2 Population distribution of asthma medication use

Key points

- Between July 2002 and June 2004 there were 17,660,774 prescriptions subsidised by the PBS for asthma medications among 2,277,294 people in Australia.
- Fifty-five per cent of those who were dispensed asthma medications were female, 36% were aged 5 to 34 years and two-thirds lived in major cities.
- Use of all asthma medications increased with age.
- Use of inhaled corticosteroids and long-acting beta agonists, alone or in combination, was lowest in remote areas.
- Over half of all people who were prescribed inhaled corticosteroids were concession card holders, which is considerably higher than the proportion of concession card holders in the Australian population overall.
- The volume of inhaled corticosteroids dispensed to concession card holders was at least twice as great as that given to patients who were general beneficiaries. This raises the possibility that lack of affordability may limit use among general patients.

2.1 Introduction

Understanding the patterns of asthma medication use and how this varies in different population groups enables a better understanding of how the condition is being managed in the community and whether some groups are at risk of poorer quality asthma care. The aim of these analyses was to describe the rate of medication use for asthma in the community as a whole, and to assess variation by age group, sex, socioeconomic status and remoteness of residence. This will help to guide programs that will improve the use of medications for asthma.

2.2 Methods

Defining populations of interest

The following age groups were defined: 0 to 4 years, 5 to 14 years, 15 to 34 years, 35 to 64 years, and 65 years and over. For the analyses that were limited to concessional beneficiaries, that is, for short-acting beta agonists and oral corticosteroids, there were no population denominator data for children aged less than 15 years (see 'Population denominator data sources' below). Hence the age classification for these analyses was 15 to 34 years, 35 to 64 years and 65 years and over.

Analysis of socioeconomic status used the Socio-Economic Indexes for Areas (SEIFA), published by the Australian Bureau of Statistics (ABS 2003), as locality-based indicators of socioeconomic status. For the analysis presented here we used the Index of Relative Socio-Economic Disadvantage, which is derived from Census data on educational attainment, income, occupation, wealth, living conditions and access to services. Localities, based on postcode of residence, were classified into five quintiles of socioeconomic disadvantage (where 1 = most disadvantaged localities and 5 = most advantaged localities).

Using postcode, remoteness of residence was classified using the Australian Standard Geographical Classification (ASGC). This was developed by the ABS as an indicator of remoteness and allows a quantitative comparison between 'city' and 'country' Australia (ABS 2001a). Using this classification, postcodes were categorised into five Remoteness Area classes: *Major cities*, *Inner regional*, *Outer regional*, *Remote* and *Very remote*.

As prescriptions for inhaled corticosteroids and long-acting beta agonists are subsidised for all beneficiary categories, people who had been dispensed any inhaled corticosteroids or long-acting beta agonists were categorised as either concession card holders (including RPBS concession card holders) or general beneficiaries.

Where an individual's demographic characteristics changed during the study period, the characteristics were categorised based on the earliest record for that individual in the study data set.

Population denominator data sources

In the analyses of inhaled corticosteroids and long-acting beta agonists, the source of the denominator population of interest was the estimated resident population of Australia in 2001, obtained from the ABS. Further analyses of inhaled corticosteroids and long-acting beta agonists were carried out using the total estimated number of people in Australia with asthma or COPD as the denominator population, which was obtained from the 2001 National Health Survey (NHS) for people aged 15 years and over.

Because the analyses of short-acting beta agonists and oral corticosteroids were restricted to concession card holders, the population values were estimated as the average number of concession card holders in 2001. This estimate was also obtained from the 2001 NHS, in which people were asked to indicate possession of a Department of Veterans' Affairs entitlement card, health care card, pensioner concession card or Commonwealth Seniors Health card (ABS 2001b). This information was only acquired for people aged 15 years and over. The denominator populations are shown in Appendix 3.

Calculations

Medications were quantified in defined daily doses by assigning the defined daily dose (DDD) units to each PBS item using the Anatomical Therapeutic Chemical (ATC) classification system. DDD units (usually in milligrams or micrograms) are 'the assumed average maintenance dose per day for a drug used for its main indication in adults' (WHO Collaborating Centre for Drug Statistics Methodology 2006). This transforms the doses of different medications into a common unit of measurement that enables the addition of doses of different drugs in the same medication class and also enables comparisons to be made between different medication classes. All PBS items are classified by the ATC classification system, and can be directly linked to DDD units using the ATC Index available at

<www.whocc.no/atcddd/indexdatabase>. ATC codes are shown in Appendix 1. For instance, among inhaled corticosteroids, one DDD unit of budesonide is 800 μg, one DDD unit of beclomethasone is 800 μg and one DDD unit of fluticasone is 600 μg. Therefore, 800 μg of budesonide plus 600 μg of fluticasone is equivalent to 2 DDDs of inhaled corticosteroid.

First, the total number of DDDs dispensed in each record of the PBS data set was calculated for the dose strength represented by each PBS item code using the following formula:

Equation 2.1

$$DDDs = \frac{N \times M \times Q}{DDD\ unit}$$

where N is the number of prescriptions dispensed per record, M is the strength of each dose (milligrams or micrograms), Q is the average quantity of doses per prescription and *DDD unit* is one defined daily dose for the particular PBS item. In each medication class, the total DDDs dispensed in the population were calculated by summing DDDs within the populations of interest, that is, a selected combination of age group, sex, SEIFA quintile and ASGC category.

Therefore:

Equation 2.2

Total DDD in population = sum of DDDs in the population of interest

For formulations that combined medications from more than one class, in this case inhaled corticosteroids plus long-acting beta agonists, each drug was counted separately as contributing to both inhaled corticosteroids and to long-acting beta agonists.

Where the demographic data for a PIN changed during the course of the study period, the data associated with the earliest prescription supplied to that PIN were used. If demographic data were missing for a PIN, it was not included in the analyses related to the missing variables. This affected only a small proportion of PINs (Table 2.1).

Table 2.1: Missing demographic data

Demographic characteristic	Number of PINs with data missing	Per cent of PINs with data missing
Age group	1,289	0.06
Sex	840	0.04
Postcode	554	0.02
SEIFA category[(a)]	17,592	0.77
ASGC category[(a)]	765	0.03

(a) Postcodes were used to generate SEIFA and ASGC categories. It is noteworthy, however, that as some postcodes (e.g. new postcodes) could not be mapped to a category, missing SEIFA and ASGC categories were more common than missing postcodes.

The rate was then calculated as follows:

Equation 2.3

$$DDD \text{ per } 1{,}000 \text{ population per day} = \frac{Total\ DDD\ in\ population \times 1{,}000}{P \times Y}$$

where P is the denominator population of interest and Y is the total number of study days (in this case Y was 2 years or 731 days, including allowance for the leap year in 2004).

The independent effects of demographic characteristics on the population rate of use of asthma medications were quantified using log binomial models assuming the response

$$\frac{DDD / day}{population}$$

was a binomial proportion. The log function was used as the link so that rate ratios (RRs) could be calculated directly from the parameter coefficients of each model. To adjust for over-dispersion of the data, a Pearson's scale factor was used. The models were adjusted for age group, sex, socioeconomic status (SEIFA quintiles) and ASGC categories of remoteness.

2.3 Results

Demographic characteristics of the study population

Between July 2002 and June 2004 there were 17,660,774 prescriptions (after exclusions as outlined in Section 1.3) subsidised by the PBS for asthma medications among 2,277,294 people in Australia. A large proportion of the study population lived in localities in the most disadvantaged SEIFA quintile. This is likely to be because data for two of the medication classes on which the study data set was based (short-acting beta agonists and oral corticosteroids) were only complete for concessional beneficiaries who are more likely to be socioeconomically disadvantaged. Fifty five per cent of the study population were female, 36% were aged 5 to 34 years and two-thirds lived in *Major cities*. Among people aged 5 to 34 years, in whom the diagnosis of asthma was more certain, the distribution of demographic characteristics was similar to that for all ages (Table 2.2). It should be noted that while these medication classes are commonly used to treat asthma, they might also be used to treat other conditions. As also noted previously, not all asthma medications are dispensed through the PBS. Therefore, the number of individuals who are included in this dataset does not equate to the number of individuals with asthma in Australia.

Table 2.2: Demographic characteristics of people who were dispensed asthma medications that were subsidised by the PBS, Australia, 2002–03 to 2003–04

	All ages		Age 5 to 34 years	
Demographic characteristics	**Number**	**Per cent**	**Number**	**Per cent**
Sex				
Male	1,012,761	44.5	393,529	48.2
Female	1,263,633	55.5	423,044	51.8
Age group				
0 to 4 years	96,426	4.24	—	—
5 to 14 years	314,754	13.8	314,754	38.6
15 to 34 years	501,819	22.1	501,819	61.5
35 to 64 years	791,970	34.8	—	—
65 years and over	570,596	25.1	—	—
Socioeconomic status				
SEIFA 1 (most disadvantaged)	521,387	23.1	188,845	23.3
SEIFA 2	370,422	16.4	130,092	16.1
SEIFA 3	426,050	18.9	154,450	19.1
SEIFA 4	498,380	22.1	181,298	22.4
SEIFA 5 (most advantaged)	442,952	19.6	155,971	19.2
Remoteness category[(a)]				
Major cities	1,515,577	66.6	551,645	67.6
Inner regional	494,325	21.7	171,230	21.0
Outer regional	228,038	10.0	79,763	9.77
Remote	29,981	1.32	10,966	1.34
Very remote	8,165	0.36	2,880	0.35
All persons[(b)]	**2,277,294**	**100**	**816,573**	**100**

(a) Remoteness category based on Australian Standard Geographical Classification (ASGC).

(b) The overall number may be slightly greater than the sum of the subgroups as a small proportion of records were missing demographic data (see Table 2.1) and does not exclude individuals whose first date of supply was after 23 June 2004 or records of items where a person had filled more than 96 prescriptions for the item in a single medication class.

Concession card holder status

The beneficiary status of study subjects who had received inhaled corticosteroids was examined because all patient beneficiary categories are subsidised by the PBS for this medication class.

Over half (56%) of all people who were dispensed inhaled corticosteroids were holders of government concession cards at the time of their earliest inhaled corticosteroid prescription. Forty-five per cent of those aged 5 to 34 who were dispensed inhaled corticosteroids were concession card holders (Table 2.3).

The proportion of concession card holders among those dispensed inhaled corticosteroids is substantially higher than the proportion of concession card holders in the general population and in the subset of people with asthma or COPD. In the 2001 NHS, 35% of the general population and 41% of those who reported a diagnosis of asthma or COPD were concession

card holders (data obtained from ABS NHS 2001 confidentialised unit record files) (Table 2.3). This suggests that people who were dispensed inhaled corticosteroids were more likely to be concession card holders than people in the general population or people with a diagnosis of asthma or COPD.

Table 2.3: Beneficiary status in comparison populations in Australia

	At earliest inhaled corticosteroid prescription (PBS data 2002–04)		All persons (NHS 2001)		People who report having asthma or COPD (NHS 2001)	
Beneficiary status	All ages	Age 5 to 34 years	All ages	Age 5 to 34 years	All ages	Age 5 to 34 years
General	44%	55%	65%	76%	59%	71%
Concessional (including RPBS)	56%	45%	35%	24%	41%	29%

Medication use and demographic characteristics

In the Australian population, use of both inhaled corticosteroids and long-acting beta agonists increased with age (Table 2.4). Eighty-one DDDs of inhaled corticosteroids and 35 DDDs of long-acting beta agonists were used per day for every 1,000 people aged 65 years and over. This pattern of increasing use with age was also observed for inhaled corticosteroids and long-acting beta agonists that were used in combination formulations (Table 2.5). Use of asthma medications did not differ greatly with socioeconomic status, although in the population as a whole there tended to be higher rates of use among people living in areas of greater socioeconomic disadvantage. However, this was not observed when the analysis was limited to people aged 5 to 34 years. People living in more remote areas had lower rates of use of inhaled corticosteroids and long-acting beta agonists, both alone and in combined formulations. There were much higher rates of inhaled corticosteroids and long-acting beta agonists dispensed to concession card holders than to general beneficiaries, both alone and in combined formulations. This higher rate of dispensing of inhaled corticosteroids to concession card holders was not attributable to any real difference in the prevalence of asthma or COPD between concession card holders and general beneficiaries.

Table 2.4: Use of inhaled corticosteroids and long-acting beta agonists, Australia, 2002–03 to 2003–04

	DDD/1,000 persons/day			
	Inhaled corticosteroids[a]		Long-acting beta agonists[a]	
Demographic characteristics	**All ages**	**Age 5 to 34 years**	**All ages**	**Age 5 to 34 years**
Age group (years)				
0 to 4	1.66	—	1.21	—
5 to 14	7.81	7.81	5.73	5.73
15 to 34	13.7	13.7	6.03	6.03
35 to 64	27.4	—	11.4	—
65 and over	81.4	—	35.4	—
Sex				
Male	24.0	11.5	10.6	5.94
Female	27.9	12.1	12.3	5.92
Socioeconomic status				
SEIFA 1 (most disadvantaged)	28.2	11.1	12.2	5.52
SEIFA 2	28.3	11.3	12.6	5.80
SEIFA 3	27.3	11.9	12.2	6.13
SEIFA 4	25.5	11.5	11.3	5.81
SEIFA 5 (most advantaged)	25.8	12.7	11.5	6.25
Remoteness category (ASGC)				
Major cities	26.2	12.3	11.5	6.12
Inner regional	27.7	11.7	12.4	6.10
Outer regional	24.2	10.1	11.0	5.29
Remote/very remote	14.3	6.46	6.08	3.18
Beneficiary category[b]				
Concession card holders	60.7	24.4	26.2	10.8
General beneficiaries	17.2	10.9	7.22	4.78
All persons	**26.0**	**11.8**	**11.5**	**5.93**
	DDD/1,000 persons with asthma or COPD/day			
Beneficiary category[b]				
Concession card holder	375	126	162	56.1
General	139	74.0	58.3	32.4

(a) Examples of 1 DDD unit:
Inhaled corticosteroids = budesonide/beclomethasone 800 µg or fluticasone 600 µg
Long-acting beta agonists = salmeterol 100 µg, (e)formoterol 24 µg.

(b) Age 15 years and over. Denominator based on data from 2001 National Health Survey.

Table 2.5: Use of combined formulations of inhaled corticosteroids and long-acting beta agonists, Australia, 2002–03 to 2003–04

	DDD/1,000 persons/day			
	Inhaled corticosteroid in combined formulations[a]		Long-acting beta agonist in combined formulations[a]	
Demographic characteristics	**All ages**	**Age 5 to 34 years**	**All ages**	**Age 5 to 34 years**
Age group (years)				
0 to 4	0.61	—	1.15	—
5 to 14	3.94	3.94	5.37	5.37
15 to 34	7.93	7.93	5.50	5.50
35 to 64	15.9	—	9.65	—
65 and over	45.3	—	27.8	—
Sex				
Male	13.8	6.48	8.97	5.50
Female	15.5	6.76	10.3	5.41
Socioeconomic status				
SEIFA 1 (most disadvantaged)	16.2	6.26	10.3	5.12
SEIFA 2	16.2	6.37	10.5	5.33
SEIFA 3	15.8	6.84	10.3	5.66
SEIFA 4	14.4	6.50	9.41	5.33
SEIFA 5 (most advantaged)	14.0	6.94	9.55	5.70
Remoteness category (ASGC)				
Major cities	14.9	7.01	9.70	5.65
Inner regional	15.6	6.44	10.30	5.56
Outer regional	13.5	5.50	9.05	4.83
Remote/ very remote	7.66	3.32	5.09	2.91
Beneficiary category[b]				
Concession card holder	34.7	14.5	21.2	9.80
General	9.69	6.22	6.26	4.38
All persons	**14.7**	**6.62**	**9.62**	**5.46**
	DDD/1,000 persons with asthma or COPD/day			
Beneficiary category[b]				
Concession card holder	214	74.9	131	50.8
General	78.2	42.1	50.5	29.6

(a) Examples of 1 DDD unit:
Inhaled corticosteroids in the combined formulations Seretide: fluticasone 600 µg (inhaled corticosteroid) and salmeterol 100 µg (long-acting beta agonist) Symbicort: budesonide 800 µg and formoterol 24 µg.

(b) Age 15 years and over only. Denominator based on data from 2001 National Health Survey.

Differences in demographic characteristics did not explain the higher rate of inhaled corticosteroid and long-acting beta agonist use with age, the lower rates among people living in remote areas and the much higher rate among concession card holders (Table 2.6 and Table 2.7). Among people of all ages and those aged 5 to 34 years, concession card holders

used at least 2.5 times the amount of inhaled corticosteroids and long-acting beta agonists that general beneficiaries used.

Among people of all ages, use of these medication classes was slightly higher among people in more disadvantaged socioeconomic quintiles. However, this was not observed when the analysis was limited to those aged 5 to 34 years. Use of inhaled corticosteroids and long-acting beta agonists was slightly higher in females when all ages were combined; however, there was little difference among those aged 5 to 34 years.

Table 2.6: Effect[a] of demographic characteristics on use of inhaled corticosteroids, Australia, 2002–03 to 2003–04

	All ages		Age 5 to 34 years	
Demographic characteristics	**Unadjusted[b] RR (95% CI)[a]**	**Adjusted[c] RR (95% CI)[a]**	**Unadjusted[b] RR (95% CI)[a]**	**Adjusted[c] RR (95% CI)[a]**
Age group (years)				
0 to 4	0.33 (0.23–0.49)	0.33 (0.23–0.48)	—	—
5 to 14 (reference category)	1.00	1.00	—	—
15 to 34	1.76 (1.50–2.07)	1.75 (1.51–2.04)	—	—
35 to 64	3.53 (3.04–4.11)	3.53 (3.08–4.05)	—	—
65 and over	10.5 (9.06–12.2)	10.4 (9.07–12.0)	—	—
Sex				
Male (reference category)	1.00	1.00	1.00	1.00
Female	1.16 (0.92–1.45)	1.07 (1.02–1.13)	1.06 (0.94–1.18)	1.05 (0.94–1.18)
Socioeconomic status				
SEIFA 1 (most disadvantaged)	1.10 (0.77–1.55)	1.17 (1.07–1.27)	0.87 (0.73–1.04)	0.93 (0.78–1.11)
SEIFA 2	1.12 (0.78–1.63)	1.17 (1.06–1.28)	0.89 (0.73–1.08)	0.95 (0.79–1.16)
SEIFA 3	1.07 (0.75–1.53)	1.12 (1.03–1.22)	0.94 (0.78–1.12)	0.98 (0.82–1.17)
SEIFA 4	1.00 (0.71–1.41)	1.04 (0.96–1.13)	0.91 (0.77–1.08)	0.94 (0.80–1.10)
SEIFA 5 (most advantaged) (reference category)	1.00	1.00	1.00	1.00
Remoteness category (ASGC)				
Major cities (reference category)	1.00	1.00	1.00	1.00
Inner regional	1.05 (0.80–1.39)	0.97 (0.90–1.03)	0.95 (0.82–1.09)	0.95 (0.82–1.10)
Outer regional	0.92 (0.62–1.36)	0.87 (0.79–0.96)	0.80 (0.66–0.98)	0.81 (0.66–1.00)
Remote	0.72 (0.26–2.04)	0.77 (0.60–0.98)	0.65 (0.39–1.08)	0.66 (0.40–1.10)
Very remote	0.34 (0.04–2.60)	0.40 (0.25–0.65)	0.27 (0.10–0.73)	0.28 (0.10–0.75)
Beneficiary category[d]				
Concession card holder	3.56 (3.00–4.23)	2.50 (2.24–2.78)	2.23 (1.86–2.68)	2.40 (2.06–2.81)
General	1.00	1.00	1.00	1.00

(a) Measured as rate ratios (RR) with 95% confidence intervals (95% CI).

(b) Unadjusted rate ratios were estimated with a log binomial model and may differ slightly from rate ratios calculated from the crude rates.

(c) Adjusted for the effects of other variables in the model except beneficiary category.

(d) Adjusted for the effects of all other variables in the model, but limited to ages 15 years and over.

Table 2.7: Effect[a] of demographic characteristics on use of long-acting beta agonists, Australia, 2002–03 to 2003–04

	All ages		Age 5 to 34 years	
Demographic characteristics	Unadjusted[b] RR (95% CI)[a]	Adjusted[c] RR (95% CI)[a]	Unadjusted[b] RR (95% CI)[a]	Adjusted[c] RR (95% CI)[a]
Age group (years)				
0 to 4	0.27 (0.20–0.37)	0.27 (0.21–0.36)	—	—
5 to 14 (reference category)	1.00	1.00	—	—
15 to 34	1.05 (0.93–1.19)	1.05 (0.94–1.18)	—	—
35 to 64	2.01 (1.80–2.24)	2.01 (1.82–2.22)	—	—
65 and over	6.25 (5.61–6.96)	6.18 (5.59–6.82)	—	—
Sex				
Male (reference category)	1.00	1.00	1.00	1.00
Female	1.16 (0.93–1.44)	1.08 (1.03–1.13)	1.00 (0.92–1.07)	0.99 (0.93–1.06)
Socioeconomic status				
SEIFA 1 (most disadvantaged)	1.07 (0.76–1.49)	1.12 (1.04–1.21)	0.88 (0.79–0.99)	0.93 (0.84–1.03)
SEIFA 2	1.13 (0.79–1.61)	1.15 (1.06–1.25)	0.93 (0.82–1.05)	0.97 (0.87–1.09)
SEIFA 3	1.08 (0.76–1.52)	1.11 (1.03–1.21)	0.98 (0.88–1.10)	1.01 (0.91–1.12)
SEIFA 4	0.99 (0.71–1.38)	1.03 (0.96–1.11)	0.93 (0.84–1.04)	0.95 (0.86–1.04)
SEIFA 5 (most advantaged) (reference category)	1.00	1.00	1.00	1.00
Remoteness category (ASGC)				
Major cities (reference category)	1.00	1.00	1.00	1.00
Inner regional	1.07 (0.82–1.40)	0.99 (0.93–1.05)	1.00 (0.92–1.08)	1.00 (0.92–1.09)
Outer regional	0.95 (0.66–1.38)	0.90 (0.83–0.98)	0.85 (0.76–0.96)	0.85 (0.76–0.96)
Remote	0.70 (0.25–1.93)	0.74 (0.59–0.93)	0.65 (0.48–0.88)	0.65 (0.48–0.89)
Very remote	0.33 (0.05–2.40)	0.40 (0.26–0.62)	0.27 (0.15–0.49)	0.28 (0.15–0.51)
Beneficiary category[d]				
Concession card holders	3.05 (2.65–3.52)	2.46 (2.20–2.75)	2.27 (1.87–2.74)	2.46 (2.08–2.89)
General beneficiaries	1.00	1.00	1.00	1.00

(a) Measured as rate ratios (RR) with 95% confidence intervals (95% CI).

(b) Unadjusted rate ratios were estimated with a log binomial model and may differ slightly from rate ratios calculated from the crude rates.

(c) Adjusted for the effects of other variables in the model except beneficiary category.

(d) Adjusted for the effects of all other variables in the model, but limited to ages 15 years and over.

Among government concession card holders aged 15 years and over, use of short-acting beta agonists and oral corticosteroids also increased with age. Those aged 65 years and over used 88 DDDs of short-acting beta agonists per 1,000 persons per day and 22 DDDs of oral corticosteroids per 1,000 persons per day (Table 2.8). There were slight differences in use between males and females. As this was limited to concession card holders, a greater proportion were represented in the two most disadvantaged quintiles than in the general population and therefore socioeconomic impacts could not be investigated in this population.

Table 2.8: Use of short-acting beta agonists and oral corticosteroids, concession card holders, Australia, 2002–03 to 2003–04

	DDD/1,000 persons/day			
	Short-acting beta agonists[a]		Oral corticosteroids[a],[b]	
Demographic characteristics	**Age 15 years and over**	**Age 15 to 34 years**	**Age 15 years and over**	**Age 15 to 34 years**
Age group (years)				
15 to 34	46.7	46.7	4.56	4.56
35 to 64	66.3	—	12.0	—
65 and over	88.4	—	21.9	—
Sex				
Male	73.0	48.6	13.9	3.90
Female	68.1	45.5	14.2	4.99
Remoteness category (ASGC)				
Major cities	70.7	47.0	14.2	4.64
Inner regional	69.9	47.8	14.3	4.49
Outer regional, Remote, Very remote	68.2	43.1	12.8	4.30
All persons	**70.2**	**46.7**	**14.1**	**4.56**

(a) Examples of 1 DDD: Short-acting beta agonists = Salbutamol MDI 800 µg or Salbutamol nebuliser 10 mg. Oral corticosteroids = Prednisone 10 mg.

(b) Oral corticosteroids are only those dispensed to individuals who had also been dispensed other respiratory medications.

Multivariate analyses adjusting for demographic variables indicated that the observed increase in use of short-acting beta agonists or oral corticosteroids with age was not explained by differences in other demographic characteristics. Females had slightly higher use of oral corticosteroids than males, though there was little difference among people aged 15 to 34 years. Remoteness category did not have significant effects on the use of these medication classes (Table 2.9 and Table 2.10).

Table 2.9: Effect[a] of demographic characteristics on use of short-acting beta agonists, concession card holders, Australia, 2002–03 to 2003–04

	Age 15 years and over		Age 15 to 34 years	
Demographic characteristics	**Unadjusted[b] RR (95% CI)[a]**	**Adjusted[c] RR (95% CI)[a]**	**Unadjusted[b] RR (95% CI)[a]**	**Adjusted[c] RR (95% CI)[a]**
Age group (years)				
15 to 34 (reference category)	1.00	1.00	—	—
35 to 64	1.43 (1.21–1.69)	1.43 (1.21–1.69)	—	—
65 and over	1.89 (1.61–2.21)	1.89 (1.61–2.21)	—	—
Sex				
Male (reference category)	1.00	1.00	1.00	1.00
Female	0.93 (0.80–1.08)	0.95 (0.85–1.06)	0.94 (0.75–1.18)	0.94 (0.74–1.18)
Remoteness category (ASGC)				
Major cities (reference category)	1.00	1.00	1.00	1.00
Inner regional	0.99 (0.83–1.18)	1.00 (0.87–1.14)	1.01 (0.77–1.33)	1.01 (0.77–1.33)
Outer regional, Remote, Very remote	0.95 (0.76–1.19)	0.96 (0.81–1.14)	0.90 (0.63–1.29)	0.90 (0.63–1.29)

(a) Measured as rate ratios (RR) with 95% confidence intervals (95% CI).

(b) Unadjusted rate ratios were estimated with a log binomial model and may differ slightly from rate ratios calculated from the crude rates.

(c) Adjusted analysis presents the results for each variable after adjusting for the effects of other variables.

Table 2.10: Effect[a] of demographic characteristics on use of oral corticosteroids[b], concession card holders, Australia, 2002–03 to 2003–04

	Age 15 years and over		Age 15 to 34 years	
Demographic characteristics	**Unadjusted[c] RR (95% CI)[a]**	**Adjusted[d] RR (95% CI)[a]**	**Unadjusted[c] RR (95% CI)[a]**	**Adjusted[d] RR (95% CI)[a]**
Age group (years)				
15 to 34 (reference category)	1.00	1.00	—	—
35 to 64	2.63 (2.05–3.38)	2.64 (2.05–3.39)	—	—
65 and over	4.80 (3.79–6.08)	4.81 (3.79–6.10)	—	—
Sex				
Male (reference category)	1.00	1.00	1.00	1.00
Female	1.02 (0.79–1.31)	1.06 (0.93–1.20)	1.28 (1.01–1.63)	1.28 (1.00–1.64)
Remoteness category (ASGC)				
Major cities (reference category)	1.00	1.00	1.00	1.00
Inner regional	1.01 (0.75–1.35)	1.03 (0.89–1.20)	0.97 (0.72–1.30)	0.97 (0.73–1.29)
Outer regional, Remote, Very remote	0.89 (0.60–1.31)	0.92 (0.76–1.12)	0.91 (0.62–1.34)	0.92 (0.64–1.32)

(a) Measured with rate ratios (RR) with 95% confidence intervals (95% CI).

(b) Oral corticosteroids are only those dispensed to individuals who had also been dispensed other respiratory medications.

(c) Unadjusted rate ratios were estimated with a log binomial model and may differ slightly from rate ratios calculated from the crude rates.

(d) Adjusted analysis presents the results for each variable after adjusting for the effects of other variables.

2.4 Discussion

Inhaled corticosteroids and long-acting beta agonists

The use of inhaled corticosteroids and long-acting beta agonists increased with age, was lower in those living in remote areas, and was higher among holders of government concession cards. There were no consistent differences between males and females.

Age

The higher rate of use in older people, compared with younger people, may be due to the presence of COPD in older persons. Among people aged 5 to 34 years, most of the medications included in this study would be used for asthma, and total medication use was much lower when analyses were confined to this age group. In older persons, these medications are commonly used to treat COPD, as well as asthma. This extra reason for use may explain the higher use of 'asthma' medications in older persons.

Remoteness

The lower use of inhaled corticosteroids and long-acting beta agonists in remote areas may reflect differences in access to health care. This could signal the need for further effort to focus on people in rural and remote regions of Australia. However, it is noteworthy that Remote Area Aboriginal Health Services have access to medications under s. 100 of the National Health Act and these are not included in the PBS data (DoHA 2006a). This may account for some of the apparent under-use in remote areas.

Socioeconomic status

Among people of all ages, the use of inhaled corticosteroids and long-acting beta agonists rose with greater socioeconomic disadvantage. Interestingly, this trend was not observed among people aged 5 to 34 years. Generally, pharmaceutical use has been observed to be highest among people with lower socioeconomic status and this is put down to poorer health in this subgroup of the population (Metge et al. 1999). However, use of inhaled corticosteroids in the United States was reported to be higher among people of higher socioeconomic status (Adams R et al. 2002). The differences among these findings may reflect inconsistency in the measurement of socioeconomic status. In our study, this is based on locality rather than individual characteristics such as income and level of education. More fundamental differences between countries in the nature of their health care systems and socioeconomic gradients may also explain these different patterns. In countries without subsidised access to medications, it is very likely that the cost of medications represents a substantial barrier to their use among people with limited economic resources.

Concession card holder status

Over half of the subjects who were dispensed inhaled corticosteroids were concession card holders, which was disproportionately high in comparison with the general population or people with asthma or COPD. The volume of inhaled corticosteroids and long-acting beta agonists dispensed in relation to the number of people in the population was more than twice as great among those who were concession card holders than among those who were

general beneficiaries. This was also true when the analysis was limited to people aged 15 to 34 years who were most likely to have asthma. When analyses were adjusted for other demographic variables, concession card holders were dispensed at least 2.5 times more inhaled corticosteroids or long-acting beta agonists than general beneficiaries. It seems most likely that this higher rate of use by concessional beneficiaries is attributable to greater affordability, because concession card holders pay a much lower copayment than general patients.

Getting a valid estimate of the number of Australians holding concession cards presented several difficulties. All methods to quantify the number of concession card holders in Australia are limited by the constantly changing nature of peoples' concession card status (for example, due to changing employment or pension status). Data from the 2001 NHS was used to estimate the total number of people with government health concession cards as the population denominator for the analyses of short-acting beta agonist and oral corticosteroid use. As this information was not available for all age groups, analyses of the population distribution of asthma medication use among concession card holders were restricted to those aged 15 years and over. Data from the NHS was also used to estimate the number of people in Australia with asthma or COPD. Although these data are based on self-report, they indicate that the higher rate of use of inhaled corticosteroids among concession card holders is not attributable to a higher prevalence of asthma and COPD in this population.

Short-acting beta agonists and oral corticosteroids

Among concession card holders, the use of short-acting beta agonists and oral corticosteroids was also higher for older people. The need to limit these analyses to concession card holders meant it was not possible to judge the impact of socioeconomic status, as concession card holders already represent a more socioeconomically disadvantaged subgroup. Therefore, it is not possible to draw conclusions about short-acting beta agonist and oral corticosteroid use by socioeconomic status. Studies elsewhere have explored this. In Canada, Lynd and colleagues (2004) found that higher short-acting beta agonist use was associated with greater levels of socioeconomic disadvantage even when controlling for level of asthma severity.

Unlike the observations made of inhaled corticosteroids and long-acting beta agonists, no link was found between remoteness of residence and use of short-acting beta agonists and oral corticosteroids. This could be due to limiting the populations to concession card holders who might be more highly represented in regional and remote localities. Further study will be necessary to investigate this relationship.