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How we analysed COVID antiviral uptake

Peter Breadon and Iris Chan

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1 How we analysed COVID antiviral uptake

1.1 What we analysed

Our analysis looked at COVID antiviral uptake between March 2022 – when antivirals first became available via the Pharmaceutical Benefits Scheme (PBS) – and September 2023.

We found there were large disparities in antiviral uptake between different groups in Australia (see Figure 1.1 and Figure 1.2).

To make sure our findings were robust, we performed a regression analysis of different predictors of COVID prescription rates. If disparities remain after accounting for other predictors of COVID disease, then the evidence suggests that the group of interest is missing out on care.

1.2 Data

1.2.1 Data source

Our COVID antivirals analysis uses unit-record data from the Australian Bureau of Statistics' Personal Level Integrated Data Asset (PLIDA).[1] The data we used for this report are:

- the 2021 Census,
- PBS data from March 2022 to September 2023,
- Medicare Benefits Schedule data from January 2011 to September 2023, and
- spine linkage between the 2021 Census and the Medicare Consumer Directory.

We restricted our sample to people in the 2021 Census who were not overseas visitors to Australia.

1. ABS PLIDA (2024).

1.2.2 Data linkage

We further restricted our sample to 2021 Census records that can be linked to the Medicare Consumer Directory. We expect this to make our findings on any access gaps conservative, because data linkage tends to be lower for disadvantaged groups. Data linked to multiple records were distributed equally across the linked records.

1.3 Eligible cohort

COVID antivirals are subsidised under the PBS for people who are at risk of developing severe disease requiring hospitalisation. This includes people aged 70 and older, and younger people with chronic illnesses, such as diabetes or heart failure.[2]

For simplicity, we restricted our analysis to people aged 70 and older.

1.4 Dispensing rates

We calculated dispensing rates per 1,000 people aged 70 and older. We included both molnupiravir (item 12910L) and nirmatrelvir/ritonavir (item 12996B) dispensed on the PBS General Schedule from March 2022 to September 2023,[3] where the patient is aged 70 or older at the time of the prescription. These measures include multiple doses dispensed to the same individuals.

Most oral COVID treatments are recorded in the PBS data, but if patients receive their full course of medication inside a hospital, then their prescription will not be recorded in the PBS.

2. Department of Health and Aged Care (2024).
3. COVID antivirals first became available on the PBS in March 2022 (see Allard et al (2023); September 2023 is our latest available data.

1.5 Regression results

1.5.1 Regression sample

To model the probability of being dispensed a COVID antiviral, we looked at whether each person aged 70 and older had ever been dispensed a COVID antiviral from March 2022 to September 2023.

Our sample comprised those aged 68 and older as at the 2021 Census – conducted in August 2021 – which means the youngest people in the sample would be just over 70 by September 2023. Our sample was further restricted to such people who were not overseas visitors, and whose record could be linked to the Medicare Consumer Directory. Our sample had 3,274,564 observations.

We constructed an indicator variable for whether each of these people had been dispensed either molnupiravir or nirmatrelvir/ritonavir on the PBS General Schedule.[4]

We coded missing or not-applicable values as indicator variables in our sample. This allowed us to estimate our regression coefficients from all available data while still accounting for missing/not applicable values.

1.5.2 Regression indicator variables

We derived the indicator variables for our model from self-reported patient demographics in the 2021 Census, and patient interactions with the health system according to Medicare data.

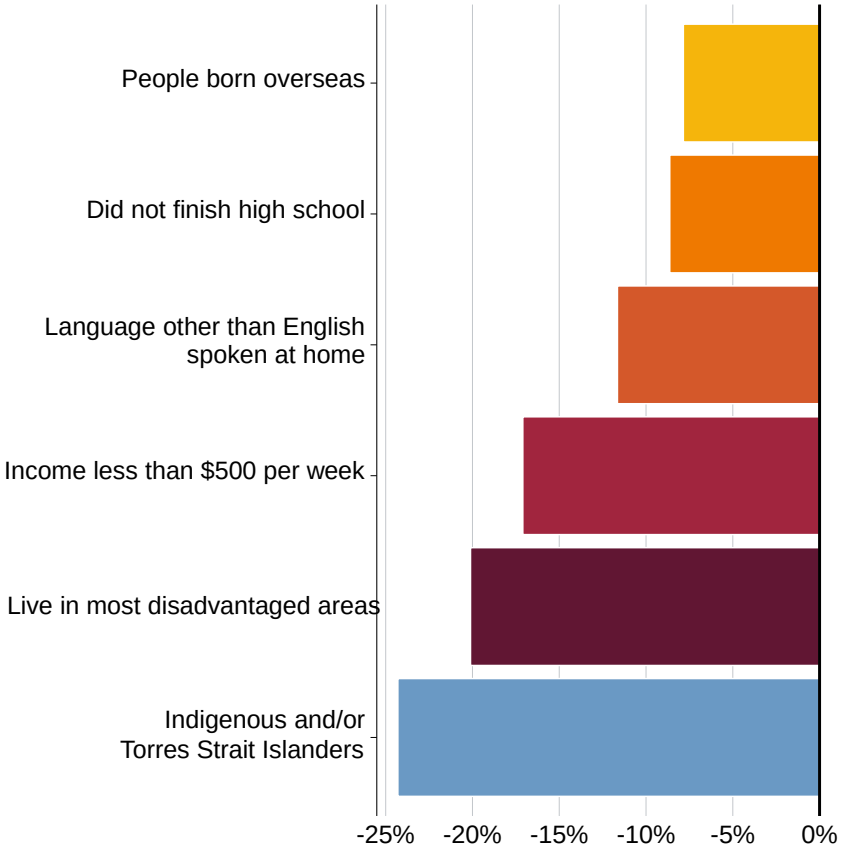
Patient demographics

Indigenous – We defined a person as Indigenous if they identified in the 2021 Census as Aboriginal, Torres Strait Islander, or both

4. Given that there are no contraindications for molnupiravir (see TGA (2023)) – which remains an alternative to nirmatrelvir/ritonavir – we have not taken contraindications into account in further restricting our sample for analysis.

Figure 1.1: Disadvantaged Australians are less likely to get COVID antivirals

COVID antiviral rate per 1,000 people aged 70 and older, compared to the national average, March 2022 to September 2023



Note: Rate per thousand calculated from total antivirals dispensed in the period through the PBS, divided by the population (in thousands) of non-visitors aged 70 and older as at the 2021 Census. Most disadvantaged areas are those people who live in the bottom decile of socio-economic status. Income is based on total household equivalised income, as reported in the Census 2021. See Chapter 1 on the preceding page for more detail.

Source: Grattan Institute analysis of ABS PLIDA (2024).

Aboriginal and Torres Strait Islander; and not Indigenous if they identified as non-Indigenous.[5]

Age – We used age at the 2021 Census, and date of birth from the Census data. We grouped people in five-year age buckets from 70 and older.

Gender – We used gender (male or female) as self-reported in the Census.

Country of birth – The regions and corresponding country of birth (BPLP) codes are:[6]

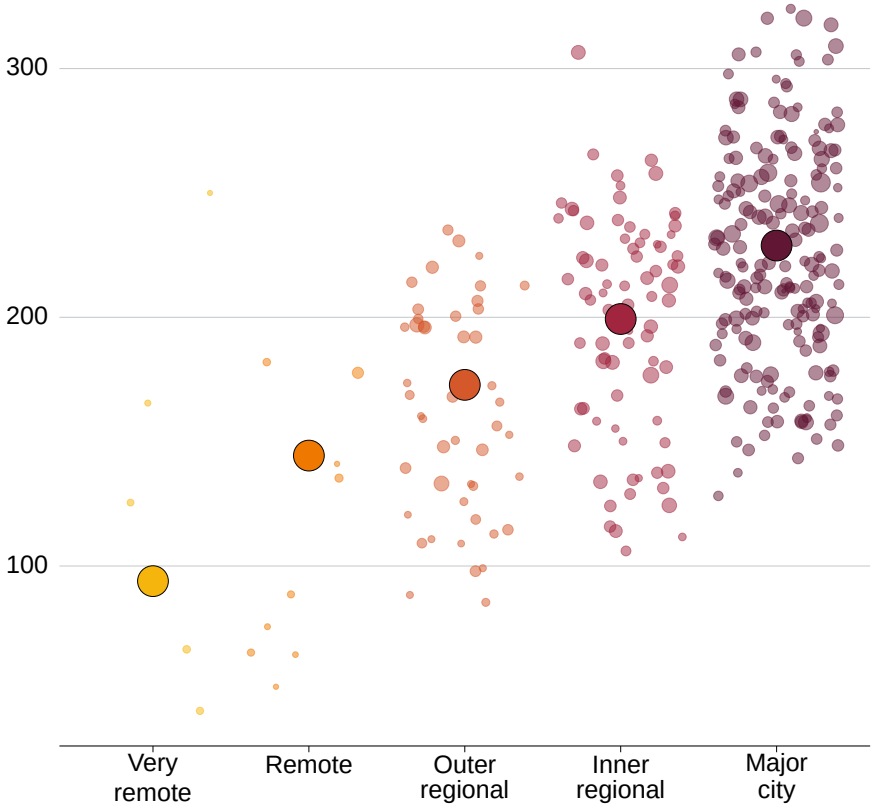
- Australia: 1; 1100 to 1199
- Oceania and Antarctica (excluding Australia): 1000; 1201 to 1607
- North-western Europe: any code in the 2000s
- Southern and eastern Europe: any code in the 3000s
- North Africa and the Middle East: any code in the 4000s
- South-East Asia: any code in the 5000s
- North-East Asia: any code in the 6000s
- Southern and Central Asia: any code in the 7000s
- Americas: any code in the 8000s
- Sub-Saharan Africa: any code in the 9000s.

Education – We defined a person's education level according to their highest level of education attainment in the Census, known as their HEAP.[7]

5. For more detail, see ABS (2021a).
6. For more detail, see ABS (2021b).
7. For more detail, see ABS (2021c).

Figure 1.2: COVID antiviral prescription rates are much higher in major cities

COVID antivirals dispensed per 1,000 people aged 70 and above by home SA3, March 2022 to September 2023



Notes: Rate per thousand calculated from total antivirals dispensed in the period through the PBS, divided by the population (in thousands) of non-visitors aged 70 and older as at the 2021 Census (see Chapter 1 on page 3 for more detail).

Source: Grattan Institute analysis of ABS PLIDA (2024).

English proficiency – We defined a person as being proficient in English if they speak English only, or use another language and speak English well/very well; and not proficient if they use another language and speak English not well/not well at all.[8]

Language other than English – We defined a person who speaks a language other than English at home as a binary variable, according to the Census.[9]

Index of Relative Social Disadvantage (IRSD) – We used each person's SA1-level IRSD decile where available, and SA2-level IRSD decile otherwise.[10]

Household income – We defined a person's income according to their Census-reported weekly equivalised household income, grouped into $500 increments from less than $500 per week up to $3,500 and more per week.

Remoteness area – We used the remoteness area classification of a person's usual residence from the Census. For figures showing SA3s by remoteness, we used the modal remoteness classification in that SA3 by population.

Residential care – We used residential care status as reported in the Census ('Residential status in a non-private dwelling (RLNP)').[11]

Patient health status

Health conditions – We used the following self-reported long-term health conditions from the Census:

- asthma (HASTP code 021)
- cancer (HCANP code 031)
- dementia (HDEMP code 041)
- diabetes (HDIAP code 051)
- heart disease (HHEDP code 061)
- kidney disease (HKIDP code 071)
- lung condition (HLUNP code 081)
- whether has had a stroke (HSTRP code 101)
- arthritis (HARTP code 011)
- mental health condition, including depression or anxiety (HMHCP code 091).

If a patient had two or more of these conditions, this was defined in a separate variable.

GP access factors

We derived the measures for continuity, regularity, and frequency using Medicare data of patient visits to a GP between 2016 and 2019. This period was chosen to gauge a person's typical pre-COVID pattern of visits.

We first identified GP visits from all Medicare services provided since 2011. We focused on Medicare service providers who had ever provided 10 or more services in the MBS Group classification 'A01' (GP attendances) since 2011; we then identified select GP services provided by these providers outside of a hospital. This is a conservative approach that should allow us to identify GP visits through 'core' GP services provided.

8. For more detail, see ABS (2021d).
9. ABS (2021e).
10. For more detail, see ABS (2023).
11. ABS (2021f).

GP continuity of care

Continuity of care quantifies how much an individual visits the *same* GP within their GP visits:[12]

$$\frac{\sum_{j=1}^{S} n_j^2 - N}{N(N-1)}$$

where N is their total number of GP visits, n_j is the number of visits to GP j, and S is the number of different GPs they visit.

We categorised the index values into four groups:[13] low (index is below 0.5), moderate (0.5 and higher but below 0.75), high (0.75 and higher but below 1), and perfect (1).

Regularity of visits

Regularity is determined by a relative variance index that measures whether GP visits are evenly spaced:[14]

$$1/\left(1 + \frac{\mathrm{sd}(days)}{\mathrm{mean}(days)} \times 100\right)$$

where $days$ is the number of days between GP visits, and $\mathrm{sd}(days)/\mathrm{mean}(days)$ is the coefficient of variation. This measure can only be calculated where there are at least three GP visits in the period. We split this measure into quintiles across the Australian population.

Frequency of visits

Frequency is calculated by counting the number of GP visits over the period. We split this measure into quintiles across the Australian population.

12. As per Bice and Boxerman (1977).
13. As defined in Youens et al (2021).
14. Following Youens et al (2019).

1.5.3 Regression results

The regression results in Figure 1.3 on the following page, Figure 1.4 on page 9, and Figure 1.5 on page 10 show estimates that are broadly similar to our raw descriptive results discussed above.[15] Importantly, the results for socio-economic status cannot be explained by disadvantage in low-COVID regional areas. Indigenous Australians are no longer the most disadvantaged group after controlling for other measures of disadvantage – but the raw disparity is more concerning than the results here since there is no acceptable reason Indigenous people should have higher rates of other disadvantage.

1.6 Limitations and robustness checks

1.6.1 Limitations

This analysis assumes similar rates of COVID infection among different groups. Infection rates may in fact vary. For example, people in less densely populated rural areas may have had lower infection rates.

However, our outcome measure is binary (it measures whether someone was dispensed at least one antiviral script), and the study period was long, covering 18 months when community infection rates were high across Australia. In addition, the results are similar to those for COVID vaccination, which should not be heavily influenced by infection rates.[16]

For these reasons, it is safe to assume that much of the variation in antiviral dispensing is not due to differences in infection rates.

15. We used both a logit model and linear probability model. We present the estimates of a linear probability model in Figure 1.3 on the next page, for ease of interpretation.
16. Breadon and Burfurd (2023). We used a robustness check with a nine-month vaccination window, to take account of vaccination being delayed by infection and illness. Vaccination gaps between different groups remained large, and similar to our findings for antiviral dispensing disparities.

1.6.2 Potential bias from different timing of infection across groups

Our finding of large access discrepancies across groups may in part be due to groups with antiviral access contracting COVID early on in the pandemic. This may lower their motivation for getting an antiviral the next time they contract COVID – for instance, because their symptoms may be less severe upon re-infection, or because they are less concerned about infection risks.

As a robustness check, we calculated the same dispensing rates for those 70 and older across different groups using only data from Western Australia (Figure 1.6 on page 10). Western Australia provides a good point of comparison because COVID only arrived there in large numbers after antivirals became available.[17] The dispensing rates in Figure 1.6 on page 10 show a much greater disparity for Indigenous West Australians, but less disparity for low socio-economic areas when compared to all of Australia in Figure 1.1 on page 4.

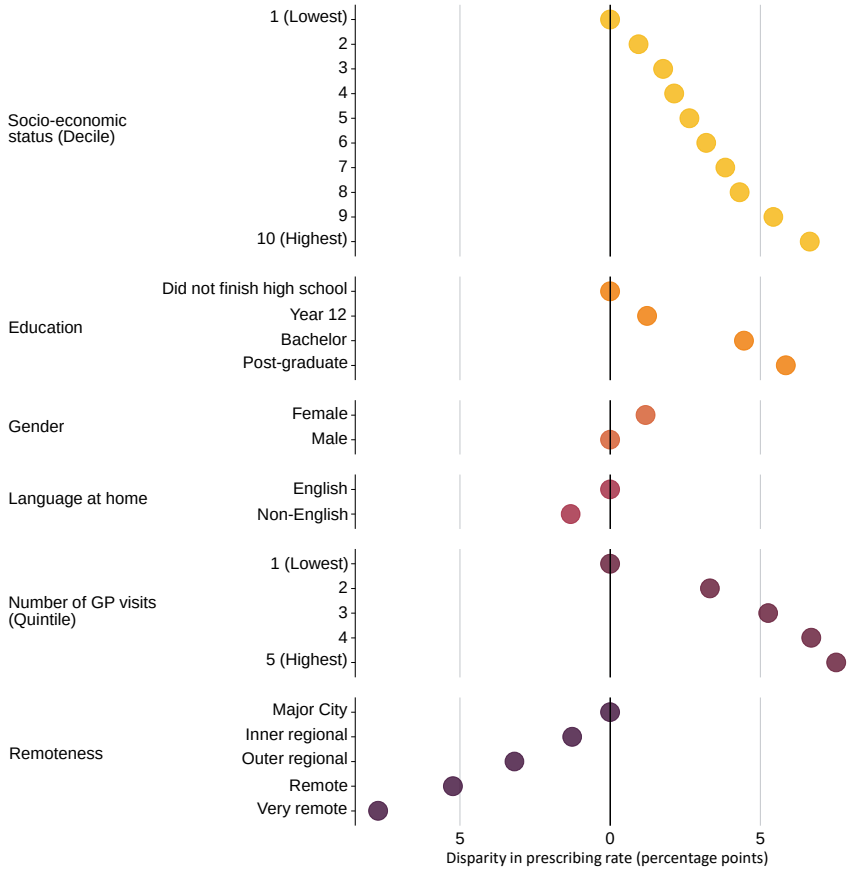
1.6.3 Access for remote communities

For remote regions, access to these antivirals may be provided by an intermediary rather than to the patient directly. If this is material, our analysis would underestimate the prescription rates in these regions.

As a robustness check, we also looked at 'prescriber bag' PBS records for the same drugs (PBS item numbers 13144T and 13147Y). These are items provided without charge to prescribers, who can provide them for free to patients in emergencies.[18]

17. The first COVID wave hit Western Australia around March 2022: covid19data.com.au (2023). This was the same month that the WA Government re-opened the state's borders and antivirals first became available on the PBS: Towie (2022).
18. DHAC (2023).

Figure 1.3: How often you see your doctor, where you live, and how much your earn all affect your likelihood of getting COVID antivirals
Percentage point difference in likelihood that someone aged 70 and older has been dispensed a COVID antiviral between March 2022 and September 2023



Note: This is the likelihood that a person is dispensed a COVID antiviral under the PBS at any point in the period, from a sample of everyone who would be 70 by the end of the period.

Source: Grattan Institute analysis of ABS PLIDA (2024).

Using the postcode of the prescriber as a proxy for their area of work, we find that including these prescriber bag doses does not result in any material difference in dispensing rates in remote regions.

1.6.4 Alternative regression samples

Our GP access measures (described in Section 1.5.2 on page 7) would include people who only entered the Medicare system at some point after 2016 – for instance, recent migrants. Our measures of GP visits for these people would not be able to capture visits they made before they entered the Medicare system, and thus be too low as a measure of their 'typical' GP visits.

Similarly, our sample would capture people who exited the Medicare system after March 2022. That means our measure of whether they had been dispensed an antiviral (Section 1.5.1 on page 4) – which would classify many of these people as not getting an antiviral – would underestimate the true dispensing probability.

As a robustness check to address these issues, we constructed an alternative smaller data sample for regression analysis. This sample is restricted to people who have had at least one Medicare service before 2016 and after February 2022; this reduces our sample slightly, to 3,123,115 observations. The regression results from this alternative sample show that our findings on disparities are robust, with little difference in most coefficients and/or relative effects across groups.

Figure 1.4: Other patient factors also affect likelihood of getting antivirals

Regression coefficients for likelihood of being dispensed a COVID antiviral between March 2022 and September 2023 (percentage points)

Variable	Term	Coefficient
Continuity of GP care	Low	0 (baseline)
	Moderate	0.0
	High	-0.7***
	Perfect	-2.1***
	<2 visits	-0.1
Regularity of GP care	Quintile 1	0 (baseline)
	Quintile 2	1.3***
	Quintile 3	1.6***
	Quintile 4	1.8***
	Quintile 5	1.2***
Health status	Asthma	2.6***
	Cancer	0.9***
	Dementia	2.6***
	Diabetes	0.7***
	Cardiovascular disease	1.6***
	Kidney disease	-0.9***
	Lung disease	0.7***
	Stroke	-0.2
	Arthritis	1.7***
	Mental health	0.1
	2+ health conditions	-0.7***
Residential care status	Not in residential care	0 (baseline)
	In residential care	10.8***
Indigenous status	Not Indigenous	0 (baseline)
	Indigenous	-3.2***

*Notes: Coefficients are percentage points. Coefficients indicated by *, **, and *** are statistically significant at the 5%, 1%, and 0.1% level respectively. The sample includes only patients aged 70 and older.*

Source: Grattan Institute analysis of ABS PLIDA (2024).

Figure 1.5: Other patient factors also affect likelihood of getting antivirals

Regression coefficients for likelihood of being dispensed a COVID antiviral between March 2022 and September 2023 (percentage points)

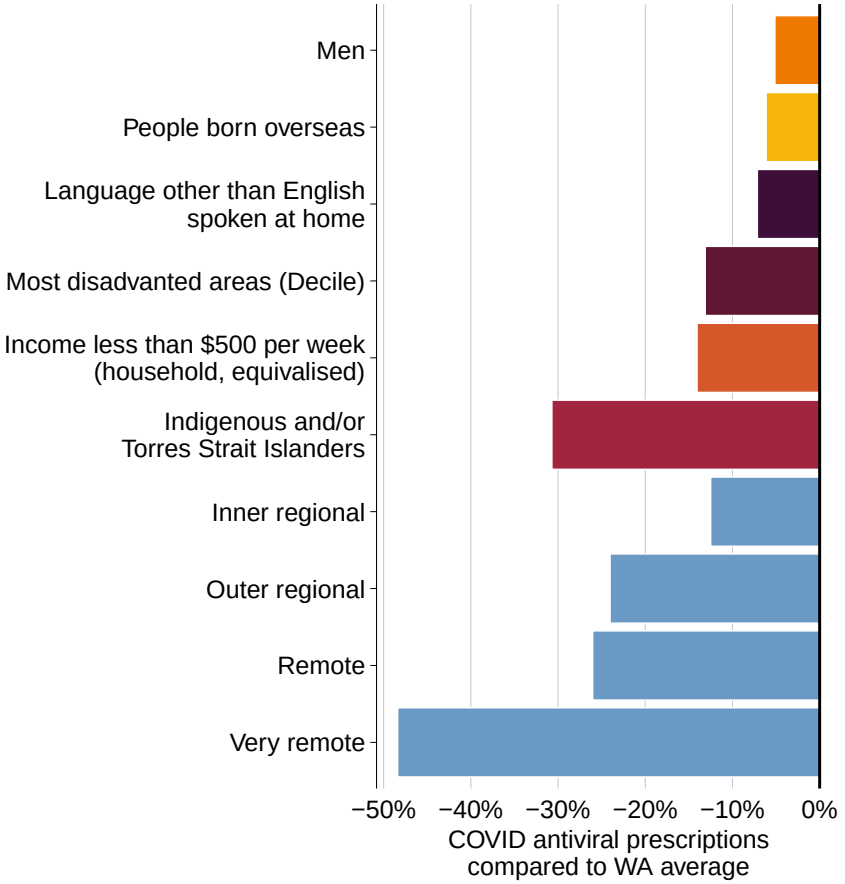
Variable	Term	Coefficient
Age	70-74 years	0 (baseline)
	75-79 years	1.2***
	80-84 years	1.1***
	85+ years	0.4***
Household income	<$500 per week	0 (baseline)
	$500-$999 per week	2.0
	$1,000-$1,499	2.9***
	$1,500-$1,999	3.5***
	$2,000-$2,499	4.2***
	$2,500-$2,999	5.2***
	$3,000-$3,499	5.3***
	$3,500+	6.1***
Country of birth	Australia	0 (baseline)
	Oceania and Antarctica	-4.4***
	North-West Europe	-1.5***
	Southern and Eastern Europe	-1.7***
	North Africa and the Middle East	-3.5***
	South-East Asia	-2.0***
	North-East Asia	0.8***
	Southern and Central Asia	-1.6***
	Americas	-2.1***
	Sub-Saharan Africa	-0.7**
	Other	-1.5***
English proficiency	Not proficient	0 (baseline)
	Proficient	1.0***

*Notes: Coefficients indicated by *, **, and *** are statistically significant at the 5%, 1%, and 0.1% level respectively. The sample includes only patients aged 70 and older.*

Source: Grattan Institute analysis of ABS PLIDA (2024).

Figure 1.6: The large disparities in COVID antiviral prescribing are evident even in Western Australia

Antiviral rate, comparison of selected groups with state average, Western Australia



Note: Antivirals dispensed in the period through the PBS, divided by the population (in thousands) of non-visitors aged 70 and older as at the 2021 Census.

Source: Grattan Institute analysis of ABS PLIDA (ibid).

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