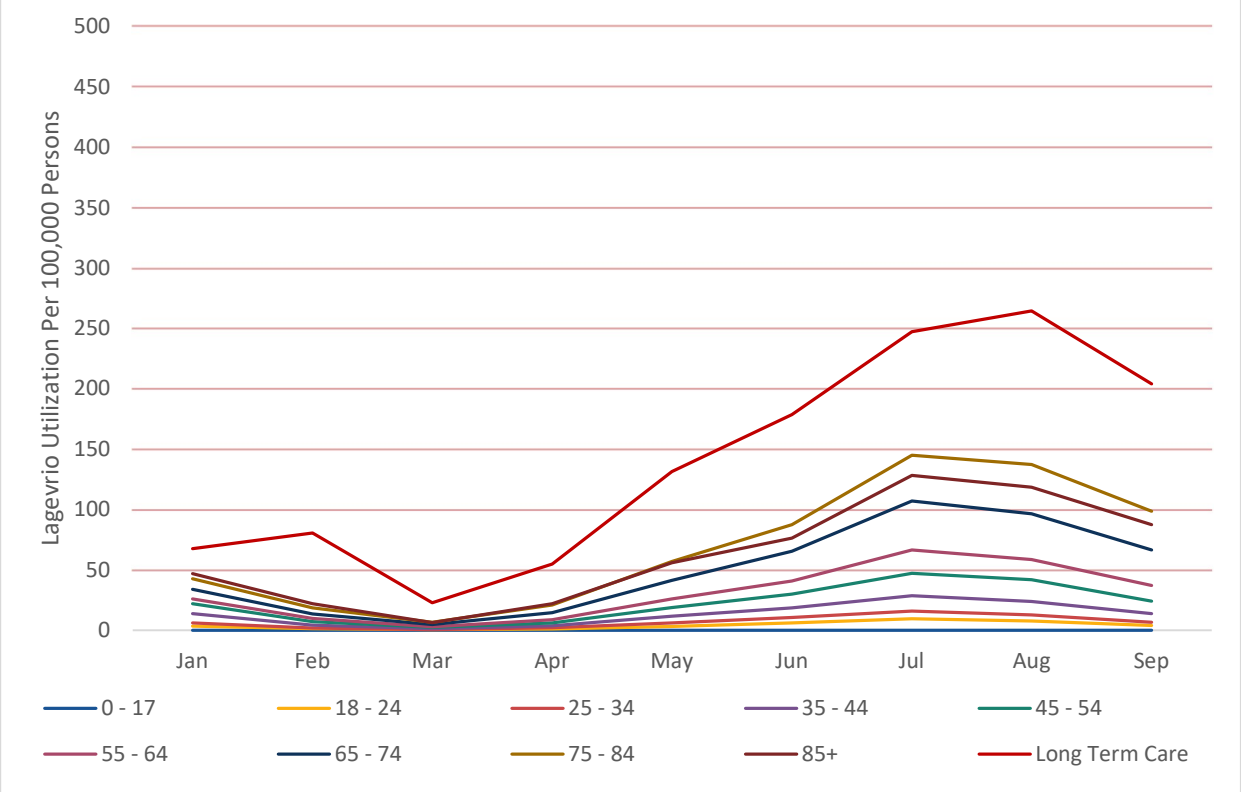


Figure 2. Lagevrio Utilization in Retail Channel by Age Group (and LTC Population)



IMPUTING LONG-TERM CARE UTILIZATION BY AGE

The previous section examined utilization by age group for retail pharmacy prescriptions, which omit LTC settings, where older adults are disproportionately represented. In this section, we take the LTC prescriptions, previously treated as a separate group, and impute them based on the underlying age distribution of the LTC population in order to be able to combine them with the age-cohort retail data. Table 3 and Table 4 show the results of this LTC imputation by age cohort for the four affected age groups.

Table 3. Paxlovid Utilization in Retail Channel with LTC Imputation by Age Group

Age Group	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22
55 - 64	22.6	12.2	15.0	88.9	370.0	488.5	713.0	572.0	355.8
65 - 74	30.0	18.7	24.3	139.8	525.8	702.6	1,043.1	840.9	554.1
75 - 84	38.8	24.8	28.2	165.1	585.6	779.2	1,174.4	966.1	648.5
85+	51.9	34.6	27.2	158.2	529.6	650.9	998.1	843.3	565.0

Table 4. Lagevrio Utilization in Retail Channel with LTC Imputation by Age Group

Age Group	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22
55 - 64	26.4	10.2	3.2	9.1	26.7	42.0	68.2	60.1	38.4
65 - 74	34.6	14.4	5.1	15.0	42.6	67.3	109.8	99.2	68.5
75 - 84	45.3	21.7	7.5	23.1	61.8	94.3	154.4	147.3	106.4
85+	57.3	34.5	10.0	30.4	76.4	104.1	166.7	159.5	119.1

Additionally, Figures 3 and 4 visualize these updated distributions of the prescription use rates for Paxlovid and Lagevrio using the same approach as in Tables 3 and 4. Table 3 and Figure 3 show that the incorporation of the LTC prescriptions helps explain the previous finding of relatively lower utilization rates among the age 85+ cohort. Where previously we found the 85+ cohort had the third highest Paxlovid utilization rate, significantly behind both the 65-74 and 75-84 cohorts, now we find that the 85+ cohort has utilization rates approximately equal to that of the 65-74 cohort and has narrowed the remaining gap relative to the 75-84 cohort.

LTC prescriptions lead to an even larger relative increase in estimated Lagevrio utilization for the age 85+ cohort than for Paxlovid. Where previously we found the aged 85+ cohort to have the second highest utilization rate of Lagevrio, behind only that of the 75-84 aged cohort, we now find that when accounting for LTC prescription imputations that the aged 85+ cohort has the highest rate of Lagevrio utilization of any of the age cohorts. This finding is both a result of the disproportionate share of the LTC population that is aged 85 or older, but also a result of Lagevrio having a disproportionate utilization in LTC settings. Thus, after incorporating prescription data from LTC settings, both Paxlovid and Lagevrio have more consistent patterns of increasing utilization with age.

Figure 3. Paxlovid Utilization by Age Group, After LTC Imputation

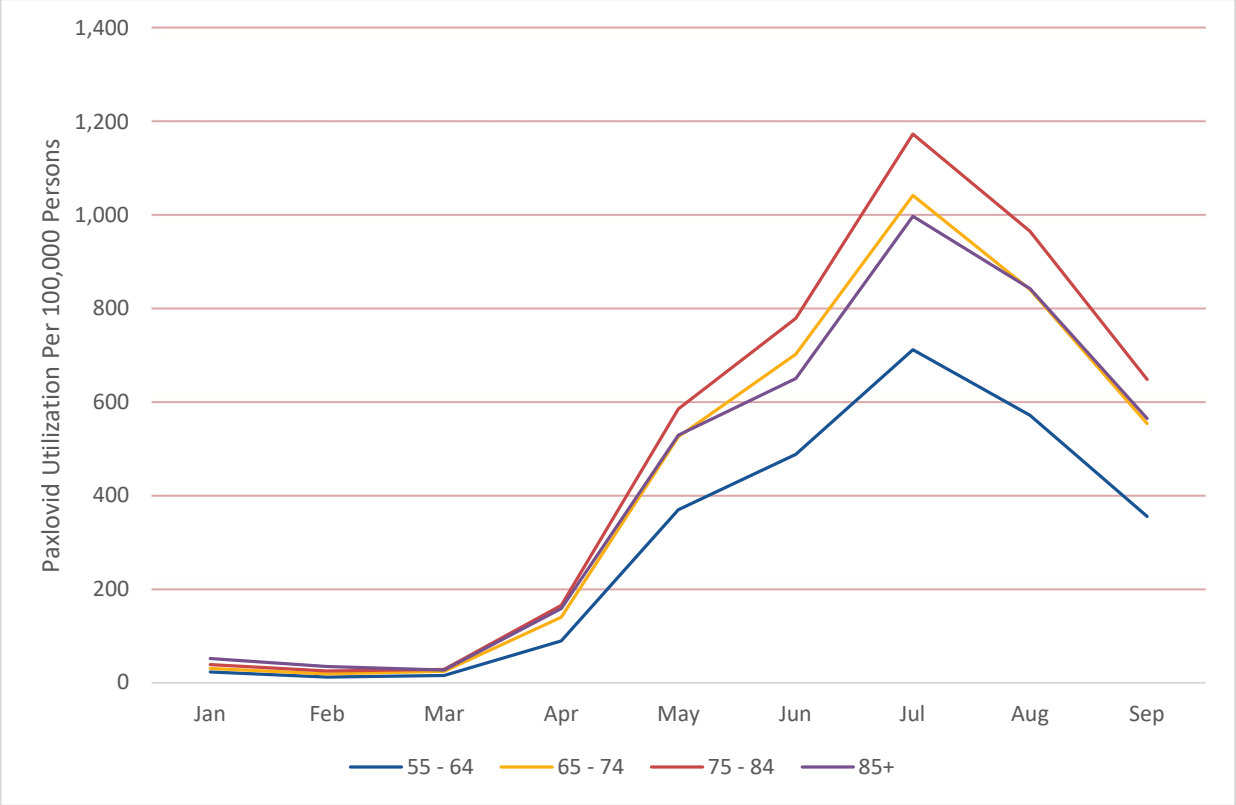
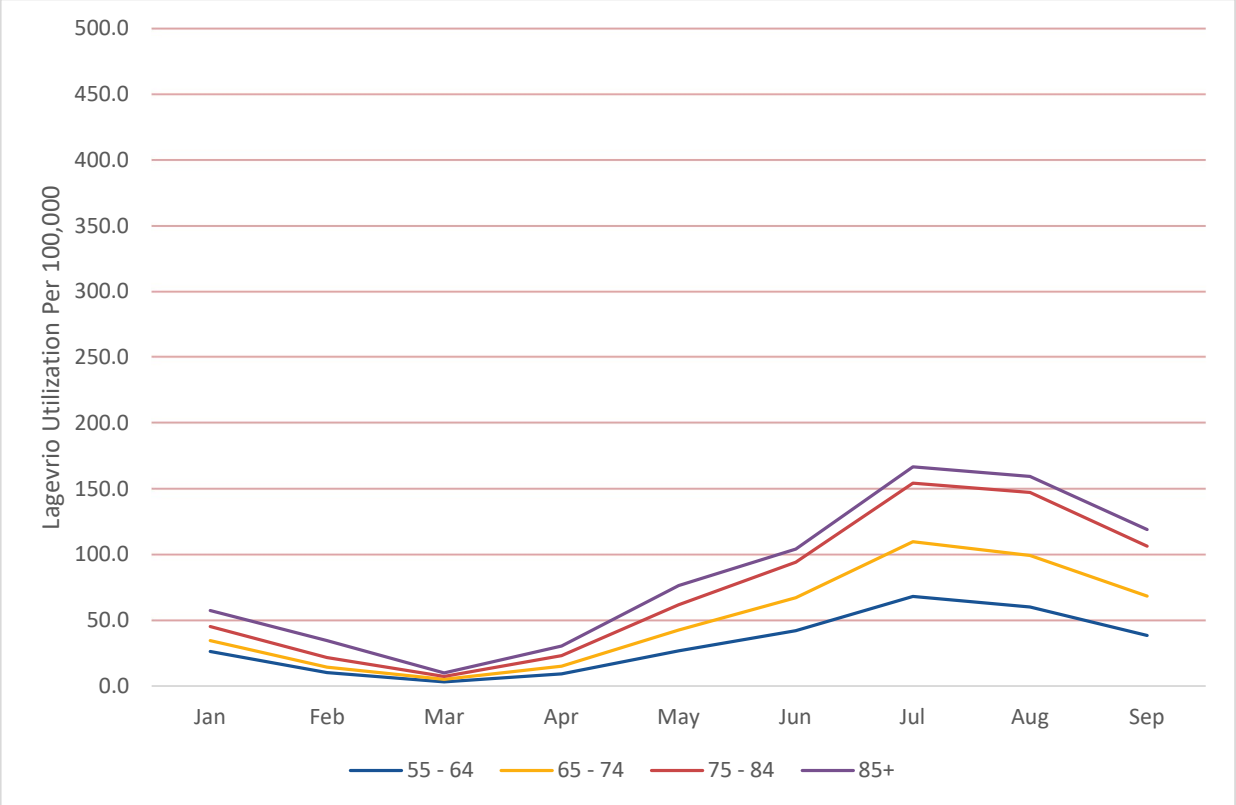


Figure 4. Lagevrio Utilization by Age Group, After LTC Imputation



COMPARING PAXLOVID TO LAGEVRIO UTILIZATION BY AGE

This section compares the share of oral antiviral prescriptions by group for the two drugs. Table 5 uses the most recent month of data (September 2022) from the combined retail and imputed LTC prescriptions and compares the patient counts of Lagevrio to Paxlovid separated by age brackets. We find that Paxlovid represents a significant majority of oral antiviral prescriptions for all age cohorts and totals approximately 90% share when aggregating all age cohorts together (vs. 10% for Lagevrio). However, Lagevrio's utilization share rises across the age spectrum from essentially zero percent of the pediatric prescriptions (for whom Lagevrio is not authorized) to approximately 17% of the 85+ cohort's prescriptions. Combining these results with that of prior sections of this report, we find that the comparatively low utilization of Paxlovid in adults 85 and over (relative to adults 75-84) is partially offset by disproportionately higher Lagevrio prescribing, which may reflect higher rates of contraindications to Paxlovid in this age group. More specifically, Lagevrio rates were roughly 12.7 prescriptions per 100,000 higher in September 2022 for the 85+ age group than the 75-84 year-old group (Table 4), which is about 15% of the gap in Paxlovid prescribing for that month.

Table 5. Lagevrio vs. Paxlovid Utilization by Age Group, September 2022: Retail with LTC Imputation.

	Lagevrio		Paxlovid		Combined
Age Group	Count	Age Share	Count	Age Share	Count
0 – 17*	14	0%	6,590	100%	6,604
18 - 24	1,162	7%	16,645	93%	17,807
25 - 34	3,062	7%	41,797	93%	44,859
35 - 44	5,930	8%	71,313	92%	77,243
45 - 54	9,988	9%	104,291	91%	114,280
55 - 64	16,601	10%	153,936	90%	170,538
65 - 74	22,222	11%	179,818	89%	202,041
75 - 84	16,789	14%	102,361	86%	119,150
85+	7,219	17%	34,256	83%	41,474
Total	82,988	10%	711,007	90%	793,995

Note: *Lagevrio is not authorized for use in patients under 18.

UTILIZATION BY GENDER

Table 6 and Table 7 show utilization by age and gender for Paxlovid and Lagevrio, respectively. Looking across all age groups and time periods, women represent a modest majority of those filling prescriptions for both Paxlovid and Lagevrio; on average, women account for approximately 58% and 57% of Paxlovid and Lagevrio prescriptions, respectively.

Table 6. Female Share of Paxlovid Prescription Utilization

Age Group	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22
0 - 17	49%	43%	50%	53%	52%	53%	53%	49%	50%
18 - 24	57%	48%	65%	61%	60%	59%	59%	59%	59%
25 - 34	64%	59%	58%	60%	61%	61%	61%	62%	62%
35 - 44	62%	62%	58%	58%	60%	60%	61%	62%	62%
45 - 54	59%	59%	58%	58%	59%	59%	60%	61%	61%
55 - 64	55%	56%	55%	56%	57%	58%	58%	59%	59%
65 - 74	53%	55%	53%	55%	56%	56%	56%	57%	57%
75 - 84	52%	53%	51%	54%	55%	54%	55%	55%	55%
85+	56%	57%	57%	58%	59%	58%	59%	59%	59%

Table 7. Female Share of Lagevrio Prescription Utilization

Age Group	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22
0 – 17*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18 - 24	59%	41%	48%	59%	63%	62%	60%	58%	61%
25 - 34	61%	63%	56%	59%	62%	62%	62%	65%	65%
35 - 44	62%	61%	60%	61%	62%	61%	63%	64%	64%
45 - 54	61%	62%	58%	58%	60%	60%	61%	62%	61%
55 - 64	57%	58%	58%	57%	56%	57%	57%	57%	58%
65 - 74	54%	54%	53%	52%	54%	54%	54%	54%	54%
75 - 84	54%	55%	54%	51%	51%	52%	52%	52%	51%
85+	60%	62%	53%	57%	57%	57%	58%	57%	55%

Note: *Lagevrio is not authorized for use in patients under 18. Share is omitted due to small sample size.

STATE-LEVEL UTILIZATION PATTERNS

Table 8 displays monthly average prescription rates per 100,000 persons for each of Paxlovid and Lagevrio separately by state (including Washington D.C.), as well as the share of the total, for May to September 2022. The table orders states from highest to lowest per capita utilization rate of the combined total of Paxlovid and Lagevrio. We find wide variation in the state-level utilization rate, with a minimum monthly average Paxlovid utilization rate of 130.9 per 100,000 in North Dakota, a maximum rate of 495.3 per 100,000 in Rhode Island, and a median value of 281.1 per 100,000. Similarly for Lagevrio, we find large variation by state, with a minimum monthly average utilization rate of 5.4 per 100,000 in North Dakota, a maximum rate of 95.9 in Arkansas, and a median value of 23.6. We find significant variation in the underlying share of the total antiviral prescriptions that each of Paxlovid and Lagevrio constitute. For Paxlovid, we find a minimum of 75.1% in Arkansas, a maximum of 98.1% in Massachusetts, and a median of 92.1% (with Lagevrio comprising the remainder of utilization in each state)

Table 8. State-Level Paxlovid and Lagevrio Utilization from Retail Channel: Average Monthly Rates Per 100,000 Persons (May – September 2022)

State	Prescription Rate Per 100,000 Persons			Share of Total COVID-19 Antiviral Prescriptions	
	Total	Paxlovid	Lagevrio	Paxlovid	Lagevrio
RI	523.9	495.3	28.6	94.5%	5.5%
MA	469.1	460.3	8.9	98.1%	1.9%
VT	423.7	404.3	19.3	95.4%	4.6%
NJ	422.4	400.6	21.8	94.8%	5.2%
DC	421.7	403.3	18.4	95.6%	4.4%
ME	408.5	388.5	19.9	95.1%	4.9%
AL	407.5	314.9	92.6	77.3%	22.7%
NM	403.9	372.1	31.8	92.1%	7.9%
NC	399.9	347.3	52.6	86.8%	13.2%
TX	399.8	354.4	45.4	88.6%	11.4%
CT	399.2	363.2	35.9	91.0%	9.0%
MD	396.5	369.5	26.9	93.2%	6.8%
AR	385.2	289.3	95.9	75.1%	24.9%
TN	380.3	298.7	81.6	78.5%	21.5%
HI	375.5	354.5	21.0	94.4%	5.6%
WV	374.4	329.6	44.8	88.0%	12.0%
FL	374.0	345.8	28.1	92.5%	7.5%
NY	365.2	338.2	26.9	92.6%	7.4%
SC	351.2	327.6	23.6	93.3%	6.7%
VA	343.1	310.1	33.0	90.4%	9.6%
DE	335.3	295.4	39.9	88.1%	11.9%
MS	331.7	288.4	43.3	87.0%	13.0%
MI	329.1	308.0	21.1	93.6%	6.4%
PA	325.0	303.7	21.2	93.5%	6.5%
NH	322.6	304.2	18.4	94.3%	5.7%
GA	320.4	278.6	41.8	87.0%	13.0%
KS	304.0	281.1	23.0	92.5%	7.5%
KY	302.5	256.3	46.2	84.7%	15.3%
IL	291.4	276.5	14.9	94.9%	5.1%
AK	289.2	260.4	28.7	90.1%	9.9%
NE	281.9	241.5	40.4	85.7%	14.3%
CA	279.8	268.5	11.3	96.0%	4.0%
IN	278.9	253.7	25.1	91.0%	9.0%
LA	276.8	239.1	37.8	86.4%	13.6%
IA	273.5	240.7	32.8	88.0%	12.0%
MN	266.9	249.2	17.7	93.4%	6.6%
MO	257.0	231.3	25.7	90.0%	10.0%
OH	256.3	237.6	18.7	92.7%	7.3%
WA	255.4	239.2	16.2	93.6%	6.4%
OK	253.1	227.2	25.9	89.8%	10.2%
NV	247.0	225.3	21.7	91.2%	8.8%
CO	241.1	221.7	19.4	92.0%	8.0%
OR	230.7	213.0	17.7	92.3%	7.7%
AZ	227.0	212.2	14.8	93.5%	6.5%
WI	226.5	205.7	20.8	90.8%	9.2%
UT	221.2	214.7	6.5	97.1%	2.9%
MT	215.0	188.9	26.1	87.9%	12.1%
SD	211.9	201.0	11.0	94.8%	5.2%
ID	178.3	163.5	14.8	91.7%	8.3%
WY	177.4	159.6	17.8	90.0%	10.0%
ND	136.3	130.9	5.4	96.0%	4.0%

Moreover, Figures 5 and 6 visually demonstrate the data presented in Table 8 in map form, which shows higher Paxlovid prescribing rates per 100,000 in the Northeast and in Texas, and that Lagevrio prescribing was generally highest in the South.

Figure 5. State-Level Paxlovid Utilization Rates from Retail Channel
Average Monthly Rates Per 100,000 Persons (May – September 2022)

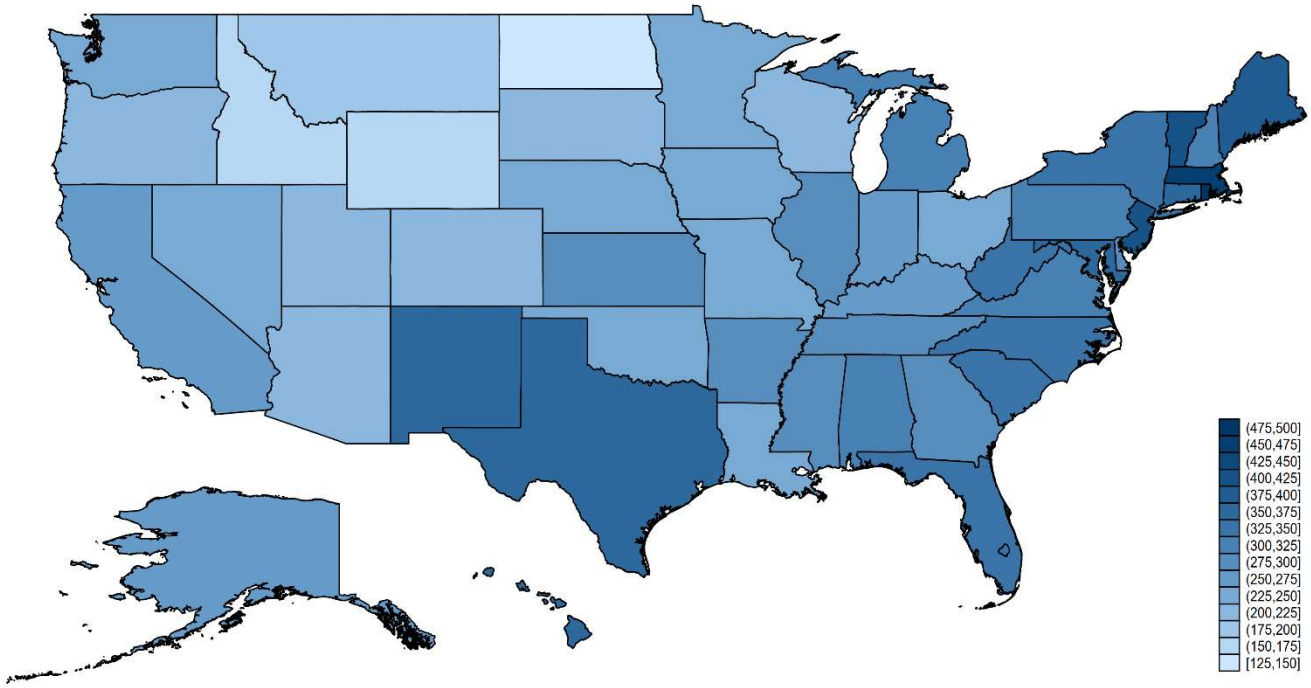


Figure 6. State-Level Lagevrio Utilization Rates from Retail Channel
Average Monthly Rates Per 100,000 Persons (May – September 2022)

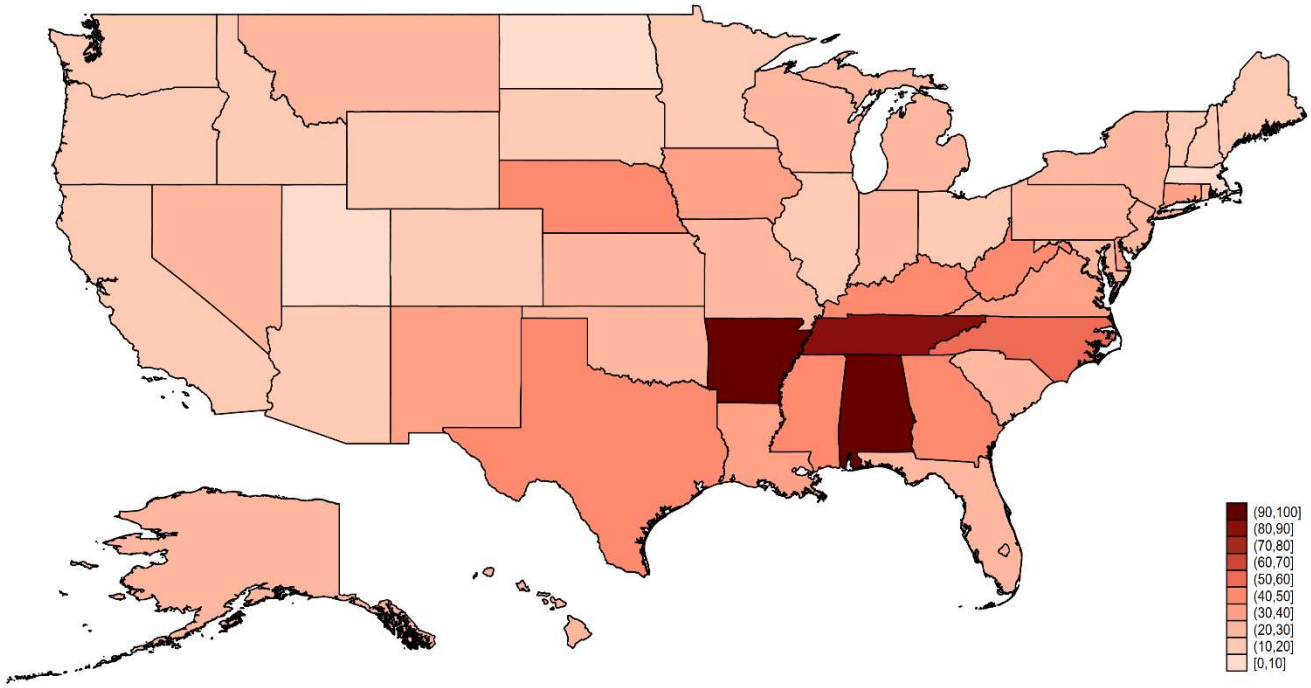
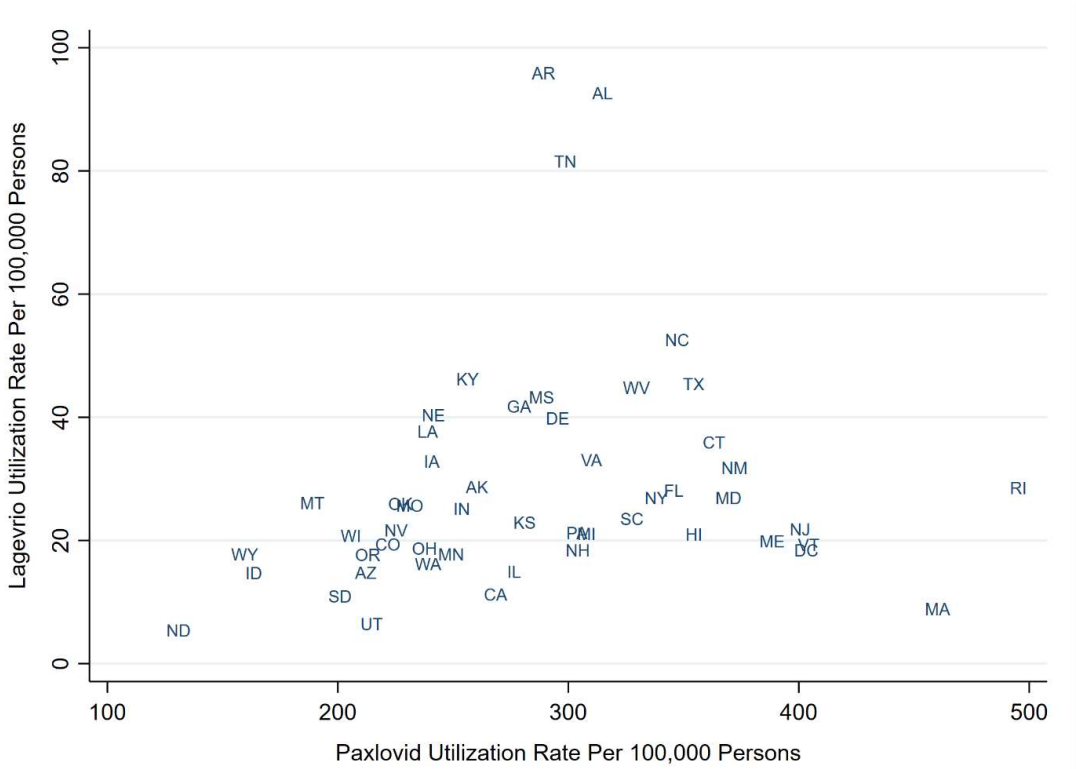


Figure 7 shows a scatterplot of the average monthly utilization rates of Paxlovid and Lagevrio. On average, states with higher per capita Paxlovid utilization rate also generally have higher Lagevrio utilization rates, though with significant variation. Over the sample period, the utilization rates of Paxlovid and Lagevrio are positively correlated, but only modestly, with a correlation coefficient of 0.17.

Figure 7. State-Level Paxlovid and Lagevrio Utilization Rates from Retail Channel Average Monthly Rates Per 100,000 Persons (May – September 2022)



In order to examine this significant heterogeneity in antiviral utilization across states, we employ regression analysis, modeling the rates of Paxlovid or Lagevrio use as a function of COVID-19 case rates, COVID-19 death rates, the cumulative vaccination rate at the start of the given month, and several state-level demographic factors including income and health insurance coverage.

In column 1 we present our primary specification analyzing the correlates of Paxlovid utilization rates, where we find that COVID-19 case rates positively predict Paxlovid utilization with a coefficient of 0.167 that is statistically significant at the 1% level. The coefficient indicates that each additional 1,000 diagnosed COVID-19 cases are statistically associated with 167 additional Paxlovid prescriptions, reflecting a 16.7% marginal treatment rate for additional confirmed COVID-19 cases; if we instead calculate a simple "overall average" treatment rate, we estimate that 34.7% of confirmed cases received Paxlovid. Additionally, the cumulative vaccination rate also positively predicts Paxlovid utilization, with a coefficient of 0.002 that is also statistically significant at the 1% level. This coefficient indicates that each additional 1,000 administered doses of COVID-19 vaccinations are associated with 2 additional uses of prescription Paxlovid. The only other variable that is statistically significantly predictive of Paxlovid utilization is the Medicare Population Share with a coefficient of 6.749 which is statistically significant at the 5% level. This coefficient can be interpreted as showing that each incremental percentage point of the population that is covered under Medicare is associated with an increase in the utilization rate of Paxlovid of 6.749 prescriptions per 100,000. COVID-19 death rates, personal income, Medicaid Population Share and Uninsured Population Share are not significantly associated with Paxlovid utilization.

In column 3 we present an analogous specification analyzing the correlates of Lagevrio utilization. Again we find that the COVID-19 reported case rate is a significant positive predictor of Lagevrio utilization. Each 1,000 incremental reported COVID-19 cases is associated with 22 additional prescriptions of Lagevrio, reflecting a 2.2% marginal treatment rate for additional confirmed COVID-19 cases; the non-regression based "overall average" treatment rate was 3.5%. No other variables were significantly associated with Lagevrio utilization.

Table 9. Statistical Correlates of Paxlovid and Lagevrio Utilization Rates in Retail Channel Average Monthly Rates Per 100,000 Persons (May – September 2022)

	Paxlovid Rate		Lagevrio Rate	
	(1)	(2)	(3)	(4)
COVID-19 Case Rate (Per 100K Persons)	0.167***	0.208***	0.022***	0.030***
	(0.02)	(0.02)	(0.01)	(0.00)
COVID-19 Death Rate (Per 100K Persons)	-1.357	-0.072	0.380	0.198
	(2.49)	(1.22)	(0.57)	(0.26)
Cumulative Vaccination Rate (Per 100K Persons)	0.002***	-0.003	-0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)
Personal Income	-0.444		-0.039	
	(1.41)		(0.31)	
Medicaid Population Share	0.442		0.704	
	(1.52)		(0.52)	
Medicare Population Share	6.749**		1.314	
	(3.34)		(0.97)	
Uninsured Population Share	4.366		0.796	
	(3.75)		(0.84)	
Month Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	No	Yes	No	Yes
Clusters	51	51	51	51
R^2	0.692	0.921	0.403	0.852
Observations	255	255	255	255

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Furthermore, in columns 2 and 4, we re-run the corresponding headline specifications of columns 1 and 3 but replace the state-level measures (Personal Income, Medicaid, Medicare, and Uninsured Population Shares) with state fixed effects to additionally capture other stable characteristics of each state that may affect antiviral utilization. We find that the estimated marginal treatment rates rise from 16.7% and 2.2% to 20.8% and 3.0% for Paxlovid and Lagevrio respectively. Finally, in additional robustness tests presented in the Appendix, we show that our results are largely similar if we use logarithmic transformations for the variables in Table 9, but that these logarithmic transformations help demonstrate that the associations between COVID-19 case rates and utilization rates of Paxlovid and Lagevrio are proportionate in magnitude, and that the larger statistical association found here with Paxlovid is predominantly the result of a higher baseline level of utilization for Paxlovid compared to Lagevrio.

DISCUSSION

Using prescription drug data from January through September 2022, this report identifies several important patterns in oral antiviral utilization for COVID-19.

First, both Paxlovid and Lagevrio have similar time trends by age across the sample period—where utilization declined modestly in the first quarter of the year and then dramatically increased in the second quarter and

finally tapered modestly in the third quarter. These time trends likely reflect the corresponding national changes in COVID rates, opening direct distribution to Federal Retail Therapeutic Pharmacy Partners, and launch of the federal Test-to-Treat program, combined with the typical pattern that new drugs experience upon launch related to scaling up of manufacturing, distribution, and patient/physician awareness. These latter phenomena related to new drug launch potentially explains the comparatively lower utilization rates of both Paxlovid and Lagevrio in the first quarter of 2022 relative to the summer peak utilization rate for each, despite still significant COVID-19 case rates.

Second, we find that rates of oral antiviral utilization generally increase with age and that the highest rates were found in the LTC population. The lone exception to this was that we found lower rates in the 85+ age group then other age groups over 65. Reasons that the oldest seniors may have lower utilization rates than 75-84 year-old adults could include differences in case rates, different prescribing patterns, and different rates of clinical contraindications. Notably, our age-group analysis does not factor in case rates (which may be difficult to assess across age groups in a consistent fashion, given changing patterns of home and rapid testing that do not appear in most official statistics). In addition, Paxlovid has several drug-drug interactions and is not recommended in patients with severe renal impairment (as well as hepatic impairment),[§] which is nearly twice as common (2.9% vs. 1.5%) among Medicare beneficiaries 85 and older than among those 75-84 years old.** Evaluation by a clinician should be obtained for patients with potential renal impairment or for patients where modification of other medications is needed due to potential drug interactions to prescribe Paxlovid, instead of by a state-licensed pharmacist. We also note that the exception of the 85+ cohort to the general pattern of increasing utilization rates across age appears to be significantly related to the disproportionate share of the oldest age groups receiving medication through the LTC channel, as the otherwise anomalously low rates for aged 85+ patients were offset significantly for Paxlovid, and fully for Lagevrio, by imputing LTC utilization by age distribution. Moreover, we demonstrated that for the age 85+ cohort, higher utilization rates of Lagevrio partially offset lower rates of Paxlovid, but not entirely. Further analysis is needed as to whether the slightly lower total antiviral utilization among adults over 85 reflects missed opportunities for treatment that can prevent severe complications from COVID-19 including death.

Third, we found significant heterogeneity in antiviral utilization by state, with average monthly per capita rates of antiviral use from May through September 2022 varied by a factor of 4 for Paxlovid and 18 for Lagevrio. Our regression analysis found that COVID-19 case rates were positively predictive of both Paxlovid and Lagevrio use in similar (proportionate) effect size, but with much higher treatment rates for Paxlovid than Lagevrio. These results should be interpreted with caution, however, as official confirmed case counts are likely a significantly underestimate due to underreporting of home testing.

Finally, we found that the cumulative rate of COVID-19 vaccinations was positively predictive of Paxlovid utilization (but not Lagevrio); while this is not a causal finding, it raises important potential implications about the relationship between vaccination and therapeutic uptake. This is a somewhat unexpected finding and suggests that, at a state-level, antiviral use is not replacing vaccine uptake. Rather, states with higher vaccine rates appear to also have greater awareness of or demand for COVID-19 therapeutics. This suggests a potential compounding negative public health effect in some states, where lower vaccination rates are coupled with lower treatment rates – even after adjusting for COVID caseloads. These findings of variable oral antiviral use across states suggests potential opportunities for policymakers to improve distribution, patient and provider awareness, and use of these life-saving treatments.

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§ Defined as an estimated Glomerular Filtration Rate (eGFR) less than 30 mL/min. https://www.fda.gov/media/155050/download

** Calculated as a percentage of the population in fee-for-service Medicare without end-stage renal disease, from https://api-adr.usrds.org/api/referenceTables?year=2021&referenceTable=CKD_Ref_B_%20Prevalence_2021

APPENDIX: SUPPLEMENTARY REGRESSION ANALYSIS

In this Appendix we provide additional robustness tests as a supplement to the regression analysis in the main body of the report. Here we replace several variables of our original analysis with logarithmic transformations. This has a few potential advantages over our base model. First, for right-skewed variables logarithmic transforms can be more robust, as they are less affected by extreme outliers. Second, since Paxlovid is much more commonly prescribed than Lagevrio, logarithmic transforms have the advantage of making coefficients more comparable between the two drugs, as the coefficient estimates tell us about proportional changes rather than changes in levels. For example, columns 1 and 3 present the headline regression estimates from the main analysis but with logarithmic transforms, where we find that the coefficient on the Log COVID-19 Case Rate variable is significant for both Paxlovid and Lagevrio with coefficients of 0.592 and 0.666 respectively, both of which are statistically significant at the 1% level. The logarithmic transforms of both the dependent and independent variables allow us to interpret these coefficients as saying that a one percent increase in underlying COVID-19 case rates is associated with a 0.592 or 0.666 percent increase in the utilization rates of Paxlovid and Lagevrio respectively – meaning overall utilization for the two antivirals increases in similar proportion to rising case rates.

Interpreting the effect of vaccination rates on antiviral utilization, the logarithmic version in column 3 shows that a one percent increase in the cumulative vaccination rate is associated with a 1.445 percent increase in the utilization rate of Paxlovid, which is statistically significant at the 1% level. However, column 3 shows that there is again no statistically significant association of vaccination rates with Lagevrio use.

Table A1. Statistical Correlates of Paxlovid and Lagevrio Utilization Rates in Retail Channel: Robustness Tests
Average Monthly Rates Per 100,000 Persons (May – September 2022)

	Log Paxlovid Rate		Log Lagevrio Rate	
	(1)	(2)	(3)	(4)
Log COVID-19 Case Rate	0.592***	0.729***	0.666***	0.800***
	(0.05)	(0.04)	(0.09)	(0.04)
Log COVID-19 Death Rate	-0.032	-0.001	0.062	0.025
	(0.04)	(0.02)	(0.07)	(0.03)
Log Cumulative Vaccination Rate	1.445***	-1.230	-0.338	2.586
	(0.33)	(2.15)	(0.74)	(3.77)
Log Personal Income	-0.281		-0.258	
	(0.32)		(0.79)	
Medicaid Population Share	0.000		0.025	
	(0.01)		(0.02)	
Medicare Population Share	0.022*		0.058	
	(0.01)		(0.04)	
Uninsured Population Share	0.011		0.043	
	(0.01)		(0.03)	
Month Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	No	Yes	No	Yes
Clusters	51	51	51	51
R^2	0.751	0.939	0.497	0.930
Observations	255	255	255	255

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Interpreting the effect of the Medicare Population Share variable here in a so called “log-linear” specification (where the dependent variable is log transformed but the independent variable is not) finds a coefficient of 0.022 (which is statistically significant at the 10% level) implying that a one percentage point increase in the

share of the population that is covered by Medicare is associated with a 2.2% increase in the utilization rate of Paxlovid.

Finally, in columns 2 and 4, we re-run the corresponding specifications of columns 1 and 3 but replace the state-level measures (Personal Income, Medicaid, Medicare, and Uninsured Population Shares) with state fixed effects to additionally capture other stable characteristics of each state that may affect antiviral utilization. Here we find that the estimated marginal treatment elasticities rise from 0.592 and 0.666 to 0.729 and 0.800 for Paxlovid and Lagevrio respectively.

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