Failure to access prescribed pharmaceuticals by older patients with chronic conditions

Ian McRae^{1,4} PhD, Research Fellow

Kees van Gool² PhD, Associate Professor

Jane Hall² PhD, Professor

Laurann Yen³ MPsych, Senior Fellow

Michael Wright² MBBS, MSc, Research Fellow

¹Centre for Research on Ageing, Health and Wellbeing, Research School of Population Health, The Australian National University, Florey, Building 54, Mills Road, Canberra, ACT 0200, Australia.

²Centre for Health Economics Research and Evaluation, University of Technology Sydney, Level 2, Building 5 Block D, 1–59 Quay Street, Haymarket, NSW 2000, Australia. Email: kees.vangool@uts.edu.au; jane.hall@uts.edu.au; michael.wright@uts.edu.au

³Department of Health Services Research and Policy Research, School of Population Health, The Australian National University, 62A Mills Road, Canberra, ACT 0200, Australia. Email: laurann.yen@anu.edu.au

⁴Corresponding author. Email: ian.s.mcrae@anu.edu.au

Abstract

Objective. Medication adherence is a significant public health concern. Australian studies of statins show patients facing the highest copayments are the least likely to be adherent. This study examined whether the association identified between adherence and costs for statins also applies to a wider group of medications prescribed for Australian patients with chronic conditions.

Methods. Data from 267 086 participants in the Sax Institute's 45 and Up Study linked to data from the Pharmaceutical Benefits Scheme (PBS) provided by the Department of Human Services were used. Patients using angiotensin II receptor blockers, angiotensin-converting enzyme inhibitors, glitazones and bisphosphonates were identified and classified according to concessional status and whether they had access to the PBS 'safety net'. Data were analysed using mainly descriptive methods to investigate the association of adherence with cost and other selected covariates.

Results. Across medications, the group facing the highest copayment was least adherent. Speaking a language other than English at home and facing high levels of psychological distress were also associated with lower levels of adherence.

Conclusions. As for statins, the main financial determinant of adherence is cost in the form of prescribed copayments, suggesting that this may apply across many medications.

What is known about the topic? Previous studies have shown patients' concern about the costs of pharmaceuticals, and more detailed studies of statins show that the lowest adherence relates to patients facing the highest copayments.

What does this paper add? This paper provides support for the contention that the results found for statins broadly apply across more medications used by people with chronic conditions.

What are the implications for practitioners? Although practitioners cannot affect legislated copayments, they can consider the costs of options for medications for patients with chronic conditions, especially those general patients who have not reached the safety net, and they can be aware that patients from homes where English is not spoken and patients with high levels of psychological distress are also likely to have low adherence without intervention.

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Introduction

Medication adherence is a major concern for the health of any community¹ and numerous studies have identified financial, social, psychological and other barriers to adherence.^{1–4} Despite having a comprehensive safety net in the Pharmaceutical

Benefits Scheme (PBS), previous studies indicate that many Australian patients do not purchase prescribed medications for financial reasons.^{5–8}

Australian studies^{8–10} have addressed factors associated with adherence in the use of statins, in particular showing that statin

adherence was strongly related to the level of financial support to which patients were entitled. The purpose of this study was to extend these analyses to further medications to explore whether the results hold more widely.

Australian institutional arrangements for pharmaceuticals

Most prescriptions in Australia are filled privately and supported by the Australian Government's PBS. The PBS subsidises approved prescription medicines with fixed patient copayments, which are lower for patients holding government issued concession cards (more than one in four Australians¹¹). Copayments are removed for concessional patients and reduced for non-concessional ('general') patients once a 'safety net threshold' of total annual copayments for a family is reached. This threshold is calculated each calendar year, with families paying the higher copayments unless they exceed the threshold for the relevant year. Table 1 shows the copayments and thresholds for 2008 (in the middle of the time period we analysed). We denote these copayment categories as concessional non-safety net (CNSN), concessional safety net (CSN), general non-safety net (GNSN) and general safety net (GSN).

Although few medications are priced below the concessional copayment, many are priced below the general copayment. General patients purchasing these medications who have not reached the safety net threshold pay a price determined by the pharmacist. Because there was no PBS contribution, these payments were not recorded in the PBS system during the period under investigation.

Methods

Data sources

The data source was the Sax Institute's 45 and Up Study,¹² which is based in the population of the state of New South Wales (NSW), Australia. Prospective participants were randomly sampled from the Department of Human Services (formerly Medicare Australia) enrolment database, which provides near-complete coverage of the population. People aged ≥ 80 years and residents of rural and remote areas were oversampled. In all, 267 086 participants (~11% of the NSW population and ~18% of those invited) joined the 45 and Up Study by completing a baseline questionnaire (from 2006 to 2009) and giving signed consent for follow-up and linkage of their information to routine health databases.

The present study linked 45 and Up survey data with PBS data for the period 2005–11. Data linkage was completed by the Sax Institute using a unique identifier that was provided to the Department of Human Services.

PBS data cover all prescriptions funded under the PBS, and includes costs of each prescription, number of tablets or capsules, whether patients are general or concessional, and whether patients have reached a safety net. Self-reported data from the

survey included a range of relevant social and demographic information.

Medications assessed

The medication classes included in the study were selected because they are typically long-term medications used to manage chronic conditions, have no perceivable immediate benefit for patients, are of sufficient price to be included in PBS data and are used by relatively large populations. It was also essential that the period that a particular prescription should cover was known, so medications that were used 'as needed' rather than a fixed number per day could not be included. For comparative purposes results are also reported for statins, some of which were reported previously⁸ and some of which are reported here for the first time.

The four medication classes were angiotensin II receptor blockers (ARBs), angiotensin-converting enzyme (ACE) inhibitors (both treatments for hypertension with similar adherence rates^{13,14}), glitazones, used in the treatment of diabetes, and bisphosphonates, used in the treatment of osteoporosis. Glitazones (rosiglitazone and pioglitazone) are used to manage Type 2 diabetes when first-line therapy is inadequate or not tolerated. Adherence levels for glitazones are expected to be below those of antihypertensives,¹⁵ with those for bisphosphonates, which are complex to take,^{16,17} lower still (bisphosphonates must be taken on an empty stomach with no food for a period and patients must stay upright for half an hour after taking them).

Although glitazones and bisphosphonates were almost all priced above the general copayment level in the study period and only 5.4% of statin prescriptions covered fell below general copayment level, this is not the case for the blood pressure medications, with 89.0% of ARBs and 91.9% of ACE inhibitors in the categories other than GNSN being below the general copayment. Despite this, the blood pressure medications were included in this study because there are 147 000 ARB prescriptions and 103 000 ACE inhibitor prescriptions in the GNSN categories. However, care must be taken in addressing questions about these patients because they relate only to the more expensive formulations.

Measure of adherence

The ratio of the number of days notionally covered by a quantity of medication to the number of days actually covered is the medication possession ratio (MPR).⁹ For medications taken at one per day, the MPR is the quantity purchased divided by the number of days covered, assumed to be the time between purchases. For medications with different usage patterns the quantity must be converted to 'days covered' before calculating the MPR. We used the common threshold of an MPR $>80\%$ to define adherence as a dichotomous variable.⁹

Adherence to medications can be considered within periods of initiation, implementation and discontinuation.¹ In this study,

Table 1. Per prescription copayments and annual safety net thresholds for the Pharmaceutical Benefits Scheme, 2008

Data from Australian Government, Department of Health (<http://www.pbs.gov.au/info/healthpro/explanatory-notes/front/fee>, accessed 30 January 2019)

	Copayment (A\$)	Family safety net threshold (A\$)	Safety net copayment (A\$)
Concessional patients (pension or healthcare cards)	5.00	290.00	Nil
General patients (non-concessional)	31.30	1141.80	5.00

we are dealing with periods within a year, so we are primarily examining the implementation period. Adherence measures are generally lower for people who fail to initiate and those discontinuing¹⁸ than for those in the implementation phase, so we expected higher estimates of adherence than those studies that included initiation and discontinuation periods.

Categories

To allocate person-years to categories (e.g. CSN), we allocated survey participants to concessional or general categories depending on which comprised the majority of all prescriptions purchased by a given person in the year. We then defined the group as 'safety net' if more than 20% of prescriptions for that person-year were under safety net arrangements, based on the view that 20% will affect behaviour. As reported previously, sensitivity analysis showed little difference between using 10% and 30% of prescriptions to define the safety net group.⁸

Analysis

Because the safety net system operates on an annual cycle, for each selected medication we examined annual adherence by copayment category. We further examined changes in adherence when patients moved between non-safety net and safety net categories within each year. Finally, for a set of selected covariates, we report the ratio of mean adherence for those in the 'active' group (e.g. holding private health insurance) to those in the 'inactive' group for each medication within each category, as well as the significance of the difference between the mean adherence in the 'active' and 'inactive' groups, determined using a standard *t*-test for comparison of means of two groups with unequal variances. The variables selected were language spoken at home, private health insurance, degree of psychological distress and regular smoking. These were the most significant in the previous statin modelling,^{8–10} and in modelling undertaken for the additional medications. For reasons of parsimony, these models are not reported here, but are available from the authors. Relative adherence rates are also reported for high and low levels of income (defined as above or below A\$50 000 per annum) because this was a material consideration in relation to statins, as well as for the dosage frequency for bisphosphonates, which is a specific issue for these medications.

The Sax Institute's 45 and Up Study was approved by the University of NSW Human Research Ethics Committee. The project was approved by the NSW Population and Health Services Research Ethics Committee (Reference no. 2013/11/487).

Analysis was undertaken in Stata ver. 12.1 (StataCorp LP, College Station, TX, USA).

Results

Sample structure

The relevant number of people and prescriptions in the 45 and Up dataset overall and the number of persons and person-years used in the analysis following exclusion of implausible or unusable data are given in Table 2.

Person-years excluded were those that could not be analysed (e.g. all prescriptions on one day, values missing), where adherence measures were not meaningful (e.g. <3 or >24 prescriptions in a year), where average cost per individual 'pill' was more than A\$1.30, which is well above the maximum copayment for these medications, where the average quantity purchased per day covered was more than threefold standard usage and where there was a gap of ≥ 6 months between purchases (including periods across years).

Each medication class includes formulations that are combined with other medications. For example, some ARBs are provided alone and some are provided in combination with other blood pressure management medications. For completeness we included both the combinations and the medications used alone. Like statins, ARBs and ACE inhibitors are mainly dispensed in packets of 28 to be taken one per day; small numbers are dispensed in other sizes, and these were excluded. Although most prescriptions for glitazones relate to packs of 28 pills (taken at one per day), 9.0% have 56 pills taken at two per day, and adjustment has been made for this usage rate, with packs of other sizes excluded. Bisphosphonates are available in daily, weekly, monthly and annual formulations.¹⁶ We excluded the annual version and converted the weekly and monthly to daily equivalents.

Adherence patterns

As indicated in Table 3, the average rate of adherence for the tested medications was closely related to the concessional and safety net categories, with similar patterns across medications. There are two consistent factors: the GNSN groups have the lowest adherence levels and the safety net categories have higher adherence than the comparative non-safety net categories.

Because our measure of adherence did not address discontinuation or failure to initiate (see above),¹ and we excluded person-years with few prescriptions, the estimated levels of medication adherence are somewhat higher than those reported elsewhere, although there are wide ranges of estimates in the literature.^{9,14–16} A previous study using the same dataset but

Table 2. Sample structures for person-year data
ACE, angiotensin-converting enzyme; ARBs, angiotensin receptor blockers

Medication	Total no. people claiming for this medication over the period	Total no. prescriptions claimed	No. people in final sample	No. person-years in final sample
Statins	106 808	4 744 153	94 114	442 344
ARBs	63 508	2 554 933	53 835	229 827
ACE inhibitors	60 370	2 251 920	47 978	195 862
Glitazones	3770	107 978	3159	10 067
Bisphosphonates	19 252	586 170	15 969	53 716

Table 3. Relationship between safety net categories and mean adherence

Data show mean percentage adherence in each category, with 95% confidence intervals in parentheses. ACE, angiotensin-converting enzyme; ARBs, angiotensin receptor blockers

Category	Statins ⁸	ARBs	ACE inhibitors	Glitazones	Bisphosphonates
Concessional safety net	90.8 (90.6–90.9)	91.6 (91.4–91.8)	92.3 (92.1–92.5)	89.9 (89.1–90.8)	85.4 (84.9–85.9)
Concessional non-safety net	82.4 (82.2–82.5)	87.2 (87.0–87.4)	88.1 (87.9–88.3)	81.8 (80.3–83.4)	82.2 (81.7–82.7)
General safety net	86.0 (85.7–86.4)	93.8 (93.5–94.2)	93.5 (93.1–93.9)	89.5 (88.0–90.9)	82.6 (81.2–84.0)
General non-safety net	70.0 (69.7–70.3)	80.3 (79.4–81.2)	84.7 (83.8–85.7)	78.3 (75.9–80.7)	77.9 (76.8–78.9)
Total	82.6 (82.5–82.7)	89.1 (89.0–89.2)	90.0 (89.8–90.1)	86.6 (86.0–87.3)	83.0 (82.7–83.3)

Table 4. Changes in adherence status between non-safety net and safety net categories

ACE, angiotensin-converting enzyme; ARBs, angiotensin receptor blockers

	People with no safety net prescriptions		People adherent in non-safety net period with safety net prescriptions		People not adherent in non-safety net period with safety net prescriptions		Total no. periods ^A
	No. periods ^A	% Adherent in non-safety net period	No. periods ^A	% Adherent in safety net period	No. periods ^A	% Adherent in safety net period	
Concessional							
Statins	162 096	79.7	127 133	87.9	11 006	74.7	300 235
ARBs	110 601	83.0	77 433	88.4	10 207	67.5	198 241
ACE inhibitors	97 777	82.4	68 164	88.9	10 067	68.2	176 008
Glitazones	2453	83.4	4014	90.2	377	69.8	6844
Bisphosphonates	24 819	81.7	16 901	88.3	2873	66.8	44 593
General							
Statins	104 223	69.2	29 170	89.5	3689	79.4	137 082
ARBs	12 946	73.8	3939	92.7	1347	75.6	18 232
ACE inhibitors	8348	75.1	3108	96.0	1044	75.9	12 500
Glitazones	1404	81.9	1322	91.6	137	70.1	2863
Bisphosphonates	6831	78.9	2102	88.7	429	71.3	9362

^A‘Periods’ are those parts of person-years (including whole person-years) with scripts covered by the safety net or not, as appropriate.

incorporating initiation and discontinuation estimated 80.1% adherence for concessional patients and 56.7% adherence for general patients for statins.⁹

As indicated in Table 4, most patients did not reach the safety nets. For both concessional and general patients, and for all medications, approximately 90% of those adherent before reaching the safety net remain adherent, whereas of those not adherent before reaching the safety net between 68% and 76% become adherent. Therefore, the high levels of adherence for safety net categories in Table 3 are due to the combination of patients adherent in the non-safety net period maintaining their adherence and patients non-adherent in the pre-safety net period becoming adherent when copayments are reduced.

Covariates

Table 5 provides the relative mean levels of adherence for high and low incomes, as well as for the set of covariates outlined in the Methods.

Consistent with findings for statins reported previously,⁸ in the case of blood pressure medications, among those in the general non-safety net category, those with a lower income have lower adherence and, among the concessional safety net category, people with a low income have higher adherence. All but

one of these estimates are significant. However, patterns of adherence to glitazones and bisphosphonates were different and were mostly not significant.

Almost all comparisons for speaking a language other than English at home, for having higher levels of psychological distress and for current smoking showed lower levels of adherence for the ‘active’ group. These estimates are generally significant, with levels of significance declining with smaller samples. Conversely, private health insurance was associated with higher levels of adherence for the active group (i.e. those holding insurance), again with most estimates being significant and broadly lower levels of significance with smaller samples.

Although for bisphosphonates comparisons of daily and monthly dosages were not significant due to the relatively few patients with daily dosages, all ratios showed that a longer duration between doses was associated with higher adherence, and three of the four monthly–weekly comparisons were significant.

Discussion

The purpose of this study was to observe whether conclusions drawn about the role of costs in adherence to statins⁸ in Australia can be applied to other medications. For all the medications

Table 5. Major covariates ($P < 0.05$ was considered significant)
ACE, angiotensin-converting enzyme; ARBs, angiotensin receptor blockers

	Concessional non-safety net		Concessional safety net		General non-safety net		General safety net	
	Ratio ^A	<i>P</i> -value	Ratio ^A	<i>P</i> -value	Ratio ^A	<i>P</i> -value	Ratio ^A	<i>P</i> -value
Income								
Statins	1.007	NS	0.989	<0.01	1.054	<0.001	1.010	NS
ARB	0.990	<0.05	0.981	<0.001	1.031	<0.05	1.001	NS
ACE inhibitors	0.991	<0.05	0.983	<0.01	1.017	NS	0.998	NS
Glitazones	0.936	NS	0.953	NS	0.940	NS	0.974	NS
Bisphosphonates	1.002	NS	1.010	NS	1.021	NS	0.986	NS
Private health insurance								
Statins	1.052	<0.001	1.016	<0.001	1.118	<0.001	1.032	<0.001
ARB	1.023	<0.001	1.004	NS	1.065	<0.001	1.006	NS
ACE inhibitors	1.031	<0.001	1.005	<0.05	1.051	<0.001	0.994	NS
Glitazones	1.058	<0.01	0.994	NS	1.000	NS	1.077	<0.01
Bisphosphonates	1.031	<0.001	1.010	NS	1.065	<0.01	1.073	<0.05
Language spoken at home is other than English								
Statins	0.917	<0.001	0.957	<0.001	0.826	<0.001	0.948	<0.001
ARB	0.926	<0.001	0.961	<0.001	0.870	<0.001	0.981	<0.05
ACE inhibitors	0.949	<0.001	0.965	<0.001	0.974	NS	0.978	<0.05
Glitazones	0.863	<0.001	0.948	<0.001	0.938	NS	0.954	NS
Bisphosphonates	0.964	<0.001	1.004	NS	0.972	NS	0.963	NS
Kessler Psychological Distress Scale								
Statins	0.918	<0.001	0.974	<0.001	0.900	<0.001	0.942	<0.001
ARB	0.937	<0.001	0.979	<0.001	0.940	<0.01	0.977	<0.001
ACE inhibitors	0.938	<0.001	0.972	<0.001	0.975	NS	0.988	NS
Glitazones	0.902	<0.001	0.963	<0.01	0.797	<0.001	0.958	NS
Bisphosphonates	0.916	<0.001	0.938	<0.001	0.993	NS	1.039	NS
Current regular smoking								
Statins	0.905	<0.001	0.973	<0.001	0.911	<0.001	0.968	<0.01
ARB	0.956	<0.001	0.995	NS	0.973	NS	0.986	NS
ACE inhibitors	0.940	<0.001	0.980	<0.001	0.947	<0.05	1.002	NS
Glitazones	0.936	NS	0.990	NS	0.843	<0.01	0.972	NS
Bisphosphonates	0.935	<0.001	0.916	<0.001	0.976	NS	0.955	NS
Timing of bisphosphonates								
Weekly vs daily	1.063	NS	1.053	NS	1.095	NS	1.239	NS
Monthly vs weekly	1.044	<0.001	1.045	<0.001	1.105	<0.001	1.016	NS

^AThe ratios of mean adherence are for: (1) a high (i.e. above A\$50 000 per year) versus low family income; (2) having versus not having private health insurance; (3) speaking versus not speaking a language other than English at home; (4) having greater than a 'low' level of distress versus a low level of distress, as measured by the Kessler Psychological Distress Scale; (5) currently smoking regularly versus not smoking regularly; and (6) for the frequency with which bisphosphonate medication is taken, weekly versus daily and monthly versus weekly.

tested in this study, the patients facing the highest out-of-pocket costs (the GNSN patients) had the lowest adherence levels. For both general and concessional patient groups, those on the safety net always had higher adherence levels. This result is driven, in part, by more than two-thirds of those not adherent before reaching the safety net becoming adherent after reaching it.

Although the results of this study fit the broad expectations of how people respond to changing prices, our ability to examine these issues at a household level is limited. Further research in this area is warranted, given that both financial constraints and safety net thresholds apply at a family level rather than an individual patient level. Future analysis should address family-level decision making, and whether there is prioritising in drug purchasing within a family. Unfortunately, the data used in this analysis do not define families, and so are not amenable to addressing this issue, and it would be necessary to obtain household-level data in order to explore this issue.

One factor that provided additional support for our views regarding the effects of costs on statin management⁸ was the role of income, because the GNSN patients with the lowest income had the lowest level of adherence. Although this pattern was broadly followed in the blood pressure medications, for glitazones and bisphosphonates the effect of income was mostly insignificant, with no clear patterns. These results may be due, in part, to the relatively small samples for glitazones and bisphosphonates, but also because these medications have greater barriers in the form of more specific indications (first-line diabetes measures failed or the patient has a fracture aligned with osteoporosis), and the doctor must obtain 'authority' from the Department of Human Services, generally by telephone, in order to prescribe them. Although these results do not detract from the conclusion that the GNSN patients have the poorest levels of adherence, they do suggest that for some medications the low-income segment of this category is little different to the

higher-income patients. GNSN patients using blood pressure medications do not comprise a complete sample because some are prescribed below copayment formulations, meaning there is a risk that the behaviour of those in our sample may be different to that of patients prescribed the lower-cost formulations for whom we have no information. Although it is likely that adherence rates will be higher in the latter group because they face lower prices, and it is also likely that the effect of income would be similar in these two subgroups, there is no information on the excluded group to confirm this expectation.

As for previous studies, across all medications and categories, speaking a language other than English at home has negative associations with adherence, as does having 'more than low levels of distress' on the Kessler psychological distress scale. Adherence was generally associated with holding private health insurance, which may be a 'healthy adherer bias',¹⁹ with those more attentive to their health both adhering to prescribed medicines and holding private health insurance, and was negatively associated with being a smoker, possibly the converse of the 'healthy adherer bias'. The private health insurance result could also be an effect of income, because people with a higher income are more likely to hold private health insurance. For concessional patients with a family income below A\$50 000, 47% held private health insurance, compared with 87% of those with higher incomes. For general patients, the respective proportions are 70% and 89%. We also confirmed the well-known result¹⁶ that adherence to bisphosphonates is better when the medication must be taken less frequently.

Overall, the main results of our previous analysis,⁸ and hence the policy conclusions, apply. If adherence levels are to be improved, the place to start, noting the large differences in legislated copayments between categories of patients, is the GNSN group. Adherence across this set of medications could be improved by reducing out-of-pocket costs for the GNSN group in various ways, including simply reducing copayments, reducing the safety net threshold or broadening definitions of 'concessional'. One approach that avoids much of the funding going to people already adherent would be a stepped approach with two or three thresholds, and smaller copayment reductions. In addition, to reducing financial barriers, provision of medical advice in home languages for those not using English at home, better awareness by health providers of the need to support those in psychological distress with managing their medications and further advice to prescribers on the optimal forms of bisphosphonate would be valuable.

Study limitations

The main constraint on selecting medications is that prescriptions that cost less than the general copayment were not recorded on the PBS for the period under investigation. We included general patients for ARBs and ACE inhibitors where some of the scripts are priced below the general copayment because they have large samples, and their results prove to be broadly consistent with results from the other medications.

Conclusions

Using linked survey and administrative data, medication adherence can be explored with drugs used on a long-term basis for

chronic conditions. In this study we compared four groups of medications with the previously studied statins, and consistently found that higher out-of-pocket costs per prescription were associated with poorer medication adherence. Although the number of medications studied remains limited, the consistency of the results suggests that they are likely to apply more widely.

In particular, for each of the target medications, the GNSN group, which faces the highest out-of-pocket costs, was the least adherent category. Because many patients are on multiple medications, the effects of cost on the therapeutic management of complex and chronic illness may be especially compromised. If the full benefits of these medications are to be available, consideration should be given to reducing the financial barriers for GNSN patients, potentially using a stepped safety net arrangement.

This study also provides results in relation to non-financial variables that are consistent with previous studies, and with clear implications for measures that would improve adherence to these medications, and hence their effectiveness and value to the community.

Competing interests

The authors have no competing interests to declare.

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