Thorax 1990;45:176–182

Why are hospital admission and mortality rates for childhood asthma higher in New Zealand than in the United Kingdom?

E A Mitchell, H R Anderson, P Freeling, P T White

Abstract

New Zealand has higher mortality and hospital admission rates for asthma than England and Wales. To determine the reasons for this the available data on asthma mortality and hospital admissions from the Auckland region of New Zealand were compared with data from the South West Thames Region of England for 1979–86 and data from previous surveys on prevalence of wheeze (Auckland 1985, Croydon 1978). In addition, a survey of general practitioners was carried out to determine their approach to the management of asthma, patient simulations being used. Asthma mortality in children of European descent aged 5–14 years was 2·5 times higher in Auckland than in South West Thames. The reported lifetime, 12 month, and one month prevalences of wheeze were also higher in Auckland (by 18·5%, 32·1%, and 87·5%). Unexpectedly, the hospital admission rate for asthma in children of European descent aged 5–14 years was 5% less in Auckland than in South West Thames. Comparative studies of hospital case notes and of the replies from general practitioners showed that in Auckland the duration of illness before admission was greater and that general practitioners were less likely to admit patients with acute asthma. The overall standard of general practitioner care in Auckland was, if anything, higher than in South West Thames but in both areas there was considerable variation. On balance it was concluded that the higher mortality rate in New Zealand is explained by higher levels of morbidity rather than relative deficiencies in care. Nevertheless, the implications of the lesser use of hospital care for acute asthma observed in Auckland need further consideration.

School of Medicine, University of Auckland, New Zealand
E A Mitchell

St George's Hospital Medical School, London
H R Anderson
P Freeling
P T White

Address for reprint requests: Professor H R Anderson, Department of Clinical Epidemiology and Social Medicine, St Georges Hospital Medical School, London SW17 0RE.

Accepted for publication 15 December 1989

A comparison of hospital admission rates for childhood asthma in developed countries has shown that, although the rates vary considerably between countries, all have had a large increase in recent years.[1] This does not appear to be an artefact due to diagnostic transfer but it is not clear to what degree it reflects changes in morbidity or in the criteria for admission. More important, there are also considerable international differences in asthma mortality,[2,3] with the possibility of an upward trend in some countries.[4–7]

Both New Zealand and England and Wales have experienced an increase in admissions for childhood asthma, but in 1985 the rates for children (0–14 years) were 75% higher in New Zealand than in England and Wales.[8,9] Mortality from asthma in this age group, though not increasing in either country, was three times higher in New Zealand than in England and Wales.[10]

In this paper we compare admission and mortality data, information from prevalence surveys, data extracted from hospital case notes, and the approach of general practitioners to the care of acute and chronic childhood asthma between the Auckland Region of New Zealand and the South West Thames Health Region of England. We attempt to determine whether the differences in admission and mortality rates between these two countries are likely to be explained by differences in asthma morbidity, by differences in admission criteria, or by differences in the primary care of childhood asthma.

Methods

MORTALITY AND HOSPITAL ADMISSION DATA

For New Zealand (population 3·3 million) and for the Auckland Region (population 890 000) admission and mortality rates for asthma (ICD 493) were obtained from the National Health Statistics Centre (B Borman, personal communication). For England and Wales (population 50 million) and for the South West Thames Region (population 3 million) data were obtained from the Office of Population Censuses and Surveys.[8,11] Population denominators for calculating rates were obtained from official government sources.

CASE NOTE SURVEYS

The same protocol was used to extract clinical information from the hospital records in the two countries. The data obtained included age, sex, number of readmissions in the calendar year of the index admission, mode of referral, duration of wheeze before admission, respiratory and pulse rates at the time of admission, and length of hospital stay. The Auckland Hospital Board supplied a list of all discharges from hospitals in Auckland in 1985 of patients aged 5–14 years with a main diagnosis of asthma (ICD 493). A 2 in 3 sample of these discharged patients was selected, of whom 137 were of European descent (to be

referred to in the subsequent text as Europeans). All had been admitted for acute asthma.

For the South West Thames Region the method of selecting cases was similar to that described in an earlier study.[12] From a list of discharges with a main diagnosis of asthma provided by Hospital Activity Analysis all acute admissions were selected and one admission per person was selected at random. From these a 26% sample was selected from each of the 17 hospitals to provide a target sample of 200 cases. Twenty one per cent of case notes were unavailable and sampling was continued within each hospital until the target was reached.

APPROACH TO MANAGEMENT OF ACUTE ASTHMA BY GENERAL PRACTITIONERS

The approach to the management of acute childhood asthma by general practitioners was assessed by using a patient management problem. The methods and results of a previous survey have been described.[13] In 1985 the patient management problem was sent to all general practitioners in Auckland and to all those with main surgeries in five health districts (population 1·25 million) of the South West Thames Region (population 3 million). The problem was designed to incorporate the average features seen in cases of acute asthma in school age children who are admitted to hospital.[12] It begins with a history, given by a mother on the telephone to the general practitioner, of acute severe asthma in her 8 year old son; this began 18 hours previously and is unresponsive to his usual treatment for an attack—two puffs of salbutamol from a metered dose inhaler four hourly as required. General practitioners are asked whether they would visit the child at home, ask for him to be brought to the surgery or clinic, or ask for more details before taking a decision. They are then given further details of the history and the findings of the examination of the child and asked whether or not they would have the child admitted to hospital and if not what treatment they would give. The scenario states that after 30 minutes there is no response to the treatment chosen. The general practitioner is asked to decide once more whether or not to send the child to hospital.

APPROACH TO MANAGEMENT OF CHRONIC ASTHMA BY GENERAL PRACTITIONERS

Another patient management problem was used to assess the approach of general practitioners to the management of chronic childhood asthma. It describes a 10 year old girl with chronic asthma whom the general practitioner is seeing for the first time. She has had wheeze for seven years and for the last six months has woken regularly at night with coughing. She has had 12 days off school in the last term owing to asthma, but has not required admission to hospital. Dust avoidance measures have not helped. She uses a salbutamol metered dose inhaler, up to two puffs four times a day. Peak expiratory flow is 130 l/min (about 50% of the predicted value). General practitioners are asked whether or not they would refer the child for specialist opinion at this point and, if not, what investigations, management, and follow up they would give. The scenario continues with the child still short of breath at follow up and the peak flow recording unchanged. The general practitioner is again asked to decide whether or not to refer the child to a specialist. Finally, the general practitioners' attitudes to the participation of specialists in the management of a child with chronic asthma are elicited.

PREVALENCE

The method of assessing prevalence used in the Auckland survey has been described in detail elsewhere.[14] A stratified random sample of standard 2 and 3 classes was selected from the Auckland Region in 1985. Fifty per cent were aged 9, 37% aged 8, 12% aged 10, and 1% aged 6, 7, or 11. A questionnaire, completed by the child's parents, sought details about any history of wheezing illness.

For the South West Thames Region an indication of the prevalence of wheezing was obtained from a population survey in 1978 of all children in the school cohort aged 8 and 9 years attending school in the Croydon District (population 320 000). The methods and results have been reported previously.[15] This survey comprised a short questionnaire completed by parents, followed by a home interview of a stratified sample of 284 wheezy children that obtained more data on severity and medical care.

The data were compared by χ^2 or t tests as

Table 1 Comparison of deaths from asthma between New Zealand and England and Wales and between Auckland and South West Thames regions in children aged 5–14 years: numbers (n) and rates per 1 000 000

	New Zealand				*England and Wales*		*Auckland*				*South West Thames*	
	Total		*European**		*Total*		*Total*		*European**		*Total*	
Year	*n*	*Per 10⁶*	*n*	*Per 10⁶*	*n*	*10⁶*	*n*	*Per 10⁶*	*n*	*Per 10⁶*	*n*	*10⁶*
1979	10	16·4	8	15·5	28	3·7	2	13·0	2	16·4	1	2·5
1980	16	26·6	13	25·5	27	3·7	5	32·8	5	41·7	2	5·0
1981	8	13·4	6	12·0	40	5·7	3	19·8	2	17·0	2	5·3
1982	9	15·4	6	12·2	36	5·3	1	6·7	0	0	4	10·8
1983	6	10·4	6	12·4	33	5·0	0	0	0	0	3	8·3
1984	5	8·8	2	4·2	30	4·7	1	6·9	0	0	0	0
1985	4	7·2	3	6·5	19	3·0	2	14·0	1	8·9	1	2·9
1986	8	14·7	5	11·0	22	3·5	0	0	0	0	0	0
1987	NA	NA	NA	NA	26	4·2	NA	NA	NA	NA	4	11·8
1979–86	66	14·2	49	12·6	235	4·3	14	11·8	10	10·8	13	4·4

*Non-Maori, non-Pacific Islander.
NA—not available.

Table 2 Comparison of admissions for asthma between New Zealand and England and Wales and between Auckland and South West Thames regions in children aged 5–14 years: numbers (n) and rates per 100 000

	New Zealand				England and Wales		Auckland				South West Thames	
	Total		European*		Total		Total		European*		Total	
Year	n	Per 10^5	n	Per 10^5	n†	10^5	n	Per 10^5	n	Per 10^5	n†	Per 10^5
1979	2060	338	1527	296	1068	142	371	242	232	190	57	135
1980	2076	345	1510	297	1212	165	391	257	250	208	72	180
1981	2730	459	2048	408	1423	201	502	332	332	282	85	220
1982	2244	384	1648	335	1530	224	414	277	259	223	108	291
1983	2349	409	1739	360	1655	251	404	274	272	236	94	260
1984	2555	452	1878	396	1734	269	386	266	244	215	114	322
1985	2478	446	1790	385	1780	280	380	266	216	192	91	260
1986	2814	515	2037	446	NA	NA	458	324	273	246	NA	NA
1979–86	19 306	417	14 177	364	10 402	220	3306	279	2072	224	621	237

*Non-Maori, non-Pacific Islander.
†10% sample of all admissions.
NA—Not available.

appropriate. The results show the 95% confidence intervals for differences

Results

MORTALITY AND HOSPITAL ADMISSION DATA

The 1979–85 mortality rates for asthma in children aged 5–14 years, both for the two countries and for Auckland versus South West Thames, are compared in table 1. The rate in European children is lower than the total rate for both Auckland and New Zealand. Rates by racial group are not available in England and Wales. Mortality rates for individual years are not compared because of small numbers, but the average annual mortality for 1979–86 was higher both nationally and regionally in New Zealand—by factors of about 3 and 2·5.

Admission rates from 1979 to 1985 for children aged 5–14 are compared in table 2. Admissions have increased with time in both countries and the New Zealand rates were on average 90% higher than those in England and Wales. The Auckland rates were lower than those for New Zealand as a whole but were on average 17% higher than those for South West Thames. The Auckland rate for European children, however, was 5% lower than the rate for South West Thames.

CASE NOTES SURVEY

Table 3 gives the results of the case note surveys. There were no significant differences in age, sex, percentage referred by general practitioners, or readmission ratio (number of admissions in the calendar year of the index admission). In Auckland, however, children were significantly less likely than in South West Thames to be admitted with asthma of less than 18 hours' duration (24·5% *v* 40·2%). The mean respiratory rates were identical in the two areas and the mean pulse rate, though 7 beats/min higher in Auckland than in South West Thames, was not significantly different. The mean lengths of hospital stay were similar.

Table 3 Comparison of case notes of children aged 5–14 years admitted for asthma in Auckland and South West Thames (SWT) regions

	Auckland n = 137	SWT n = 202	Difference	95% confidence limits
No of admission/No of persons	1·32	1·26		
Age (mean (SD) (y))	8·7 (2·8)	8·2 (2·7)	+0·5	−0·01, 1·1
Male (%)	58·4	65·8	−7·4	−3·1, 17·9
Referred by general practitioner (%)	50·4	45·0	+5·4	−5·4, 16·2
Wheezing for < 18 h before admission (%)	24·8	40·2	−15·4	5·5, 25·3
Respiratory rate on admission (mean (SD), /min)	35 (11)	35 (11)	0	−2·4, 2·4
Pulse rate on admission (mean (SD), /min)	125 (21)	118 (19)	+7	−2·6, 11·4
Length of stay (mean (SD), days)	2·7 (2·5)	2·6 (2·5)	+0·1	−0·4, 0·6

Table 4 Patient management problem: home visit and admission decisions in Auckland and South West Thames (SWT) regions in a case of acute severe asthma

	Auckland n = 324 (%)	SWT n = 334 (%)	Difference (%)	95% confidence limits
Visit at home	40	78	−38	−30·1, −44·1
Ask to come to surgery	32	3	29	23·7, 34·5
Require more information before deciding	28	20	8	1·5, 14·5
Admit immediately	27	49	−22	−14·4, −28·8
Admit if no response after treatment for 30 min (% of those not admitting immediately)	89	83	6	0·7, 11·3
Continue to treat at home	8	3	5	1·8, 8·9

APPROACH TO ACUTE ASTHMA MANAGEMENT BY GENERAL PRACTITIONERS

The general practitioner response rate in Auckland (57%) was similar to that in South West Thames (52%). There were important and statistically significant differences in initial management (table 4). In Auckland 40·4% of general practitioners would visit the home compared with 77·5% in South West Thames. In Auckland 31·8% of general practitioners would ask the family to bring the child to the surgery or clinic compared with 2·7% in South West Thames. There was no difference between the two groups in their willingness to see the patient.

In Auckland general practitioners were significantly less likely to arrange immediate admission to hospital (26·9%) than general practitioners in South West Thames (48·5%; table 4). Of those general practitioners who would not send the child to hospital immediately a high proportion in both regions reported that they would arrange admission if after 30 minutes there were no response to initial treatment. A small but significantly higher proportion of Auckland general practitioners, however, reported that they would continue to manage the child in the community even if there were no response to 30 minutes of initial treatment (8·3% *v* 3·0%).

Table 5 shows the initial drug treatment the general practitioners would have used for this acute attack. In Auckland 93·2% of general practitioners would use an adrenergic drug and

Table 5 Patient management problem: initial drug treatment in Auckland and South West Thames (SWT) regions in a case of acute severe childhood asthma

	Auckland n = 237 (%)	*SWT n = 172 (%)*	*Difference (%)*	*95% confidence limits*
Adrenergic drug				
Any	93	82	11	4·6, 27·0
Parenteral	6	7	−1	−3·3, 6·3
Nebulised	81	58	23	14·1, 31·9
Anticholinergic drug				
Any	26	1	25	17·4, −31·6
Xanthines				
Any	23	23	0	−7·8, 8·8
Parenteral	10	9	1	−4·3, 7·1
Suppository	0	8	8	
Corticosteroids				
Oral	14	16	−2	−9·1, 5·1
Parenteral	17	20	−3	−10·7, 4·7
Other				
Cromoglycate	3	8	−5	−8·8, 0·4
Ketotifen	0·4	0		
Antihistamine or sedative	0	5	−5	
Antibiotic	3	6	−3	−7·3, 0·7

80·6% would give it by nebuliser, compared with 82·0% and 57·6% for South West Thames general practitioners. In Auckland 66 of the 220 general practitioners (30%) who would use an adrenergic drug changed from salbutamol by metered dose inhaler (the type stated in the scenario) to fenoterol (63/66 by nebuliser). In South West Thames 17 of 141 doctors (12%) who would give an adrenergic drug changed from salbutamol, 16 to terbutaline and one to a fenoterol-ipratroprium preparation. There were substantial differences in the use of anticholinergic drugs, all of which would be given in combination with an adrenergic drug (Auckland 25·7% *v* South West Thames 1·2%).

Similar proportions of general practitioners in the two samples were prepared to give corticosteroids and xanthines, using similar routes of administration (oral or parenteral). Suppositories containing xanthines were used by some United Kingdom doctors (7·6%) but by none of the New Zealanders. Other drugs, such as sodium cromoglycate, antihistamines, and antibiotics, were used infrequently overall but more by doctors in the United Kingdom.

Table 6 Patient management problem: management in Auckland and South West Thames (SWT) regions in a case of chronic childhood asthma

	Auckland n = 237 (%)	*SWT n = 249 (%)*	*Difference (%)*	*95% confidence limits or χ^2*
Investigations ordered by general practitioners not referring to specialist				
Lung function tests	44	26	18	9·8, 26·2
Monitoring/diary of peak flow rates	20	11	9	2·7, 15·3
Chest radiograph	59	38	21	12·4, 29·6
Skin or other allergy tests	38	11	27	19·6, 34·4
Blood tests	47	16	31	23·0, 39·0
Other tests	16	6	10	4·6, 15·4
Nil	9	43	−34	−41·5, −26·5
Drug management by general practitioners not referring to specialist				
Adrenergic drugs	79	67	12	4·4, 19·6
Regular theophylline	59	35	24	15·4, 32·6
Cromoglycate	49	69	−20	−28·5, −11·5
Inhaled steroids	38	25	13	5·0, −21·0
Antihistamines or antibiotics	3	7	−4	−7·7, −0·3
Interval to follow up consultation				
1–6 days	11	14	3	
1 week	43	43	0	
2 weeks	36	35	1	χ^2 = 3·6 (NS)
3 weeks	3	3	0	
4 or more weeks	6	6	0	

APPROACH TO CHRONIC ASTHMA MANAGEMENT BY GENERAL PRACTITIONERS

In Auckland 16% of general practitioners would refer the child with chronic asthma to a specialist at the first consultation compared with 25% of general practitioners in South West Thames (95% confidence interval for difference 2·8—15·3). At the first follow up consultation the proportion of doctors referring the child to a specialist were similar (53% and 56%). Table 6 summarises the investigations ordered by the general practitioners who decided to continue to manage the child. The proportions of general practitioners in Auckland ordering investigations were significantly greater than that in South West Thames for each category. Table 6 gives the drug management proposed by general practitioners not referring to a specialist. There were substantial differences, with more general practitioners in Auckland who would use inhaled steroids and theophylline for prophylaxis than in South West Thames, but more general practitioners in South West Thames who would use cromoglycate. A significantly higher proportion of Auckland doctors would prescribe adrenergic drugs and of these 18 out of 218 changed the type of adrenergic from salbutamol by metered dose inhaler (as stated in the scenario) to fenoterol, and a further seven doctors mentioned fenoterol as a possible treatment. The corresponding proportions for the third drug mentioned—terbutaline—were 2/218 and 3/218. A smaller proportion of doctors in South West Thames would change the adrenergic drug prescribed from salbutamol to another type (7/167), the chosen drugs being terbutaline (5) and orciprenaline (2). The intervals before the follow up consultation were almost identical in the two regions, with about 55% of general practitioners choosing one week or less.

The general practitioners' attitudes to the participation of the specialist in the management of chronic childhood asthma are shown in table 7. Their assessments of the value of specialist advice were similar in Auckland and South West Thames, as were their views on the programme of care that would have the best long term outcome for a child with chronic severe asthma. The reasons for referral to a specialist were similar, except that fewer general practitioners in Auckland than in London would refer the child for allergy testing (18% *v* 37%), and fewer felt the need to rule out serious underlying disease.

PREVALENCE

In Auckland 1084 European children took part in the prevalence study (84% response) and in the Croydon District of South West Thames 3698 (89% response). The reported lifetime, 12 month, and one month prevalences of wheeze are compared in table 8. All of these measures of prevalence were higher in Auckland, the greatest difference being in the prevalence of wheeze in the last month (+87·5%) and the least being in the lifetime prevalence (+18·5%).

Table 7 General practitioners' attitudes to participation of specialists in the management of chronic childhood asthma in Auckland and South West Thames (SWT) regions

	Auckland n = 237 (%)	SWT n = 249 (%)	Difference (%)	95% confidence limits or χ^2
General practitioners' assessment of the value of specialist advice				
Essential	45	9	4	χ^2 = 4·5 (NS)
Very helpful	34	29	5	
Helpful	46	50	4	
Rarely helpful	14	11	3	
Of little use	0	1	1	
Reasons for general practitioner referral to specialist				
Consultant support	72	74	−2	NS
Treatment	69	63	6	NS
Rule out serious disease	39	47	−8	−15·6, −0·5
Access to latest advances	44	42	2	NS
Allergy testing	18	37	−19	−25·8, −12·2
Diagnosis	12	16	−4	NS
Prognosis	10	10	0	NS
Best programme of care for a child with chronic severe asthma				
Hospital asthma clinic 6 weekly	7	4	3	χ^2 = 4·22 (NS)
Hospital asthma clinic and general practitioner 6 weekly	32	30	2	
Yearly hospital assessment and general practitioner 6 weekly	44	45	1	
Hospital assessment at request of general practitioner only	17	21	4	

Discussion

The aim of this study was to explore reasons for the differences in asthma mortality and admission rates between New Zealand and England and Wales. The method adopted was to compare data for the 5–14 age group of two large regions of these countries obtained from four sources: available mortality and hospital admission data; random samples of hospital case notes, surveys of general practitioners on the basis of patient simulations; and previously conducted prevalence surveys.

During 1979–86 mortality was three times higher in New Zealand than in England and Wales and this order of difference was also observed in the Auckland-South West Thames comparison. Hospital admissions were rising in both countries during this period and remained about twice as high in New Zealand. Over the period 1979–1985–6 as a whole the ratio of admissions to deaths in New Zealand (294:1) was about 60% of that in England and Wales (512:1). The difference in admission rates between the two regions was, however, much less, with the Auckland rates only 20% above those of South West Thames. In Auckland, as in the rest of New Zealand, admission rates are higher in non-European groups.[16] In South West Thames the non-European population is proportionately smaller and there is little evidence that their morbidity or admissions from asthma differ from those of Europeans.[15 17] When the non-European population was excluded from the Auckland sample, the admission rates were found to be 5% lower in Auckland than in South West Thames. We must now explain why for Europeans Auckland has a higher mortality rate than South West Thames alongside a lower ratio of admissions to mortality, less than half of that in South West Thames (Auckland 207:1, South West Thames 539:1).

Table 8 Prevalence and severity of childhood asthma in Auckland and South West Thames (SWT) regions

	Auckland n=1084 (%)	SWT n=3968 (%)	Difference (%)	95% confidence limits	Auckland − SWT / SWT (%)
Lifetime prevalence	25·6	21·6	4·0	1·1, 6·9	18·5
Period prevalence					
Last 12 months	14·8	11·2	3·6	1·3, 5·9	32·1
Last month	7·7	4·1	3·6	1·9, 5·3	87·5

The comparative data on asthma prevalence are of particular importance but need to be interpreted with caution. They are unlikely to be biased by age because the age distribution of the two groups was very similar. The questions used were also similar but not identical, and in Croydon the one month prevalence estimate was based on an interview rather than a questionnaire completed by parents as in Auckland. A more serious problem is that a period of seven years separated the surveys and if there had been an increase in the prevalence of asthma over time this might help to account for the differences observed. A recent review of prevalence surveys in the UK found little evidence for an increase in lifetime or 12 month period prevalence in the 20 years up to 1986.[18] In 1985 a large survey of Nottingham children aged 4–11[19] found a 12 month period prevalence of wheeze of 11·5%, very close to the 1978 Croydon value of 11·2%, given the different age structures of the two samples. The prevalence of frequent wheezing, however, in the last 12 months (more than four episodes) in Nottingham was higher than in Croydon (more than five episodes; 4·4% *v* 2·3%). In Wales Burr and others[20] conducted two surveys of asthma symptoms 15 years apart and found evidence for a 55% increase in the 12 month period prevalence of asthma, from 9·8% to 15·2%. This was supported by an increase in the prevalence of exercise provoked bronchoconstriction. Thus the prevalence and range of severity of asthma in Croydon in 1985 might have been underestimated by using 1978 data. Comparison of the prevalence data may also be affected by seasonal bias. The Croydon survey was done in February, when admissions are generally low. The Auckland survey was done over the months of May, June, and July, which lie between the autumn and the spring peaks of admissions. Thus the surveys were done at different seasons but neither coincided with known peaks of admissions for childhood asthma.

The reported lifetime prevalence rates for asthma did not differ substantially between the two countries, whereas in Auckland there was a much higher period prevalence of asthma both in the last 12 months and in the last month before interview. As the recency of wheeze correlates with frequency and severity,[15] this observation suggests that asthma is more severe in Auckland than in South West Thames.

If asthma is more severe in Auckland than in South West Thames, why are admission rates not higher in Auckland? Both the hospital case note survey and the general practitioner patient simulation survey were consistent in suggesting that in Auckland there is a somewhat greater willingness to treat asthma in the community and delay admission. In the case note study our indicators of severity were the duration of symptoms and the level of vital signs on admission. The duration of the attack is gen-

erally accepted as an important indicator of severity. The use of the pulse and respiration rates, however, as indicators of severity for epidemiological purposes has yet to be systematically validated, though they are accepted as important in the clinical assessment of asthma. In Auckland the proportion of patients wheezing for more than 18 hours before admission was considerably greater than in South West Thames. This indicates that there is a relative delay in admission in Auckland. There were, however, no significant differences in the respiration rate or pulse rate, though the latter was higher in Auckland. Using a clinical scoring system that included pulse rate, a study which compared the severity of asthma on admission to hospital in Christchurch, New Zealand, with that in Leeds, England, found evidence for greater severity among children admitted for asthma in Christchurch.[21 22]

The general practitioner patient simulation found that only 26·9% of general practitioners in Auckland would arrange admission in the simulated case immediately, compared with 48·5% in South West Thames. Nearly all general practitioners in both countries would send the child to hospital if there were no response to initial treatment, but the proportion continuing to treat at home remained significantly higher in Auckland. Although the validity of the patient management problem approach was not examined in this study, two general practice based studies have found that the treatment proposed in a simulated case corresponds well with actual practice.[23 24]

Together, the case note study and the patient simulations provide convincing evidence that in Auckland there is, in relation to the morbidity and mortality levels, a greater reliance on primary care for the treatment of the acute attack. Although the quality of this care is apparently no less than in South West Thames in terms of the types of drug administered, this finding does raise the question of whether the lesser use of admission to hospital might have contributed to the higher mortality in Auckland.

The patient simulation exercise also pointed to other important differences in asthma management by general practitioners. The most prominent difference in the management of the acute case was that more general practitioners in Auckland used adrenergic drugs and were more likely to give it by nebuliser. This was supplemented by an anticholinergic drug in 25% of Auckland responses but in only 1% of those from London. There was no difference in the proportions of general practitioners using theophylline, corticosteroids, or any parenteral treatment. General practitioners in South West Thames tended overall to use other drugs, such as cromoglycate, antihistamines, theophylline suppositories, and antibiotics, more than general practitioners in Auckland. These drugs have no value in the acute episode.[25] We conclude that general practitioners in Auckland are using treatment for acute severe asthma that is at least as appropriate, if not more so, than that selected by their colleagues in South West Thames.

The management of chronic asthma by general practitioners, as shown by the second patient management problem, also showed substantial differences between the countries, especially in the investigations ordered and the choice of prophylactic asthma drugs used. The treatment proposed by the Auckland general practitioners tended to be more intensive. Between countries there was no difference in the interval before the follow up consultation or in general practitioners' attitudes to the participation of specialists in the management of chronic asthma.

We must emphasise that within both countries there were wide variations in the approach to both simulated cases. These variations were at least as great as the differences between countries and raise important questions concerning the effects of such variations on patient outcome and efficiency. The recently published international consensus statement on the management of asthma is therefore timely.[26]

There is much interest in the types of adrenergic drugs in use in New Zealand as a result of the report that the use of fenoterol by metered dose inhaler is associated with an increased risk of death in severe asthma.[27] The present study is unable to compare the types of adrenergic drug used fully because both patient simulation scenarios state that the child is having salbutamol by metered dose inhaler at the time of presentation. Nevertheless, it is notable that in both cases a sizeable proportion of Auckland general practitioners changed to another type of adrenergic drug, predominantly fenoterol—in contrast to their British colleagues, who tended to continue with salbutamol.

We postulate, on the basis of this analysis, that the higher childhood asthma mortality in Auckland than in South West Thames is most likely be a result of the relatively higher level of morbidity which exists in Auckland. The quality of general practitioner care for asthma, as judged by simulation studies, was at least as good if not better in Auckland than in South West Thames. The possibility that the relatively greater willingness to manage asthma in the community might also contribute to the differences in mortality must also be considered.

From New Zealand we thank Allen and Hanburys Ltd, which funded part of the general practitioner survey. The Department of Health of South Auckland supported in part the hospital case note survey. The prevalence study was funded by the Medical Research Council of New Zealand and the McKenzie Trust. From the United Kingdom we thank Connie Norman for organising, collecting, and processing the hospital and general practitioner survey data. The UK part of the study was funded by the British Lung Foundation. We thank also all the parents, children, and general practitioners who took part.

1 Mitchell EA. International trends in hospital admission rates for asthma. *Arch Dis Child* 1985;**60**:376–8.
2 Jackson RT, Beaglehole R, Rea HH, Sutherland DC.

Mortality from asthma: a new epidemic in New Zealand. *Br Med J* 1982;**285**:771–4.
3 Jackson RT, Sears MR, Beaglehole R, Rea HH. International trends in asthma mortality, 1970–1985. *Chest* 1988;**94**:914–9.
4 Burney PGJ. Asthma mortality in England and Wales: evidence for a further increase, 1974–84. *Lancet* 1986; ii:323–6.
5 Evans R 3rd, Mullally DI, Wilson RW, *et al.* National trends in the morbidity and mortality of asthma in the US. Prevalence, hospitalization and death from asthma over two decades: 1965–1984. *Chest* 1987;**91**:65–74S.
6 Mao Y, Semenciw R, Morrison H, MacWilliam L, Davies J, Wigle D. Increased rates of illness and death from asthma in Canada. *Can Med Ass J* 1987;**137**:620–4.
7 Sly RM. Mortality from asthma. *J Allergy Clin Immunol* 1988;**82**:705–17.
8 Department of Health and Social Security and Office of Population Censuses and Surveys, Welsh office. *Hospital Inpatient Enquiry*. London: HMSO (annually).
9 National Health Statistics Centre. *Hospital and selected morbidity data*. Wellington: Department of Health (annually).
10 Sears MR, Rea HH, Fenwick J, *et al.* Deaths from asthma in New Zealand. *Arch Dis Child* 1986;**61**:6–10.
11 Office of Population Censuses and Surveys and Welsh Office. *Mortality statistics* (series DHI). London: HMSO (annually).
12 Anderson HR, Bailey P, West S. Trends in the hospital care of acute childhood asthma 1970–8: a regional study. *Br Med J* 1980;**281**:1191–4.
13 Anderson HR, Freeling P, Patel SP. Decision-making in acute asthma. *J R Coll Gen Pract* 1983;**33**:105–8.
14 Asher MI, Pattemore PK, Harrison AC, *et al.* International comparison of the prevalence of asthma symptoms and bronchial hyperresponsiveness. *Am Rev Respir Dis* 1988; **138**:524–9.
15 Anderson HR, Bailey PA, Cooper JS, Palmer JC, West S. Morbidity and school absence caused by asthma and wheezing illness. *Arch Dis Child* 1983;**58**:777–84.
16 Mitchell EA, Borman B. Demographic characteristics of asthma admissions to hospitals. *NZ Med J* 1986;**99**:576–9.
17 Johnston IDA, Bland JM, Anderson HR. Ethnic variation in respiratory morbidity and lung function in childhood. *Thorax* 1987;**42**:542–8.
18 Anderson HR. Is the prevalence of asthma changing? *Arch Dis Child* 1989;**64**:172–5.
19 Hill RA, Standen PJ, Tattersfield AE. Asthma, wheezing and school absence in primary schools. *Arch Dis Child* 1989;**64**:246–51.
20 Burr ML, Butland BK, King S, Vaughan-Williams E. Changes in asthma prevalence: two surveys 15 years apart. *Arch Dis Child* 1989;**64**:1452–6.
21 Dawson KP. The severity of acute asthma attacks in children admitted to hospital. *Aust Paediatr J* 1987;**23**:167–8.
22 Conway SP, Littlewood JM. Admission to hospital with asthma. *Arch Dis Child* 1985;**60**:636–9.
23 Chaput De Saintonge DM, Hathaway NR. Antibiotic use in otitis media: patient simulations as an aid to audit. *Br Med J* 1981;**283**:883–4.
24 Rethans JJE, Van Boven CPA. Simulated patients in general practice: a different look at the consultation. *Br Med J* 1987;**294**:809–12.
25 Phipps RJ. Miscellaneous therapies for asthma: anticholinergic, antihistaminic, and nonsteroidal anti-inflammatory drugs; gold; and alcohol. In: Weiss EB, Segal S, Stein M, eds. *Bronchial asthma: mechanisms and therapeutics*. 2nd ed. Boston: Little, Brown and Co, 1985:741–55.
26 Warner JO, Gotz M, Milner AD, *et al.* Management of asthma: a consensus statement. *Arch Dis Child* 1989;**64**: 1065–79.
27 Crane J, Pearce N, Flatt A, *et al.* Prescribed fenoterol and death from asthma in New Zealand 1981–3: case control study. *Lancet* 1989;i:917–22.