

Asthma medicines (SABAs, LABAs and ICSs) and hospitalisations by age and by ethnicity over time

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Summary

PHARMAC staff have analysed PharmHouse dispensings data for asthma medicines, and asthma (and chronic obstructive pulmonary disease (COPD)) hospitalisation data over time, by age and ethnicity.

The PharmHouse extract gave information on 2,464,955 dispensings for asthma medications. Most drug utilisation analysis was restricted to 2003/04 (half of the extract), as dispensing data for previous years were insufficient to examine time trends. Many of the analyses were conducted for 0-34 year-olds only, to remove the effects of COPD.

The analyses are also limited through using ecological data, using unlinked hospitalisation and pharmaceutical databases, and so cannot reliably connect usage with outcomes. We have not yet performed any cohort analyses by linking individuals' drug utilisation with outcomes.

Despite these limitations, the results seem to raise three issues of particular concern:

1. Lower than expected use of inhaled corticosteroids (ICSs) and long-acting beta agonists (LABAs) for asthma among Maori and Pacific people (across all ages), alongside higher hospitalisation rates. Other indices too suggest poorer asthma control for these ethnic groups. *This is consistent with previous work showing higher asthma hospitalisation rates in Maori and Pacific people, and disparities between utilisation and need by ethnic group in other disease states in New Zealand.*
2. Likely poorer control of asthma in young children and late adolescents/early adults.
3. The high use of asthma medicines for COPD. This includes the higher use of LABAs by older patients than younger (where the majority of older patients should have predominantly COPD rather than predominantly asthma).

Key findings are:

- Possibly 350,400 patients in New Zealand use inhaled corticosteroids (ICSs) (including Symbicort), 63,000 use long-acting beta agonists (LABAs) (including Symbicort), and 429,500 use short-acting beta agonists (SABAs). Of these figures, 53%, 42% and 2/3rds respectively are likely to be people with predominantly asthma (rather than COPD));
- Treatment utilisation varies by age. For example, SABA and ICS usage rates are highest in young children; LABA use is higher in middle ages;

- Ratios of SABA to ICS dispensings (a measure of possible poor asthma control at population level) also vary by age – highest in young children, with another peak at age 15 to 34.
- Asthma hospitalisation rates vary widely by ethnicity. Age-standardised rates in NZ Europeans aged 0-34 have if anything reduced, while rates in Maori and Pacific people have risen. In 2003/04 Maori and Pacific people aged 0-34 had hospitalisation rates 2.6 and 2.9 times (respectively) that of NZ Europeans.
- Asthma treatment utilisation also varies by ethnicity. For example:
 - The use of LABAs is much higher in NZ Europeans than other ethnic groups.
 - Rates of ICS use are the same for NZ Europeans and Maori, but less for Pacific patients.
 - Rates of SABA use are highest in Maori and lower in Pacific patients, contrasting with the highest rates of hospitalisations occurring in Pacific patients.
 - Relative to NZ Europeans, Maori and especially Pacific patients have higher SABA/ICS ratios (suggesting poorer control) and lower ICS/hospitalisation ratios (suggesting unmet need, where hospitalisation proxy higher need than in NZ Europeans).
 - SABA/ICS ratios over changed little over time for Maori patients, although Pacific patients have seen some decrease.

Contents

Summary.....	1
Contents.....	2
Context	3
Methods	3
Dispensings measured in the data extract.....	6
Patterns of asthma medicine use by age	9
Asthma hospitalisations by ethnicity and time.....	13
Asthma drug use by ethnic group.....	15
Caveats to the analysis.....	20
Implications for policy	21
Additional (more detailed) tables.....	23

Context

PHARMAC staff have recently analysed PharmHouse dispensings data for asthma medicines, relating these to NZHIS hospitalisation episode data for asthma and chronic obstructive pulmonary disease (COPD), in order to derive comparative utilisation rates over time by age and ethnicity.

The analysis is in response to a directive by PHARMAC's Board at its June 2004 meeting that PHARMAC staff provide the Board with "an analysis of asthma hospitalisation rates in Maori relative to non-Maori, associated with temporally-relevant utilisation rates of asthma pharmaceuticals and other PHARMAC interventions".

Methods

PHARMAC staff obtained from NZHIS counts of hospital discharges for asthma (IC9-CM code 493) for the 5 years 1 July 1999 to 30 June 2004, clumped into 6-month time periods and stratified by age and ethnic group. Similar hospitalisation data were obtained for COPD (codes 490-492, 496) but these did not include ethnicity.

PHARMAC staff concurrently extracted one-way encrypted NHI-annotated dispensing claims data from the PharmHouse data warehouse for inhaled corticosteroids (ICSs), inhaled long-acting beta-agonists (LABAs) and inhaled/oral short-acting beta-agonist relievers (SABAs), for the period July 1999 to June 2004. Encrypted NHIs then linked with NHI data to assign dates of birth and ethnicity codes to each dispensing, enabling the calculation of age at time of dispensing. Data were then aggregated into strata comprising age x ethnic group x 6-month time period x TG2 group and chemical. Scripts and dispensings were summed for each stratum.

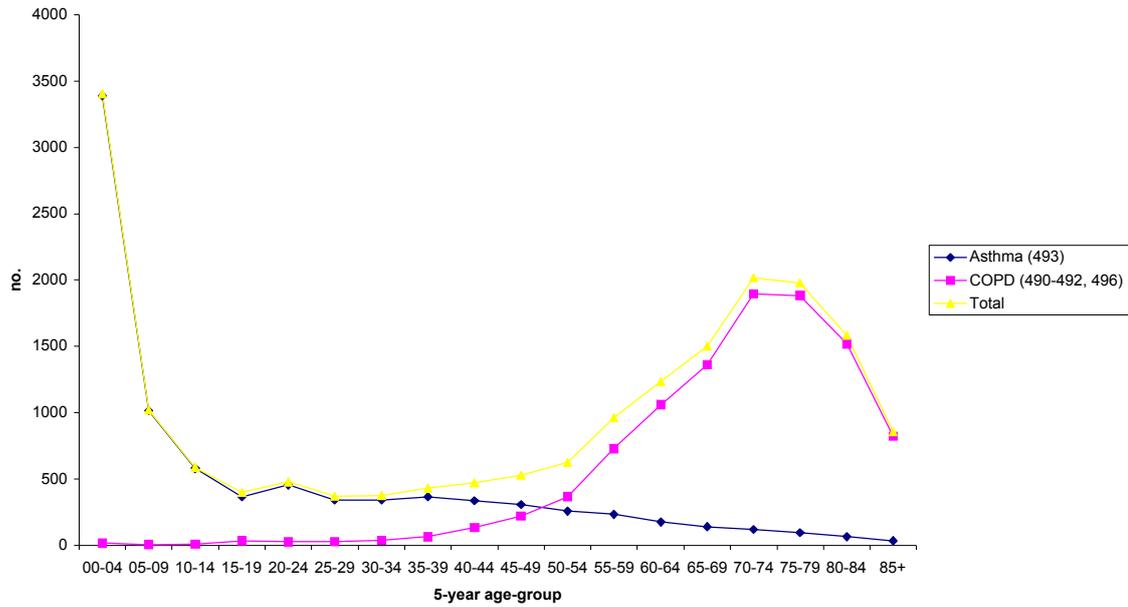
'Dispensings equivalents' were derived for ICSs and LABAs, to adjust for beclomethasone and budesonide BADs/MDIs containing 200 doses (equivalents to 50 day's treatment at 2 puffs b.d.), compared with fluticasone, Symbicort (combination budesonide/eformoterol ICS/LABA device), eformoterol and salmeterol being equivalent to 30 days' treatment. Each Dispensing equivalent was therefore assumed to represent one person-month's usage of ICS or LABA. Similarly, salbutamol MDI equivalents were derived for SABAs to adjust for some devices containing 400 doses (compared with 200 doses in each dispensing of salbutamol 200 mcg).

For comparison, dispensing equivalents were calculated by TG2 group x chemical x time period for all PharmHouse data (i.e. all dispensings in New Zealand, regardless of the presence of encrypted NHIs).

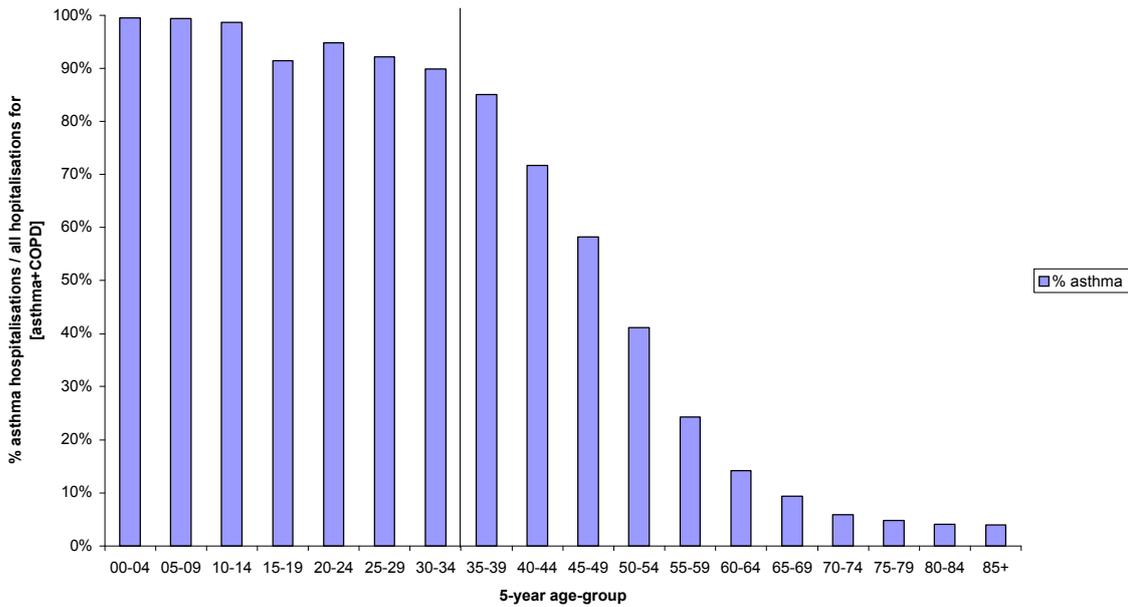
We obtained counts of NHIs by TG2 class, in order to estimate numbers of patients with NHIs using asthma drugs and compare these with dispensings – to estimate rates of dispensings per patient each year (a measure of compliance).

To estimate ICS, SABA etc use specific to asthma (rather than COPD), we weighted age-specific counts of dispensing equivalents by age-specific proportions of asthma/[asthma+COPD combined] hospitalisations for the relevant time period (see graphs below).

Asthma and COPD hospitalisations 2003/04, by age-group



Asthma and COPD hospitalisations 2003/04, by age-group



(Note that we used hospitalisation data to estimate asthma/COPD ratios by age for asthma pharmaceutical, since these were the only reliable such data available).

Age-specific utilisation and hospitalisation rates by ethnicity over time were calculated from the above dispensing equivalents etc., denominated by age/ethnic-specific Census 2001 population counts (downloaded from the Statistics NZ website). Age-standardised rates for ages 0-34 was undertaken using the direct method, standardised to relevant weights from Segi's world population. The age-range 0-34 was chosen as being specific to asthma and not likely to be unduly confounded by some ICS and SABA use etc. being for COPD (where prevalence rises dramatically with age). Restricting analysis of asthma hospitalisations to the 0-34 age-range is often done in the New Zealand setting, to reduce confounding by COPD.

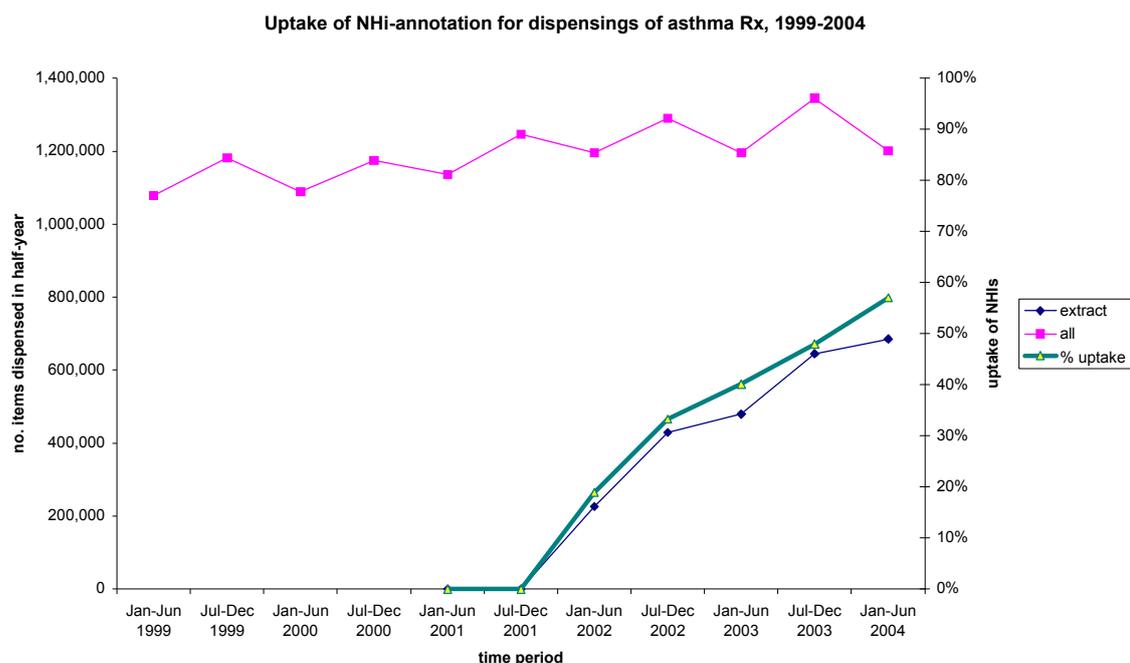
In discussion with NZHIS, ethnicity rates were adjusted for missing data, by redistributing those dispensing episodes or hospitalisations non-specifically coded “54 Other” or “99 Other” to the known ethnic groups. Although less of a problem for hospitalisations – where 2.2% of hospitalisations were coded as 54 or 99 (c.f. 4.0% of people in the Census 2001 had their ethnicity ascribed as “not stated”), it was a problem for the PharmHouse asthma medicines data – where 15.7% of items had ethnicity codes 54 or 99.

Estimates of patient numbers for all New Zealand by drug were obtained by dividing dispensing-equivalent based patient numbers in the extract by the % [no. of dispensing equivalents for the drug in the extract]/[no. dispensing equivalents in all PharmHouse data] for the relevant time period.

For simplicity and in order to meet time deadlines, there was no attempt to use the NHI numbers to link across different asthma medications at individual patient level (in order to examine combinations of drugs). Nor were formulation data collected, nor days treatment data nor other data able to determine average daily doses (ADDs). Nor was there any attempt to examine a cohort of patients in order to track utilisation over time. Data for anticholinergic short-acting relievers and for other asthma treatments were not collected.

Dispensings measured in the data extract

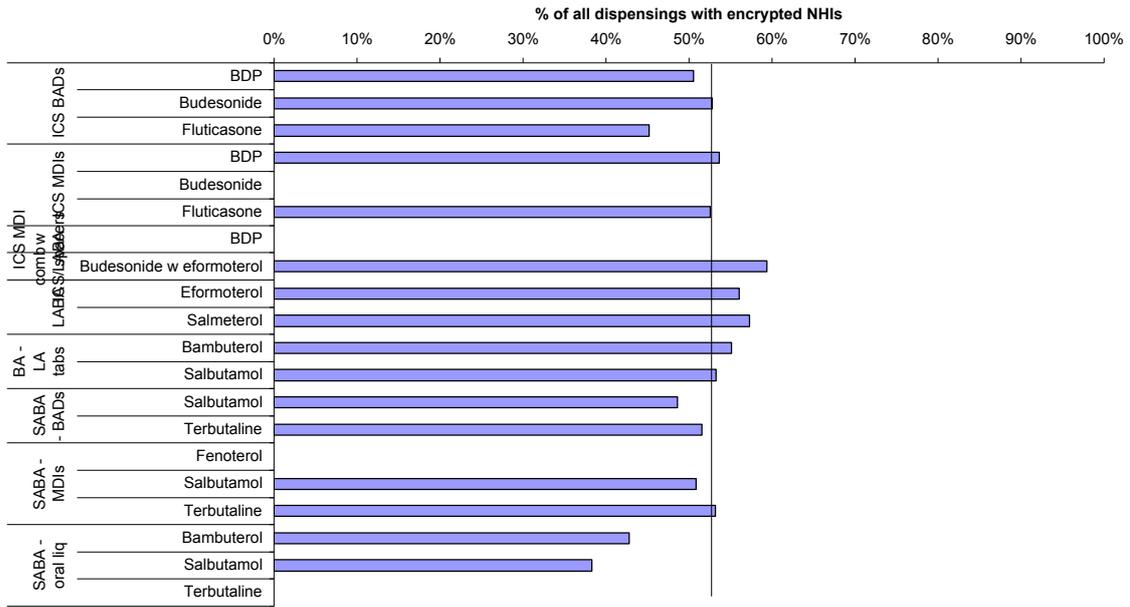
The extract derived information on 2464955 dispensings for asthma mediations. Dispensings in the extract for 2003/04 represented half of all dispensings for asthma Rx (1330100 in extract/2545455 all). Uptake of NHI annotation had progressed substantially, from none in early 2001 and 9% for the whole 2001/02 year, to 37% in 2002/03, to 52% for 2003/04 (see graph below).



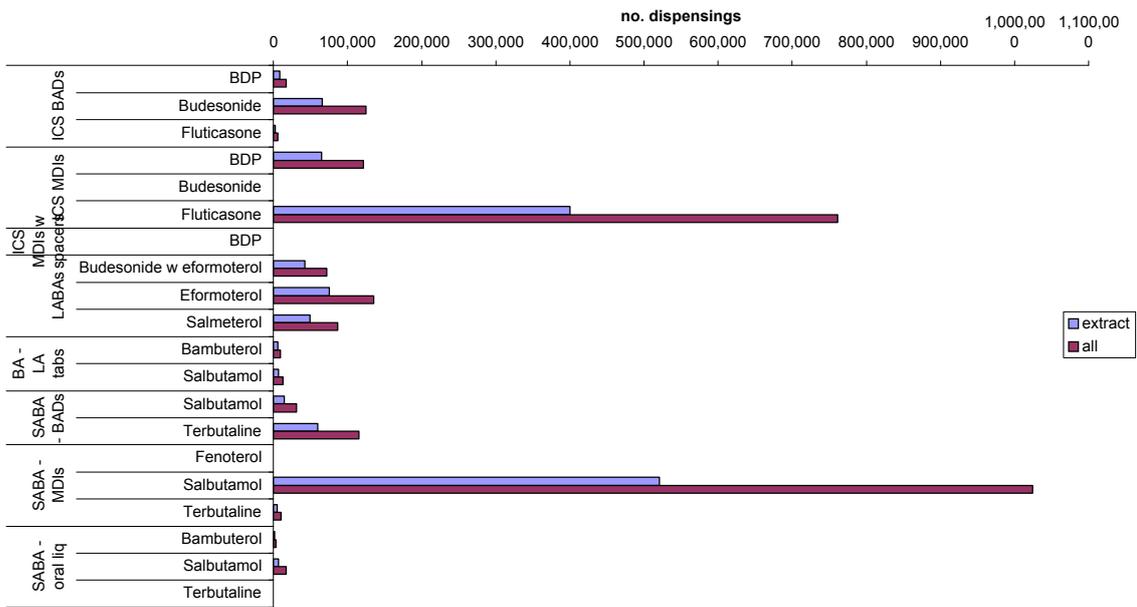
This means that time series analysis is impossible for asthma drugs – with too few points and too great changes in uptake over time to be able to make valid comparisons over time. Hence, utilisation analysis has been restricted to the most recent 2003/04 year – apart from analysis of SABA/ICS ratios (which should not be affected by differences in uptake over time, assuming both SABA and ICS NHI uptake changes are similar).

Dispensings by Rx in 2003/04 in the extract appeared to be in similar proportions to all dispensings over that same period, varying from 38% to 59%.

Extract vs. all, asthma Rx 2003/04



Extract vs. all, asthma Rx 2003/04



The 1.3 million dispensings in the extract for 2003/04 equated to 1430884 dispensings equivalents (accounting for BDP and Pulmicort normatively lasting more than one month). Of the dispensings there were 429023 individual NHI numbers representing individual patients – that is, on average each patient had 3.33 dispensing-equivalent items dispensed that year (see table below).

NHI extract

Tg Level2 Name	Data FYR				count NHIs 2004	FYR 2004			
	No. of Items	2002	disp equiv	2004		NoNHIs	items/pt/yr	disp equiv/py	% of pt yr
ICS BADs	76,753	18,452	126,186	30,061	30,862	2.49	4.09	34%	197.3
ICS MDIs	465,233	80,751	508,586	95,270	145,671	3.19	3.49	29%	131.2
ICS MDIs w spacers		29		48					
LABAs	167,695	18,019	167,695	18,019	36,018	4.66	4.66	39%	120.0
SABA - BADs	74,346	18,111	89,257	25,389	31,245	2.38	2.86		144.1
SABA - MDIs	526,161	86,287	531,401	87,561	179,447	2.93	2.96		121.2
SABA - oral liq	7,759	2,042	7,759	2,042	5,850	1.33	1.33		120.0
Total	1,317,947	223,691	1,430,884	258,390	429,093	3.07	3.33		
ICSs w/o comb ICS/LABA	541,986		634,772		176,533	3.07	3.60	30%	140.5
LABAs incl comb ICS/LABA	167,695		167,695		36,018	4.66	4.66	39%	120.0
SABAs	608,266		628,417		216,542	2.81	2.90		

Applying the extract results to all PharmHouse data and asthma/asthma+COPD therefore meant estimates of 350,400 patients in News Zealand using ICS (including Symbicort) during 2003/04, of whom there were possibly 186,300 with predominantly asthma (rather than predominantly COPD – being 53% of all patients). Likewise there could have been 63,000 patients using LABAs (including Symbicort) – of whom just less than half (43%) could be predicted to have predominantly asthma (27,200 patients). For SABAs there were perhaps 429,500 patients, with 2/3rds likely to be asthma rather than COPD (282,400 patients) – see table below.

estimates of pyes and pt numbers

all NZ, extrapolated from NHI extract

Actual/Forecast	Actual
FYR	2004

Rx class	ATCLeve2Name	Data		disp equiv/pt*	no. patients*	pyes	no. pts asthma**	% asthma**/ asthma+COPD	prvl asthma :1000*
		Items	disp equiv						
ICS	ICS BADs	146,925	241,034	4.09	58,951	20,086			
	ICS MDIs	882,764	963,599	3.49	275,997	80,300			
	ICS MDIs w spacers	0	0			0			
ICS/LABA	LABAs	71,728	71,728	4.66	15,406	5,977			
LABAinh	LABAs	221,404	221,404	4.66	47,554	18,450			
SABA	SABA - BADs	146,067	176,763	2.86	61,877				
	SABA - MDIs	1,034,133	1,043,985	2.96	352,540				
	SABA - oral liq	19,950	19,950	1.33	15,042				
Total		2,522,971	2,738,463						
ICSs incl comb ICS/LABA			1,276,361	3.64	350,354	106,363	186,296	53%	49.8
LABAs incl comb ICS/LABA			293,132	4.66	62,960	24,428	27,152	43%	7.3
SABAs			1,240,698	2.89	429,458		282,407	66%	75.6

*probable underestimate of pt nos., through overestimating dispensings/pt (because earlier data less likely to have NHIs ascribed, hence too few p
 **derivation includes age-specific % hospitalisations for asthma/hospitalisations for asthma+COPD combined

Note though the above patients numbers may well be underestimates, through overestimating the numbers of dispensings per patient. This is because dispensings occurring earlier in the year would be less likely to have NHIs ascribed, hence there would be too few patients.

Patterns of asthma medicine use by age

Stratifying by age, there were 563,900 dispensing equivalents in the extract in 2003/04 for asthma drugs in patients aged less than 35 years (39% of the 1.4 million dispensings equivalents). 35% of ICS (including Symbicort) and 48% of SABA dispensing equivalents were in patients aged less than 35 (see table below).

Tg Level1	Respiratory System and Allergies
FYR	2004

Sum of disp equiv			Rx ICS			
age 0-34	agegroup	5-yr	ICS incl	LABAinh	SABA	Total
	3	agegroup	comb			
+	0-4	00-04	33,441	1,276	56,789	91,506
	5-14	05-09	40,301	2,714	42,217	85,232
		10-14	38,422	3,766	43,151	85,339
	15-24	15-19	31,192	3,735	39,568	74,495
		20-24	29,058	4,223	38,086	71,367
25-34	25-29	28,862	4,680	37,178	70,720	
	30-34	35,195	5,978	44,103	85,276	
+ Total			236,471	26,372	301,092	563,935
-(35-64)	35+	35-39	37,448	7,171	43,310	87,929
		40-44	44,785	8,377	46,130	99,292
		45-49	41,328	8,323	38,603	88,254
		50-54	41,977	9,104	35,323	86,404
		55-59	46,608	11,034	34,620	92,262
		60-64	48,642	11,856	31,779	92,277
-(35-64) Total			260,788	55,865	229,765	546,418
-(65+)	35+	65-69	48,063	12,480	28,106	88,649
		70-74	48,884	12,083	26,617	87,584
		75-79	43,524	10,495	22,295	76,314
		80-84	27,804	5,912	14,491	48,207
		85+	11,814	1,912	6,051	19,777
-(65+) Total			180,089	42,882	97,560	320,531
Total			677,348	125,119	628,417	1,430,884

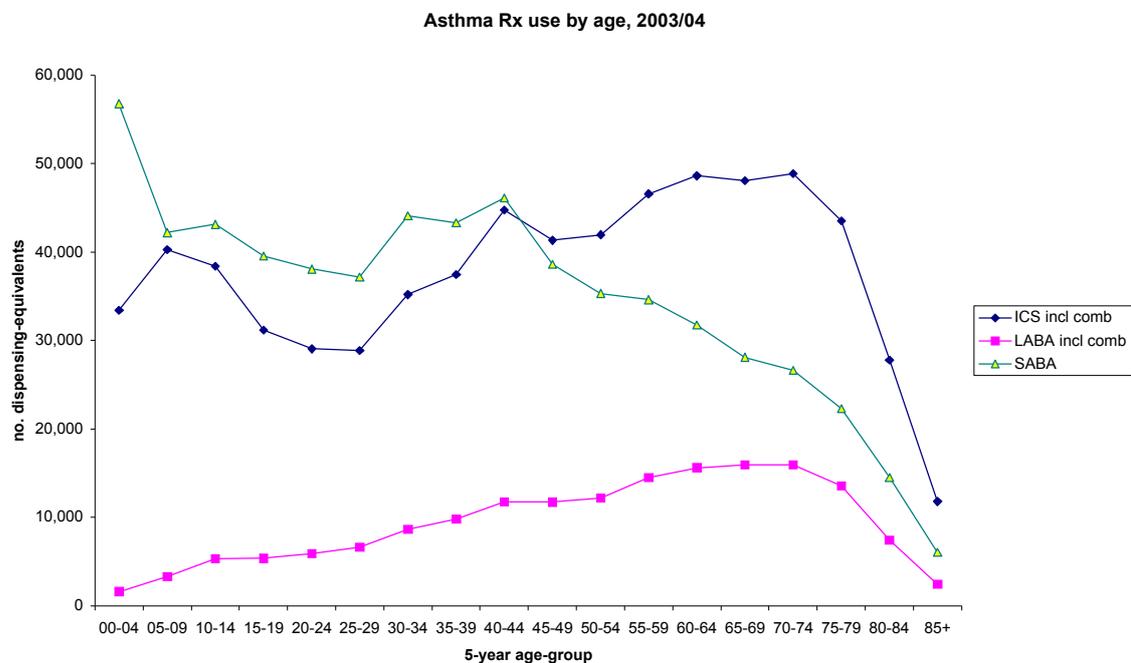
Extrapolating to all New Zealand means estimates of 116,700 patients aged 0-34 with asthma using ICSs (including Symbicort), 13,000 aged 0-34 using LABAs, and 196,300 aged 0-34 using SABAs – see below table. However again, patient numbers may well be underestimates, through overestimating the numbers of dispensings per patient.

estimates of pyes and pt numbers, by 5-year age-group

disp-equiv/pt (mean; NOT adjusted for age)*	disp-equiv pmes - all NZ (extrapolated from extract)			% asthma	est. no. pts with asthma*		
	ICS incl comb	LABA incl c	SABA		ICS incl comb	LABA incl c	SABA
					3.64	4.66	2.89
00-04	63,014	2,795	112,120	99.6%	17,221	598	38,638
05-09	75,942	5,779	83,350	99.4%	20,723	1,234	28,681
10-14	72,401	9,256	85,194	98.6%	19,603	1,961	29,088
15-19	58,777	9,397	78,120	91.5%	14,756	1,846	24,731
20-24	54,755	10,329	75,194	94.8%	14,245	2,103	24,669
25-29	54,386	11,556	73,401	92.1%	13,755	2,287	23,411
30-34	66,320	15,084	87,074	89.9%	16,370	2,913	27,102
35-39	70,565	17,143	85,508	85.1%	16,487	3,134	25,193
40-44	84,391	20,557	91,076	71.7%	16,610	3,166	22,604
45-49	77,876	20,494	76,215	58.3%	12,453	2,564	15,368
50-54	79,099	21,336	69,739	41.2%	8,942	1,887	9,942
55-59	87,826	25,367	68,351	24.2%	5,845	1,321	5,736
60-64	91,659	27,307	62,742	14.2%	3,565	831	3,077
65-69	90,568	27,902	55,490	9.4%	2,334	563	1,803
70-74	92,114	27,882	52,551	5.9%	1,493	353	1,074
75-79	82,014	23,682	44,018	4.8%	1,070	242	724
80-84	52,393	12,967	28,610	4.0%	581	113	400
85+	22,262	4,300	11,947	4.0%	243	37	164
Total	1,276,361	293,132	1,240,698	45.7%	186,296	27,152	282,407
total pts	350,354	62,960	429,458		186,296	27,152	282,407
prevalence :1000					49.8	7.3	75.6
%asthma/[asthma+COPD]					53%	43%	66%
age 0-34	445,594	64,196	594,453		116,673	12,941	196,320
est. no. pts*	122,313	13,788	205,765		116,673	12,941	196,320
prevalence :1000					62.1	6.9	104.5
%asthma/[asthma+COPD]					95%	94%	95%

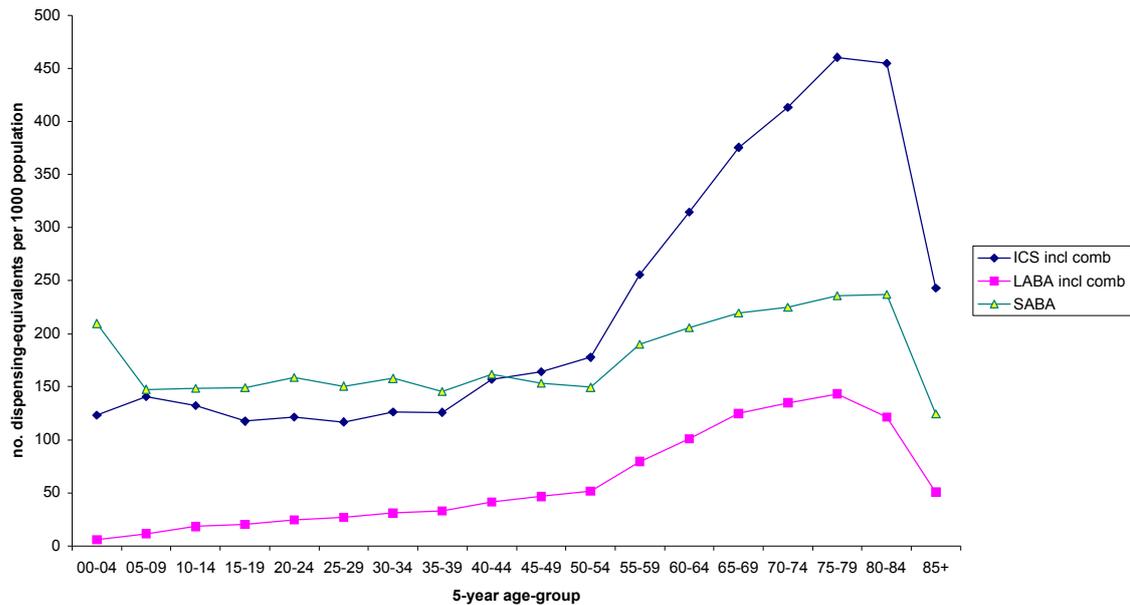
*probable underestimate of pt nos., through overestimating dispensings/pt (because earlier data less likely to have NHI's ascribed, hence too few pts)

As seen in the below graph, distributions of asthma drug classes varied according to age – SABA use is generally in younger patients, whereas more older than younger patients use LABAs, and with a mixed pattern for ICS use (see below figure).



Denominating by underlying age-specific population changes the patterns to show rates of SABA use being uniform but slightly higher in older age-groups, and marked age-gradations by age for ICSs and LABAs (see figure).

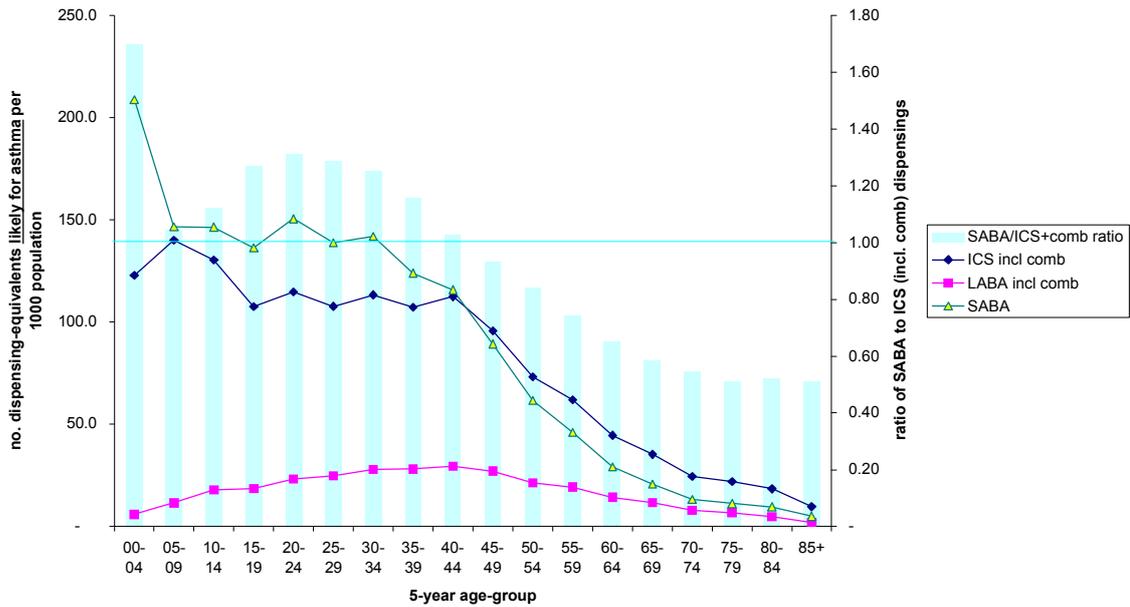
Rates of asthma Rx use by age, 2003/04



However, such analyses need to take into account not only rates per head of population but also to restrict to those patients likely to be treated predominantly for asthma (rather than predominantly COPD). Doing this gives the most valid picture (see below figure), showing:

- SABA use highest in young children, then declining with age;
- Similarly higher use in younger patients than older for ICSs;
- LABA use still higher in middle ages than elsewhere, even after excluding likely predominantly COPD;
- Ratios of SABA to ICS dispensings (a measure of possible poor asthma control at population level) are highest in young children, then peak again at ages 15 to 34, then decline thereafter;
- An ongoing need for asthma drugs in older patients (aged 35+) – rates are lower than for younger age groups, but there are still appreciable numbers of older patients using asthma medications who need those treatments for asthma (not just presuming COPD).

Rates of asthma Rx use by age in patients with likely asthma, 2003/04



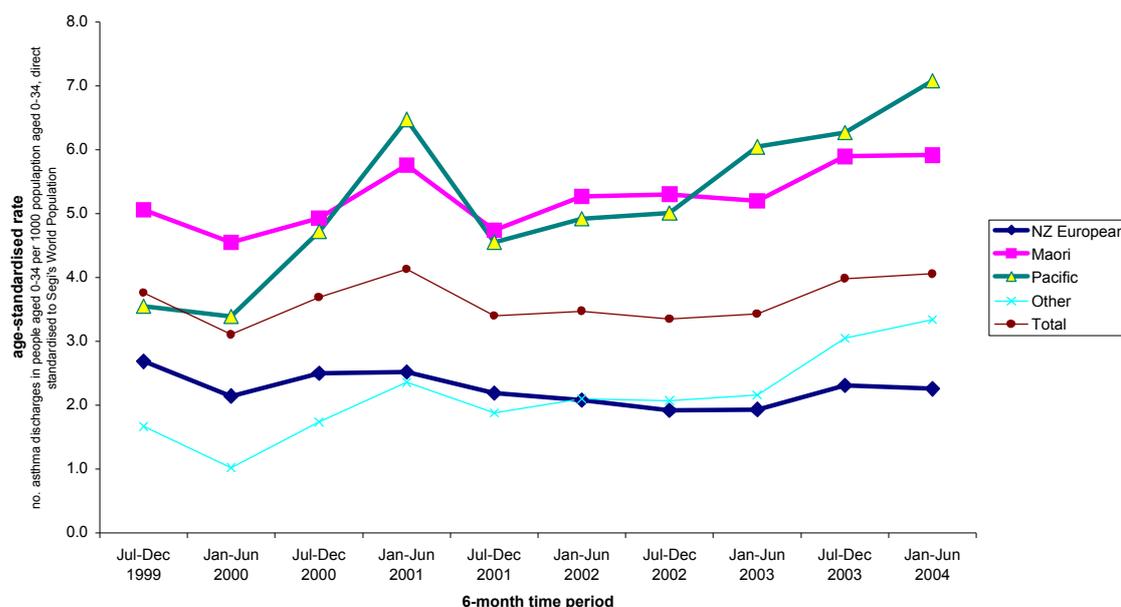
Key issues from these patterns then are likely poorer control of asthma in young children and late adolescents/early adults, and the high use of asthma medicines for COPD. This includes the higher use of LABAs by older patients than younger patients.

The higher use of LABAs by older patients appears to contradict the intent of the Special Authority criteria – which specify use in poorly controlled asthma. This is where (according to the hospitalisation data) the majority of older patients will have predominantly COPD rather than predominantly asthma.

Asthma hospitalisations by ethnicity and time

Over the 5 years July 1999 to June 2004, there were 29971 hospital admissions for asthma. Age-standardised rates of hospitalisations for asthma in patients aged 0-34 have been reasonably constant, with rates of 3.5 to 4.0 hospitalisations per 1000 population per year. However, while age-standardised rates in NZ Europeans aged 0-34 appear to be reducing if anything, rates in Maori and Pacific people have risen (see figure below).

Age-standardised rates of asthma hospitalisations ages 0-34 by ethnic group, late 1999 to early 2004



Age-standardised rates in Maori aged 0-34 continue to be higher than those of NZ Europeans, being 2.6 times higher in 2003/04. Likewise, rates in Pacific people were nearly three times that of NZ Europeans that same year. Excess rates were due particularly to excess very young Maori and Pacific patients.

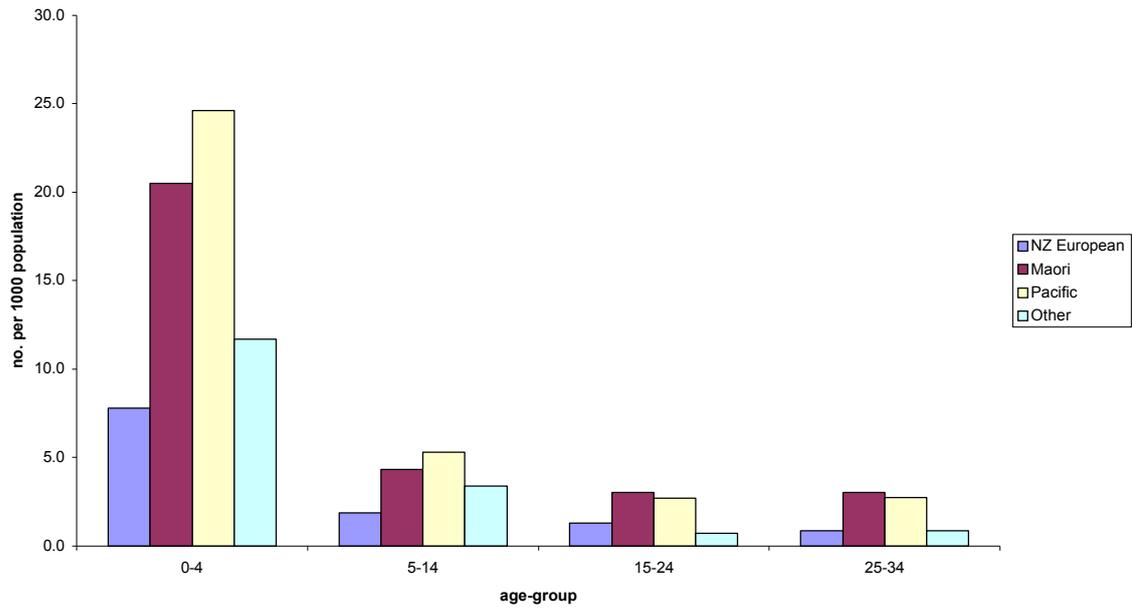
Rates of hospitalisations for asthma, 2003/04

hospitalisations for asthma

rates:1000 - accounting for missing ethnicity data

agegroup	NZ European	Maori	Pacific	Other	Total	RR Maori / NZEurp	RR Pacific / NZEurp
0-4	7.8	20.5	24.6	11.7	12.5	2.6	3.2
5-14	1.9	4.3	5.3	3.4	2.8	2.3	2.8
15-24	1.3	3.0	2.7	0.7	1.6	2.4	2.1
25-34	0.9	3.0	2.7	0.9	1.3	3.5	3.2
(crude total)	2.2	6.5	7.6	2.7	3.4		
age-standardised	2.6	6.8	7.7	3.7	4.0	2.6	2.9

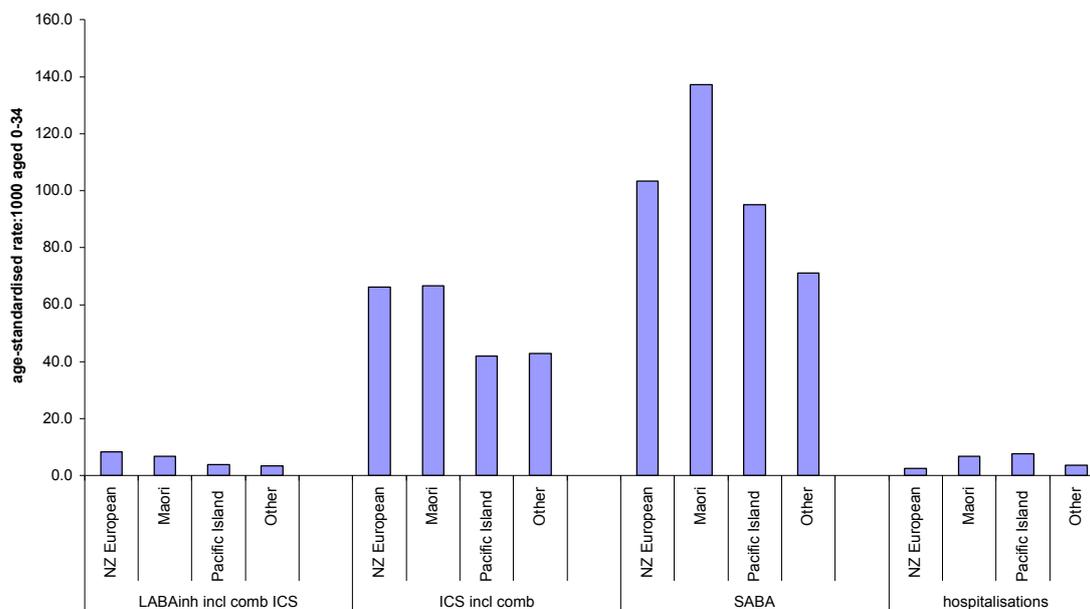
Asthma hospitalisation rates 2003/04 x age x ethnicity



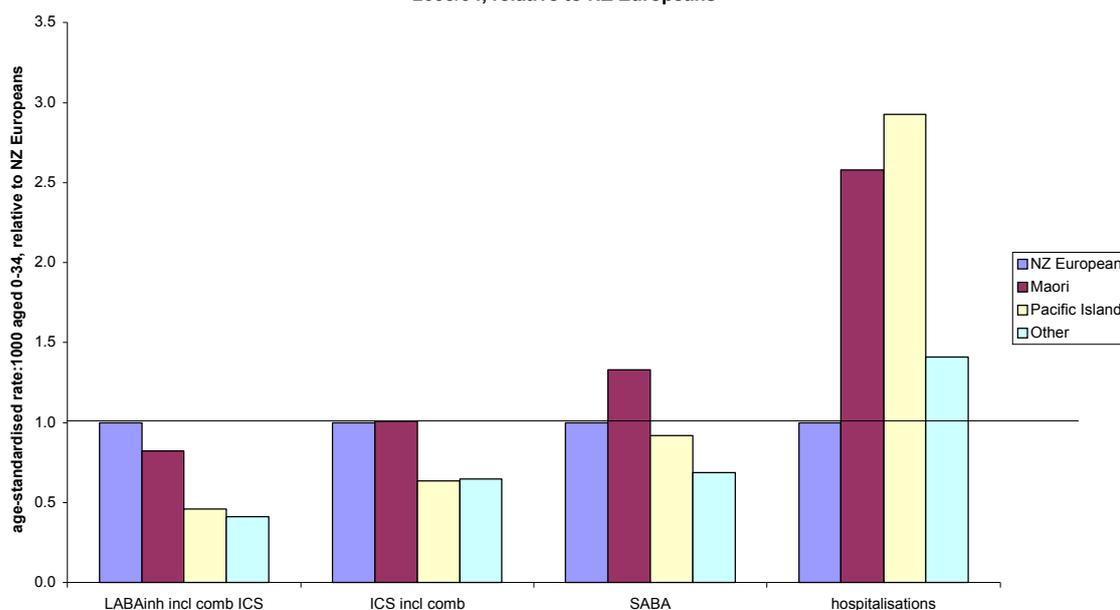
Asthma drug use by ethnic group

According to age-standardised rates of dispensing equivalents in 2003/04 in patients with likely asthma aged 0-34, the use of LABAs is much higher in NZ Europeans than other ethnic groups. Conversely, rates of ICS use were the same for NZ Europeans and Maori, but less for Pacific patients. Rates of SABA use were highest in Maori and lower in Pacific patients, which contrasted with the highest rates of hospitalisations occurring in Pacific patients (see figures and table below).

Asthma Rx use and hospitalisations in asthma patients - by ethnic group, 2003/04

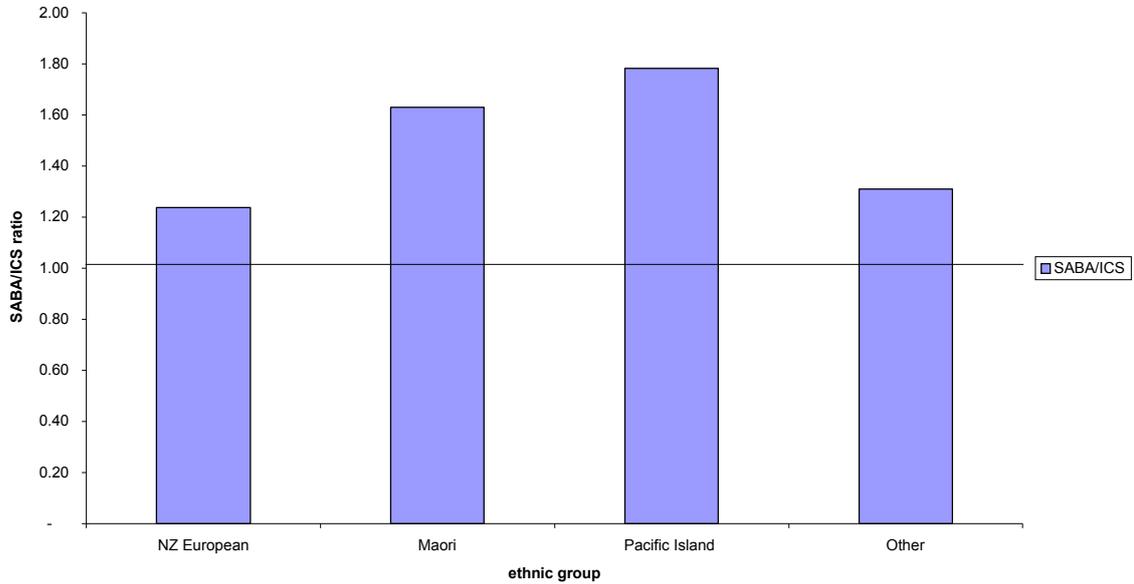


Relative patterns of asthma Rx use and hospitalisations in asthma patients - by ethnic group, 2003/04, relative to NZ Europeans

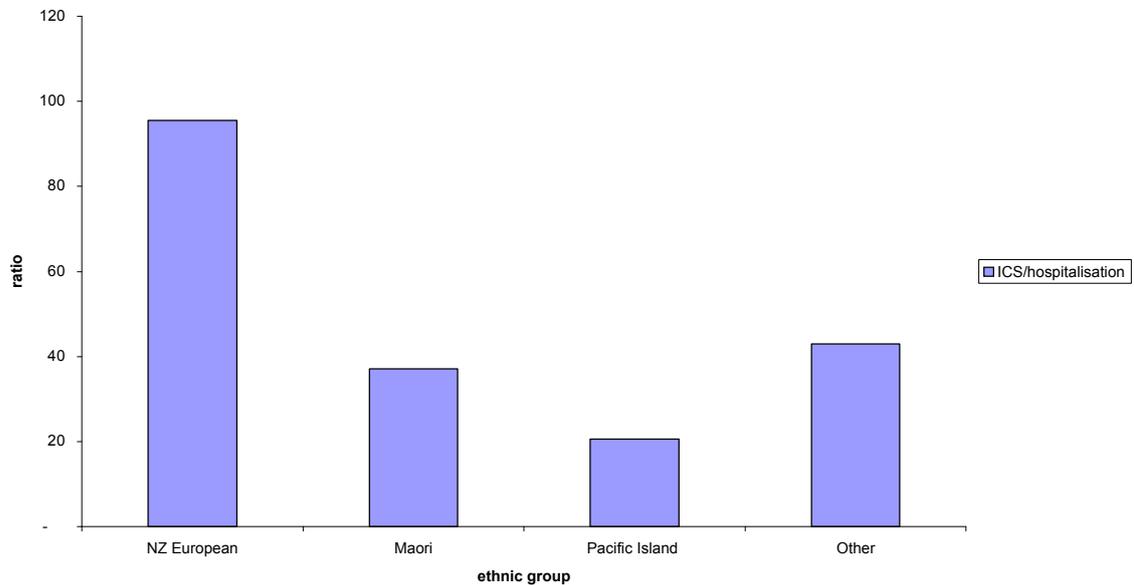


Combining the above patterns, then relative to NZ Europeans, Maori and especially Pacific patients had higher SABA/ICS ratios (suggesting poorer control) and lower ICS/hospitalisation and LABA/hospitalisation ratios (suggesting unmet need, where hospitalisation proxy higher need than in NZ Europeans) – see figures and table below.

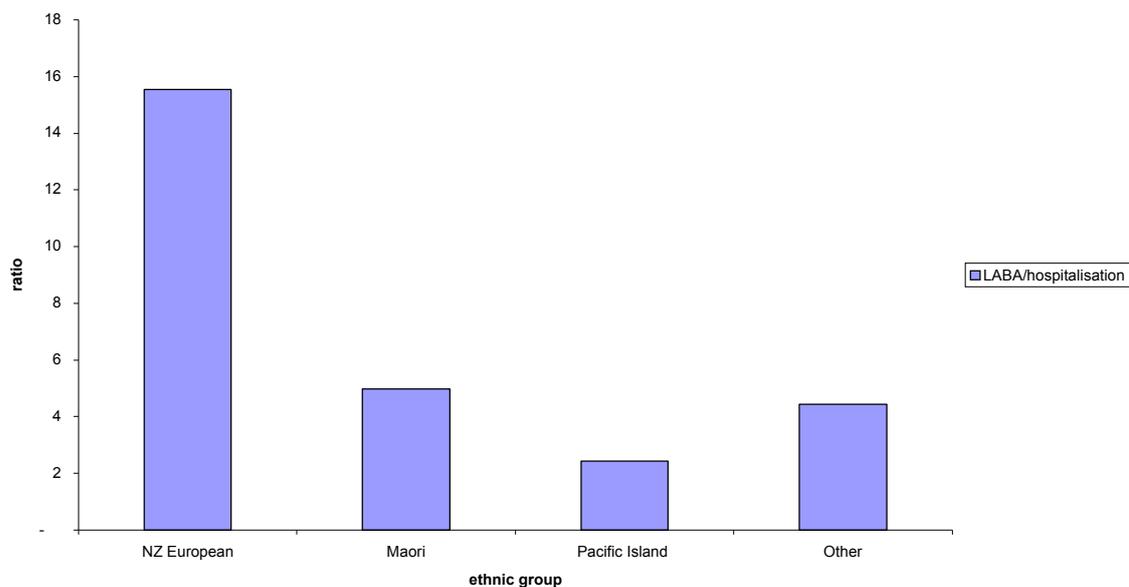
SABA to ICS (incl. Symbiocort) ratios in 2003/04 by ethnic group - suggesting poorer asthma control
(from age-standardised rates ages 0-34)



ICS to hospitalisation ratios in 2003/04 by ethnic group - suggesting unmet need for asthma Rx in some groups
(from age-standardised rates ages 0-34)



LABA (incl. Symbiocort) to hospitalisation ratios in 2003/04 by ethnic group - suggesting unmet need for asthma Rx in some groups (from age-standardised rates ages 0-34)



Possible rates of Rx use in patients with asthma*

rates:1000 - accounting for missing ethnicity data

ICS incl comb

agegroup	NZ European	Maori	Pacific Island	Other	Total	RR Maori / NZEurp	RR Pacific / NZEurp
0-4	57.8	81.6	56.9	70.1	63.6	1.4	1.0
5-14	75.2	66.6	43.8	63.0	70.0	0.9	0.6
15-24	66.9	57.0	32.5	17.3	57.6	0.9	0.5
25-34	61.2	65.9	38.8	21.7	57.3	1.1	0.6
(crude total)	60.9	60.5	38.4	33.6	62.2		
age-standardised	66.3	66.6	42.0	42.9	62.4	1.0	0.6

SABA

agegroup	NZ European	Maori	Pacific Island	Other	Total	RR Maori / NZEurp	RR Pacific / NZEurp
0-4	104.4	223.1	192.7	161.5	142.7	2.1	1.8
5-14	99.6	114.9	83.3	84.8	100.2	1.2	0.8
15-24	111.0	109.2	60.1	24.8	98.0	1.0	0.5
25-34	99.0	129.1	70.4	29.2	96.1	1.3	0.7
(crude total)	94.5	123.1	86.1	53.1	104.6		
age-standardised	103.3	137.2	95.0	71.1	106.7	1.3	0.9

LABAinh incl comb ICS

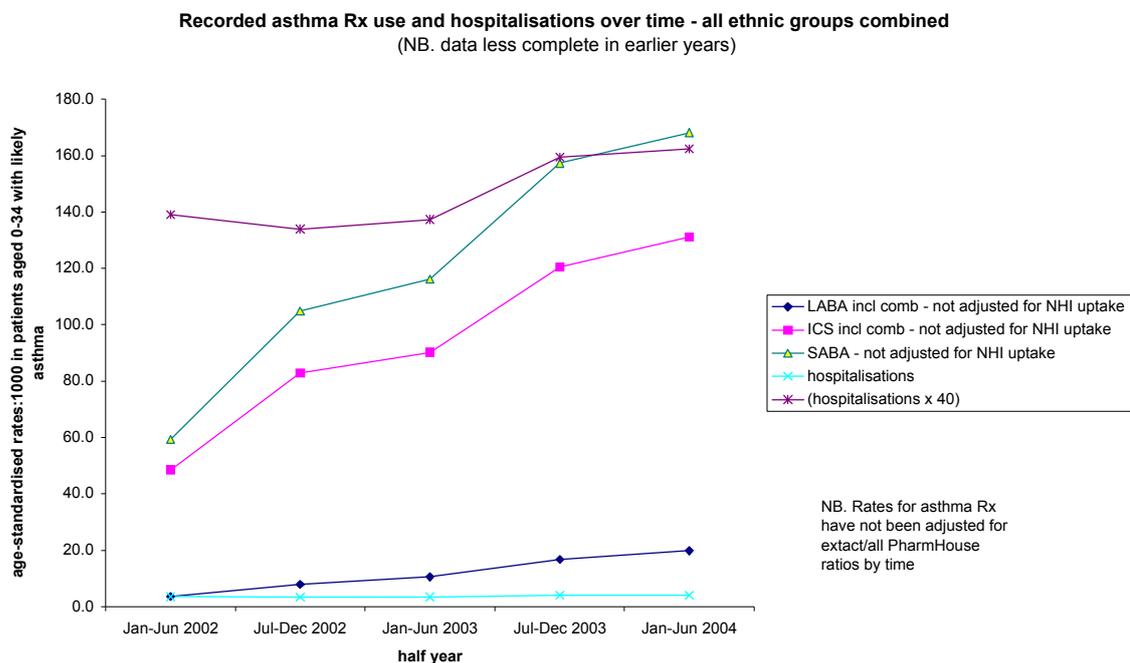
agegroup	NZ European	Maori	Pacific Island	Other	Total	RR Maori / NZEurp	RR Pacific / NZEurp
0-4	2.0	2.5	2.8	2.3	2.2	1.2	1.4
5-14	6.4	4.3	2.7	4.3	5.5	0.7	0.4
15-24	9.5	6.9	3.3	1.8	7.8	0.7	0.3
25-34	10.9	10.6	5.2	3.3	9.9	1.0	0.5
(crude total)	7.3	5.6	3.1	2.7	6.9		
age-standardised	8.3	6.8	3.8	3.4	7.3	0.8	0.5

*probable underestimate of pt nos., through overestimating dispensings/pt (because earlier data less likely to have NHIs ascribed, hence too few pts)

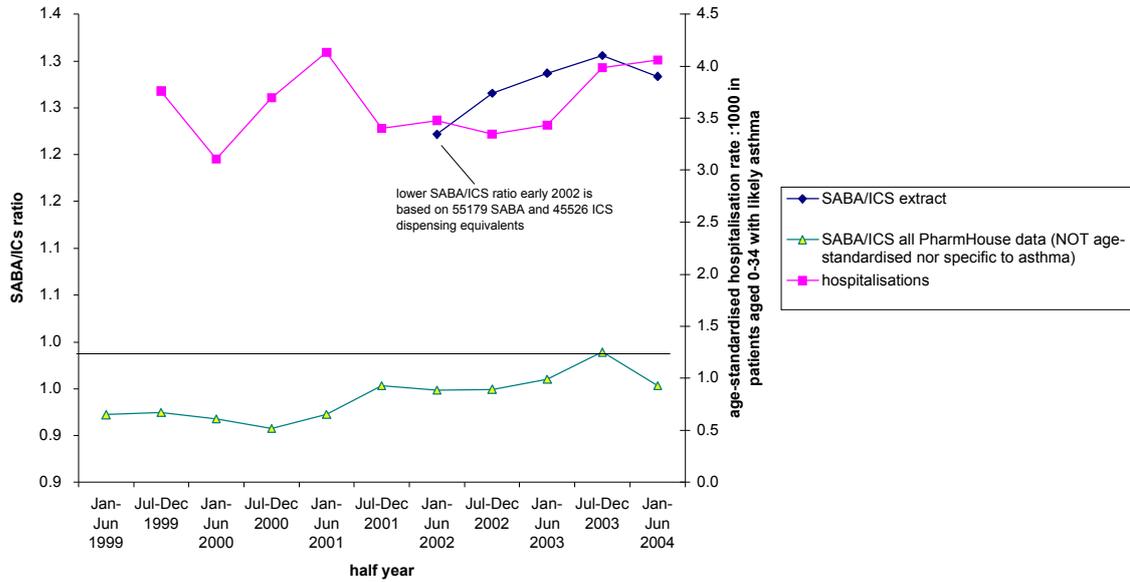
The lack of comparable data over previous years makes it difficult to compare asthma Rx use with hospitalisation rates over time (see first of graphs below). However, SABA/ICS ratios do provide some idea as to trends for the extract over time. These show a number of features:

- There was no apparent clear correlation between SABA/ICS ratios and asthma hospitalisations (see second of graphs below).
- The extract's SABA/ICS ratios were higher than all PharmHouse data, and showed greater increases over time – but this might be explained by severity/patients mix factors, with the age restrictions and asthma-specific modelling for the extract.
- The continuing higher ratios for Pacific and Maori patients, but with no real changes over time apart from a decrease in the Pacific ratio (see third of graphs below).

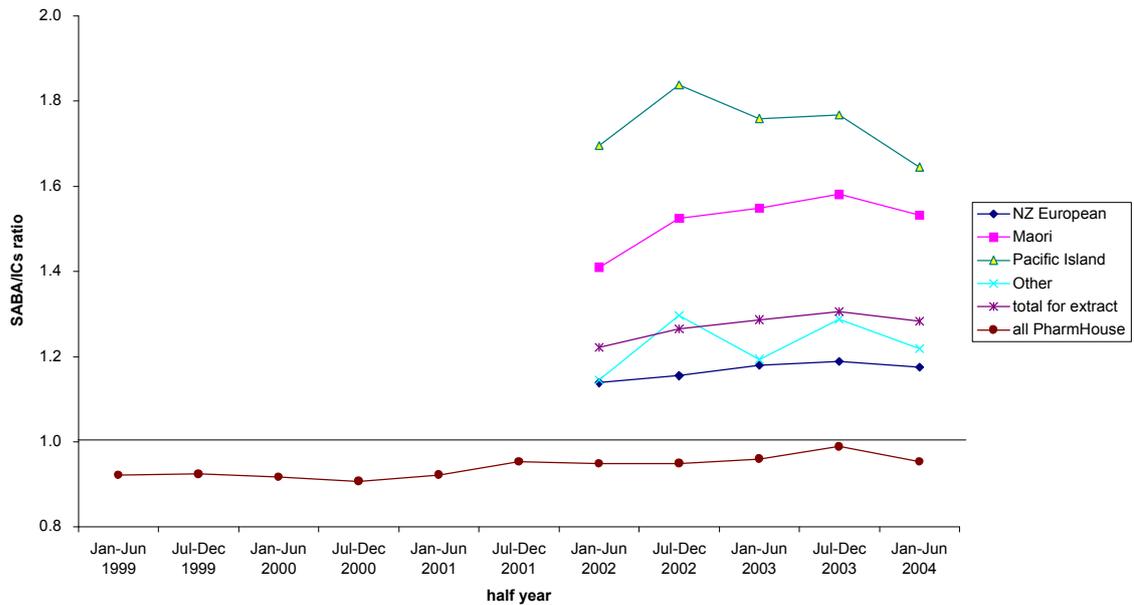
There are insufficient time series data to examine ethnic rates of asthma medicine use over time related to PHARMAC's Demand Side Asthma Campaign and other PHARMAC interventions.



SABA/ICS (including Symbicort) ratios and asthma hospitalisation rates over time - all ethnic groups combined (NB. extract's data are less complete in earlier years)



SABA/ICS (including Symbicort) ratios and asthma hospitalisation rates over time, by ethnicity



Caveats to the analysis

With over 50% of scripts data in PharmHouse now tagged with one-way encrypted NHI numbers, patient- (not dispensing-) based analysis of pharmaceutical use is now possible, including by ethnicity (using NHI data fields). This makes achievable such analysis of hospitalisation versus various pharmaceutical mix combinations by ethnicity, at least over recent times.

However, the rapid increase in NHI-tagging of dispensing data means that analysis can only be valid when covering recent times; longitudinal trends incorporating earlier measurement periods cannot be validly incorporated. Reliable data would probably cover too short a time to detect meaningful trends

In New Zealand, comparisons between pharmaceutical use and hospitalisations are limited by narrow timeframes. Pharmaceutical utilisation data for inhaled medications in New Zealand are only available since the beginning of 1999; coding changes make data before this time unreliable. Likewise, routinely available hospitalisation data are available only up to the calendar year 2002. This means there are too few years' data to comfortably examine trends – just four years.

Any changes in Maori trends relative to non-Maori relative to pharmaceutical use will be associations only and cannot necessarily be ascribed causation. This would again be for reasons of confounding (see below), namely multiple other factors leading to hospital admissions, for reasons beyond the simple availability of pharmaceuticals; local variation in bed supply; and diagnostic shift and miscoding in hospitalisation data, alongside differential effects of double counting of readmissions and of inter-hospital transfers as “new” admissions.

The above analysis is an ecological one, using separate hospitalisation and pharmaceutical utilisation databases. Ecological or cross-sectional analyses can illustrate potential relationships, however they cannot examine any causative association (e.g. usage with outcomes). Other explanatory variables include:

- Hospital care supply. This is where thresholds to admission are determined only in part by the severity of asthma ('demand'). Supply factors include bed availability, which can vary by season, region and year according to funding levels; alternative service provision (outpatient services, short-term 'holding'/assessment wards in Emergency Departments); clinical protocols; and the extent of competing illnesses (e.g. the winter surge in cardiorespiratory admissions placing pressure on bed availability).
- There are also issues of diagnostic shift and miscoding. This is where in past years in NZ there has been up to 30% discordance in level-1 ICD-9 diagnoses recorded in hospital administrative databases.¹ In other words, what may be coded as "asthma" may be something else, and vice versa. We do not have any data to show the degree to which diagnostic discordance has changed over recent years.
- Double counting of readmissions and of inter-hospital transfers as “new” admissions further biases the data. Again we do not know how these underlying patterns have varied over recent years.

¹ Smith MW. Hospital discharge diagnoses: how accurate are they and their international classification of diseases (ICD) codes? NZ Med J 1989 Sep 27;102(876):507-8.

Longitudinal analytical methods (e.g. using linked datasets), could better illustrate an association. However, they too are prone to some errors such as confounding and selection bias.

Any observed association between pharmaceutical dispensings and hospitalisation outcomes will probably be subject to confounding from other factors. For example, New Zealand and international research has demonstrated there are multiple factors leading to hospital admissions, for reasons beyond the simple availability of pharmaceuticals. These include socio-economic and behavioural factors, adherence to prescribed courses of medicines, to name but a few. Many are also associated with pharmaceutical utilisation (e.g. socio-economic position).

At this stage we have not linked patients' and populations' drug utilisation with outcomes such as death and hospitalisations (although deaths over time are so few as to be statistically meaningless anyway).

To most clearly demonstrate changes in hospital utilisation with pharmaceuticals, data could be gathered as part of a prospective randomised controlled trial, analysing by intention-to-treat. This may guard against biases, such as:

- overstating the impact of treatment (hence the need for controls, blinding, and inclusion of dropouts (intention-to-treat analysis)),
- comparison groups being different – i.e. confounding from known and unknown variables (hence the need for randomisation)

None of these features can be adequately controlled for by simple comparisons of overall rates of hospital use with overall rates of pharmaceutical use.

Implications for policy

This analysis is a 'first cut', aiming to rapidly gain a picture of patterns and features of asthma need and pharmaceutical use by ethnic groups over time. It has shown that in any subsequent cohort analysis (using NHI-linked patient-specific data) that time series analysis will still be infeasible for pharmaceutical use, i.e. only cross-sectional analysis would be possible.

Hence we could still ask, "what disparities are there in current use of asthma drugs when compared to need?" But we would be unable to ask "what has been happening with disparities in asthma drug use over time?"

The above data do suggest lower than expected use of ICSs and LABAs for asthma in Maori and Pacific people across all ages, when compared with their high use of SABAs (for Maori at least) and higher hospitalisation rates for asthma. The above associations between ethnicity and low asthma pharmaceutical use and high asthma hospitalisation rates are consistent with previous work showing higher asthma hospitalisation rates in Maori etc. and disparities between utilisation and need by ethnic group in other disease states in New Zealand. This present analysis has the advantage of including data in Pacific people and other ethnic groups.

However, the evidence is low grade, with recognised limitations in the methods; information would improve with a linked analysis of a cohort of patients.

Based though on consistency with work elsewhere, PHARMAC staff plan to look at Demand Side activities focussing on Maori and Pacific patients' use of asthma medications,

particularly in children. This is consistent with PHARMAC's Maori Responsiveness strategies for both children and respiratory disease.

Note there is no similar responsiveness strategy for Pacific people – a point that could be revisited again.

It is also important to emphasise likely systemic factors behind the disparities between asthma need and pharmaceutical use for patients with asthma – rather than patients and families being indifferent of whatever. Such systemic features would include access to primary health care, the reach and effectiveness of asthma education, and differences in asthma management.

Additional (more detailed) tables

Tg Level1 Name	Respiratory System and Allergies
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No. of Items		FYR		
Tg Level2 Name	Chemical Name	2002	2003	2004
ICS BADs	BDP	4,268	9,032	8,368
	Budesonide	13,146	51,337	65,781
	Fluticasone	1,038	2,471	2,604
ICS MDIs	BDP	21,778	50,604	65,030
	Budesonide	1		
	Fluticasone	58,972	276,663	400,203
ICS MDIs w spacers	BDP	29	56	
LABAs	Budesonide w eformoterol	1,200	15,059	42,576
	Eformoterol	9,196	44,269	75,629
	Salmeterol	7,623	32,294	49,490
Beta-agonists - LA t	Bambuterol	1,272	4,776	5,276
	Salbutamol	1,686	5,908	6,877
SABA - BADs	Salbutamol	7,278	16,530	14,911
	Terbutaline	10,833	43,652	59,435
SABA - MDIs	Fenoterol	148	196	
	Salbutamol	84,865	344,084	520,921
	Terbutaline	1,274	4,433	5,240
SABA - oral liq	Bambuterol	337	1,137	1,212
	Salbutamol	1,705	5,704	6,547
	Terbutaline		1	
Total		226,649	908,206	1,330,100

extract 2004 %	days/disp	ICS+LAB A pyes	% ICS+LABA pyes
0.6%	50	1,162	2%
4.9%	50	9,136	14%
0.2%	30	217	0%
4.9%	50	9,032	14%
0.0%	50	-	0%
30.1%	30	33,350	50%
0.0%	50	-	0%
3.2%	30	3,548	5%
5.7%	30	6,302	9%
3.7%	30	4,124	6%
0.4%			
0.5%			
1.1%			
4.5%			
0.0%			
39.2%			
0.4%			
0.1%			
0.5%			
0.0%			
100.0%		66,872	100%

c.f. fcdb 2004 disp	ICS+LAB A pyes	% ICS+LAB A pyes	extract 2004/fcdb'04 disp	ICS+LAB A pyes
16,569	2,301	2%	51%	51%
124,594	17,305	14%	53%	53%
5,762	480	0%	45%	45%
121,253	16,841	13%	54%	54%
0	0	0%		
761,511	63,459	51%	53%	53%
0	0	0%		
71,728	5,977	5%	59%	59%
134,969	11,247	9%	56%	56%
86,435	7,203	6%	57%	57%
9,576			55%	
12,908			53%	
30,696			49%	
115,371			52%	
0				
1,024,281			51%	
9,852			53%	
2,835			43%	
17,115			38%	
0				
2,545,455	124,814		52%	54%

age 0-34	+		
FYE	2003/2004	NHI extract/all	53.1%
Rx ICS	ICS incl comb	disp equiv/pt	3.64

disp equiv	ethnic group 2					
agegroup	NZ Europe	Maori	Pacific Isla	Other	Not stated	Total
0-4	18,189.0	8,887.0	3,009.3	2,360.0	995.3	33,440.7
5-14	48,549.7	13,175.0	3,856.0	4,139.7	9,003.0	78,723.3
15-24	37,305.7	8,199.3	2,105.7	1,513.0	11,126.0	60,249.7
25-34	40,156.7	8,875.3	2,353.3	1,555.7	11,116.3	64,057.3
Total	144,201.0	39,136.7	11,324.3	9,568.3	32,240.7	236,471.0

age-standardised rate

*probable underestimate of pt nos., through overestimating dispensings/pt (because earlier data less likely to have NHI's ascribed, hence too few pts)

age 0-34	+		
FYE	2003/2004	NHI extract/all	50.7%
Rx ICS	SABA	disp equiv/pt	2.89

disp equiv	ethnic group 2					
agegroup	NZ Europe	Maori	Pacific Isla	Other	Not stated	Total
0-4	24,909.0	18,418.0	7,720.0	4,120.0	1,622.0	56,789.0
5-14	48,574.0	17,175.0	5,541.0	4,212.0	9,866.0	85,368.0
15-24	47,400.0	12,024.0	2,983.0	1,659.0	13,588.0	77,654.0
25-34	50,174.0	13,434.0	3,299.0	1,617.0	12,757.0	81,281.0
Total	171,057.0	61,051.0	19,543.0	11,608.0	37,833.0	301,092.0

age-standardised

*probable underestimate of pt nos., through overestimating dispensings/pt (because earlier data less likely to have NHI's ascribed, hence too few pts)

age 0-34	+		
FYE	2003/2004	NHI extract/all	57.2%
Rx LABA	LABAinh incl comb ICS	disp equiv/pt	4.66

disp equiv	ethnic group 2					
agegroup	NZ Europe	Maori	Pacific Isla	Other	Not stated	Total
0-4	859.0	364.0	201.0	107.0	68.0	1,599.0
5-14	5,851.0	1,207.0	330.0	398.0	815.0	8,601.0
15-24	7,783.0	1,449.0	313.0	235.0	1,505.0	11,285.0
25-34	10,173.0	2,039.0	447.0	335.0	2,246.0	15,240.0
Total	24,666.0	5,059.0	1,291.0	1,075.0	4,634.0	36,725.0

age-standardised

*probable underestimate of pt nos., through overestimating dispensings/pt (because earlier data less likely to have NHI's ascribed, hence too few pts)

rates:1000 - accounting for missing eth

disp equiv					
	NZ Europe	Maori	Pacific Isla	Other	Total
	211.5	298.5	208.3	256.5	232.7
	276.5	244.9	161.1	231.6	257.1
	261.3	222.7	127.0	67.6	224.8
	244.8	263.6	155.3	86.7	229.4
	252.8	255.6	162.7	140.6	237.1
	252.3	253.1	159.3	160.0	237.0

rates:1000 - accounting for missing eth

disp equiv					
	NZ Europe	Maori	Pacific Isla	Other	Total
	303.0	647.3	559.3	468.6	414.0
	290.3	335.0	242.9	247.3	292.1
	343.8	338.2	186.3	76.7	303.6
	314.2	409.9	223.6	92.6	305.0
	310.4	412.6	290.6	176.5	316.4
	264.3	265.2	166.9	167.6	248.3

rates:1000 - accounting for missing eth

disp equiv					
	NZ Europe	Maori	Pacific Isla	Other	Total
	9.4	11.5	13.1	10.9	10.3
	30.2	20.4	12.5	20.2	26.1
	47.6	34.3	16.5	9.2	39.1
	55.8	54.5	26.5	16.8	50.6
	39.6	30.3	17.0	14.5	34.2
	36.4	30.0	16.7	14.6	31.8

hospitalisations for asthma

age 0-34	+
FYE	2003/2004

count	ethnic group 2					Total	
	agegroup 3	NZ Europe	Maori	Pacific	Other		Not stated
0-4		1288	1172	682	206	42	3390
5-14		685	481	262	125	41	1594
15-24		412	253	101	36	16	818
25-34		311	226	92	34	16	679
Total		2696	2132	1137	401	115	6481

age-standardised

rates:1000 - accounting for missing eth

hospitalisations for asthma

	NZ Europe	Maori	Pacific	Other	Total
	7.81	20.52	24.62	11.67	12.52
	1.88	4.31	5.28	3.37	2.76
	1.27	3.03	2.69	0.71	1.62
	0.85	3.02	2.73	0.85	1.29
	2.21	6.50	7.62	2.75	3.45
	2.64	6.82	7.73	3.73	4.02