



## Regional variations in asthma hospitalisations among Maori and non-Maori

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### Abstract

**Aim** To examine regional patterns of asthma hospitalisations in Maori and non-Maori.

**Methods** We studied asthma hospitalisations in Maori and non-Maori during 1994–2000. Hospitalisation rates for Maori and non-Maori were calculated for ages 5–34 years in each of the 74 territorial authorities (TAs), of which 15 are urban and 59 predominantly rural. The data were also analysed separately for Maori and non-Maori in the age groups 0–4, 5–14, 15–34 and 35–74 years.

**Results** For Maori, the highest hospitalisation rates were in Tauranga, Invercargill, Wanganui, South Wairarapa and Gisborne; the lowest rates were in Rodney, Tasman, Franklin, Waitaki and North Shore City. The rate of asthma hospitalisation was higher in Maori than non-Maori in each age-group: 0–4 years relative risk (RR) = 1.43; 5–14 years RR = 1.08; 15–34 years RR = 1.31; 35–74 years RR = 2.97. The differences were higher in rural areas (RR 1.65, 1.17, 1.34 and 3.13 respectively) than in urban areas (RR 1.25, 1.00, 1.22, 2.79 respectively).

**Conclusions** These analyses confirm previous evidence that asthma hospitalisation rates are higher in Maori than in non-Maori, despite the fact that asthma prevalence is similar in Maori and non-Maori children. They also indicate that this excess of hospitalisations is higher in rural than in urban areas, although the difference is not large.

Although the prevalence of asthma is similar in Maori and non-Maori children, Maori children and adults experience excess morbidity and higher hospitalisation rates than non-Maori.<sup>1,2</sup> The Maori Asthma Review concluded that asthma was more severe and that hospitalisation and mortality rates for Maori exceeded those of non-Maori primarily due to inadequate access to appropriate healthcare and asthma education.<sup>3,4</sup> It was suggested that these problems of access might be particularly acute in rural areas. More generally, there is widespread interest in regional differences and a common belief that asthma prevalence may be higher in rural areas.<sup>5</sup>

In fact, few studies have examined regional differences in asthma prevalence or severity in New Zealand, and those that have been conducted have found little evidence of regional differences. The New Zealand arm of the International Study of Asthma and Allergies in Childhood (ISAAC) was conducted in six New Zealand centres in 1992–1993.<sup>6</sup> Three of these were urban (Auckland, Wellington, Christchurch) and three were ‘provincial’ (Bay of Plenty, Hawke’s Bay, Nelson). In general, there were no regional differences in prevalence rates of asthma symptoms with the possible exception of Nelson, which had slightly lower prevalence rates in the 6–7 years age group.

Similar analyses for adults were conducted as part of the New Zealand component of the European Community Respiratory Health Survey (ECRHS).<sup>7,8</sup> The 12-month-period prevalence of asthma (defined as woken by shortness of breath, or an attack of asthma in the past year, or current asthma medication) was 15.2% overall, but was 22.1% in Maori, 20.6% in Pacific people and 14.3% in 'others' (this study in adults therefore found a difference in asthma symptom prevalence between Maori and non-Maori in contrast with previous studies in children, which have generally found asthma prevalence to be similar in Maori and non-Maori)<sup>1</sup>. The regional findings were not presented separately for Maori and non-Maori. However, overall there was no urban/rural difference in adult asthma prevalence: the prevalence of asthma was 15.5% in urban areas, 14.7% in provincial areas, and 13.8% in rural areas. In North Island electorates, the highest age- and ethnicity-standardised prevalences were found in some of the electorates in the Auckland and Wellington urban regions, although prevalence was also high in some rural electorates including Raglan (18.0%), Horowhenua (18.4%) and Wairarapa (18.4%); the lowest prevalences were found in other rural electorates including King Country (5.5%), Matamata (10.1%) and Rotorua (10.3%). In South Island electorates, the highest prevalences were found in the Christchurch and Dunedin urban areas, and the lowest prevalences were again found in rural electorates including Clutha (11.3%), Rangiora (9.5%), and Wallace (9.4%).

Thus, previous studies of asthma prevalence in New Zealand children and adults show little evidence of systematic urban/rural differences in asthma prevalence. The small differences that may exist involve slightly lower prevalence in rural areas. However, these findings were not reported separately for Maori and non-Maori, and were related to asthma prevalence rather than severity. While they are imperfect measures of asthma morbidity, hospitalisation and mortality rates do nonetheless provide important information as markers of asthma severity, although it is possible that the level of severity may still be underestimated. While these analyses examine regional and ethnic differences in asthma hospitalisation rates we acknowledge that trends in asthma admission rates are difficult to interpret, being dependent on asthma severity, access to healthcare and individual patterns of medical practice.<sup>2</sup>

## Methods

**Calculation of Maori and non-Maori rates** There are considerable problems in the calculation of Maori health statistics, particularly when examining time trends, because of changes in both the numerator and denominator information. These issues have been reviewed in depth elsewhere,<sup>2,9-12</sup> but will be considered briefly here. Prior to 1986, both deaths and census data were based on a biological definition of Maori; from the 1986 Census the question became one of self-identification, and for the 1986 and 1991 censuses the 'sole Maori' definition is the most appropriate in calculating mortality and hospitalisation rates because this provides reasonable consistency over time.<sup>9,10</sup> Changes to ethnicity recording for death certificates in 1995, and further modification of the ethnicity question in the 1996 Census mean that, for both numerator and denominator data, the 'Maori ethnic group' definition is most appropriate from 1996 onwards.<sup>11,12</sup> These problems are less acute when calculating hospitalisation rates, as in this study, since the methods of recording ethnicity in hospitalisation data have not changed markedly during the period under consideration. Furthermore, we are not examining time trends during this period, but rather we are comparing hospitalisation rates in different regions during this time period as a whole. Thus, problems in the classification of ethnicity are likely to result in an underestimate of the overall relative risk between Maori and non-Maori, but are less likely to affect the regional comparisons within Maori and within non-Maori data.

**Hospitalisation data** We studied asthma hospitalisations (defined here as the primary diagnosis, ICD-9 code 493) in Maori and non-Maori during 1994–2000 using the Ministry of Health filtered, publicly

funded discharge data set (excludes hospital transfers and duplicate records). For the reasons previously discussed, census data using the 'sole Maori' definition have been used in the calculation of the population totals and hospitalisation rates for 1994 and 1995, while the 'Maori ethnic group' definition is used for the 1996–2000 data set. There were only a small number of hospitalisations for Pacific people in many areas, and therefore the Pacific data were excluded from the analyses. Hence, the term 'other' refers to hospitalisation rates for non-Maori/non-Pacific people.

**Data analysis** We calculated hospitalisation rates for Maori and non-Maori in each of the 74 territorial local/land authorities (TLAs), commonly referred to as territorial authorities (TAs). TAs were chosen as the area unit for analysis because these provided reasonable numbers of hospitalisations, and it was possible to classify them as urban or rural. The boundaries of TAs are defined according to 'community of interest' considerations including the relevance of the community components to each other and the ability of the unit to effectively service its community.<sup>13</sup> The 74 TAs comprise 15 cities and 59 districts. This classification provides a useful proxy for urban versus rural populations. The term 'urban' relates to the city authorities whose populations are predominantly urban; the term 'rural' relates to those district authorities that have the greatest proportion of their population residing in rural and smaller urban areas.

The TA-based hospitalisation rates are calculated using the spatially aggregated hospitalisation records, which contain the patients' resident domicile codes (alternatively known as census area units). However, there still remain some TAs where hospitalisation or denominator numbers for particular age groups are too small to reliably calculate. Any TAs with fewer than 15 counts for the 1994–2000 period are designated on the maps (Figures 1 and 2) as 'insufficient data'. The 15-count cut-off is due to the large increase in relative standard error (>25% RSE) below this.

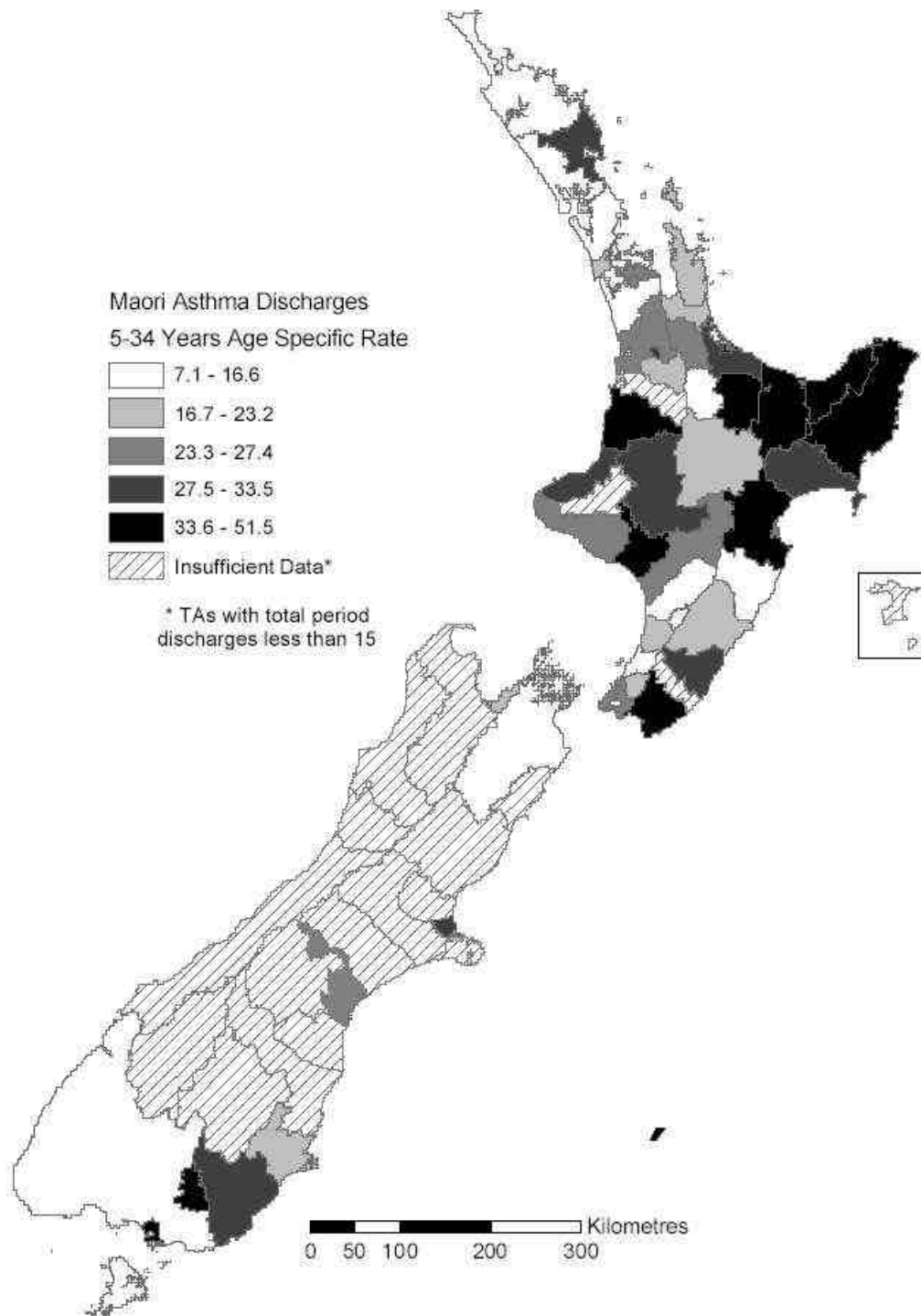
Analyses of deaths typically focus on the 5–34 age range, because of the difficulty in confirming asthma diagnoses for deaths outside of these years.<sup>14</sup> While the data are reasonably accurate for asthma hospitalisations<sup>15</sup> we have focused on the 5–34 age group in presenting the findings although other age groupings (0–4, 5–14, 15–34 and 35–74 years) were also analysed and have been included. The software used for the mapping was Environmental Systems Research Institute ArcView 3.2 desktop Geographic Information System. The data were extracted from the NZHIS National Minimum Dataset using SAS 8 for Windows.

## Results

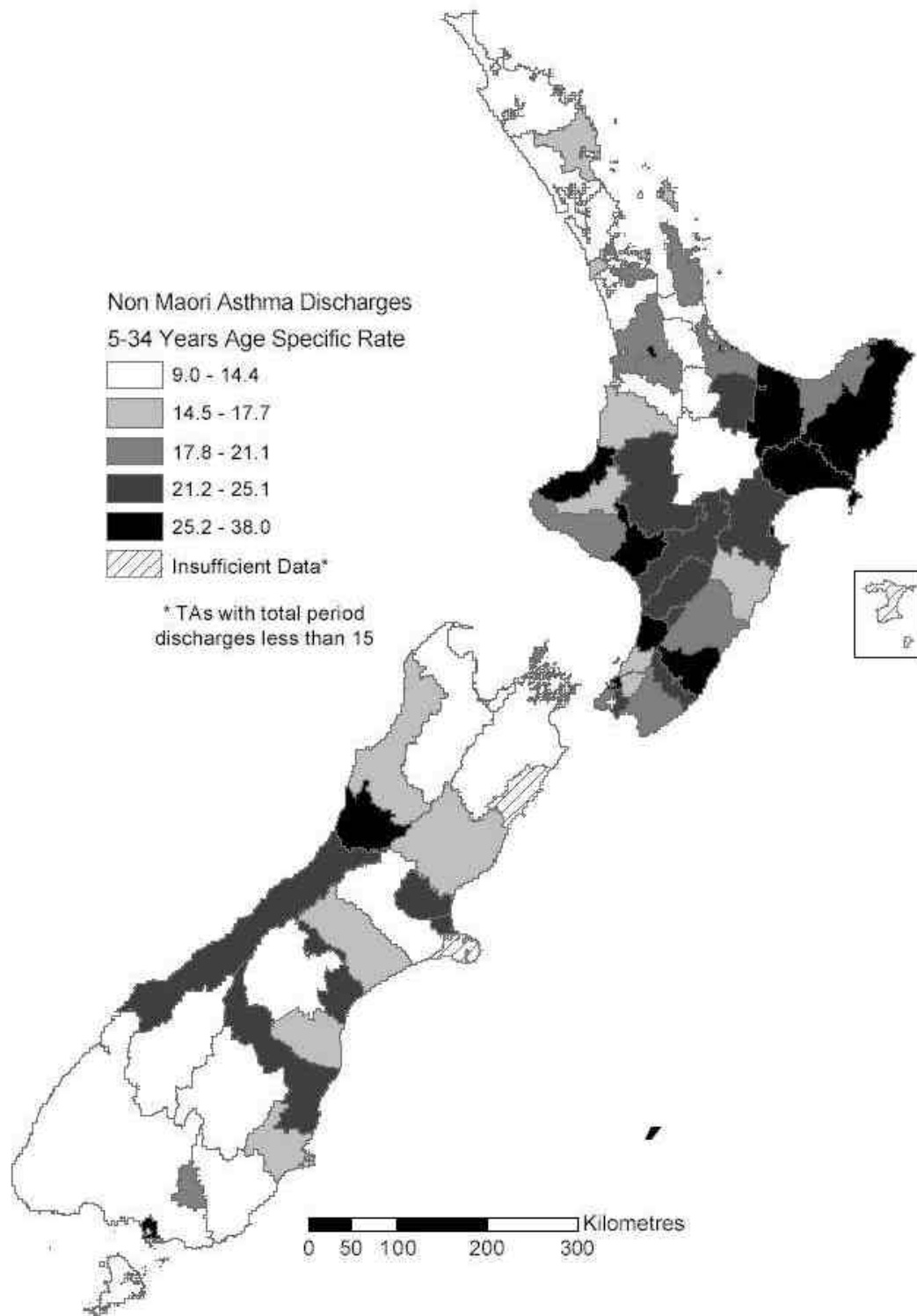
Each of the TAs were ranked based on asthma hospitalisation rates for Maori and non-Maori. Figure 1 shows the map of 5–34 year age-specific discharge rates (per 10 000 per year) for Maori by TA. The highest rates were in Tauranga, Invercargill, Wanganui, South Wairarapa and Gisborne; the lowest rates were in Rodney, Tasman, Franklin, Waitaki and North Shore City. Figure 2 shows the corresponding patterns for non-Maori. Table 1 presents the number of admissions and hospitalisation rates for Maori and non-Maori with the total rate, ranked from highest to lowest, for each TA.

We also conducted regional analyses separately in Maori and non-Maori for the 0–4, 5–14, 15–34 and 35–74 age groups (not shown in the figures). For Maori the highest rates in the 0–4 age group (per 10 000 per year) were in Invercargill (18.08), Tauranga (17.91), Hastings (17.51), Masterton (17.49) and New Plymouth (15.84). In the 5–14 years age group, Invercargill (5.76), Wanganui (4.96), Queenstown Lakes (4.55) and Gisborne (4.43) recorded the highest hospitalisation rates; for 15- to 34-year-olds, South Wairarapa (3.39), Kaikoura (3.27) and Tauranga (3.25) had the highest rates; while Stratford (6.48), Central Hawke's Bay (6.31) and South Taranaki (5.21) had the highest asthma hospitalisation rates for the 35–74 years age group.

**Figure 1. Maori 5–34 year age-specific asthma discharge rates by territorial authority (1994–2000)**



**Figure 2. Non-Maori 5–34 year age-specific asthma discharge rates by territorial authority (1994–2000)**



**Table 1. Maori/non-Maori hospitalisation rates for ages 5–34 years by territorial authority 1994–2000**

Territorial authority	Maori		Non-Maori		Total	
	Number	Rate*	Number	Rate*	Number	Rate*
Wanganui District	161	47.4	376	36.9	537	39.5
Gisborne District	341	45.5	233	31.9	574	38.8
Whakatane District	193	36.8	209	38.0	402	37.4
Tauranga District	259	51.5	560	32.6	819	36.8
New Plymouth District	119	32.2	623	36.2	742	35.5
Masterton District	47	30.0	177	33.9	224	33.0
Rotorua District	389	42.9	315	25.1	704	32.6
Grey District	8	19.1	130	33.9	138	32.4
Invercargill City	133	49.0	405	28.5	538	31.8
Opotiki District	70	37.4	22	20.8	92	31.4
Kawerau District	63	33.5	24	25.6	87	30.9
Wairoa District	65	31.7	31	26.7	96	29.9
Napier City	92	26.0	379	30.7	471	29.7
Hastings District	253	41.5	355	24.0	608	29.1
Hamilton City	248	29.5	847	28.0	1095	28.3
Far North District	265	32.1	190	24.1	455	28.2
Porirua City	99	26.7	346	28.1	445	27.8
Ruapehu District	79	31.9	75	21.9	154	26.1
Christchurch City	291	31.3	2211	24.7	2502	25.3
South Wairarapa District	24	46.8	39	19.3	63	24.9
Lower Hutt City	162	27.3	612	24.3	774	24.8
Horowhenua District	45	20.0	167	26.5	212	24.8
Timaru District	23	23.5	267	24.3	290	24.2
Rangitikei District	37	23.3	89	24.3	126	24.0
Waitomo District	48	36.1	27	15.0	75	24.0
Westland District	6	15.8	54	25.0	60	23.6
Papakura District	102	27.3	201	20.9	303	22.7
Carterton District	6	20.9	38	22.8	44	22.5
Gore District	19	34.8	69	19.8	88	21.8
Manukau City	468	25.7	1427	20.4	1895	21.5
Palmerston North C	69	16.5	499	22.2	568	21.3
Waimakariri District	12	13.9	192	22.0	204	21.2
Waitaki District	4	9.7	120	22.0	124	21.1
Thames-Coromandel District	29	20.8	99	21.1	128	21.0
Western Bay of Plenty District	70	28.7	135	18.4	205	21.0
Manawatu District	22	15.1	166	21.9	188	20.8
Whangarei District	185	28.7	236	17.0	421	20.7
South Taranaki District	54	25.8	139	18.8	193	20.3
Waikato District	101	24.3	153	17.8	254	19.9
Tararua District	26	19.4	85	18.6	111	18.8
Wellington City	139	26.6	888	17.9	1027	18.7
Waipa District	47	19.4	184	18.5	231	18.7
Upper Hutt City	36	18.0	176	17.7	212	17.8
North Shore City	66	12.7	884	18.2	950	17.6
Auckland City	304	23.2	1727	16.9	2031	17.6
Hurunui District	4	18.1	42	17.5	46	17.6
Marlborough District	26	16.4	167	17.7	193	17.5
Dunedin City	59	19.3	640	17.4	699	17.5
Waimate District	2	19.8	33	17.2	35	17.3
Kapiti Coast District	27	15.9	142	17.5	169	17.2
Buller District	6	17.3	45	16.7	51	16.8

Central Hawke's Bay District	19	16.6	48	16.5	67	16.5
Waitakere City	166	19.3	701	15.8	867	16.4
Ashburton District	6	13.3	106	16.0	112	15.8
Stratford District	9	21.3	39	14.8	48	15.7
Clutha District	20	31.5	64	13.2	84	15.4
Taupo District	67	17.9	78	12.8	145	14.8
Mackenzie District	2	16.7	17	14.4	19	14.6
Nelson City	31	22.9	148	13.4	179	14.4
Southland District	17	15.0	122	14.3	139	14.4
Rodney District	16	7.1	245	15.3	261	14.3
Matamata-Piako District	42	27.4	91	11.6	133	14.2
Kaikoura District	6	30.1	8	10.0	14	14.0
Kaipara District	25	16.6	47	12.7	72	13.8
Hauraki District	23	18.1	49	12.2	72	13.6
South Waikato District	49	15.9	61	11.0	110	12.7
Selwyn District	3	4.7	94	12.5	97	11.9
Central Otago District	2	4.6	46	12.5	48	11.7
Otorohanga District	5	4.8	30	13.8	35	10.9
Tasman District	10	9.4	98	9.6	108	9.6
Queenstown-Lakes District	6	16.5	40	9.0	46	9.5
Franklin District	30	9.4	108	9.0	138	9.1
Chatham Islands District	1	6.6	1	11.3	2	8.4
Banks Peninsula District	4	17.3	12	6.9	16	8.1
<b>All New Zealand*</b>	<b>6036</b>	<b>27.9</b>	<b>19829</b>	<b>21.0</b>	<b>25865</b>	<b>22.3</b>

\*5–34 years age-specific rate per 10 000

Table 2 shows the findings (as age-specific rates per 10 000) grouped into urban and rural areas. In each age group the relative risk of hospitalisation for Maori was higher in rural TAs than in urban TAs, whereas for non-Maori overall the relative risk of hospitalisation was higher in urban than in rural TAs.

**Table 2. Hospitalisation rates by age and ethnicity for rural/urban territorial authorities (per 10 000)**

Age group	Maori	Other	Relative risk (RR) Maori vs other	95% CI
<b>0–4 years</b>				
Rural	1108.7	673.0	1.65	1.58–1.71
Urban	1003.8	805.3	1.25	1.20–1.30
<b>Total</b>	<b>1064.7</b>	<b>745.0</b>	<b>1.43</b>	<b>1.39–1.47</b>
<b>5–14 years</b>				
Rural	262.0	222.9	1.17	1.11–1.24
Urban	241.9	245.7	1.00	0.92–1.05
<b>Total</b>	<b>254.1</b>	<b>234.8</b>	<b>1.08</b>	<b>1.04–1.13</b>
<b>15–34 years</b>				
Rural	173.3	129.2	1.34	1.27–1.42
Urban	140.0	114.5	1.22	1.15–1.30
<b>Total</b>	<b>157.7</b>	<b>120.1</b>	<b>1.31</b>	<b>1.26–1.37</b>
<b>35–74 years</b>				
Rural	259.2	82.8	3.13	2.98–3.29
Urban	244.4	87.7	2.79	2.63–2.95
<b>Total</b>	<b>253.4</b>	<b>85.4</b>	<b>2.97</b>	<b>2.86–3.08</b>

## Discussion

We have examined regional patterns of asthma hospitalisations in Maori and non-Maori. There are some limitations to the data that should be noted. First, as with our earlier paper examining time trends in hospitalisation and mortality rates,<sup>2</sup> the lack of standardised ethnicity data means that the monitoring of Maori hospitalisation trends is not straightforward, although these problems are unlikely to be of major concern when making regional comparisons during the same time period. Second, the hospitalisation data represent episodes of care and may include people who have been hospitalised on more than one occasion. Similarly, many admissions in the age groups 0–4 years and 35 years or more that are classified as asthma will be due to viral infections and chronic obstructive pulmonary disease respectively. However, this factor is unlikely to have significantly affected the regional patterns presented here.

These analyses confirm previous evidence that asthma hospitalisation rates are higher in Maori than in non-Maori,<sup>2</sup> despite the fact that asthma prevalence is similar in Maori and non-Maori children.<sup>1</sup> They further indicate that this excess of hospitalisations is higher in rural than in urban areas, although the difference in hospitalisation rates is not large. We found non-Maori hospitalisation rates were generally higher in urban areas in contrast with the pattern for higher rates in rural areas seen in the Maori population.

These findings are in contrast with previously published data on regional differences in asthma prevalence.<sup>6,7</sup> The earlier studies showed little or no urban/rural difference, and the small differences that did exist appeared to involve slightly lower prevalences in rural areas. Thus, differences in prevalence are unlikely to account for the higher asthma hospitalisation rates for Maori in rural areas. This suggests that what we have observed reflects differences in asthma exacerbation and disease severity. It is possible that there may be some real differences in asthma prevalence between some TAs; however, the evidence from this review indicates that there does not seem to be any systematic urban/rural difference.

The Maori Asthma Review concluded that asthma was more severe and that hospitalisation and mortality rates for Maori exceeded those of non-Maori primarily because of inadequate access to appropriate healthcare and asthma education.<sup>3,4</sup> It was also reported that these problems may be particularly severe in rural areas. At the individual level, cost was a major factor related to access identified in the Maori Asthma Review.<sup>3</sup> Costs included travel to the doctor's surgery, doctor's fees and prescription charges. These costs might be further exacerbated for those living in isolated rural communities. There was also strong support expressed in the Review for low-cost health clinics, but only as a 'second best' option to the provision of free primary healthcare. The introduction in 1997 of free consultations for patients under six years old may have relieved some of the financial burden associated with visits to GPs for this age group.<sup>16</sup> However, prescription costs for medications remain a major issue and, obviously, there are significant numbers of people with asthma who have been outside of the qualifying age parameter. Similarly, in a 1998 study of 401 low-income households around New Zealand, 56% of participants had not visited a doctor in the previous year because of cost and 17% identified asthma as a condition that had gone untreated as a result of this.<sup>17</sup> GP consultation fees and prescription charges have been under review as part of the Primary Health Care Strategy.<sup>18</sup>

A study of access and utilisation of primary healthcare amongst Maori and low-income New Zealanders, using data collected during 1994–1995, found cost to be a significant barrier in both population groups, together with poor access to public transport and isolated populations in rural settings.<sup>19</sup> Overseas studies have found that inaccessibility of acute hospital services may increase the risk of asthma mortality.<sup>20</sup> Geographic isolation and limited public transport were documented in the Maori Asthma Review as being significant factors for Maori in their decision making about accessing health services. There was also the additional factor of cost associated with transport for those living in rural or isolated areas, with very limited options available in terms of public transport.<sup>3</sup> The recently announced funding for rural services by the Ministry of Health<sup>21</sup> will concentrate resources on supporting and retaining primary healthcare teams currently working in rural areas as well as provide for some national initiatives to be undertaken for encouraging the recruitment of primary healthcare workers to rural areas on both a short- and long-term basis.

In addition to issues of cost and geographic isolation, the Maori Asthma Review identified differential management of asthma and inadequate access to appropriate healthcare and asthma education as contributing to the high asthma morbidity rate amongst Maori.<sup>3</sup> One study found that Maori were less likely to have an action plan and less likely to use a peak flow meter. Relative to the severity of their asthma, Maori lost more time from work or school and needed more hospital services.<sup>22</sup> A further study in Auckland found that 33% of Polynesian children were not receiving any asthma drugs in the 24 hours prior to a hospital admission compared with 14% of European children. It also found that fewer Maori children were taking preventive medications compared with European children (13% vs 25%). The study concluded that rates of acute, severe asthma, resulting in higher admission rates for Maori and Pacific Islanders, were primarily due to differences in medical management. Issues such as compliance and utilisation of services have been shown to be contributing factors, but the major influence was that of the prescribing patterns of medical practitioners.<sup>23</sup> Similar conclusions have been reached in subsequent studies, which propose that differences in asthma morbidity, between Maori and non-Maori, are most likely related to differences in access to, and delivery of, asthma care.<sup>1</sup> It is not clear whether these problems of asthma management are particularly acute in rural areas. However, where Maori have been actively involved in the planning, establishment and maintenance of rural, community-led asthma self-management programmes, improved access to health services and reduced asthma morbidity was seen.<sup>24,25</sup>

Passive exposure to tobacco smoke may contribute to the increased hospital admissions seen in Maori children, although it is unlikely to entirely explain the level of greater asthma severity reflected in hospital admission rates.<sup>26</sup> One New Zealand study of adult asthma prevalence suggests that the increased frequency of symptoms amongst adult Maori may in part be a reflection of greater non-allergenic bronchial symptoms related to increased exposure to tobacco, both actively and passively, compared with non-Maori.<sup>27</sup>

In summary, while we have found that there are rural/urban differences in Maori and non-Maori asthma hospitalisation rates, these differences are not large, and there are Maori/non-Maori differences within urban areas as well as within rural areas. However, it is likely that the higher asthma hospitalisation rates among Maori that we have observed reflect differences in asthma exacerbation and disease severity as a

result of reduced access to asthma health services, which may be particularly acute for those people living in rural areas.

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