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Thomas Plunkett
Karinna Saxby
Yuting Zhang

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Thomas Plunkett*¹ Karinna Saxby² and Yuting Zhang²

- 1) Centre for Health Economics, Monash Business School, Monash University, Caulfield, Australia
- 2) Melbourne Institute of Applied Economic and Social Research, the Health Analytics, Leadership and Economics (HALE) Hub, The University of Melbourne, Melbourne, Australia

* Corresponding author, Thomas.plunkett@monash.edu

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**Melbourne Institute of
Applied Economic and Social Research
The University of Melbourne
Victoria 3010 Australia
T +61 3 8344 2100
E melb-inst@unimelb.edu.au
W melbourneinstitute.unimelb.edu.au**

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ABSTRACT

Cost-related medication non-adherence is prevalent across many healthcare systems and is associated with poorer health outcomes. Pharmaceutical expenditure ceiling policies that reduce patient copayments once cumulative spending reaches a defined limit offer financial protection against high out-of-pocket medication costs.

Using whole-of-population administrative prescription claims data, we provide the first population-level quasi-experimental evidence on the effects of reaching Australia's Pharmaceutical Benefits Scheme Safety Net on medication utilisation (n=1,537,885). We apply a dynamic difference-in-differences framework, comparing prescription use before and after individuals reach the safety net, using future threshold-crossers as controls.

Reaching the safety net increased average monthly prescriptions dispensed by 0.715 (a 15% increase). Effects were driven primarily by pre-existing medications, particularly those used to treat chronic conditions. Responses were largest among lower-income individuals, especially those not eligible for government concession pricing, people with chronic health conditions, and individuals aged 40-69 years.

These findings suggest that reducing out-of-pocket medicine costs increases medication utilisation, with the strongest effects observed among populations at elevated risk of cost-related non-adherence. The results provide new evidence on the distributional effects of pharmaceutical expenditure ceiling policies and have implications for the design of policies intended to improve equitable access to medicines.

Keywords: Prescription; Healthcare; Health Behaviour; Health Care Financing; Population Health; Medical Access; Medical Subsidy Programs.

1 | INTRODUCTION

A well-documented barrier to appropriate medication utilisation is cost (Chandra et al., 2024; Gourzoulidis et al., 2017; Stewart et al., 2023). Inappropriate medication utilisation can take the form of non-adherence, either primary (i.e., initiation of medications) or secondary (i.e., reduced or intermittent use, or complete medication abandonment); or via substitution with cheaper, suboptimal alternatives (Stewart et al., 2023).

Cost-related medication non-adherence is a prominent feature across many healthcare systems, with recent surveys reporting it affects 20% of older adults in the US; an average of 7% of adults within the EU (ranging between 1-18% depending on country); 5% of Canadians; and 8% of Australians (Australian Bureau of Statistics, 2024; Dusetzina et al., 2023; Ghinea, 2024; OECD, 2019; Rebić et al., 2024). It is estimated that reduced drug utilisation from non-adherence and non-optimised medication therapy costs the USA over US\$528 billion a year; the European Union (EU) more than €125 billion a year; and Australia more than AU\$10 billion a year (Cutler et al., 2019; European Commission & Megavoice Ireland Ltd., 2005; Watanabe et al., 2018).

Cost-related medication non-adherence has been shown to lead to poorer patient outcomes, including increased hospitalisations, emergency department, and primary care visits, and elevated mortality, along with greater economic burden due to increased healthcare utilisation and reduced productivity (Achterbosch et al., 2025; Gourzoulidis et al., 2017; Han et al., 2014; Persaud et al., 2023; Walsh et al., 2019). These effects are particularly pronounced for populations with high medication treatment needs, such as those with chronic or long-term health conditions, as these individuals have larger costs, and for lower income individuals, where the cost of medications represents a larger proportion of disposable income (Duckett et al., 2022; Law et al., 2023).

From an economic perspective, medication copayments represent the price faced by consumers when accessing prescription medicines. Reductions in copayments are therefore expected to increase medication demand, although the magnitude of this response may vary according to individuals' health needs, financial circumstances, and prior medication use. To mitigate cost-related barriers to access, many countries operate pharmaceutical subsidy programs that limit patients' out-of-pocket expenditure. One common approach is the use of annual expenditure ceilings, whereby patient copayments are reduced once a predefined spending threshold has been reached (Barnieh et al., 2014).

A systematic review by Luiza et al. (2015) found that pharmaceutical cost-sharing policies generally affect medication utilisation, healthcare utilisation, and expenditures. More recently, a Finnish study found that reaching Finland's annual pharmaceutical reimbursement threshold increased prescription medication purchases by approximately 17%, highlighting the importance of expenditure ceiling policies in shaping medication use (Verho & Harju, 2025). Evidence from a universal prescription drug insurance reform further suggests that expanding drug coverage can improve health outcomes and reduce socioeconomic disparities in health (Lebihan, 2023). However, several important questions remain unresolved. In particular, less is known about how responses to reductions in out-of-pocket medication costs vary across patient populations. Understanding such heterogeneity is important because financial barriers to medication use are concentrated among individuals with lower incomes, poorer health, and greater medication needs (Duckett et al., 2022; Law et al., 2023). Consequently, evidence on how the effects of pharmaceutical expenditure ceiling policies are distributed across populations remains limited.

In this paper, we contribute to this literature by examining the effects of reaching Australia's Pharmaceutical Benefits Scheme (PBS) safety net on prescription medication utilisation,

drawing on a whole-of-population administrative dataset containing prescription dispensing records for every Australian who reached the safety net in 2021 ($n = 1,537,885$).

Our empirical strategy exploits variation in the timing of safety net attainment using a dynamic difference-in-differences framework. Specifically, we compare outcomes among individuals who have reached the safety net with outcomes among otherwise similar individuals who will reach it later in the year. This approach enables us to estimate treatment effects associated with a substantial reduction in out-of-pocket medication costs while accounting for common trends in prescription utilisation.

Beyond estimating the average effect of reaching the safety net, we investigate treatment effect heterogeneity across populations expected to face stronger financial barriers to medication use (Gandrakota et al., 2024; Kherallah et al., 2021; Law et al., 2023; Rebić et al., 2024; The Pharmacy Guild of Australia, 2025a, 2025b). We first examine differences by beneficiary status (concessional versus general), before investigating heterogeneity by income, health status, prior safety net attainment, age, sex, and rurality. Particular attention is given to lower-income individuals who may experience affordability pressures despite being ineligible for concessional pricing (Duckett et al., 2022). To identify this group, we exploit differences in concessional eligibility thresholds between pension-age and non-pension-age Australians.

We find that after reaching their safety net threshold, patients on average fill 0.715 (95% CI: 0.708, 0.722) more prescriptions per month, corresponding to a 15% increase relative to average pre-intervention use. Decomposition of these effects shows that approximately 92% of the increase is attributable to existing medications, while only 8% arises from newly dispensed medications. The effect is substantially larger among individuals who had also reached the safety net in the previous year. We further find stronger responses among individuals with chronic health conditions, middle-aged adults, residents of major cities, and lower-income

individuals, particularly those who do not qualify for concessional pricing but would likely be eligible under the more generous income thresholds applied to older Australians.

Our study makes three contributions. First, we provide population-scale evidence on the demand response to a substantial reduction in prescription drug copayments within a universal healthcare system. Second, we leverage linked administrative data to provide detailed evidence on treatment effect heterogeneity across groups known to face elevated risk of cost-related medication non-adherence. Third, the Australian setting provides a useful context in which to study pharmaceutical demand because prescription copayments are fixed and nationally determined, reducing many of the confounding factors present in insurance systems where patient cost-sharing varies across plans, medicines, or insurers.

These findings have important implications for the design of pharmaceutical subsidy programs. As healthcare systems face growing affordability pressures and increasing demand for medicines, understanding how patients respond, and which populations respond most strongly, to reductions in out-of-pocket medication costs can help policymakers design subsidies that improve access while directing resources towards populations most likely to benefit.

The remainder of this paper is set out as follows. Section 2 provides an overview of the institutional background of Australia's universal health insurance programme and the safety net scheme. Section 3 describes the data and Section 4 the empirical strategy. Section 5 presents the results of our analyses. Section 6 discusses the main policy implications and concludes.

2 | INSTITUTIONAL SETTING

All Australian citizens and permanent residents are entitled to free or subsidised healthcare under Australia's universal health insurance scheme, Medicare. Medicare provides free public hospital care and subsidises private inpatient services, out-of-hospital medical services (such as general practitioner or optometrist services), and prescription medicines to varying degrees (Department of Health, 2025).

Prescription medications are subsidised under the PBS. All individuals pay a copayment for prescription medicines, with lower copayments for welfare recipients, aged pensioners, and low-income earners (collectively referred to as *concessional patients*). In 2021, the copayment for concessional patients was AU\$6.60 (US\$5.55) and the income threshold for eligibility was approximately AU\$33,500 (US\$28,150)¹ per year, or AU\$57,700 (US\$48,500) for Age Pension recipients aged 67 years or older (Department of Social Services, 2023, 2024). For general patients, the copayment was AU\$41.30 (US\$34.70)(Department of Health & Aged Care, 2025a). In 2022, the eligibility threshold for pension-age individuals increased substantially to AU\$90,000 (US\$75,600), whereas the threshold for non-pension-age individuals increased only marginally to approximately AU\$34,300 (US\$28,800)(Department of Social Services, 2023, 2024). This divergence highlights the distinct income thresholds applied to pension-age and working-age populations and provides a useful benchmark for defining the income groups used in our analysis.

Australia also operates a ceiling policy scheme, known as the PBS Safety Net, which has existed since 1986 (Sweeny, 2009). Under this scheme, once patients reach an annual threshold of out-of-pocket expenditure on PBS medicines, their copayments are reduced for the

¹ Converted using OECD purchasing power parity, health category, 2021, United States base reference area (1 USD = 1.19 AUD). (OECD, 2026)

remainder of the calendar year. For concessional patients, PBS medicines become free, while general patients pay only the concessional copayment of AU\$6.60 (US\$5.55) per prescription. In 2021, the PBS Safety Net thresholds were AU\$316.80 (US\$266) for concessional patients and AU\$1,497.20 (US\$1,258) for general patients. Copayments and Safety Net thresholds are typically indexed annually in line with inflation² (Department of Health & Aged Care, 2025b, 2025c). The copayment and threshold values used in this study are reported in Supplementary Table S1.

All PBS-subsidised prescriptions dispensed to an individual, or eligible members of their family, contribute towards the relevant Safety Net threshold. Eligible prescriptions may be written by medical practitioners, dentists, optometrists, nurse practitioners, and midwives, and dispensed through community pharmacies, private hospitals, or public hospitals at discharge. However, medicines supplied during a public hospital inpatient stay do not count towards the Safety Net threshold (Australian Institute of Health and Welfare, 2024). For medicines used in regular long-term therapy, such as treatments for hypertension or hyperlipidaemia, supplies obtained within 20 days of a previous monthly prescription, or within 50 days of a bimonthly prescription, do not contribute to Safety Net accumulation (Department of Health & Aged Care, 2023).

Despite its long history, empirical evidence on the effects of the PBS Safety Net remains limited. Existing studies are sparse and rely largely on modelling assumptions rather than observed utilisation data. Brown et al. (2006) examined the policy using microsimulation

² From 2025 until 2030 there will be no copayment indexation

methods, while Kemp et al. (2013) relied on assumed medicine costs. To our knowledge, no previous study has evaluated the PBS Safety Net using real-world prescription utilisation data.

3 | DATA

3.1 The Person-Level Integrated Data Asset

The data for this analysis is sourced from the Person-Level Integrated Data Asset (PLIDA), an individual-level linked dataset which combines information from population Census and various administrative data sources including healthcare use, social security records, income and taxation, and employment (Australian Bureau of Statistics, 2025). The sample for analysis was constructed using the 2021 Census linked to prescription medicine records. Census data contains sociodemographic information including age, sex, location of residence, income, and whether they had a long-term health condition.

Prescription medication records provide information on the exact date the prescription was filled, the copayment, whether the patient had reached their safety net, and the World Health Organisation (WHO) anatomical, therapeutic, and chemical code (ATC) for the medication. Using these records, we retained a sample of all individuals who had a recorded safety net dispensing in 2021.

For each individual, in each month of 2021, we calculated the total number of dispensed prescriptions for all medications and those typically used to treat chronic, or acute, conditions. Details on the chronic and acute medication classification is provided in Supplementary Table S2. To explore potential stockpiling behaviour, we also classified medications into whether they were regular, pre-existing medications or new medications. Specifically, we classified a medication as ‘new’ if there was no dispensing in the previous three months. To account for those who reached the safety net in the first few months, we also utilised the prescription records for the three months prior to 2021 (i.e., October to December of 2020).

3.2 Descriptive statistics

The descriptive statistics for all individuals who reached the Safety Net in 2021 (n=1,537,885) are presented in Table 1. The average age within the sample was 70 years old, with, approximately, 74% being of pensioner age (67 or older); 54% female; 91% concessional; 85% having a long-term health condition; and 64% living in a major city. The average total monthly prescription being filled prior to reaching the safety net was 4.71, with 0.25 being for acute conditions and 3.79 for chronic conditions.³ The median personal income within the sample was AU\$20,800-\$25,999. The median month individuals reached the PBS Safety Net was August, with the mean time receiving reduced copayments being 4.8 months. The number of people reaching the safety net naturally increased over the year, with just under 6% having reached by April, and then another 8% reaching in May. From June onwards roughly 200,000 individuals (approximately 12% of the overall sample) reached the threshold each month, until the end of the year (Figure 1).

4 | EMPIRICAL STRATEGY

As our treatment (reaching the safety net) occurs throughout the year, this creates variations in treatment timing, meaning a standard two-way fixed effects estimator could potentially be biased by comparisons that utilise already-treated individuals as controls, leading to negative weights (Roth et al., 2023). To account for this, we utilise the estimator proposed by De Chaisemartin and d'Haultfoeuille (2020), which compares treated individuals only with those not yet treated, avoiding this source of bias.

³ Note: some medications could not be classified as acute or chronic due to their nature of being used in both situations for different conditions. Hence, these values do not add up to the overall mean. See Supplementary materials for more information.

To illustrate this, we classify individuals into groups according to the calendar month in which they reach the safety net threshold, indexed $g = 1, \dots, G$, with F_g denoting the period in which group g 's treatment status changes. The month before reaching the safety net, $F_{g-1} - 1$, serves as the baseline against which outcomes are measured.

For each group g and each number of periods l , a group-specific treatment effect is constructed by taking the change in group g 's prescription utilisation between $F_g - 1$ and $F_g + l$, and subtracting the corresponding change over the same interval among individuals who have not yet reached the threshold by $F_g + l$, illustrated by this formula:

$$DID_{g,l} = Y_{g,F_g+l} - Y_{g,F_g-1} - \frac{1}{N_{g,l}} \sum_{g': F_{g'} > F_g + l} (Y_{g',F_g+l} - Y_{g',F_g-1}) \quad (1)$$

where $Y_{g,t}$ denotes total monthly prescriptions for group g in period t , and $N_{g,l}$ is the number of not-yet-treated groups used in constructing the comparison at l .

An effect at period l is then obtained by averaging across all groups for which a group-specific estimate can be formed:

$$DID_l = \frac{1}{N_l} \sum_g DID_{g,l} \quad (2)$$

with N_l denoting the number of contributing groups.

To summarise the overall effect of reaching the safety net across a three-month post-treatment window, we further aggregate these period-specific estimates into a single pooled average treatment effect on the treated (ATT):

$$\delta = \sum_{l=0}^3 \omega_l DID_l, \quad \sum_{l=0}^3 \omega_l = 1 \quad (3)$$

where the weights ω_l are proportional to N_l , the number of observations contributing to each period-specific estimate. Standard errors are computed analytically, clustered at the individual level (de Chaisemartin & D’Haultfœuille, 2023).

Notably, a key identifying assumption for the causal interpretation of this model is that differences in outcomes between treated and not yet treated individuals would evolve in parallel over time and continue to do so in the absence of treatment. We explicitly test this with pre-treatment placebo estimates. However, one such violation of these pre-trends could be anticipation. This is particularly important when investigating medication use, as earlier work examining changes in copayment levels demonstrated that individuals will change their medication usage in response to upcoming copayment changes (Kaplan & Zhang, 2017). Similarly, it is possible, we may expect a level of anticipation prior to individuals reaching the threshold, particularly for those who have reached the threshold before. To account for this, we conducted a robustness analysis using three months prior to reaching the safety net ($F_g - 3$) as the baseline.

We conducted several additional robustness checks, including: (1) estimating a semi-elasticity model using $\ln(\text{total prescriptions} + 1)$ to account for the skewed distribution of pharmaceutical medication use (Supplementary Figure S1); (2) restricting the sample to individuals who would have reached the safety net independently (i.e., excluding low-use family members); (3) excluding January and December to account for potential stockpiling behaviour, which may depress average use in the first few months of the year and inflate use at year-end; (4) excluding individuals who received multiple months’ worth of dispensings supplied at once (known as “Regulation 24” prescriptions); (5) excluding individuals who died during 2021; (6) excluding outliers, defined as those in the top 1% of monthly prescription users; (7) redefining regular and new medications using a six-month rather than three-month look-back period; and (8)

excluding residents of Victoria and New South Wales (NSW), where COVID-19 lockdowns may have affected medication use patterns during 2021.

Following the main analyses and robustness checks, we examined heterogeneity in treatment effects across patient characteristics. First, we assessed whether effects differed between concessional and general beneficiaries. This comparison is of particular interest because the policy generated different effective price changes across beneficiary groups. While the smaller reduction in copayments for concessional patients would predict weaker behavioural responses, concessional beneficiaries also tend to have lower incomes and greater healthcare needs, both of which may increase the marginal value of reduced out-of-pocket costs.

We then investigated heterogeneity by income in more detail. Specifically, individuals were classified into income categories using total personal income reported in the 2021 Census (Australian Bureau of Statistics, 2021): AU\$0, AU\$1-\$33,799, AU\$33,800-\$51,999, AU\$51,000-\$90,999, and AU\$91,000 and above. These brackets were chosen to align with concessional eligibility thresholds and their subsequent updates (Department of Social Services, 2023, 2024). To further isolate the role of income among individuals not receiving government benefits, we exploited differences in eligibility thresholds for pensioner- and non-pensioner-aged individuals. Restricting the sample to those aged under 67 years, we classified individuals as: (1) concessional; (2) "general, low income" (AU\$33,800-64,999), who would largely qualify for concession under the higher pensioner threshold; and (3) "general, high income" (AU\$65,000+), who would not qualify under either threshold.

Finally, we explored heterogeneity according to: (1) prior safety net status (whether the individual had reached the safety net in 2020); (2) the presence of a long-term health condition; (3) sex; (4) age; and (5) rurality (major city, inner regional, outer regional, remote, and very remote).

All analyses were conducted in Stata version 18.

5 | RESULTS

5.1 Main results

The main estimation results are presented in Figure 2 and Table 2 (full regression results available in Supplementary Table S3). Figure 2 shows the event-study estimates in each month relative to when individuals first reach the safety net for (1) all prescriptions filled, (2) prescriptions for acute conditions, and (3) prescriptions for chronic conditions. In the month of reaching the safety net, utilisation jumps by an average of 1.178 additional total prescriptions, mainly attributed to an uptick in the utilisation of prescriptions for chronic conditions (0.869). The average increase in subsequent months then reduces but remains higher than reference levels. This is possibly due to those with more post periods (i.e., those who reached the safety net earlier in the year) having higher pre-safety net means and less capacity for an increase.

Across the four-month post-intervention period regressed, the ATT is 0.715 (95% CI: 0.708, 0.722) additional scripts per month, which corresponds to an extra 15% per month compared with the pre-threshold mean of 4.7 prescriptions per month. From a practical perspective, for the average individual who reached the safety net in August, this would result in an additional three or four prescriptions a year.

This effect was largely driven by the intensive margin, with approximately 92% (ATT: 0.656) of the increase occurring from regular, pre-existing medications, particularly medications used to treat chronic conditions (ATT: 0.528), while at the extensive margin, only 8% (ATT: 0.059) of the increase was due to newly dispensed medications.

5.2 Robustness

Notably, our results indicate that utilisation is somewhat different in the periods prior to reaching the safety net, and the joint placebo test rejects the null of no pre-treatment effects ($p < 0.001$). Inspection of the dynamic estimates suggests that deviation from parallel trends is evident in the reference period, the month immediately prior to reaching the safety net, consistent with modest anticipatory behaviour. To assess the importance of this violation, we re-estimated the model using a reference period three months prior to reaching the safety net, a time before this anticipatory behaviour (Callaway, 2020; Callaway & Sant'Anna, 2021). In this specification, utilisation in the reference period is approximately 0.06 prescriptions higher than the baseline reference period, indicating a relatively small anticipatory response. Most importantly, the re-estimated ATT (Figure 3 and Table 3), although lessened, remains principally unchanged when the alternative reference period is used (0.636), suggesting that the main findings are not driven by pre-treatment behavioural adjustments.

The estimated treatment effect was also robust across a range of alternative specifications (reported in Table 3). Estimates were somewhat larger when the analysis was restricted to individuals who would have reached the safety net independently, while they were modestly smaller when excluding individuals with Regulation 24 prescriptions, outliers, or residents of Victoria and NSW. The semi-elasticity specification produced a qualitatively similar estimate, corresponding to a 11.3% increase in medication utilisation. Excluding individuals who died during 2021, and omitting January and December (to account for potential stockpiling behaviour), had little effect on the results. Similarly, redefining regular and new medications using a six-month rather than three-month look-back period did not materially alter the findings. Overall, the results indicate that the estimated effect of reaching the safety net is robust to alternative model specifications, sample restrictions, and outcome definitions.

5.3 Heterogeneity analyses

Heterogeneity analyses are presented in Figure 4 and Table 2 as ATT estimates. For income-related characteristics, the average treatment effect after reaching the safety net was similar for concessional and general patients, however, a clearer income gradient emerged when patients were stratified by income threshold quantiles. Among those in the lowest income quantile, the estimated ATT was 0.776 additional prescriptions per month, compared with 0.610 for those in the highest quantile. A similar pattern was observed among ‘general, low income’ individuals compared with their higher income counterparts (0.807 vs 0.670).

Demographic analyses showed larger treatment effects among individuals with a reported long-term health condition (0.736 vs 0.594), individuals aged 40 to 69 years, and those living in major cities. Effects were similar between females and males.

Subgroup-specific analyses showed that the treatment effect was substantially larger among individuals who had reached the safety net in the previous year than among those who had not (0.648 vs 0.370).

6 | DISCUSSION

In this paper, we examined the impact of Australia's PBS Safety Net, a pharmaceutical expenditure ceiling policy that substantially reduces patient copayments after an annual threshold is reached. We first estimated the overall impact of reaching the Safety Net on prescription utilisation before investigating whether responses differed according to medication type, prior medication use, and patient characteristics associated with cost-related non-adherence.

We found that reaching the Safety Net was associated with a modest increase of 0.715 prescriptions filled per month, corresponding to a 15% increase in utilisation, or around three to four additional prescriptions annually for the average individual who reached the threshold.

The increase was primarily driven by pre-existing medications, particularly those used to manage chronic conditions, and was concentrated among individuals who had previously reached the Safety Net. Overall, these findings suggest that reductions in out-of-pocket costs mainly affect ongoing medication management rather than the initiation of new therapies.

Our findings are consistent with earlier literature demonstrating that pharmaceutical utilisation responds to patient cost-sharing. In Finland, Verho and Harju (2025) found that reaching a national pharmaceutical reimbursement threshold increased prescription medicine purchases by approximately 17%, a result similar to our estimate despite differences in healthcare systems and policy design. Similarly, Einav et al. (2015) showed that Medicare Part D patients in the United States responded to nonlinear pharmaceutical insurance contracts by adjusting their medication utilisation when out-of-pocket costs changed. Together, these findings suggest that expenditure ceiling policies and reimbursement thresholds can meaningfully influence medicine use across a range of institutional settings and are important mechanisms for improving medication access internationally, particularly among populations with high medicine needs or limited financial resources.

Our results also contribute to a growing literature examining heterogeneity in responses to pharmaceutical cost-sharing. Prior work has shown that medication demand is not uniform across populations. For example, Einav et al. (2018) documented substantial heterogeneity in drug-specific price elasticities within Medicare Part D, while Chandra et al. (2024) and Guindon et al. (2022) found that individuals facing greater financial barriers or health needs exhibit larger responses to changes in prescription drug cost-sharing. Consistent with this evidence, we observed larger treatment effects among individuals with lower incomes, those living with chronic disease, and those who use medications typically prescribed for long-term conditions. These findings suggest that reductions in copayments disproportionately benefit populations facing the greatest barriers to treatment adherence.

Particularly notable was the strong response among lower-income individuals who did not qualify for concessional PBS pricing. To our knowledge, this is the first quantitative study to specifically examine this population, despite qualitative research identifying these individuals as being at elevated risk of cost-related non-adherence (Desborough et al., 2025; Duckett et al., 2022). The magnitude of the treatment effect among this group was comparable to that observed for concession card holders and larger than that of higher-income general patients. This finding provides quantitative support for claims that affordability pressures extend beyond populations formally eligible for government assistance and suggests that existing concession arrangements may not fully identify all individuals experiencing financial hardship.

The concentration of effects among existing medicines and chronic therapies also provides insight into the mechanisms through which cost-sharing affects utilisation. Financial barriers appear to influence the continuity of treatment more than initial uptake. This pattern is consistent with evidence from reviews of financial medication assistance programs showing that reducing out-of-pocket costs primarily improves adherence and persistence among existing users rather than generating large increases in treatment initiation (Hung et al., 2021). Similarly, evidence from nonlinear insurance settings suggests that patients alter medication purchasing behaviour in response to changes in current out-of-pocket costs, particularly for medications used on an ongoing basis (Einav et al., 2015; Simonsen et al., 2021).

Our study also contributes directly to the limited Australian literature on the PBS Safety Net. Existing Australian studies have largely focused on modelling financial impacts rather than measuring behavioural responses. Brown et al. (2006) found that older and lower-to-middle-income households were most likely to reach the Safety Net, while Kemp et al. (2013) reported that the policy reduced out-of-pocket costs and increased discretionary household income. However, both studies relied on simulation methods rather than observed utilisation behaviour.

To our knowledge, this study is the first to use population-level administrative data to evaluate the impact of reaching the PBS Safety Net on prescription medicine utilisation.

These results should, however, be considered within the context of several limitations. First, our data did not identify individuals sharing a family Medicare card, despite Safety Net accumulation occurring at the family level. However, a robustness analysis restricted only to individuals who reached the Safety Net independently produced similar results. Second, our event-study estimates indicated some evidence of anticipatory behaviour immediately prior to Safety Net attainment. This is consistent with previous evidence from nonlinear pharmaceutical insurance arrangements, where patients adjust medication purchasing in anticipation of future changes in out-of-pocket costs (Kaplan & Zhang, 2017). Reassuringly, the magnitude of this anticipation effect was modest, and our findings remained qualitatively similar when using an alternative reference period three months prior to reaching the Safety Net. While the results should therefore be interpreted as behavioural responses associated with Safety Net attainment, rather than definitive causal estimates under perfectly parallel pre-treatment trends, the robustness analyses suggest that anticipatory behaviour is unlikely to materially affect our substantive conclusions. Third, the PLIDA dataset does not contain information on potentially important downstream outcomes such as emergency department presentations, hospitalisations, or longer-term health outcomes. Consequently, we cannot determine whether the observed increases in medication utilisation translated into improved health. Finally, the analysis was conducted using 2021 data, a period affected by the COVID-19 pandemic. While sensitivity analyses excluding heavily affected jurisdictions produced similar results, we cannot entirely rule out the influence of pandemic-related behavioural changes.

Despite these limitations, this study provides several unique contributions. To our knowledge, this is the first population-level quasi-experimental study of the impact of the PBS Safety Net on medication utilisation in Australia and one of the few studies internationally to examine

heterogeneity in responses across a wide range of socioeconomic and clinical groups. By capturing all Australians who reached the PBS Safety Net, the study provides a level of precision and external validity that has not previously been possible.

The findings also have important policy implications. While the PBS Safety Net appears to function as intended by reducing financial barriers and increasing medication utilisation, the larger responses observed among lower-income populations suggest that some groups may remain underutilising medicines prior to reaching the threshold. This interpretation is consistent with broader evidence that pharmaceutical utilisation is highly responsive to affordability among vulnerable populations. Particularly noteworthy was the strong response among lower-income general beneficiaries who were not eligible for concessional pricing, suggesting that existing concession arrangements may not fully identify all individuals experiencing affordability pressures. Recently, Australia has introduced several initiatives aimed at improving medicine affordability, including reductions in PBS copayments, changes to dispensing arrangements, freezes on annual indexation, and reductions in Safety Net thresholds. Our findings suggest that further reform may be warranted to improve the equity of financial protection provided by the PBS.

Several potential policy approaches exist. Internationally, some countries link pharmaceutical expenditure ceilings to income, while others use shorter accumulation periods or integrated healthcare expenditure caps that combine medication and healthcare spending (Barnieh et al., 2014; Lee & Cheong, 2017). The comparatively large responses observed among lower-income non-concessional patients suggest that reforms targeted at this group may yield particularly large benefits, whether through further reductions in out-of-pocket costs, expanded eligibility for concessional arrangements, or alternative approaches to targeting financial assistance. Future research should investigate alternative Safety Net designs and evaluate whether

increased medication utilisation following threshold attainment translates into improved health outcomes and reduced healthcare utilisation.

Overall, our findings demonstrate that reducing prescription medicine costs increases utilisation, particularly among populations at elevated risk of cost-related non-adherence. The effects are concentrated among chronic therapies and vary substantially across socioeconomic and clinical groups. These results strengthen the evidence that pharmaceutical expenditure ceiling policies improve access to medicines while highlighting opportunities to better target financial protection toward those experiencing the greatest affordability challenges.

7 | REFERENCES

- Achterbosch, M., Aksoy, N., Obeng, G. D., Ameyaw, D., Ágh, T., & van Boven, J. F. M. (2025). Clinical and economic consequences of medication nonadherence: a review of systematic reviews [Review]. *Frontiers in Pharmacology*, Volume 16 - 2025. <https://doi.org/10.3389/fphar.2025.1570359>
- Australian Bureau of Statistics. (2021). *Age (AGEP)*. ABS. <https://www.abs.gov.au/census/guide-census-data/census-dictionary/2021/variables-topic/population/age-agep>
- Australian Bureau of Statistics. (2024). *Patient Experiences 2023-24*. ABS. <https://www.abs.gov.au/statistics/health/health-services/patient-experiences/latest-release>
- Australian Bureau of Statistics. (2025). *Person Level Integrated Data Asset (PLIDA)*. ABS. <https://www.abs.gov.au/about/data-services/data-integration/integrated-data/person-level-integrated-data-asset-plida>
- Australian Institute of Health and Welfare. (2024). *Medicines in the health system*. Australian Government. <https://www.aihw.gov.au/reports/medicines/medicines-in-the-health-system>
- Barnieh, L., Clement, F., Harris, A., Blom, M., Donaldson, C., Klarenbach, S., Husereau, D., Lorenzetti, D., & Manns, B. (2014). A systematic review of cost-sharing strategies used within publicly-funded drug plans in member countries of the organisation for economic co-operation and development. *PloS one*, 9(3), e90434. <https://doi.org/10.1371/journal.pone.0090434>
- Brown, L., Abello, A., & Harding, A. (2006). Pharmaceuticals Benefit Scheme: Effects of the Safety Net. *Agenda: A Journal of Policy Analysis and Reform*, 13(3), 211–224.
- Callaway, B. (2020). Difference-in-Differences for Policy Evaluation. In K. F. Zimmermann (Ed.), *Handbook of Labor, Human Resources and Population Economics* (pp. 1–61). Springer International Publishing. https://doi.org/10.1007/978-3-319-57365-6_352-1
- Callaway, B., & Sant’Anna, P. H. (2021). Difference-in-differences with multiple time periods. *Journal of Econometrics*, 225(2), 200–230.
- Chandra, A., Flack, E., & Obermeyer, Z. (2024). The Health Costs of Cost Sharing. *Q J Econ*, 139(4), 2037–2082. <https://doi.org/10.1093/qje/qjae015>
- Cutler, R. L., Torres-Robles, A., Wiecek, E., Drake, B., Van der Linden, N., Benrimoj, S. I. C., & Garcia-Cardenas, V. (2019). Pharmacist-led medication non-adherence intervention: reducing the economic burden placed on the Australian health care system. *Patient Prefer Adherence*, 13, 853–862. <https://doi.org/10.2147/ppa.S191482>
- De Chaisemartin, C., & d’Haultfoeuille, X. (2020). Two-way fixed effects estimators with heterogeneous treatment effects. *American Economic Review*, 110(9), 2964–2996.
- de Chaisemartin, C., & D’Haultfoeuille, X. (2023). Two-way fixed effects and differences-in-differences estimators with several treatments. *Journal of Econometrics*, 236(2), 105480. <https://doi.org/10.1016/j.jeconom.2023.105480>
- Department of Health, Disability & Ageing, . (2025). *The Australian health system*. Commonwealth of Australia. <https://www.health.gov.au/about-us/the-australian-health-system>

- Department of Health & Aged Care. (2023). *PBS Safety Net early supply rule - Consumer Frequently Asked Questions*. Commonwealth of Australia. <https://www.pbs.gov.au/info/general/safety-net-faq>
- Department of Health & Aged Care. (2025a). *Pharmaceutical Benefits: Fees, Patient Contributions and Safety Net Thresholds*. Commonwealth of Australia. <https://www.pbs.gov.au/info/healthpro/explanatory-notes/front/fee>
- Department of Health & Aged Care. (2025b). *The Safety Net Scheme*. Commonwealth of Australia. https://www.pbs.gov.au/info/healthpro/explanatory-notes/section1/Section_1_5_Explanatory_Notes
- Department of Health & Aged Care. (2025c). *Strengthening Medicare: Cheaper medicines to get even cheaper*. Commonwealth of Australia. <https://www.health.gov.au/ministers/the-hon-mark-butler-mp/media/strengthening-medicare-cheaper-medicines-to-get-even-cheaper>
- Department of Social Services. (2023). *Guides to Social Policy Law Social Security Guide: 3.4.1.10 Qualification for Age*. Commonwealth of Australia. <https://guides.dss.gov.au/social-security-guide/3/4/1/10>
- Department of Social Services. (2024). *Guides to Social Policy Law Social Security Guide: 4.10.7 Historical concession cards income & assets limits*. Commonwealth of Australia. <https://guides.dss.gov.au/social-security-guide/4/10/7>
- Desborough, J., Maskell-Knight, C., Wang, S., Parkinson, A., Butler, D., Law, H.-D., Butler, K., Watts, L., Huynh, E., Hodson, F., Ibrahim, S., Veitch, J., Kingsford-Smith, J., Kidd, M., & Donaldson, C. (2025). Lived experience of out-of-pocket costs of health care and medicines by people with chronic conditions and their families in Australia: a systematic review of the qualitative literature. *Health Policy*, 158, 105359. <https://doi.org/10.1016/j.healthpol.2025.105359>
- Duckett, S., Stobart, A., & Lin, L. (2022). *Not so universal: how to reduce out-of-pocket healthcare payments*. Grattan Institute. <https://grattan.edu.au/wp-content/uploads/2022/03/Not-so-universal-how-to-reduce-out-of-pocket-healthcare-payments-Grattan-Report.pdf>
- Dusetzina, S. B., Besaw, R. J., Whitmore, C. C., Mattingly, T. J., 2nd, Sinaiko, A. D., Keating, N. L., & Everson, J. (2023). Cost-Related Medication Nonadherence and Desire for Medication Cost Information Among Adults Aged 65 Years and Older in the US in 2022. *JAMA Netw Open*, 6(5), e2314211. <https://doi.org/10.1001/jamanetworkopen.2023.14211>
- Einav, L., Finkelstein, A., & Polyakova, M. (2018). Private Provision of Social Insurance: Drug-Specific Price Elasticities and Cost Sharing in Medicare Part D. *American Economic Journal: Economic Policy*, 10(3), 122–153. <https://doi.org/10.1257/pol.20160355>
- Einav, L., Finkelstein, A., & Schrimpf, P. (2015). The Response of Drug Expenditure to Nonlinear Contract Design: Evidence from Medicare Part D. *The Quarterly Journal of Economics*, 130(2), 841–899. <https://doi.org/10.1093/qje/qjv005>
- European Commission, & Megavoice Ireland Ltd. (2005). *A Low Cost, Environmentally, Friendly Smart Packaging Technology to Differentiate European SME Suppliers to Service the Needs of the Blind, Illiterate and Europe's Aging Population* (Project ID:

- 17893). European Union/European Commission.
<https://cordis.europa.eu/project/id/17893>
- Gandrakota, N., Ramakrishnan, M., Sudireddy, K., & Shah, M. K. (2024). Factors affecting Cost-Related Medication Non-Adherence among US population with Cardiovascular Risk Factors. *medRxiv*, 2024.2003.2011.24304136.
<https://doi.org/10.1101/2024.03.11.24304136>
- Ghinea, N. (2024). Cost barriers to medication access in Australia: an analysis of the Patient Experience Survey in context. *Medical Journal of Australia*, 221(8), 414–416.
<https://doi.org/10.5694/mja2.52427>
- Gourzoulidis, G., Kourlaba, G., Stafylas, P., Giamouzis, G., Parissis, J., & Maniadakis, N. (2017). Association between copayment, medication adherence and outcomes in the management of patients with diabetes and heart failure. *Health Policy*, 121(4), 363–377. <https://doi.org/10.1016/j.healthpol.2017.02.008>
- Guindon, G. E., Fatima, T., Garasia, S., & Khoe, K. (2022). A systematic umbrella review of the association of prescription drug insurance and cost-sharing with drug use, health services use, and health. *BMC Health Services Research*, 22(1), 297.
<https://doi.org/10.1186/s12913-022-07554-w>
- Han, E., Suh, D.-C., Lee, S.-M., & Jang, S. (2014). The impact of medication adherence on health outcomes for chronic metabolic diseases: A retrospective cohort study. *Research in Social and Administrative Pharmacy*, 10(6), e87–e98.
<https://doi.org/10.1016/j.sapharm.2014.02.001>
- Huber, C. A., Szucs, T. D., Rapold, R., & Reich, O. (2013). Identifying patients with chronic conditions using pharmacy data in Switzerland: an updated mapping approach to the classification of medications. *BMC Public Health*, 13(1), 1030.
<https://doi.org/10.1186/1471-2458-13-1030>
- Hung, A., Blalock, D. V., Miller, J., McDermott, J., Wessler, H., Oakes, M. M., Reed, S. D., Bosworth, H. B., & Zullig, L. L. (2021). Impact of financial medication assistance on medication adherence: a systematic review. *J Manag Care Spec Pharm*, 27(7), 924–935. <https://doi.org/10.18553/jmcp.2021.27.7.924>
- Kaplan, C. M., & Zhang, Y. (2017). Anticipatory Behavior in Response to Medicare Part D's Coverage Gap. *Health economics*, 26(3), 338–351. <https://doi.org/10.1002/hec.3311>
- Kemp, A., Preen, D. B., Glover, J., Semmens, J., & Roughead, E. E. (2013). Impact of cost of medicines for chronic conditions on low income households in Australia. *Journal of Health Services Research & Policy*, 18(1), 21–27.
<https://doi.org/10.1258/jhsrp.2012.011184>
- Kherallah, R., Al Rifai, M., Kamat, I., Krittanawong, C., Mahtta, D., Lee, M. T., Liu, J., Nasir, K., Valero-Elizondo, J., Patel, J., Al-Mallah, M. H., Petersen, L. A., & Virani, S. S. (2021). Prevalence and predictors of cost-related medication nonadherence in individuals with cardiovascular disease: Results from the Behavioral Risk Factor Surveillance System (BRFSS) survey. *Prev Med*, 153, 106715.
<https://doi.org/10.1016/j.ypmed.2021.106715>
- Law, H. D., Marasinghe, D., Butler, D., Welsh, J., Lancsar, E., Banks, E., Biddle, N., & Korda, R. (2023). Progressivity of out-of-pocket costs under Australia's universal health care system: A national linked data study. *Health Policy*, 127, 44–50.
<https://doi.org/10.1016/j.healthpol.2022.10.010>

- Lebihan, L. (2023). The impact of a mandatory universal drug insurance program on health behaviors and outcomes. *Health economics*, 32(9), 2006–2046. <https://doi.org/10.1002/hec.4699>
- Lee, T. J., & Cheong, C. (2017). Has the Copayment Ceiling Improved Financial Protection in the Korean National Health Insurance System? Evidence From the 2009 Policy Change. *J Prev Med Public Health*, 50(6), 393–400. <https://doi.org/10.3961/jpmph.17.151>
- Luiza, V. L., Chaves, L. A., Silva, R. M., Emmerick, I. C. M., Chaves, G. C., Fonseca de Araújo, S. C., Moraes, E. L., & Oxman, A. D. (2015). Pharmaceutical policies: effects of cap and co-payment on rational use of medicines. *Cochrane Database of Systematic Reviews*(5). <https://doi.org/10.1002/14651858.CD007017.pub2>
- OECD. (2019). *Health for Everyone?: Social Inequalities in Health and Health Systems*. OECD Health Policy Studies. OECD Publishing. Paris. <https://doi.org/10.1787/3c8385d0-en>
- OECD. (2026). *PPP detailed results, 2020 onwards*. OECD Data Explorer. <https://data-explorer.oecd.org/>
- Persaud, N., Bedard, M., Boozary, A., Glazier, R. H., Gomes, T., Hwang, S. W., Jüni, P., Law, M. R., Mamdani, M., Manns, B., Martin, D., Morgan, S. G., Oh, P., Pinto, A. D., Shah, B. R., Sullivan, F., Umali, N., Thorpe, K. E., Tu, K.,...team, C. M. s. (2023). Effect of Free Medicine Distribution on Health Care Costs in Canada Over 3 Years: A Secondary Analysis of the CLEAN Meds Randomized Clinical Trial. *JAMA Health Forum*, 4(5), e231127–e231127. <https://doi.org/10.1001/jamahealthforum.2023.1127>
- Purkiss, S. F., Keegel, T., Vally, H., & Wollersheim, D. (2020). A comparison of Australian chronic disease prevalence estimates using administrative pharmaceutical dispensing data with international and community survey data. *Int J Popul Data Sci*, 5(1), 1347. <https://doi.org/10.23889/ijpds.v5i1.1347>
- Rebić, N., Cheng, L., Law, M. R., Cragg, J. J., Brotto, L. A., & De Vera, M. A. (2024). Predictors of cost-related medication nonadherence in Canada: a repeated cross-sectional analysis of the Canadian Community Health Survey. *Canadian Medical Association Journal*, 196(40), E1331. <https://doi.org/10.1503/cmaj.241024>
- Roth, J., Sant’Anna, P. H. C., Bilinski, A., & Poe, J. (2023). What’s trending in difference-in-differences? A synthesis of the recent econometrics literature. *Journal of Econometrics*, 235(2), 2218–2244. <https://doi.org/10.1016/j.jeconom.2023.03.008>
- Simonsen, M., Skipper, L., Skipper, N., & Christensen, A. I. (2021). Spot price biases in non-linear health insurance contracts. *Journal of Public Economics*, 203, 104508. <https://doi.org/10.1016/j.jpubeco.2021.104508>
- Stewart, S.-J. F., Moon, Z., & Horne, R. (2023). Medication nonadherence: health impact, prevalence, correlates and interventions. *Psychology & Health*, 38(6), 726–765. <https://doi.org/10.1080/08870446.2022.2144923>
- Sweeny, K. (2009). The impact of copayments and safety nets on PBS expenditure. *Australian Health Review*, 33(2), 215–230. <https://doi.org/10.1071/AH090215>
- The Pharmacy Guild of Australia. (2025a). 1 in 5 Australians have delayed or forgone medicines due to cost. *Forefront*. <https://www.guild.org.au/news-events/news/forefront/v16n02/2-amn>

- The Pharmacy Guild of Australia. (2025b). *Women twice as likely as men to skip a prescription because of cost* <https://www.guild.org.au/news-events/news/2025/women-twice-as-likely-as-men-to-skip-a-prescription-because-of-cost>
- Verho, J., & Harju, J. (2025). Copayments for Prescription Drugs: The Drivers of Demand Responses. *Health economics*, 34(6), 1160–1170. <https://doi.org/10.1002/hec.4955>
- Walsh, C. A., Cahir, C., Tecklenborg, S., Byrne, C., Culbertson, M. A., & Bennett, K. E. (2019). The association between medication non-adherence and adverse health outcomes in ageing populations: A systematic review and meta-analysis. *British Journal of Clinical Pharmacology*, 85(11), 2464–2478. <https://doi.org/10.1111/bcp.14075>
- Watanabe, J. H., McInnis, T., & Hirsch, J. D. (2018). Cost of Prescription Drug–Related Morbidity and Mortality. *Annals of Pharmacotherapy*, 52(9), 829–837. <https://doi.org/10.1177/1060028018765159>
- WHO Collaborating Centre for Drug Statistics Methodology, & Norwegian Institute of Public Health. (2025). *International language for drug utilization research: ATC/DDD*. <https://atcddd.fhi.no/>

8 | TABLES

TABLE 1 | Pre-Safety Net means and standard deviations (SD) of monthly prescriptions filled, and proportion within subgroups.

Characteristic	Mean (SD)	Proportion (%)
All medications	4.71 (3.27)	100
Acute medications [†]	0.25 (0.67)	100
Chronic medications [†]	3.79 (2.66)	100
Concessional status		
Concessional	4.72 (3.25)	91
General	4.64 (3.46)	9
Personalised annual income		
Nil or negative income	4.62 (3.43)	6
\$1-\$33,799	4.81 (3.23)	65
\$33,800-\$51,999	4.51 (3.16)	12
\$52,000-\$90,999	4.38 (3.20)	7
\$91,000 or more	4.64 (3.58)	9
Non-pensioners (<67 years old) income thresholds		
Concessional	4.74 (3.55)	84
General, low income	4.67 (3.47)	4
General, high income	4.50 (3.41)	12
Long-term health condition status		
No LTHC	3.10 (2.63)	15
LTHC	5.04 (3.29)	85
Sex		
Female	4.68 (3.31)	54
Male	4.74 (3.22)	46
Age group (years old)		
Under 25	1.51 (2.11)	3
25-39	5.17 (3.93)	1
40-54	5.06 (3.69)	6
55-69	4.68 (3.34)	25
70 or more	4.81 (3.14)	65
Remoteness area		
Major cities	4.76 (3.34)	64
Inner regional	4.64 (3.15)	25
Outer regional	4.59 (3.10)	10
Remote	4.55 (3.15)	0.8
Very remote	4.51 (3.38)	0.2
N =	1,537,885	

[†] Some medications could not be classified as acute or chronic due to their nature of being used in both situations for different conditions. Hence, these values do not add up to the overall mean. See Supplementary materials for more information.

Abbreviations: \$ refers to 2021 Australian dollars; General, low income – General patients earning between \$33,800-\$64,999 per year; General, high income – General patients earning ≥\$65,000 per year; LTHC - Long-term health condition; SD – standard deviation; SN – safety net.

TABLE 2 | Average Treatment Effect on the Treated (ATT) across a 4-month post-intervention period, for main and heterogenous subgroup analyses

Regression group or subgroup	Estimate	SE
All medications	0.715	0.0036
Acute medications	0.041	0.0009
Chronic medications	0.528	0.0029
Pre-existing medications	0.656	0.0033
New medications	0.059	0.0013
Concessional status		
Concession	0.717	0.0038
General	0.716	0.0132
Income thresholds		
Nil or negative income	0.776	0.0151
\$1-\$33,799	0.737	0.0045
\$33,800-\$51,999	0.661	0.0101
\$52,000-\$90,999	0.661	0.0133
\$91,000 or more	0.610	0.0122
Non-pensioners (<67 years old) income thresholds		
Concession	0.790	0.0087
General, low income	0.807	0.0417
General, high income	0.670	0.0235
Long-term health condition status		
No LTHC	0.594	0.0074
LTHC	0.736	0.0041
Sex		
Male	0.722	0.0054
Female	0.709	0.0049
Age Group (years old)		
Under 25	0.517	0.0131
25-39	0.604	0.0372
40-54	0.770	0.0166
55-69	0.784	0.0075
70 and over	0.697	0.0044
Remoteness area		
Major cities	0.785	0.0047
Inner regional	0.587	0.0068
Outer regional	0.586	0.0104
Remote	0.604	0.0387
Very remote	0.787	0.0774
Previous year SN status		
Did not reach	0.370	0.0073
Reached	0.648	0.0037

Note: This table shows the average treatment effect on the treated (ATT) estimates from dynamic difference-in-differences estimates for (1) All medications; (2) Medications used to treat acute conditions; (3) Medications used to treat chronic conditions; (4) All medications by different heterogenous subgroups: (i) concessional status; (ii) income thresholds; (iii) non-pensioners income thresholds; (iv) long-term health condition status; (v) sex; (vi) age group; (vii) geographic remoteness area; and (viii) previous year safety net status.

Abbreviations: \$ refers to 2021 Australian dollars; General, low income – General patients earning between \$33,800-\$64,999 per year; General, high income – General patients earning $\geq$ \$65,000 per year; LTHC - Long-term health condition; SE – standard error; SN – Safety Net.

TABLE 3 | Average Treatment Effect on the Treated (ATT) across a 4-month post-intervention period, for alternative specifications

Analysis	Estimate	SE
Main specification	0.715	0.0036
Individually reached SN	0.784	0.0050
Deaths excluded	0.714	0.0036
Outliers excluded	0.676	0.0035
Regulation 24 excluded	0.687	0.0036
First and last months excluded	0.718	0.0036
VIC and NSW excluded	0.699	0.0041
Alternate reference period ($F_g - 3$)		
All medications	0.636	-
Acute medications	0.047	-
Chronic medications	0.430	-
Longer look-back period (6 months)		
Pre-existing medications	0.651	0.0033
New medications	0.064	0.0013
Semi-elasticity	11.3%	0.0006

Note: This table shows the average treatment effect on the treated estimates from dynamic difference-in-differences estimates for (1) All medications – main specification (for comparison); (2) All medications using three months prior to reaching the safety net ($F_g - 3$) as the baseline reference period, so as to control for any potential anticipatory behaviour; (3) All medications by specific subgroups: (i) only those who reached the safety net individually (i.e., not as part of a family group); (ii) excluding individuals who died in 2021; (iii) excluding outliers, defined as the top one percent of monthly total prescription users; (iv) excluding individuals who received multiple months' worth of medication in a single dispensing (known as a Regulation 24 prescription); (v) excluding the first and last month (i.e., January and December) from the regression; (vi) using a longer look-back period of 6 months (compared to 3 months) to define whether a medication was classified as new or pre-existing; and (vii) excluding the two most COVID-19 affected states (NSW and VIC); and (4) All medications using $\ln(\text{outcome}+1)$ as the dependent variable, to estimate semi-elasticity.

Abbreviations: NSW – New South Wales; SE – standard error; SN – Safety Net; VIC - Victoria.

9 | FIGURE LEGENDS

FIGURE 1 | Distribution of month when individuals first reached the PBS Safety Net in 2021.

This figure shows the percent of the sample of individuals who reached the safety net in 2021 by the month when individuals first reached the safety net and the cumulative percent who had reached the safety net by each month. It shows that very few individuals (around 5% cumulatively) reached the safety net by the end of April. Following this, approximately 9%-14% reached each subsequent month, with the median time to first reach the safety net being August.

FIGURE 2 | Event study estimates of dynamic difference-in-differences (DID) regressions.

This figure shows the event-study estimates in each month relative to when individuals first reach the safety net (i.e., $F_g - 1$) for three dynamic DID regressions: (1) All – total monthly dispensings for all medications; (2) Acute – medications used to treat acute conditions; and (3) Chronic – medications used to treat chronic conditions.

Note: Confidence intervals are displayed on the graph but are very small due to large sample size ($n=1,537,885$). Confidence intervals get wider as month relative to reaching the safety net increases due to sample size decreasing (as fewer individuals reached it earlier in the year and have sufficient post-intervention events to be included in later analyses).

FIGURE 3 | Event study estimates of dynamic difference-in-differences (DID) regressions for

alternate reference period. This figure shows the event-study estimates in each month relative to three months before individuals first reach the safety net (i.e., $F_g - 3$) for three dynamic DID regressions: (1) All – total monthly dispensings for all medications; (2) Acute – medications used to treat acute conditions; and (3) Chronic – medications used to treat chronic conditions.

Note: Confidence intervals are displayed on the graph but are very small due to large sample size ($n=1,537,885$). Confidence intervals get wider as month relative to reaching the safety net

increases due to sample size decreasing (as fewer individuals reached it earlier in the year and have sufficient post-intervention events to be included in later analyses).

FIGURE 4 | Heterogeneity analyses presented as the average treatment effect of the treated (ATT) estimates with 95% confidence intervals. In this figure, coefficients represent the average within-individual change in prescription medicines filled after reaching the safety net.

Abbreviations: \$ – 2021 Australian dollars. Abbreviations: LTHC – long-term health condition; NP – non-pensioner.

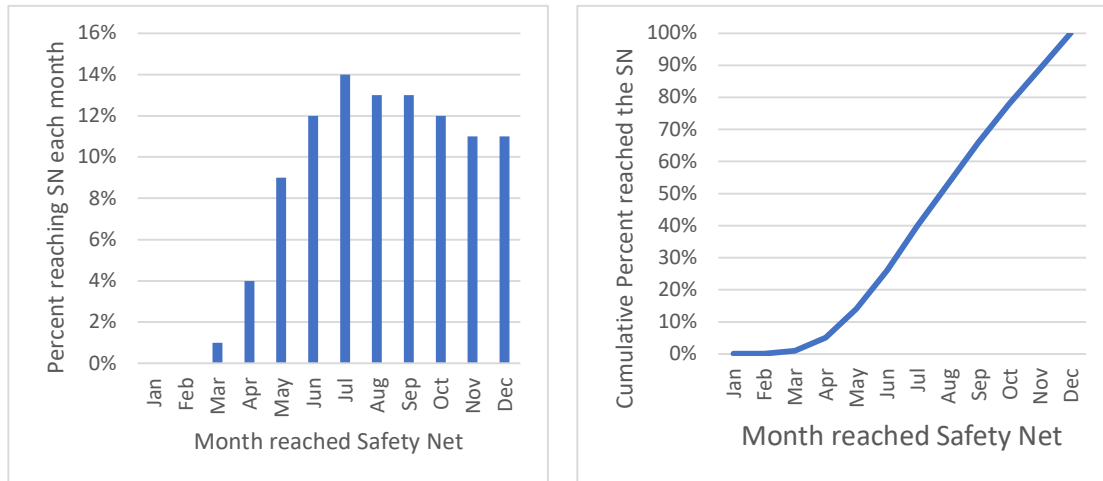


FIGURE 1

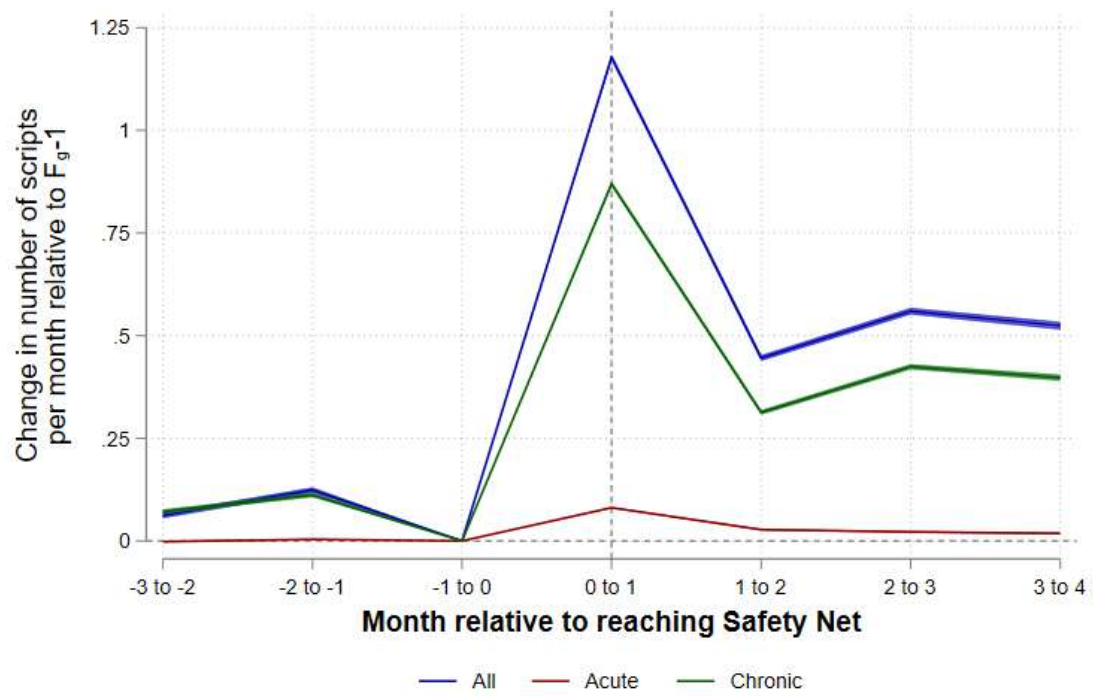


FIGURE 2

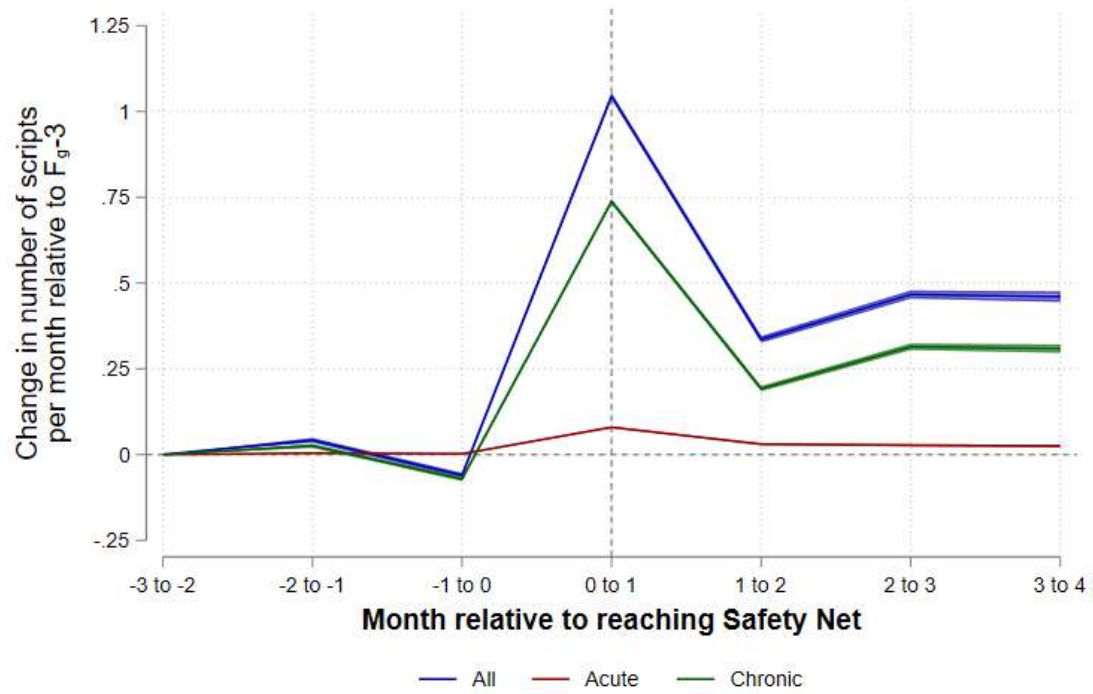


FIGURE 3

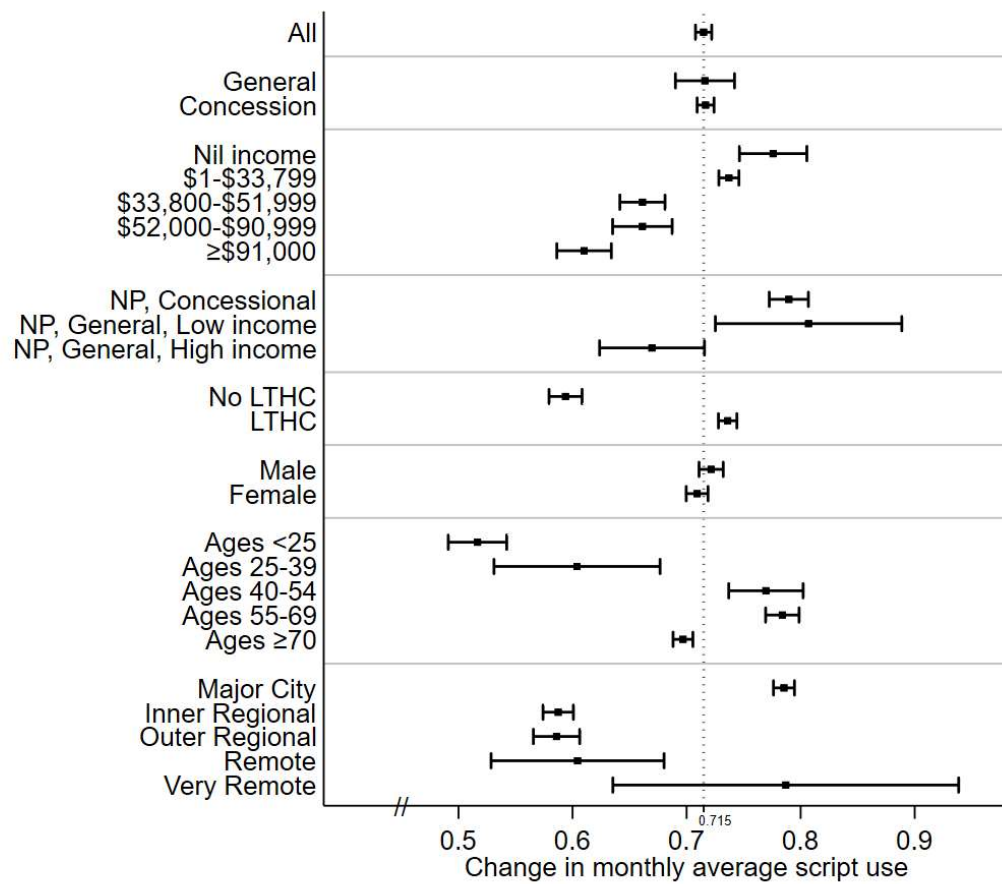


FIGURE 4

Supplementary Materials

TABLE S1 | Prescription medicine copayments and thresholds for the Pharmaceutical Benefits

Scheme, 2021

	Copayment per prescription before safety net	Annual safety net threshold	Copayment per prescription after safety net
Concession card holders	AU\$6.60	AU\$316.80	AU\$0.00
General patients	AU\$41.30	AU\$1,497.20	AU\$6.60

Notes: Sourced from (Department of Health & Aged Care, 2025a).

Classification of medicines as acute, chronic, or mixed, based on most common use

To determine whether a medication was typically for chronic or acute conditions, we categorised medications using the approach implemented by Huber et al. (2013) and Purkiss et al. (2020). This involved categorising medications using their ATC at either the 2nd-4th level, depending on the medication class (WHO Collaborating Centre for Drug Statistics Methodology & Norwegian Institute of Public Health, 2025). Where Huber et al. (2013) and Purkiss et al. (2020) only classified chronic medication classes, we assigned each medication class listed on the PBS as either chronic, acute, or mixed, depending on the conditions they are typically used to treat. For example, all ‘stomatological preparations’ (A01) are used for acute conditions, so the 2nd level (A01) was assigned acute, and any medication with an ATC beginning with A01 was categorised as an acute medication. For ‘antithrombotic agents’ (B01), heparins (B01AB), such as enoxaparin (B01AB05), are used for acute conditions, while other platelet aggregation inhibitors (B01AC), such as clopidogrel (B01AC04), are used for chronic conditions. Thus, the 4th level was utilised for this class (i.e., anything beginning with B01AB was categorised as acute and B01AC as chronic). For ‘corticosteroids for systemic use’ (H02), these medications, such as prednisolone (H02AB06), are typically used in both chronic and acute conditions, so were classified as “mixed” and not included in our analysis. The classification for each medication class is listed in Table S2.

TABLE S2 | Categorization of medicines based on their usual use (acute, chronic, or mixed)
by World Health Organization Anatomical Therapeutic Chemical (WHO ATC)
classification

Anatomical or pharmaceutical group name	ATC Code	Categorization
Stomatological preparations	A01	Acute
Drugs for acid related disorders	A02	Chronic
Drugs for functional gastrointestinal disorders	A03	Acute
Antiemetics and antinauseants	A04	Acute
Bile and liver therapy	A05	Chronic
Drugs for constipation	A06	Mixed
Antidiarrheals, intestinal antiinflammatory/antiinfective agents	A07	Mixed
Antiobesity preparations, excl. diet products	A08	Acute
Digestives, incl. enzymes	A09	Chronic
Drugs used in diabetes	A10	Chronic
Vitamins	A11	Chronic
Mineral supplements	A12	Chronic
Tonics	A13	None in PBS
Anabolic agents for systemic use	A14	Chronic
Appetite stimulants	A15	Acute
Other alimentary tract and metabolism products	A16	Chronic
Antithrombotic agents	B01	
	<i>AA, AC, AE, AF</i>	Chronic
	<i>AB, AD</i>	Acute
	<i>AX</i>	Mixed
Antihemorrhagics	B02	Acute
Antianemic preparations	B03	
	<i>AA, AB, AD, AE</i>	Chronic
	<i>AC</i>	Acute
	<i>B, X</i>	Mixed
Blood substitutes and perfusion solutions	B05	Acute
Other hematological agents	B06	Mixed
Cardiac therapy	C01	Chronic
Antihypertensives	C02	Chronic
Diuretics	C03	Chronic
Peripheral vasodilators	C04	Chronic
Vasoprotectives	C05	Acute
Beta blocking agents	C07	Chronic
Calcium channel blockers	C08	Chronic
Agents acting on the renin-angiotensin system	C09	Chronic
Lipid modifying agents	C10	Chronic
Antifungals for dermatological use	D01	Acute
Emollients and protectives	D02	Acute
Preparations for treatment of wounds and ulcers	D03	Acute
Antipruritics, incl. antihistamines, anesthetics, etc.	D04	Acute
Antipsoriatics	D05	Chronic

Antibiotics and chemotherapeutics for dermatological use	D06	Acute
Corticosteroids, dermatological preparations	D07	Mixed
Antiseptics and disinfectants	D08	Acute
Medicated dressings	D09	Acute
Anti-acne preparations	D10	Chronic
Other dermatological preparations	D11	Mixed
Gynecological antiinfectives and antiseptics	G01	Acute
Other gynecologicals	G02	
	<i>A</i>	Acute
	<i>B, C</i>	Chronic
Sex hormones and modulators of the genital system	G03	Chronic
Urologicals	G04	
	<i>B</i>	Chronic
	<i>C</i>	Mixed
Pituitary and hypothalamic hormones and analogues	H01	Chronic
Corticosteroids for systemic use	H02	Mixed
Thyroid therapy	H03	Chronic
Pancreatic hormones	H04	Acute
Calcium homeostasis	H05	Chronic
Antibacterials for systemic use	J01	Acute
Antimycotics for systemic use	J02	Acute
Antimycobacterials	J04	Chronic
Antivirals for systemic use	J05	
	<i>AA, AP, AX</i>	Mixed
	<i>AB, AC, AD,</i>	Acute
	<i>AH</i>	
	<i>AE, AF, AG,</i>	Chronic
	<i>AJ, AR</i>	
Immune sera and immunoglobulins	J06	Acute
Vaccines	J07	Acute
Antineoplastic agents	L01	Chronic
Endocrine therapy	L02	Chronic
Immunostimulants	L03	Chronic
Immunosuppressants	L04	Chronic
Antiinflammatory and antirheumatic products	M01	Chronic
Topical products for joint and muscular pain	M02	Chronic
Muscle relaxants	M03	Acute
Antigout preparations	M04	Chronic
Drugs for treatment of bone diseases	M05	Chronic
Other drugs for disorders of the musculo-skeletal system	M09	Mixed
Anesthetics	N01	Acute
Analgesics	N02	Mixed
Antiepileptics	N03	Chronic
Anti-parkinson drugs	N04	Chronic
Psycholeptics	N05	
	<i>A</i>	Chronic
	<i>B, C</i>	Mixed
Psychoanaleptics	N06	Chronic
Other nervous system drugs	N07	Mixed
Antiprotozoals	P01	Acute

Anthelmintics	P02	Acute
Ectoparasiticides, incl. scabicides, insecticides and repellents	P03	Acute
Nasal preparations	R01	Acute
Throat preparations	R02	None in PBS
Drugs for obstructive airway diseases	R03	Chronic
Cough and cold preparations	R05	Acute
Antihistamines for systemic use	R06	Mixed
Other respiratory system products	R07	Mixed
Ophthalmologicals	S01	
	<i>A, B, C, F,</i>	Acute
	<i>G, H, J, K</i>	
	<i>E, L</i>	Chronic
	<i>X</i>	Mixed
Otologicals	S02	Acute
Ophthalmological and otological preparations	S03	Acute
Allergens	V01	Acute
All other therapeutic products	V03	Acute
Diagnostic agents	V04	Acute
General nutrients	V06	Mixed
All other non-therapeutic products	V07	Acute
Contrast media	V08	Acute
Diagnostic radiopharmaceuticals	V09	Acute
Therapeutic radiopharmaceuticals	V10	Acute
Surgical dressings	V20	Acute

Notes: Medications in each anatomical or pharmaceutical group were categorized at the ATC 2nd – 4th level based on whether they are most commonly used to treat acute conditions, chronic conditions, or a mixture of both.

ATC – Anatomical Therapeutic Chemical; PBS – Pharmaceutical Benefits Scheme

TABLE S3 | Full regression results for event study plots of dynamic difference-in-differences plots with month prior to reaching the safety ($F_g - 1$) net as reference period, for (1) All medications, (2) Acute medications, and (3) Chronic medications. Regression estimation (standard error)

	All	Acute	Chronic
-3 to -2	0.0621 (0.0035)	-0.0016 (0.0009)	0.0716 (0.0029)
-2 to -1	0.124 (0.0034)	0.0038 (0.0008)	0.112 (0.0028)
-1 to 0	0 (0)	0 (0)	0 (0)
0 to 1	1.1779 (0.0037)	0.0809 (0.0009)	0.8695 (0.0029)
1 to 2	0.4456 (0.0037)	0.0275 (0.0009)	0.3132 (0.0029)
2 to 3	0.5596 (0.0042)	0.0221 (0.0011)	0.4244 (0.0033)
3 to 4	0.5242 (0.005)	0.0184 (0.0013)	0.3974 (0.0039)

Notes: Dynamic difference-in-differences regression estimations for the change in total monthly medication use relative to one month prior to reaching the Pharmaceutical Benefits Scheme Safety Net, for three months prior to, and four months post, reaching the safety net.

TABLE S4 | Full regression results for event study plots of dynamic difference-in-differences plots with three months prior to reaching the safety net ($F_g - 3$) as reference period, for (1) All medications, (2) Acute medications, and (3) Chronic medications. Regression estimation (standard error)

	All	Acute	Chronic
-3 to -2	0 (0)	0 (0)	0 (0)
-2 to -1	0.042 (0.0034)	0.004 (0.0008)	0.025 (0.0028)
-1 to 0	-0.060 (0.0035)	0.002 (0.0009)	-0.071 (0.0029)
0 to 1	1.045 (0.0044)	0.080 (0.0011)	0.738 (0.0034)
1 to 2	0.0336 (0.0049)	0.030 (0.0013)	0.192 (0.0039)
2 to 3	0.467 (0.0060)	0.027 (0.0015)	0.314 (0.0047)
3 to 4	0.460 (0.0078)	0.025 (0.0020)	0.309 (0.0061)

Notes: Dynamic difference-in-differences regression estimations for the change in total monthly medication use relative to one month prior to reaching the Pharmaceutical Benefits Scheme Safety Net, for three months prior to, and four months post, reaching the safety net.

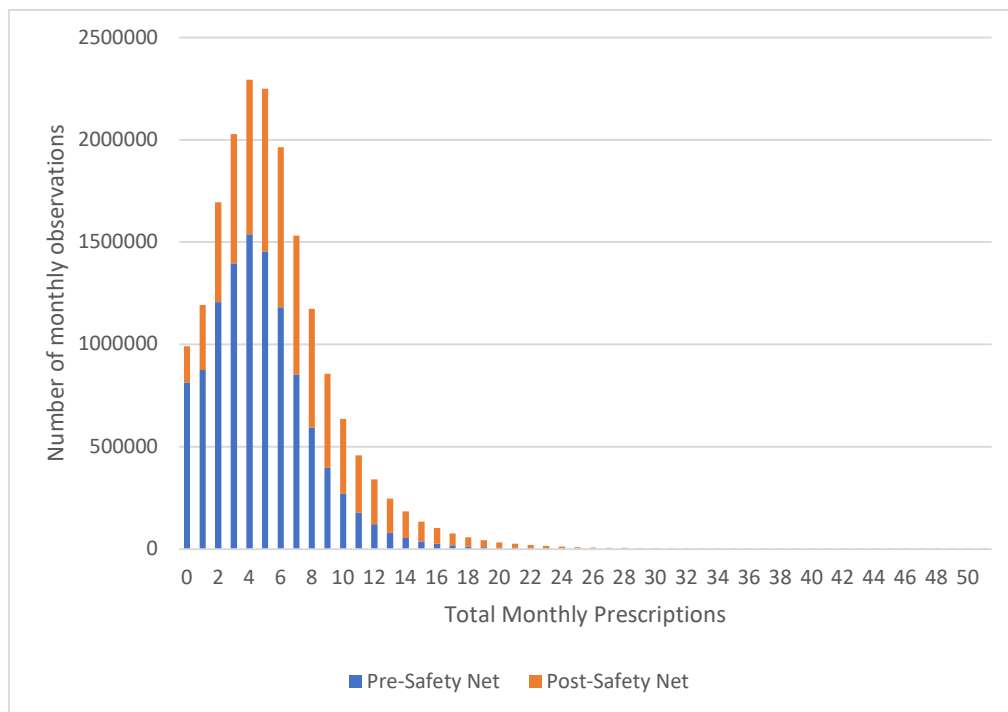


FIGURE S1 | Distribution of total monthly prescription use pre- and post-reaching the Safety Net. This figure demonstrates the skewed distribution of monthly prescription use within our sample.

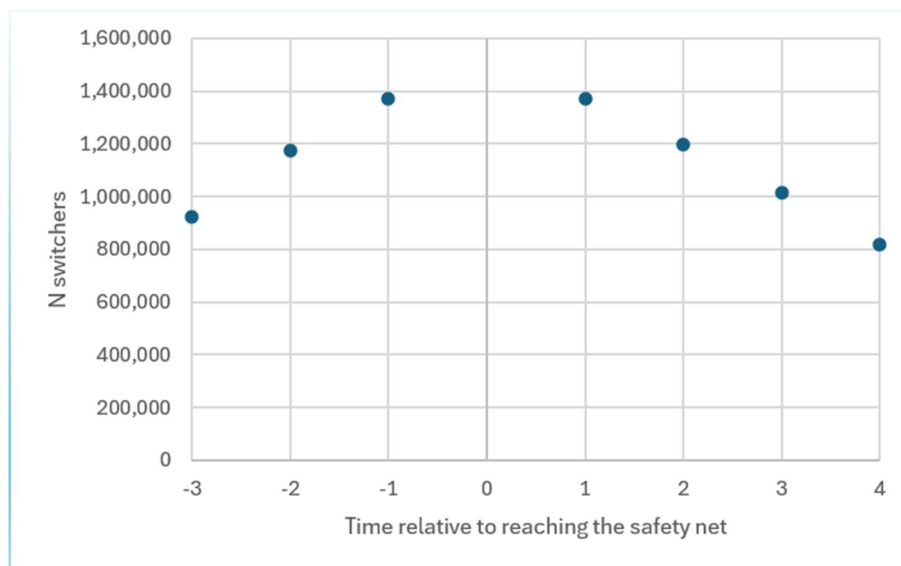


FIGURE S2 | N-switchers for each month relative to reaching the safety net. This figure shows the number of individual observations used to estimate the effect at each specific month relative to reaching the safety net. As can be observed, the number of observations decreases as the pre- and post-intervention period increases, as fewer individuals reached the safety net earlier in the year, and had sufficient post-periods available to calculate longer post-intervention estimates.

References

- Department of Health & Aged Care. (2025). *Pharmaceutical Benefits: Fees, Patient Contributions and Safety Net Thresholds*. Commonwealth of Australia. <https://www.pbs.gov.au/info/healthpro/explanatory-notes/front/fee>
- Huber, C. A., Szucs, T. D., Rapold, R., & Reich, O. (2013). Identifying patients with chronic conditions using pharmacy data in Switzerland: an updated mapping approach to the classification of medications. *BMC Public Health*, 13(1), 1030. <https://doi.org/10.1186/1471-2458-13-1030>
- Purkiss, S. F., Keegel, T., Vally, H., & Wollersheim, D. (2020). A comparison of Australian chronic disease prevalence estimates using administrative pharmaceutical dispensing data with international and community survey data. *Int J Popul Data Sci*, 5(1), 1347. <https://doi.org/10.23889/ijpds.v5i1.1347>
- WHO Collaborating Centre for Drug Statistics Methodology, & Norwegian Institute of Public Health. (2025). *International language for drug utilization research: ATC/DDD*. <https://atcddd.fhi.no/>

