The Burden of

Asthma

IN NEW ZEALAND

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Asthma and Respiratory Foundation of New Zealand (Inc.)

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< FOREWORD:

The Asthma and Respiratory Foundation of New Zealand has commissioned this report to highlight the burden of asthma in New Zealand. The Foundation believes that the Ministry of Health may have underestimated the impact of asthma on children and adults in New Zealand in the development of the New Zealand Health Strategy, and the Foundation wishes to see greater emphasis placed on the provision of adequate services for patients with asthma in this country.

As the authors of this report Dr Shaun Holt and Professor Richard Beasley note, asthma is one of the most common chronic diseases affecting children and adults in New Zealand, which has the highest prevalence of asthma in the world. Although asthma mortality has fallen, there is data both in this report and from other recent research in New Zealand to indicate that the morbidity associated with asthma remains very high. Evidence for this comes from high hospital admission rates and ongoing symptoms of severe asthma, which have been documented in many children and adults. Importantly, the disability associated with asthma is much higher than previously appreciated, with this condition rating as the number one cause of Years Lost to Disability in males and the third highest ranking cause in females. The economic consequences of this in terms of time lost from work and school are enormous. The economic burden of asthma to New Zealand has been conservatively estimated as $800 million per annum.

Based on the findings of this report, the Foundation is calling for:

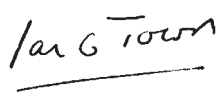
- All barriers to accessing adequate primary care to be eliminated as a matter of urgency. People with asthma need ready access to medical advice in a culturally appropriate setting, and free access to all relevant medications.

- An integrated approach to asthma management, including:
  - diagnosis and review of severity
  - provision of asthma education
  - provision of written asthma plans
  - regular review of asthma-related medication.

  The Foundation considers that adequate funding should be made available to primary health care providers to ensure that all patients can access these services.

- Increased co-ordination between secondary and primary care services. We are specifically recommending the formation of Regional Advisory Groups to assist District Health Boards in planning and co-ordinating services for people with asthma and related respiratory conditions.

Failure to address these issues will lead to an increasing burden of asthma in our society.



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< EXECUTIVE SUMMARY

Asthma is a major public health problem in New Zealand. About 15% to 20% of children and adults have asthma and there is evidence that asthma is becoming even more common. These prevalence rates are among the highest in the world, particularly in Maori and Pacific Island adults. Despite current treatments, the prevalence of severe asthma is also among the highest in the world, resulting in considerable morbidity. In terms of years lost to disability, asthma is the most important cause in males and the third highest ranking cause in females in New Zealand. Although New Zealand has experienced two drug-related asthma mortality epidemics in the 1960s and 1970s/1980s, over the last decade the rate of deaths from asthma has been similar to that in other Western countries.

The economic costs of asthma have been estimated to be around NZ$825 M per year in the late 1990s. This comprises about NZ$125 M in direct medical costs and about NZ$700 M in indirect non-medical costs, including days off work, premature disability, and death from asthma. The small proportion of asthmatics with chronic severe and/or poorly controlled disease is responsible for a disproportionately large portion of the cost.

The burden of asthma in New Zealand is likely to increase with the continuing increase in prevalence. Of concern is the incomplete understanding of the underlying causative factors that are responsible for the trend of increasing prevalence in New Zealand and other countries. Until there is greater understanding of the factors that cause asthma, particularly severe asthma, and novel public health and pharmacological measures become available to reduce the prevalence of severe asthma, the emphasis needs to remain on cost-effective management approaches which have been proven to reduce morbidity and mortality. This will require a number of public health initiatives including the greater availability of cost-effective medications and promotion of their use through proven methods such as the self-management plan system of care. It will also be crucial that financial and other barriers to primary health care are reduced through novel initiatives such as specialist nurse prescribing and restructuring of the partial government funding of primary care. Innovative programmes such as the “3+ Visit Plan” in Australia which funds patients to be reviewed regularly by their general practitioner, represents one model that could be adapted for use in New Zealand. The implementation of such measures, especially for patients with severe or uncontrolled asthma, should result in a significant reduction in the personal and economic burden of asthma in New Zealand. This warrants recognition of asthma, by the Ministry of Health, as a priority disorder in the New Zealand Health Strategy. Finally, key New Zealand research findings have contributed to a greater understanding of asthma and its management, and led to an improvement in quality of life for asthmatics in New Zealand and overseas. Further progress in asthma will need to be based on a similar multidisciplinary research effort.

CONTENTS

1. < PREVALENCE

1.A < Children

Numerous studies over the last 20 years have documented a high prevalence of asthma in New Zealand children.[1-4] The most comprehensive survey is the ISAAC (International Study of Asthma and Allergies in Childhood) programme, the largest standardised international study of asthma prevalence in children ever undertaken.[5-7] It obtained asthma prevalence data in over 700,000 children from 156 centres in 56 countries worldwide, including about 37,000 children from 6 centres in New Zealand.

In this study,[5-7] the prevalence of self-reported "wheezing in the previous 12 months" in 13–14-year-old children in New Zealand was 30.2% and a positive response to the question as to whether the individual "ever had asthma" was obtained in 24.4% (Table 1). The corresponding figures were 24.5% and 26.5% for the responses from parents of 6- to 7-year-old children (Table 2). In interpreting these figures it is necessary to acknowledge that the proportion of children responding positively to an individual question describing a symptom such as wheezing does not necessarily indicate the precise prevalence of asthma in the community. In particular, the questions based on wheezing are likely to identify some children with occasional wheezing in whom a clinical diagnosis of asthma may not be considered appropriate. However, even with this consideration these figures still indicate a very high prevalence of asthma in New Zealand children.

TABLE 1: *12-month prevalence (%) of self-reported asthma symptoms based on written questionnaire, 13–14-year age group*

	12-month prevalence	
Centre	**Wheeze**	**Ever had asthma**
Auckland	26.5	22.9
Bay of Plenty	29.5	22.3
Christchurch	29.6	25.9
Hawke's Bay	32.4	25.7
Nelson	30.9	20.2
Wellington	31.6	26.3
Total	**30.2**	**24.4**

All data are presented as percentages of the study children

TABLE 2: *12-month prevalence (%) of asthma symptoms based on parent-completed written questionnaire, 6–7-year age group*

Centre	**Wheeze**	**Ever had asthma**
Auckland	22.5	23.8
Bay of Plenty	24.0	25.7
Christchurch	27.2	28.4
Hawke's Bay	27.0	28.3
Nelson	18.7	17.6
Wellington	25.1	30.8
Total	**24.5**	**26.5**

All data are presented as percentages of the study children

One approach to improve the specificity of the recognition of clinical asthma has been the use of the asthma video questionnaire. The philosophy of the video questionnaire was that by showing rather than describing the signs and symptoms of asthma, a more accurate identification of clinical asthma could be obtained,[8] thereby reducing the problems associated with language and cultural differences inherent in international comparisons of asthma prevalence.[8-10] Using the video questionnaire in the ISAAC programme, 18.4% of New Zealand children aged 13–14 years reported clinical asthma with wheezing in the previous 12 months (Table 3). This rate provides a better estimate of the true prevalence of clinical asthma in children in New Zealand.

TABLE 3: *Prevalence (%) of self-reported clinical asthma based on video questionnaire, 13–14-year age group*

	Prevalence in last year (%)				
Centre	**Wheeze**	**Exercise wheeze**	**Night wheeze**	**Night cough**	**Severe wheeze**
Auckland	16.3	28.4	11.3	20.7	11.4
Bay of Plenty	18.6	28.4	11.4	25.2	12.8
Christchurch	17.4	32.2	11.3	22.4	13.2
Hawke's Bay	19.6	29.9	12.7	22.5	9.8
Nelson	19.0	32.3	10.5	23.3	11.7
Wellington	19.5	31.0	12.2	23.1	14.9
Total	**18.4**	**30.3**	**11.7**	**22.8**	**12.4**

All data are presented as percentages of the study children

1.B < Adults

There is a similar high asthma prevalence rate in adults in New Zealand. These data come primarily from the European Community Respiratory Health Survey (ECRHS), which is the equivalent standardised international asthma prevalence study in adults.[11,12] The first phase of this study was undertaken in four centres in New Zealand and obtained asthma prevalence data from almost 12,000 adults aged 20–44 years. The national prevalence of self-reported wheezing in the last 12 months was 25.7% (Table 4).[12,13]

TABLE 4: *Prevalence (%) of asthma symptoms in last 12 months in adults 20 to 44 years of age*

Centre	**Wheeze**	**Wheeze & breathlessness**	**Wheeze with no cold**	**Asthma medication**
Auckland	25.1	14.8	16.2	8.5
Christchurch	26.5	15.7	18.5	9.0
Hawke's Bay	23.8	14.9	15.8	7.7
Wellington	27.3	16.1	18.1	9.8
Total	**25.7**	**14.8**	**16.4**	**8.3**

All data are presented as percentages of the study children

When an operational diagnosis of asthma was made, based on waking with breathlessness, or an attack of asthma in the last year, or current asthma medications, the overall prevalence was 15.5%. The prevalence of asthma symptoms and use of asthma medications generally decreased with age, as shown in Table 5.

TABLE 5: *Symptom prevalence (%) by five-year age group (©1994 New Zealand Medical Journal. Reproduced with permission)*

Questions	20-24y	25-29y	30-34y	35-39y	40-44y
Wheezing in last 12 months	32.9	26.9	24.8	23.1	22.1
with associated SOB	19.7	16.1	15.2	13.4	13.4
without a cold	22.1	17.1	16.6	15.4	15.4
Woken with feeling of tightness	20.6	18.0	17.8	18.8	18.5
Woken by attack of SOB	11.8	10.2	10.33	10.1	9.7
Asthma attack last 12 months	10.0	8.0	7.2	7.9	6.5
Current asthma medication	11.7	9.7	7.8	8.2	7.0
Asthma	17.8	15.9	14.9	15.0	14.2

SOB: shortness of breath

The second phase of the ECRHS, which represented a detailed examination of a sub-sample of Phase I responders, identified that one in four New Zealand adults (24.9%) had bronchial hyper-responsiveness (BHR - a physiological marker of asthma) of a physiological level considered to indicate asthma.[14,15] Using the criteria of current symptoms and BHR, which has been proposed as the best method to diagnose current asthma in a population-based epidemiological sample, there were 14.2% asthmatics, similar to the figure of 15.9% for a physician diagnosis of asthma.

A related objective marker was measurement of atopic status through serum IgE levels and skin prick test sensitivity to common inhalant allergens. Phase II of the ECRHS programme showed that about one in three New Zealand adults were atopic, with 34.8% being skin prick test positive to at least one of the allergens tested, and 30.5% having an elevated total serum IgE (Table 6).[15]

TABLE 6: *Prevalence (%) of asthma symptoms, bronchial responsiveness, atopy and IgE in adults aged 20 to 44 years*

Asthma and allergy symptoms in past 12 months	%
Wheeze/whistling in the chest	28.5
Breathless with wheeze	15.8
Woken chest tightness	20.3
Shortness of breath:	9.4
at rest	7.7
woken by	15.9
Asthma ever	15.9
Asthma attack	8.4
Asthma medications	8.5
Bronchial responsiveness	
Abnormal (BHR)	24.9
Current symptoms and BHR	14.2
Atopy	
Total atopy	34.8
Specific atopy:	
house dust mites	22.1
pollens	23.8
moulds	4.9
cats	2.4
Abnormal total IgE	30.5
Raised specific IgE:	27.3
house dust mites	23.3
timothy grass	6.7
cat	5.6
ragweed	1.4
Cladosporium	

BHR: bronchial hyperresponsiveness

There has been no direct measure of the prevalence of asthma in the elderly in New Zealand; however, findings from other countries indicate that it is likely to be similarly high.[16] There is also evidence that many elderly asthmatic patients have severe disease and lung function impairment, often with a substantial degree of irreversible airways obstruction.[17]

1.C < Comparative International Rates

With the standardised international asthma prevalence data published from the ECRHS[11,12] and the ISAAC programmes,[5,7] it is now possible to compare the prevalence of asthma symptoms in New Zealand with other countries worldwide.

This comparison has confirmed that the prevalence of asthma symptoms and diagnosed asthma in New Zealand is among the highest in the world for both children (Figures 1–3) and adults (Table 7). The New Zealand rates are similar to those in other English speaking countries such as the United Kingdom, Australia and the USA, and higher than in most other countries. This overall pattern is maintained when the data are elicited by the video questionnaire, suggesting that differences in language or labelling of symptoms are unlikely to explain the major international patterns, at least in children. In adults, the observation that in New Zealand the prevalence rate of BHR is also among the highest in the world indicates that better recognition of asthma symptoms is not an explanation for New Zealand's high rates.[14]

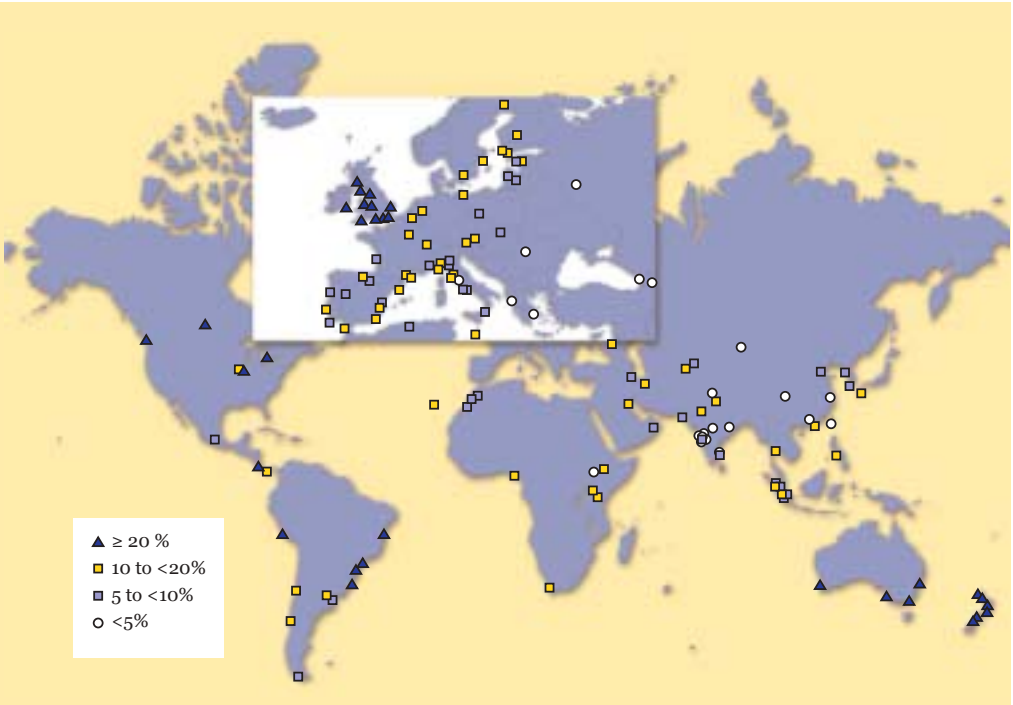

FIGURE 1: *World map for the 13–14-year age group, showing percentage of children who answered "yes" to the written question "Have you had wheezing or whistling in the chest in the last 12 months?" (© 1998 European Respiratory Journal. Reproduced with permission)*

FIGURE 2: *12-month prevalence (%) of self-reported asthma symptoms from written questionnaires in 13–14-year-old children in different countries (Reprinted with permission from Elsevier Science. The Lancet 1998; 351: 1228)*

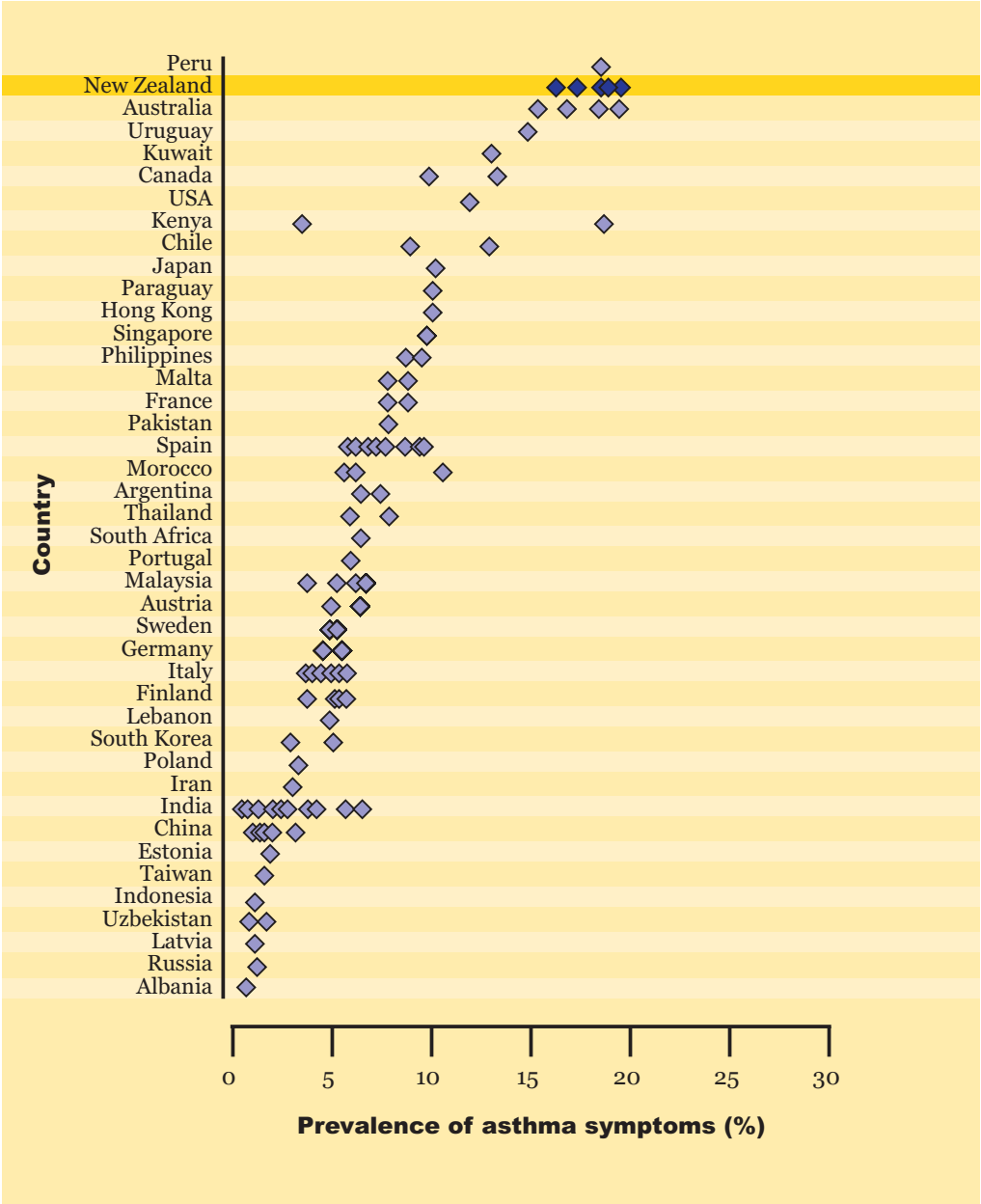

FIGURE 3: *12-month prevalence (%) of asthma symptoms from video questionnaire in 13–14-year-old children in different countries. (Reprinted with permission from Elsevier Science. The Lancet 1998; 351: 1228)*

TABLE 7: *Worldwide prevalence (%) of self-reported wheeze in previous 12 months in adults 20–44 years of age*

		Prevalence (%)	
Country	**No. of centres**	**Mean**	**Range**
India	1	4.1	–
Algeria	1	4.2	–
Italy	3	10.0	8.5–10.7
Austria	1	14.3	–
France	5	14.7	13.6–15.7
Greece	1	16.0	–
Belgium	2	16.6	12.8–20.6
Switzerland	1	16.9	–
Germany	2	17.2	13.3–21.1
Iceland	1	18.0	–
Portugal	2	18.3	17.7–19.0
Netherlands	3	20.6	19.7–21.1
Sweden	3	20.7	19.2–23.2
Spain	6	22.0	16.2–29.2
Denmark	1	24.1	–
Norway	1	24.6	–
England	3	25.4	25.2–25.7
United States	1	25.7	–
New Zealand	4	26.8	24.2–27.3
Estonia	1	26.8	–
Scotland	1	28.4	–
Ireland	2	28.7	24.0–32.0
Australia	1	28.8	–
Wales	1	29.8	–

1.D < Increasing Prevalence

There is also evidence to suggest that the prevalence of asthma in New Zealand children has increased over recent decades. This comes from studies in which the same questionnaire has been administered to children of the same age group and region on two occasions.[18] In 1989 a survey of asthma symptoms was carried out using the identical questionnaires to those used in a 1975 survey at the same rural secondary school in Wairoa, Hawke's Bay.[1,19] The prevalence of reported asthma or wheeze significantly increased from 26% to 34% (Table 8). The increase in prevalence was greater in Maori than in Europeans, with rises of 27% to 36% and 24% to 27%, respectively. Importantly, the reclassification of other respiratory problems did not account for the increase. The number of children using asthma medications had risen greatly, in excess of the increase in asthma prevalence, reflecting an improvement in the medical management of asthma. This study provides evidence that there has been a rise in the prevalence of asthma in this rural population over the 14-year period.

TABLE 8: *Changes in the prevalence (%) of asthma and asthma symptoms 1975–1989*

		Asthma not previously recognised but:						
	No history of asthma or wheeze	Asthma diagnosed		Wheeze associated with a cold only		Wheeze without a cold		
		Previous[a]	Current[b]	Previous	Current	Previous	Current	Total
1975	73.8	2.9	5.1	3.1	10.5	0	4.6	715
1989	66.0	5.3	8.0	2.1	10.6	1.1	6.9	435

[a] Before the past 12 months
[b] Within the past 12 months

A similar study has been carried out in an urban population of 13–14-year-old children living in Lower Hutt. Using identical questionnaires, it was shown that the prevalence of diagnosed asthma had increased from 7% to 14% between 1969 and 1982.[3] While it is recognised that the increasing asthma prevalence noted in both of these studies is likely to be attributed, at least in part, to an increased awareness of the symptoms of wheezing and the diagnosis of asthma, the magnitude of these increases suggests that there has been a real increase in the prevalence of asthma in both rural and urban New Zealand adolescents.

The above evidence for an increasing prevalence of asthma in New Zealand is consistent with data from other countries.[20] It has recently been reported that the prevalence of asthma in children and young adults worldwide has increased by approximately 5% per year over the past few decades.[21]

1.E < Migrant Communities

When communities from the Pacific Islands migrate to New Zealand they develop a considerably greater prevalence of asthma. This has been observed primarily in the Tokelauan community which migrated to New Zealand in the mid-1960s after a hurricane devastated their atolls. Within a 10-year period it was observed that asthma was a common problem in Tokelauan children who were born in New Zealand. When this was investigated, it was identified that the prevalence of asthma in Tokelauan children born in New Zealand was over twice that of the Tokelauan children who were born and lived on the Pacific atolls (25% vs. 11%).[22] There was also a marked increase in the prevalence of other atopic disorders, such as rhinitis and eczema.

1.F < Ethnic Differences

The prevalence of asthma is similar in Maori and non-Maori children; however, in contrast, the prevalence of asthma in Maori and Pacific Island adults is higher than that in other New Zealanders.

The most recent data in children comes from the Wellington component of the ISAAC programme, which identified that in 12–15-year-old children, the reported prevalence was similar among Maori and other children, but lower among Pacific Island children (Table 9).[23] This finding related to both the video and written questionnaires, suggesting it was not influenced by differing interpretation of the written questionnaire in different ethnic groups (Table 10). The frequency of severe attacks of

wheezing was similar in all ethnic groups, which differed from the findings in a study of risk factors for asthma symptoms in children in the Bay of Plenty.[24] In this study of 700 children aged 8–13 years, Maori children were about twice as likely to have current frequent nocturnal wheeze or current severe wheeze, and more than twice as likely to be admitted to hospital. This greater asthma severity in Maori children was likely to be related, at least in part, to the lower prescribing of prophylactic medication, which has been observed in Maori and Pacific Island children with symptoms of asthma throughout the last decade (Table 11).[24-27]

TABLE 9: *Prevalence (%) of asthma symptoms in different ethnic groups, as determined from the written questionnaire*

	By ethnicity			
	Maori	**Pacific Island**	**Other**	**Total**
Wheeze ever?	47	36	45	44
Wheeze last 12 months?	29	20	30	28
Wheeze after exercise?	17	7	22	18
Sleep disturbed by wheeze?	12	11	11	12
Night cough?	35	32	28	30
Severe attack?	11	9	11	11

TABLE 10: *Prevalence (%) of asthma symptoms in different ethnic groups, as determined from the video questionnaire*

	By ethnicity			
	Maori	**Pacific Island**	**Other**	**Total**
Wheeze ever?	52	43	46	47
Wheeze last 12 months?	38	31	36	36
Wheeze at rest?	22	18	19	20
Wheeze after exercise?	28	21	31	29
Waking with wheeze?	15	10	11	12
Waking with cough?	26	29	21	23
Severe attack?	17	12	15	15

TABLE 11: *Comparison of the prevalence (%) of asthma symptoms and related conditions between Maori and European children*

	Maori	**European**	**Odds ratio**
Wheeze ever	40.0	38.5	1.0
Current wheeze	21.3	21.5	1.0
Current nocturnal wheeze > once/week	6.1	2.8	2.2
At least 4 attacks of wheeze in the last year	7.2	5.7	1.3
Current severe wheeze[a]	6.3	3.6	1.8
Asthma ever	23.8	24.3	1.0
Ever hospitalised for asthma	9.3	4.0	2.4
Eczema	19.9	15.0	1.5
Hayfever	38.6	40.1	0.9

[a] Wheeze severe enough to limit speech to only one or two words at a time between breaths

The prevalence of asthma in adult Maori and Pacific Islanders is higher than in non-Polynesians, in contrast to the findings in children. These data come primarily from a large postal questionnaire to adults aged 20–44 years by Crane et al.,[13] which found that the prevalence of asthma (defined as being woken by shortness of breath, or attack of asthma in the last year, or current asthma medication) was 21.9% in Maori, 20.0% in Pacific Islanders and 14.6% in non-Polynesians.

Another ethnic difference is that the prevalence of asthma symptoms tends to decline with age in non-Polynesians, whereas it increases with age in Maori and Pacific Islanders. The lesser prescribing of asthma medications in Maori and Pacific Islanders with asthma is likely to contribute to these trends.[28]

In summary, the above data show that asthma tends to be more severe in Maori and Pacific Island children and also tends to be more common in Maori and Pacific Island adults, as compared with non-Polynesian New Zealanders. The most likely explanation for both of these findings is an inequality in access to healthcare in these groups. Suggested reasons for this inequality include costs of seeing a doctor (travelling to the surgery, doctors' fees, prescription charges), the location of medical services in rural areas and the cultural appropriateness of the services provided.[25]

1.G < Regional Differences

There are intriguing differences in the prevalence of asthma in different regions in New Zealand. The information in Figure 4 was obtained from a survey based on electoral rolls, in which 1 in 40 New Zealanders within the 20- to 44-year age group was studied.[28] The 25.3% prevalence of current wheezing was similar to that in the earlier studies, as was the prevalence of diagnosed asthma (15.2%) and the proportion who had been given a prescription for asthma medicines (8.5%).

Asthma prevalence was found to vary substantially between general electorates, ranging from 5.5% in King Country to 23.0% in Clevedon. There were significant urban/rural differences, as well as a marked difference in prevalence between various rural areas (Figure 4). When the prevalence rates were compared on the basis of responses in different electorates, some of the highest age and ethnic standardised rates were found in some of the electorates in Auckland, Wellington, Christchurch and Dunedin urban regions, and in some rural electorates including Raglan, Horowhenua and Wairarapa. The lowest prevalence rates were generally found in rural electorates including King Country, Matamata, Clutha, Rangiora and Wallace. While the ecological factors responsible for these regional patterns are unclear, the patterns do suggest a differing burden of asthma in different regions in New Zealand.

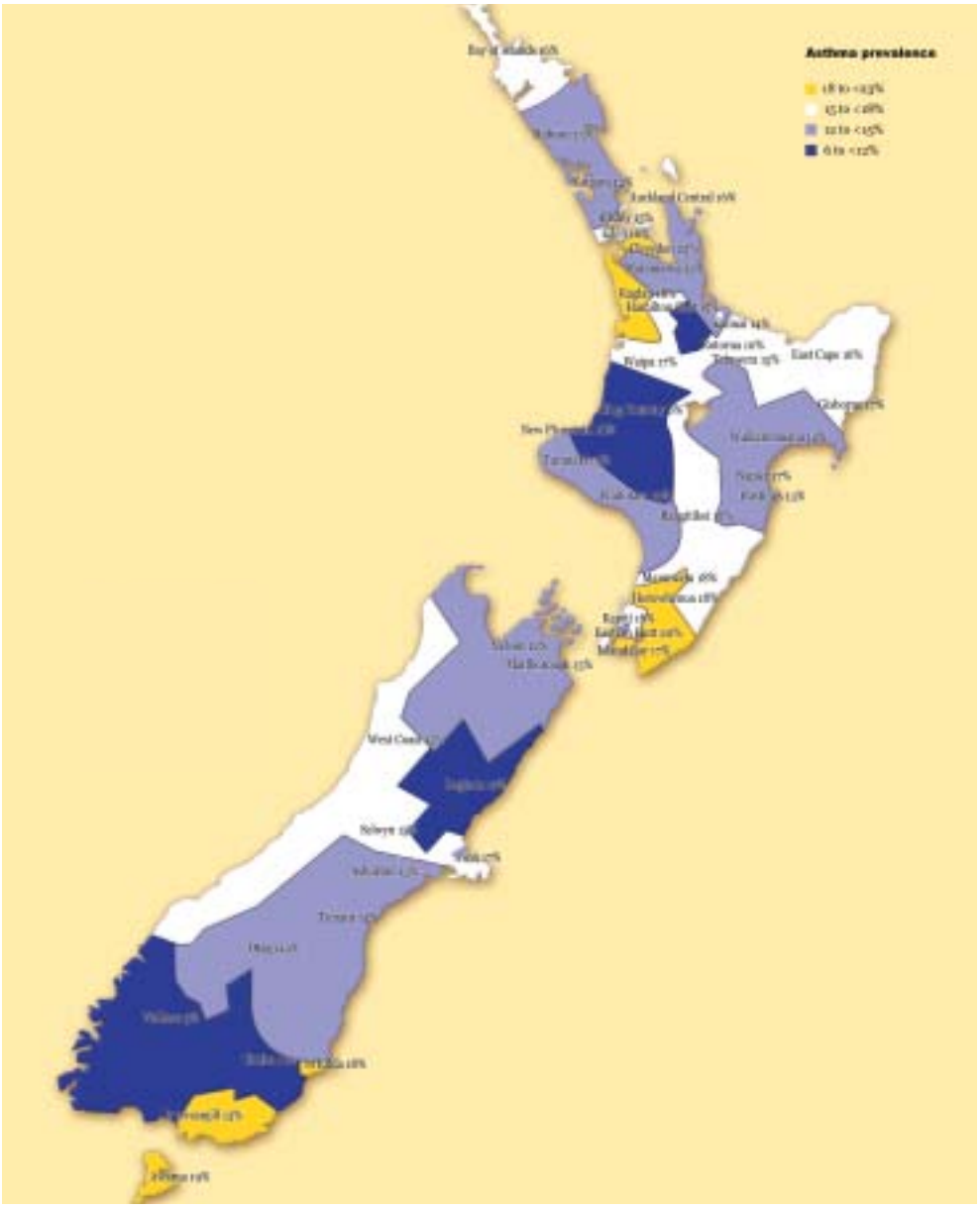

FIGURE 4: *Asthma prevalence in New Zealand electorates (© 1997 New Zealand Medical Journal. Reproduced with permission)*

1.H < Occupational Asthma

Asthma is recognised as the most common occupationally related respiratory disorder.[29] In New Zealand the high-risk occupations are farmers and farm workers, laboratory workers, food processors, plastics and rubber workers, and chemical processors (Table 12).[30] Among farmers, the types of farming associated with an elevated prevalence of asthma and allergy in New Zealand are deer and goat farming, working with horses, poultry or pigs, and crop farming (Table 13).[31] Other industries in New Zealand in which occupational asthma has been recognised as a major problem include aluminium smelting[32] and woodworking.[33] Regrettably, notification of occupational asthma to the Occupational Safety and Health Service Notifiable Occupational Disease System (NODS) is poor, indicating an under-recognition of the problem in New Zealand.[34,35]

TABLE 12: *Prevalence odds ratios for asthmatic symptoms, and for bronchial hyper-responsiveness (BHR) and asthmatic symptoms, by occupational group*

	Wheezing	BHR and wheezing
Occupational code	**Odds ratios[a]**	**Odds ratios[a]**
1 Remainder professional, administrative, clerical, service	1.00	1.0
2 Cleaners	0.90	0.55
3 Nurses	1.05	0.55
4 Farmers, farm workers	4.27	4.16
5 Hairdressers	0.28	–
6 Laboratory technicians, assistants	1.23	3.02
7 Woodworkers	1.94	1.25
8 Other food processors	2.45	0.83
9 Bakers	0.33	–
10 Plastics, rubber workers	2.08	0.84
11 Chemical processors	4.61	11.00
12 Remainder non-metal or non-electrical processors	0.62	0.93
13 Welders, solderers, and electronic processors	1.19	0.93
14 Metal making and treating	–	–
15 Remainder metal and electrical	0.78	1.05
16 Other painters	1.04	0.40
17 Spray painters	1.10	–
18 Remainder painting, assembly, and packaging	0.88	0.97
19 Construction, mining	1.07	0.56
20 Transport and storage	0.61	0.96
21 Housewives or inadequately described	1.50	1.05

[a] Adjusted for age, sex, and tobacco smoking

TABLE 13: *Prevalence (%) of symptoms of asthma in the last 12 months by self-reported farming type in a random sample of New Zealand farmers (© 1999 American Journal of Industrial Medicine. Modified and reproduced with permission)*

Farming types	Wheeze	Waking with shortness of breath	Asthma attack	Taking asthma medication	Current asthma[a]
All farmers	20.8	5.7	7.3	7.4	11.8
Market/veg. grower	21.5	6.2	7.7	7.7	10.8
Fruit grower	23.2	4.8	6.6	8.3	12.5
Nursery grower	22.5	7.0	9.9	5.6	11.3
Sheep	19.2	6.0	6.2	6.6	11.1
Beef	16.8	6.3	5.6	6.0	10.9
Deer	19.7	6.3	4.2	6.3	10.6
Goats	25.0	8.3	11.1	5.6	13.9
Horses	28.4	9.2	5.5	11.9	16.5
Pigs	25.5	9.1	12.7	10.9	18.2
Dairy	21.8	6.3	9.4	9.1	13.5
Poultry	43.5	8.7	8.7	4.4	17.4
Apiarist	18.8	0.0	0.0	0.0	0.0
Crops	24.8	5.7	6.4	9.2	12.8
Other	29.7	2.7	13.5	13.5	13.5

[a] Current asthma is defined as waking with shortness of breath, taking asthma medication, or having had an asthma attack in the last 12 months

1.1 < Role of Deprivation

In New Zealand, there are significantly higher lifetime and current prevalence rates of wheeze in children in low socio-economic status groups, but no relationship between socio-economic status and asthma diagnosis or BHR (Table 14).[36] The observation that, in lower socio-economic groups of children with asthma, the use of bronchodilators and asthma prophylactic drugs is less common suggests less satisfactory asthma management, due to lack of access to medical care. In this respect, the financial cost to access general practice care is considered to represent the greatest barrier.[37] Novel public health initiatives may be required to overcome this problem, perhaps through restructuring of the partial government funding of primary care and the implementation of specialist nurse prescribing in the field of asthma.

TABLE 14: *Prevalence (%) of asthma medication by socio-economic group in children using two definitions of asthma (© 1989 International Journal of Epidemiology. Reproduced with permission)*

	Socio-economic group		
	1-2	**3**	**4-6**
Any wheeze/exercise in last 12 months			
bronchodilators	65.5	49.3	51.1
prophylactic drugs	36.2	20.9	17.8
BHR and any wheeze/exercise wheeze in last 12 months			
bronchodilators	76.5	70.7	65.2
prophylactic drugs	41.2	29.3	26.1

BHR: bronchial hyperresponsiveness

The relationship between asthma prevalence and deprivation has also been studied in a random sample of over 25,000 adults, aged 20–50 years, which utilised the New Zealand Dep91 index of deprivation.[38] After controlling for key confounding factors, the 12-month period prevalence rates of asthma were significantly higher in the three most deprived area categories than in the least deprived category (Table 15). Overall, these findings lend weight to the case for reducing material deprivation as well as undertaking specific public health initiatives to improve access to medical care.

TABLE 15: *One-year period prevalence (%) of asthma among New Zealand adults aged 20–50 years, by area deprivation score (© 1999 Journal of Epidemiology and Community Health. Adapted and reproduced with permission from Salmond, et al. J Epidemiol Community Health 1999; 53: 476-80)*

Deprivation score[a]	**Prevalence of asthma**	**Prevalence ratio**
1 (least deprived areas)	13.1	1.00
2	12.8	0.98
3	13.1	1.00
4	15.0	1.14
5	14.9	1.14
6	14.7	1.13
7	14.9	1.14
8	16.4	1.25
9	18.6	1.43
10 (most deprived areas)	19.5	1.49

[a] *NZDep91* value

1.J < Atopy

The prevalence of atopy or atopic sensitisation in New Zealand is also among the highest in the world. This is not surprising when one considers that atopy is the most common and important risk factor for the development of asthma in both children and adults.

With regard to New Zealand children, the prevalence of allergic rhinoconjunctivitis and atopic eczema symptoms is among the highest in the world (Figures 5 and 6).[5] In the ISAAC programme the proportion of 13–14-year-old children in New Zealand reporting symptoms of these two atopic disorders was 19% and 13%, respectively.

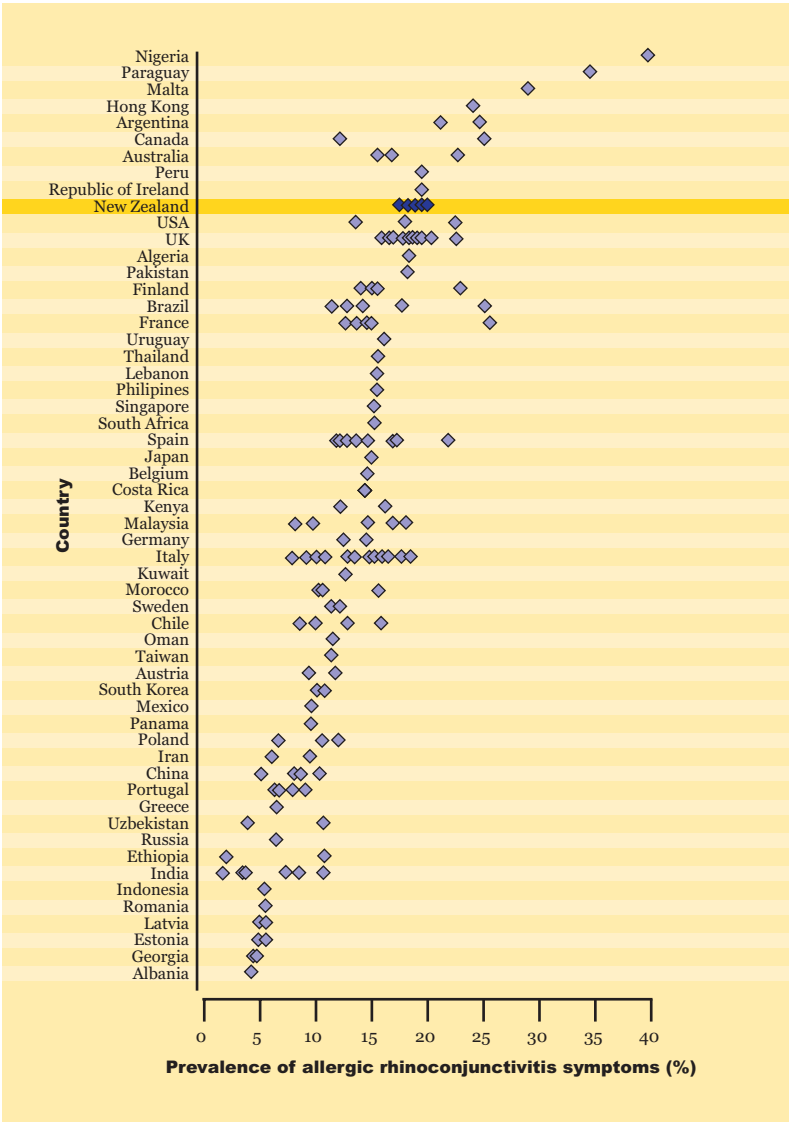

FIGURE 5: *12-month prevalence of allergic rhinoconjunctivitis symptoms in 13–14-year-old children in different countries. Reprinted with permission from Elsevier Science (The Lancet 1998; 351: 1229)*

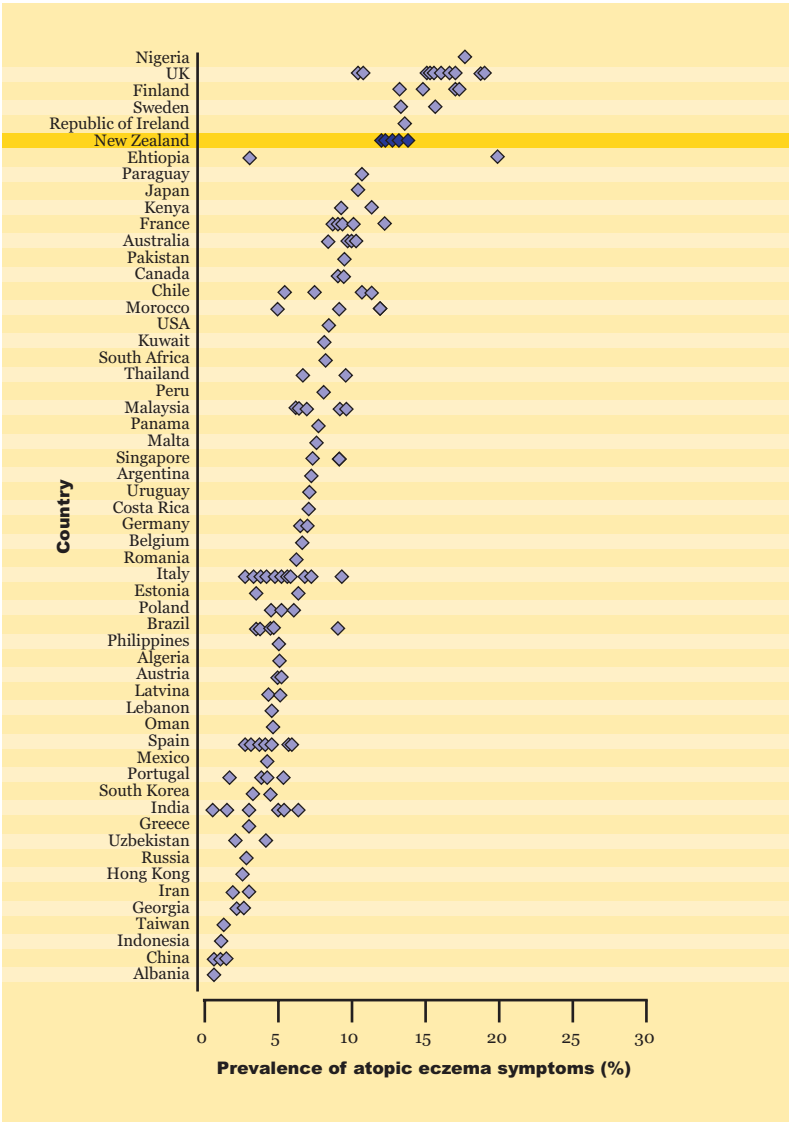

FIGURE 6: *12-month prevalence of atopic eczema symptoms in 13–14-year-old children in different countries. Reprinted with permission from Elsevier Science (The Lancet 1998; 351: 1229)*

The data in adults are derived from the ECHRS study in which "atopy" was assessed by measurement of total serum IgE level and specific IgE in 37 centres in 16 countries.[39] Centres from New Zealand had among the highest geometric mean total IgE. When the prevalence of atopy was defined as specific IgE to any of the five common inhalant allergens tested, New Zealand also had one of the highest rates measured, with over 40% of adults being "atopic" (Figure 7).

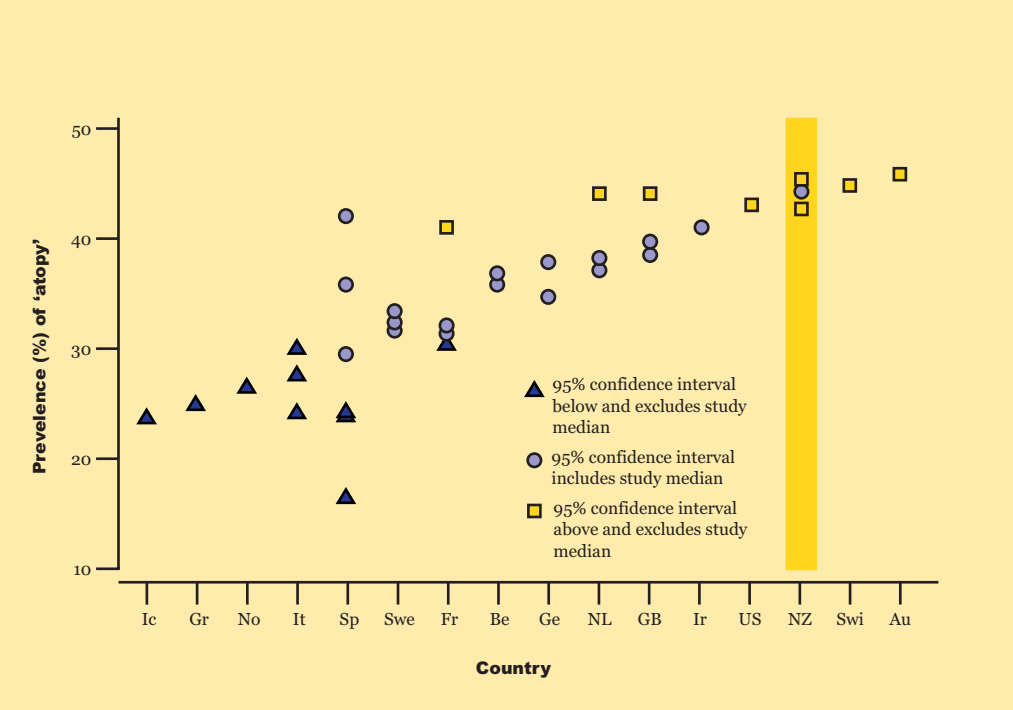

FIGURE 7: *Prevalence of atopy, defined as allergen specific IgE in adults, in centres from different countries (© 1997 Journal of Allergy and Clinical Immunology. Reproduced with permission)*

Each symbol represents the value for one centre; countries are ordered along the x-axis. Values significantly above or below the median for 35 centres are indicated. Au: Australia; Be: Belgium; Fr: France; GB: Great Britain; Ge: Germany; Gr: Greece; Ic: Iceland; Ir: Ireland; It: Italy; NL: Netherlands; No: Norway; NZ: New Zealand; Sp: Spain; Swe: Sweden; Swi: Switzerland; US: United States

2. < MORBIDITY

2.A < Prevalence of Severe Asthma Symptoms

One approach to determine the magnitude of asthma morbidity is to measure the prevalence of self-reported symptoms of severe asthma such as nocturnal awakening or severe attacks affecting speech. In children, these data are available from the ISAAC programme, in which the proportion of 13–14-year-old children from New Zealand reporting wheeze disturbing sleep or limiting speech was 3.2% and 8.0%, respectively (Table 16).[6] The corresponding figures for 6–7-year-old children were 3.5% and 5.1% (Table 17).[6]

Similar high rates of severe asthma symptoms have been observed in adults from the ECRHS programme. For example, 10.2% of New Zealand adults aged 20–44 years reported waking with breathlessness within the previous 12 months (Table 18).[12,13] The standardised international prevalence data from the ISAAC and ECRHS programmes indicate that the prevalence of severe asthma symptoms in New Zealand is among the highest recorded throughout the world (Figure 8).

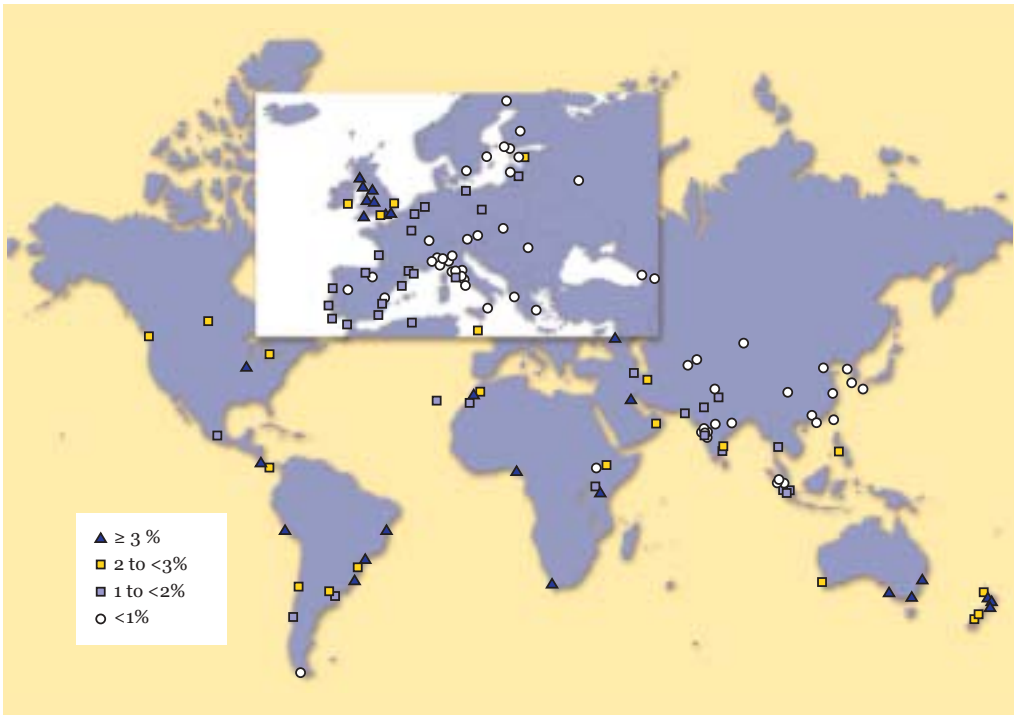

FIGURE 8: *World map of the 13–14-year age group showing the percentage of children with severe asthma symptoms*

TABLE 16: *Prevalence (%) of self-reported severe asthma symptoms in 13–14-year-old children*

	12-month prevalence		
Centre	**≥4 Attacks**	**Wheeze disturbs sleep**	**Severe wheeze limiting speech**
Auckland	8.0	2.7	8.1
Bay of Plenty	9.0	3.3	7.1
Christchurch	9.7	2.9	7.5
Hawke's Bay	11.0	4.6	8.6
Nelson	10.2	2.6	8.2
Wellington	11.1	3.0	8.3
Total	**9.9**	**3.2**	**8.0**

All data are presented as percentages of the children in the study.

TABLE 17: *Prevalence (%) of severe asthma symptoms in 6–7-year-old children*

	12-month prevalence		
Centre	**≥4 Attacks**	**Wheeze disturbs sleep**	**Severe wheeze limiting speech**
Auckland	7.9	3.7	5.3
Bay of Plenty	8.2	3.6	4.8
Christchurch	10.2	3.9	5.0
Hawke's Bay	9.9	3.7	5.6
Nelson	7.1	2.2	4.6
Wellington	9.8	3.3	4.7
Total	**9.0**	**3.5**	**5.1**

All data are presented as percentages of the children in the study.

TABLE 18: *Prevalence (%) of severe asthma symptoms in adults 20 to 44 years of age*

	Woken with chest tightness	Woken breathless at night	Asthma attack
Auckland	18.2	10.0	6.8
Christchurch	18.8	10.4	8.7
Hawke's Bay	19.5	10.7	7.2
Wellington	18.2	10.4	8.6
Total	**18.2**	**10.2**	**7.3**

All data are presented as percentages of the adults in the study.

2.B < Hospital Admission Rates

Asthma is the most common cause of child admissions to hospital.[40] Similar to the international trends, in New Zealand, hospital admissions for asthma in children exhibited a marked increase between the late 1960s and the late 1980s.[41-43] During this period, hospitalisation rates for asthma increased by about 10-fold in 0- to 14-year-old children (Figure 9) and 3- to 4-fold in the 5- to 34-year-old age group (Figure 11).[43] This increase in hospitalisation rates is considered to reflect both a real increase in the prevalence of severe disease, and a greater utilisation of hospital care due to financial barriers to primary care.[44,45] It has been proposed that fragmented and expensive care in the community led to a greater dependence on free hospital-based care, in which patients presented late in the course of their attack, and as a consequence required hospital admission.[44,45]

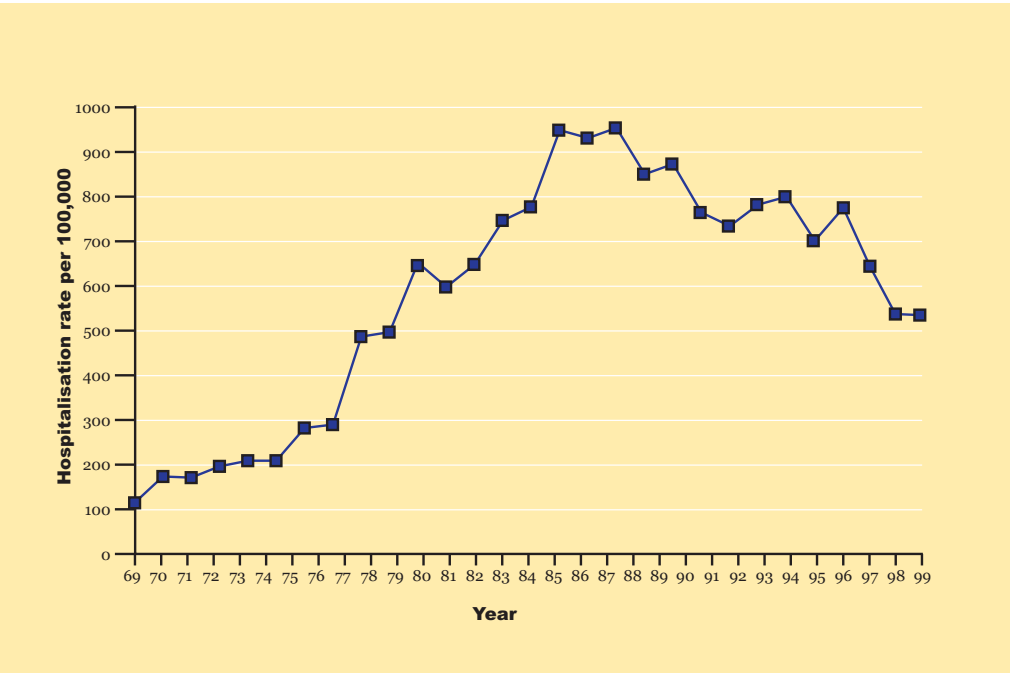

FIGURE 9: *Asthma hospitalisation rates per 100,000 in persons aged 0–14 years*

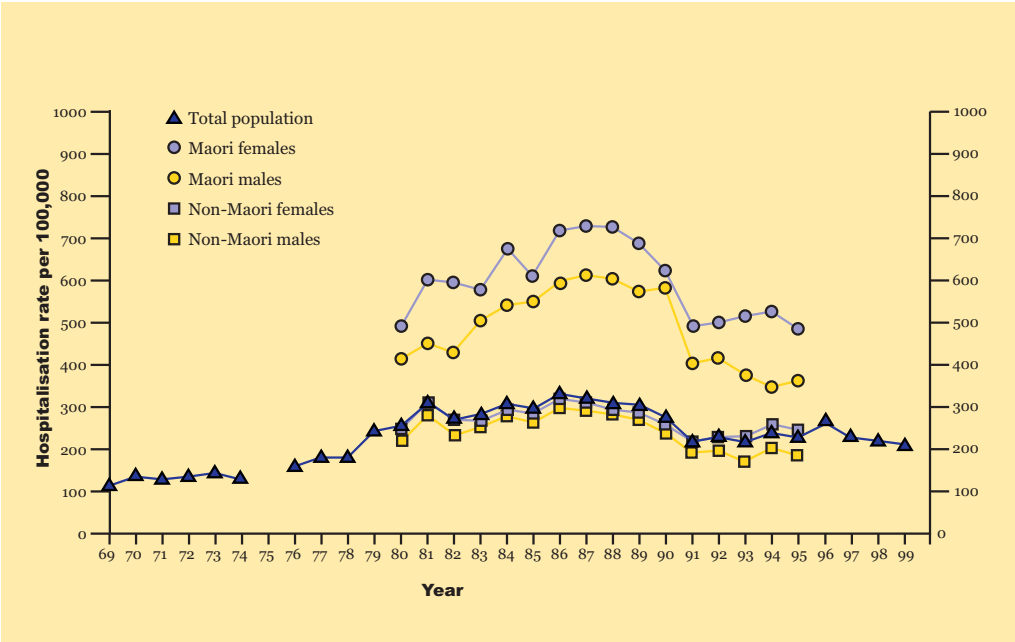

FIGURE 10: *Asthma hospitalisation rates per 100,000 for total population and by ethnicity and gender in persons aged 5–34 years**

* Ethnicity data prior to 1980, and from 1996 onwards, are not comparable with available data between these periods.

In both age groups there has been a significant reduction in asthma hospital admission rates throughout the 1990s.[43] However, in the late 1990s, there were still around 10,000 hospital admissions per year, representing about 40,000 days in hospital.

2.C < Ethnic Differences

During the last 20 years, hospital admission rates for asthma have been about 2-fold greater in Maori than in non-Maori, for both male and female (Figure 10).[18] However, the highest rates of hospital admission for asthma are found in Pacific Island children, who also have the highest admission rates for respiratory infections.[46] These findings have led to recommendations that Maori and Pacific Island children are a priority group for interventions, including improvements in socio-economic circumstances, access to early primary healthcare and ambulatory paediatric services.[46,47] Studies in Auckland have found that Maori and Pacific Islanders are less likely than non-Polynesians to have a regular general practitioner, to be on preventive medications, to have an asthma self-management plan or to use a peak flow meter.[48] Barriers to accessing care that have been identified include cost, appropriateness of care, health being a low priority, lack of information or understanding, language, geographical barriers and lack of transport.[25,37,49]

2.D < Socio-Economic Factors

The contribution of socio-economic disadvantage to the requirement for hospital admission was evident in a study of adults admitted to hospitals in Auckland.[50] About half of the subjects admitted had experienced recent financial difficulties and for one in three households the only income was their social security benefit. The impact of these circumstances was evident, with 39% having delayed

or put off a general practitioner visit because of cost, with management of the index attack compromised by concern about medical costs (10%) or time off work (20%). This study illustrates that patients admitted to hospital may be severely disadvantaged socio-economically in a way that could adversely affect their management.

In the 1996/1997 National Health Survey, nearly half (45%) of people surveyed who said they had unmet health needs relating to their general practitioners identified cost as the reason.[51] If issues such as financial barriers to healthcare are not acknowledged and addressed, the healthcare services for asthmatics will not be effectively utilised.[52]

Asthma may also have a negative impact on employment and on socio-economic standing. McClellan and Garrett [53] found that repeated hospital admissions and asthma-related sick leave from work were identified as contributing factors to employment discrimination, job dismissal and lack of career advancement. In their study, about three-quarters of their patient population attending a hospital-based outpatient clinic had not informed their employers of their asthma and about one-third of those who were employed stated that there was a problem getting time off work to attend the outpatient clinic.

2.E < Age-Specific Hospital Admission Rates

The rate of hospital admissions due to asthma are highest in children, with about one-third of all asthma admissions occurring in children aged under 5 years, and one-quarter in the 5- to 14-year age group.[54] Over the age of 14, the average monthly hospitalisation rate was about 1.8 per 1000, compared with 4 per 1000 in the 5- to 14-year age group (Table 19).

It is worthy of note that the opposite trend occurs in terms of age-specific death rates, in which the rates progressively increase with age, such that the death rate in 5- to 14-year-old children is 10 times less than in those over the age of 45 years. As a result, the ratio of hospitalisations per death in different age groups is markedly different, with a 30-fold greater rate in 5- to 14-year-old children than in those over 45 years (Table 19). While recognising the inaccuracy of death certification for asthma in those over the age of 45 years, this suggests that the threshold for admission to hospital with asthma increases markedly with age. These data also indicate that this higher threshold for admission most likely contributes to the increased risk of death from asthma in the elderly. These data underlie the requirement for a greater emphasis on the management of asthma in older New Zealanders.

TABLE 19: *Monthly rates of hospitalisations and deaths due to asthma in New Zealand (1976–1995) [Kimbell-Dunn M, Pearce N, Beasley R. Seasonal variation in asthma hospitalisations and death rates in New Zealand. Respirology (2000) Vol. 5: 241-246, modified and reproduced with permission]*

Age group (years)	Total no. of hospitalisations	Total no. of deaths	Average monthly hospitalisation rate per 1000	Average monthly death rate per 100,000	No. of hospitalisations per death
5 to 14	39,592	117	4.01	1.05	338.0
15 to 44	49,873	866	1.81	2.87	57.6
45+	31,059	2,788	1.80	14.70	11.1

2.F < Tolerance to Symptoms

One of the reasons for the high morbidity of asthma in New Zealand is the tolerance to symptoms of poor control.[55] In a telephone survey of 400 random subjects with asthma conducted in January and February 2000, 61% reported symptoms consistent with poor asthma control as defined by the World Health Organization Asthma Guidelines.[56] This proportion was even greater in Maori and Pacific Islanders, in whom 81% had poor control. Also of concern was the finding that amongst those who reported symptoms consistent with poor control, almost all (86%) were satisfied with their degree of control, indicating an inappropriate acceptance of their symptoms, and/or unrealistic criteria for control.

2.G < Comparison with Other Disorders

Comparison of the morbidity due to asthma with that due to other disorders can be made by determining the relative years lost to disability for each disorder, as a measure of the burden of non-fatal disease. This requires that non-fatal health states be assigned values (disability weights) based on social preferences for these states of being. Years lost to (severity-adjusted) disability (YLD) are determined by calculating a weighted average across all stages, sequelae or complications of the condition, for both duration and disability severity.[57] Both duration and disability distribution are adjusted for the effectiveness and coverage of currently available interventions. Incidence, average duration and disability weight are indexed by age, gender and ethnicity; these are then summed across population strata and across conditions to obtain the respective YLD totals.

Using this approach, it has been calculated that in New Zealand asthma is the highest ranking specific disease in terms of YLD in males.[57] It is the third highest ranking specific disease in females after depression and anxiety disorders. The very high ranking of asthma reflects a combination of high prevalence with prolonged and severe disability. Overall, asthma is responsible for about 7% of the total number of YLD in the whole population (Table 20).

TABLE 20: *Top ten causes of years lost to disability (YLD) by gender, 1996*

Rank	Male Cause	Female Cause	Total Cause	YLD
1	Asthma	Depression	Depression	20,497
2	COPD	Anxiety disorders	Anxiety disorders	17,930
3	Diabetes	Asthma	Asthma	17,059
4	Anxiety disorders	Diabetes	Diabetes	14,684
5	Depression	Dementia	COPD	12,418
6	Hearing disorders	Osteoarthritis	Osteoarthritis	11,126
7	IHD	COPD	Dementia	11,070
8	Osteoarthritis	IHD	IHD	9,708
9	Dementia	Stroke	Hearing disorders	9,427
10	Stroke	Breast cancer	Stroke	7,775
Top 10				**131,694**
Total				**246,509**
Top 10 as % of total				**53.4**

Source of base data: compiled from multiple sources
COPD: chronic obstructive pulmonary disease
IHD: ischaemic heart disease

3. < MORTALITY

3.A < Epidemic in the 1960s

Following the relatively stable asthma death rates during the first half of the 20th century (Figure 11),[58] asthma mortality increased dramatically in New Zealand and in at least six other Western countries in the 1960s, with mortality rates increasing 2- to 10-fold within a 2- to 5-year period (Figure 12).[59,60] The most likely explanation was that the epidemics were related to the use of the high-dose beta-agonist aerosol isoprenaline forte.[61,62] Epidemics occurred only in countries where the high-dose preparation of isoprenaline was available and there was a close association between the sales of isoprenaline forte and asthma mortality; patients who died from asthma had used excessive amounts of this drug in the situation of severe asthma. The mortality rate in New Zealand and other countries experiencing epidemics declined following warnings from regulatory bodies, a marked reduction in sales of isoprenaline forte and other changes in medical practice such as increases in hospital admissions.[59,60]

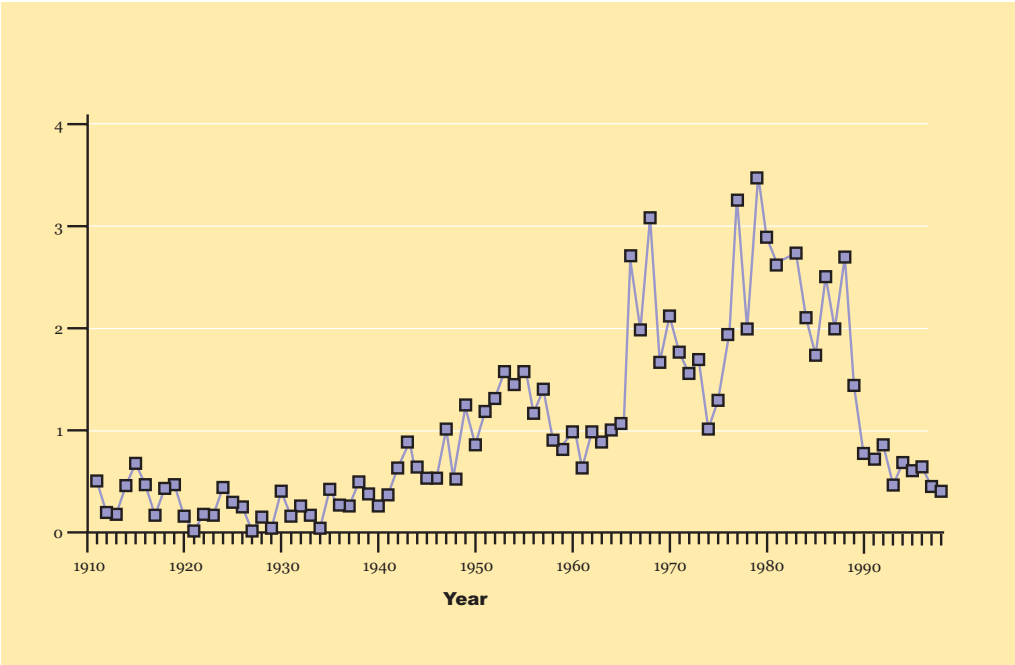

FIGURE 11: *Asthma mortality rates per 100,000 New Zealand persons aged 5–34 years*

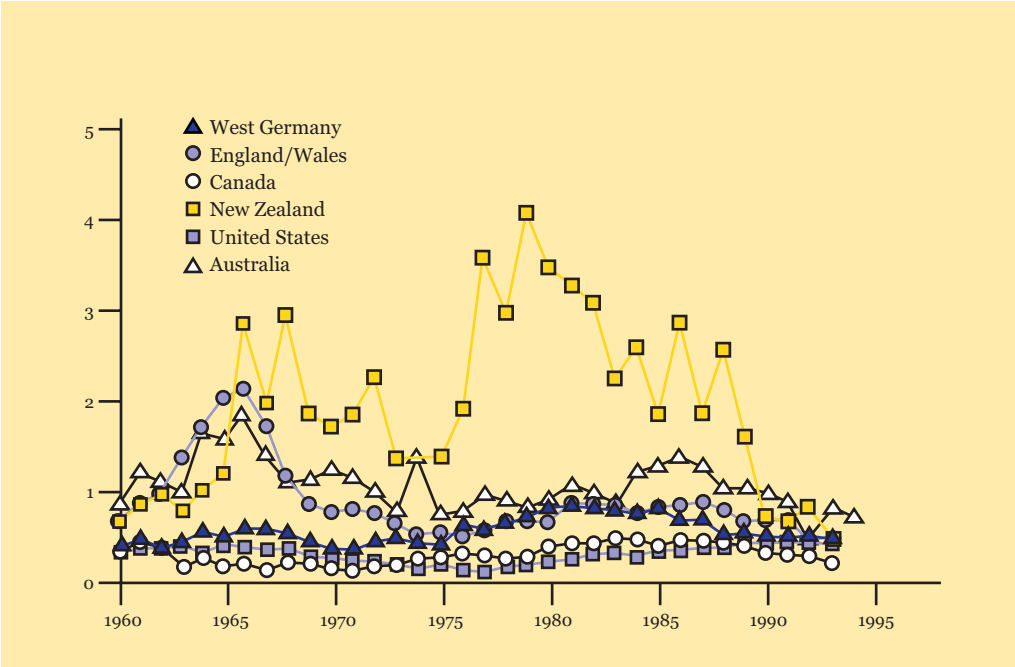

FIGURE 12: *International patterns of asthma mortality (deaths per 100,000 persons aged 5–34 years) 1960–1994, showing the different trends (Reprinted from Scheffer AL (Ed.). Fatal asthma. 1998, page 15 by courtesy of Marcel Dekker Inc.)*

3.B < The Second Epidemic

In the mid 1970s a second asthma mortality epidemic began in New Zealand but not in other countries (Figure 11).[63] Initial interest focused on the role of the beta-agonist fenoterol, which, like isoprenaline forte, was marketed in a high-dose preparation and which had similar adverse effects to those of isoprenaline, which are greater than those of salbutamol.[59,60] In addition, New Zealand had the highest per capita use of fenoterol and there was a close relationship between its introduction and increasing sales of fenoterol and the increasing mortality rates.

These observations led to the formal examination of prescribed drug therapy and asthma mortality in New Zealand. In a series of three case control studies, which employed different methods and incorporated different data sources, at different time periods throughout the epidemic, an increased risk of asthma death was consistently found in patients prescribed fenoterol but not other asthma medications.[64-66] The association between fenoterol and asthma deaths was particularly strong in sub-groups with more severe asthma, a pattern which essentially ruled out the possibility that the findings were due to confounding by asthma severity. Subsequently, a case control study from Saskatchewan, Canada confirmed that the prescription of the high-dose preparation of fenoterol was associated with an increased risk of death when compared with the more commonly prescribed beta-agonist salbutamol.[67]

Following recognition of the primary role of fenoterol in the second asthma mortality epidemic in New Zealand, the Department of Health issued warnings in 1989 about the safety of fenoterol, and in 1990 fenoterol was withdrawn from the drug tariff, which effectively removed it from the market. This regulatory restriction, together with the increasing use of inhaled corticosteroid therapy, was associated with a decrease in the asthma death rate in the 5- to 34-year age group, from an average of 2.3 per 100,000 per year during the previous 5 years to a level of 0.8 in 1990.[68] Since then, the mortality has remained low with rates around 0.5 per 100,000 representing the lowest death rates from asthma in New Zealand for 50 years.

The time trends for ICU admissions for asthma were similar to those for asthma mortality, with a steady increase during the mortality epidemic and a marked and sustained fall in 1990 with the withdrawal of fenoterol.[69]

3.C < Comparative International Rates

Currently, absolute asthma mortality rates in New Zealand are broadly within the range of those in similar Western countries. However, to enable meaningful comparisons of international asthma mortality rates it is necessary to consider the prevalence of severe asthma in the countries being compared. Utilising such prevalence data from the ISAAC study, it is possible to devise crude national case fatality rates, defined by the ratio of the asthma mortality rates to prevalence rates of severe asthma for each country. In this way an indication of national case fatality rates can be achieved, providing a different perspective on the international differences in asthma mortality from that obtained from the absolute mortality rates (Table 21). With respect to New Zealand, these data show that we have a relatively low case fatality rate.[60]

With respect to the actual number of deaths, in 1998 there was a total of 197 deaths attributed to asthma, of which 7 were in the group aged 5–34 years.[70]

TABLE 21: *Comparison of asthma mortality rates with prevalence rates of severe asthma in 12 countries*

	Asthma mortality rate[a]	Prevalence of severe asthma[b]	Ratio
Canada	0.25	8.1	0.03
USA	0.47	10.0	0.05
England	0.52	8.5	0.06
New Zealand	0.50	8.0	0.06
Sweden	0.12	2.0	0.06
Wales	0.52	9.0	0.06
Finland	0.21	3.1	0.07
West Germany	0.44	5.7	0.08
Australia	0.86	8.3	0.10
Italy	0.23	2.0	0.12
France	0.40	2.8	0.14
Japan	0.73	2.1	0.35

[a] Asthma mortality rate (per 100,000) in persons aged 5–34 years in 1993

[b] Asthma prevalence rates defined as self-reported episodes of wheezing sufficient to limit speech in previous 12 months, in 13–14-year-old children, 1993–1995

Note: Mortality and prevalence data are not available in the same age group

3.D < Socio-Economic Factors

The effect of socio-economic status on the risk of asthma mortality was assessed during the second asthma mortality epidemic in New Zealand, using a validated socio-economic classification of neighbourhoods.[71] There was a marked difference in mortality between the highest and lowest areas, with people in low socio-economic areas having a 2- to 3-fold higher death rate than those from high socio-economic areas. The study also identified that the increase in asthma deaths in New Zealand appeared to have occurred only in the middle and low socio-economic groups.

3.E < Seasonal Trends

Seasonal trends in asthma mortality have also been observed in New Zealand,[54] with patterns similar to those in other countries.[72] Asthma mortality in the 5- to 44-year age group is highest during the summer months, whereas the peak occurs during winter in the older (45+) age group. The pattern in the younger age group may be related to reduced access to or availability of medical care during the summer holidays, which is consistent with the associated reduction in hospital admissions during this period (Figures 13 and 14). In contrast, in the older age group hospital admission rates peaked during the winter months, probably reflecting the increased occurrence of respiratory tract infections causing severe exacerbations during this season (Figure 15).

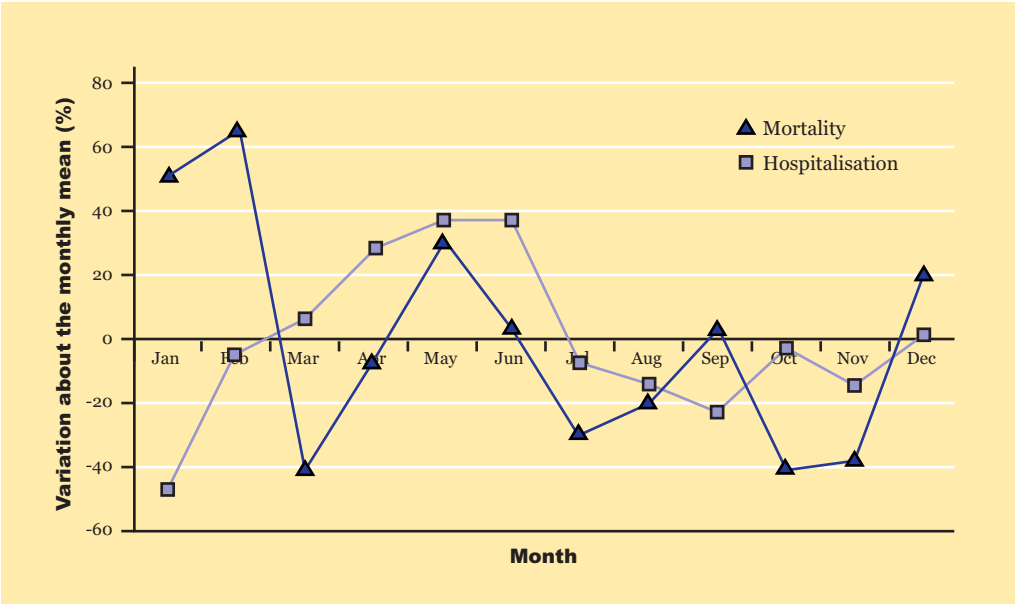

FIGURE 13: *Monthly variation (%) in hospitalisation and mortality rates for 5–14-year-olds in New Zealand (Kimbell-Dunn M, Pearce N, Beasley R. Seasonal variation in asthma hospitalisations and death rates in New Zealand. Respirology (2000) Vol. 5: 241-246, modified and reproduced with permission)*

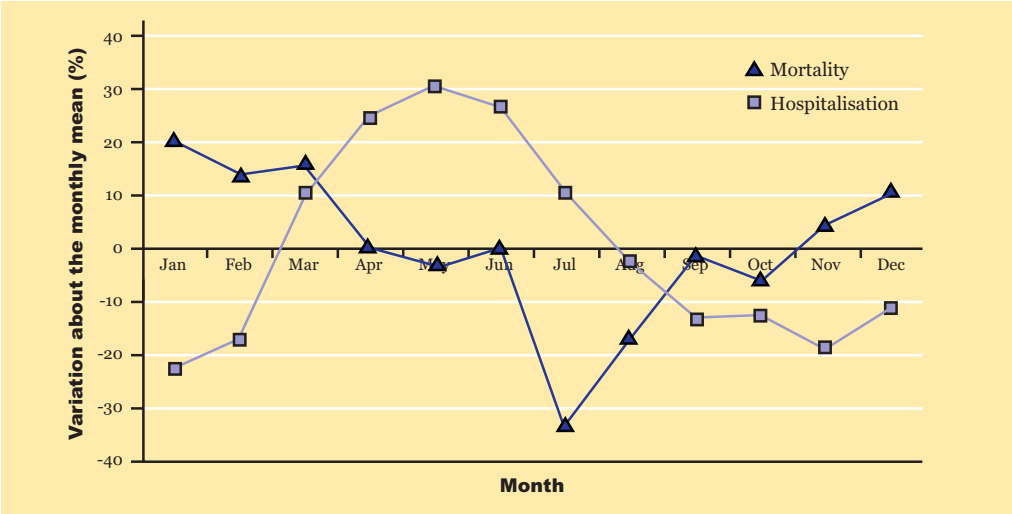

FIGURE 14: *Monthly variation (%) in hospitalisation and mortality rates for 15–44-year-olds in New Zealand (Kimbell-Dunn M, Pearce N, Beasley R. Seasonal variation in asthma hospitalisations and death rates in New Zealand. Respirology (2000) Vol. 5: 241-246, modified and reproduced with permission)*

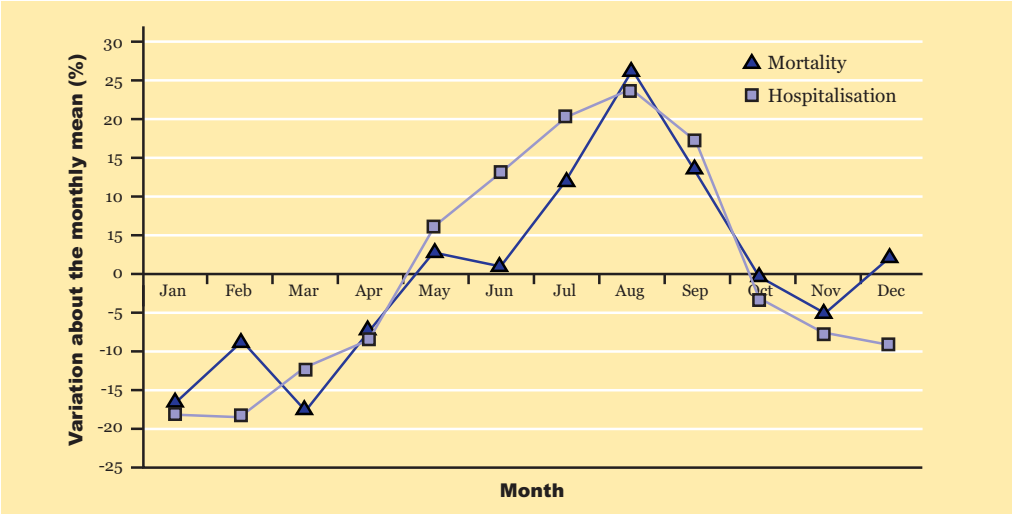

FIGURE 15: *Monthly variation (%) in hospitalisation and mortality rates for those aged 45 years and older in New Zealand (Kimbell-Dunn M, Pearce N, Beasley R. Seasonal variation in asthma hospitalisations and death rates in New Zealand. Respirology (2000) Vol. 5: 241-246, modified and reproduced with permission)*

3.F < Ethnic Differences

Prior to and throughout the second asthma mortality epidemic in New Zealand, mortality from asthma was higher in Maori than non-Maori (Table 22).[73] When expressed as age-standardised mortality rates, the rate for Maori was five times higher, and for Pacific Islanders almost three times higher than for Caucasians. While there may be many different factors contributing to these differential ethnic rates, barriers resulting in differing access to or use of medical care are likely to play a significant role. It is reassuring that since the epidemic ended, the mortality rates for Maori have been similar to those in non-Maori (Figure 16).

TABLE 22: *Age-specific and age-standardised average annual mortality rates (deaths per 100,000 per year) for asthma in New Zealand Maori, Pacific Islanders and Caucasians, 1981–1983 (©1985 New Zealand Medical Journal. Modified and reproduced with permission)*

Age (years)	Maori	Pacific Islanders	Caucasians
0–4	2.8	0.0	0.0
5–9	2.7	0.0	0.0
10–14	3.8	4.6	1.8
15–19	12.4	16.8	1.7
20–24	12.1	12.0	3.0
25–29	13.9	5.6	1.4
30–34	14.2	12.9	1.6
35–39	29.0	18.5	2.6
40–44	7.7	11.7	3.6
45–49	47.0	17.7	5.6
50–54	47.2	0.0	7.7
55–59	41.3	36.6	9.0
60–64	23.4	0.0	12.7
65–69	81.6	0.0	11.5
Age standardised	**18.9**	**9.4**	**3.4**

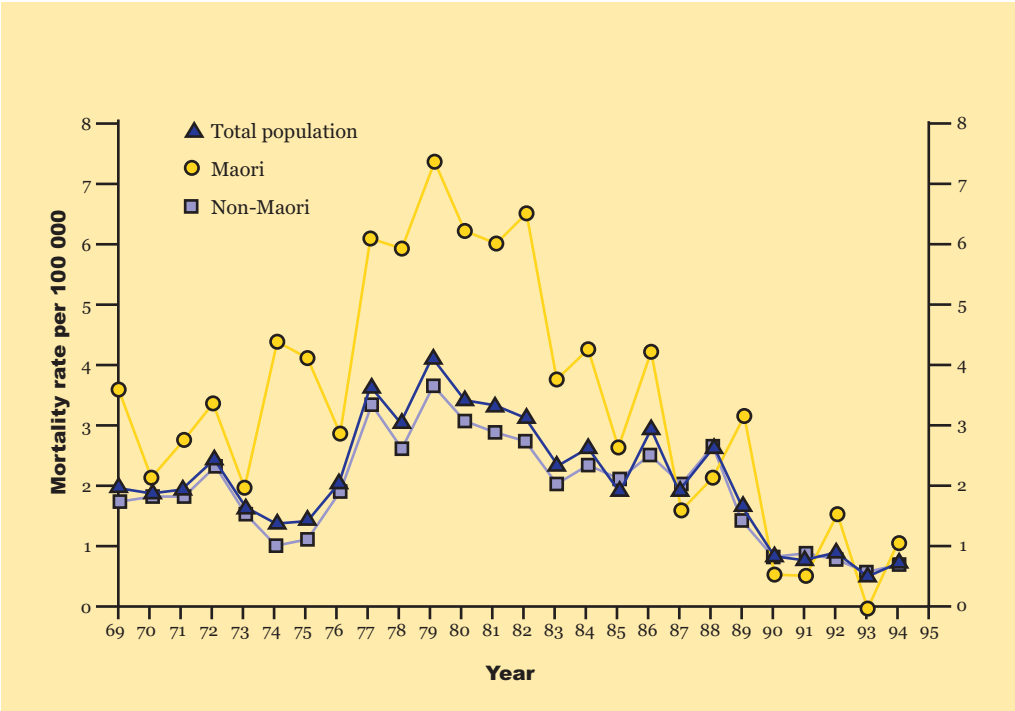

FIGURE 16: *Asthma mortality rates per 100,000 for total population, Maori and non-Maori, aged 5–34 years. Ethnicity data from 1996 onwards are not comparable with earlier data.*

3.G < Age-Specific Rates

Death from asthma seldom occurs in children under the age of 10 years. In contrast, hospital admission rates are highest in this age group (Table 19).[54] Age-specific asthma death rates are fairly constant between the ages of 10 and 45 years, increasing markedly with older age, such that the rate in adults over 60 years old is over five times greater than in 10–20-year-olds (Table 19). Even when consideration is given to the reduced accuracy of certification of asthma as the cause of death in the elderly, because of difficulty in differentiating from death due to chronic obstructive pulmonary disease, it is evident that asthma mortality in older adults is markedly higher than in younger adults or adolescent children. This trend illustrates the importance of recognising the major morbidity and mortality from asthma experienced by older New Zealanders.

3.H < Risk Factors

Recognition of the risk factors associated with death from asthma is necessary if initiatives to reduce the burden of mortality are to be developed. The New Zealand Asthma Mortality Survey identified that problems associated with long-term management were a lack of appreciation by both the patient and their doctor of the patient's chronic asthma severity, poor compliance with management, inadequate long-term use of inhaled corticosteroids and discontinuity of primary medical care with failure to attend a general practitioner between attacks.[74,75] Similar problems were identified with the treatment of severe asthma attacks, in particular the inability of the patient, family or doctor to recognise the severity of the attack, delay in seeking medical help, insufficient use of systemic steroids, a lack of written guidelines for management and over-reliance on inhaled bronchodilator treatment without additional therapy. These factors have been considered to be of particular importance in leading to a delay in seeking medical help despite the development of a life-threatening asthma attack.

Identification of these problems of assessment and management were crucial to the development in New Zealand of strategies to reduce the risk of serious morbidity and mortality. The major initiative, supported by the Ministry of Health and the Asthma and Respiratory Foundation of New Zealand, has been the development and promotion of the self-management plan system of care. This system enables patients to recognise the severity of their asthma through the identification of key symptoms and peak flow rates, to be maintained primarily on regular inhaled corticosteroids and as-required beta-agonist use, and to have a system for treating severe attacks of asthma in accordance with the plan.[76] Additional strategies which have not yet been implemented in New Zealand include the widespread availability of inhaled long-acting beta-agonist drugs and the combined inhaled corticosteroid and long-acting beta-agonist products, both of which have been shown to improve asthma control and reduce the frequency of severe attacks of asthma.[77,78]

3.I < Identification of "At Risk" Patients

A related priority is to develop a clinical profile of the severe asthmatic patient who has an increased risk of morbidity or a fatal outcome, and as a result requires more intensive medical management and supervision (Table 23). A number of clinical characteristics associated with such an increased risk have been identified, relating to the presence of severe disease, characteristics of the patient, or problems associated with the utilisation of medical care.[79,80]

TABLE 23: *Identification of the high-risk asthmatic*

1.	Adolescents
2.	Disadvantaged racial groups
3.	Psychological or psychosocial problems
4.	Three or more asthma medications prescribed
5.	Requirement for ≥ 2 beta-agonist inhalers per month
6.	Frequent visits to general practitioner with unstable asthma
7.	One or more hospital emergency department visits
8.	Recent hospital admission
9.	Previous life-threatening attack[a]

[a] Patients with a previous life-threatening attack represent those at greatest risk

The most practical and useful ways in which a clinician can recognise high-risk asthmatic patients is to identify those requesting repeat prescriptions of two or more beta-agonist inhalers per month, those who frequently visit their general practitioner or emergency department with severe asthma, or patients who have had a recent hospital admission. Among such patients the marker that is associated with the highest risk of death is a previous ICU admission for asthma, and particularly a requirement for mechanical ventilation, which has a 5-year mortality rate of up to 20%.[79,81]

A complementary approach is to identify those characteristics of individuals that put them at risk in terms of the way in which they manage their asthma or utilise medical care. These features include being a teenager, being in a disadvantaged socio-economic group and having psychosocial problems or psychiatric disorders. The range of psychosocial factors which adversely affect asthma management and which have been identified as being associated with near fatal or fatal asthma is extensive.[82] It is evident that to further reduce the burden of asthma in these high-risk individuals, a comprehensive approach is required, including consideration of socio-economic and psychiatric factors.

3.J < Years of Healthy Life Lost

In considering the impact of a disease in terms of mortality, it is informative to extend the concept of life expectancy to that of health expectancy. In this way an attempt is made to generalise the concept of years of life lost (YLL) to years of healthy life lost, representing a health gap measure which incorporates both loss of life and the loss of quality of life. This allows a composite measure of the burden of both fatal and non-fatal disease. As a result, the years lost to disability (YLD) is added to the years of life lost to premature mortality (YLL) to yield an integrated unit of health — the "disability-adjusted life-year" (DALY), with one DALY representing the loss of one year of healthy life.

Using this approach, asthma ranks as the sixth most common cause of DALY lost.[57] Overall, it accounts for over 18,000 DALY lost, representing a major burden of disease (Table 24).

TABLE 24: *Disability-adjusted life-years (DALY) lost by top 20 specific causes and gender, 1996*

Rank	Male Cause	Female Cause	Total Cause	YLD
1	IHD	IHD	IHD	73,804
2	COPD	Stroke	Stroke	30,115
3	Road traffic injury	Depression	COPD	27,848
4	Stroke	Breast cancer	Diabetes	21,263
5	Lung cancer	COPD	Depression	20,497
6	Diabetes	Anxiety disorders	Asthma	18,800
7	Suicide/self-harm	Diabetes	Anxiety disorders	17,930
8	Asthma	Asthma	Lung cancer	17,919
9	Colorectal cancer	Dementia	Road traffic injury	17,634
10	Prostate cancer	Colorectal cancer	Colorectal cancer	16,262
11	Anxiety disorders	LRTI	Dementia	14,710
12	Depression	Lung cancer	Breast cancer	13,522
13	Hearing disorders	Osteoarthritis	Suicide/self-harm	12,940
14	Dementia	Road traffic injury	LRTI	11,621
15	Osteoarthritis	Hearing disorders	Osteoarthritis	11,260
16	LRTI	Suicide/self-harm	Hearing disorders	9,428
17	Substance use	Lymphoma/myeloma	Prostate cancer	7,362
18	Peripheral arterial disease	Ovary cancer	Substance use	6,082
19	Childhood conduct disorders	Falls	Peripheral arterial disease	6,021
20	Falls	Substance use	Lymphoma/myeloma	5,460
Top 20				**360,478**
Total				**563,184**

COPD: chronic obstructive pulmonary disease
IHD: ischaemic heart disease
LRTI: lower respiratory tract infection
YLD: years lost to disability

4. < ECONOMIC BURDEN OF ASTHMA

4.A < General Observations

Another way of characterising the burden of asthma in a community is to calculate the economic costs of the illness. This is normally undertaken by calculating the direct costs, (those associated with the medical treatment of the illness) together with the indirect costs (those associated with the non-medical output losses resulting from the consequences of the illness).[83,84]

In general, indirect costs tend to be of a greater magnitude than direct medical costs, and the major components of the direct medical costs are pharmacological expenditure and hospital admissions. Another feature is that an increase in direct medical costs can potentially lead to a reduced total cost of care if it results in a disproportionately greater reduction in indirect costs due to improved clinical outcomes. Management regimes that have been shown to reduce hospital admissions and time lost from work or school, particularly in those patients with the most severe disease, would thereby have the greatest potential for reducing the economic burden of asthma.

4.B < Disproportionate Cost of Severe Asthma

The economic burden of asthma disproportionately affects those with the most severe disease. In both Western and developing countries, patients with severe asthma account for the majority of both direct and indirect costs. Estimates have shown that severe asthmatics are responsible for approximately 50% of all direct medical costs and a similar proportion of the total asthma-related costs even though they represent only up to 10% of the asthmatic population (depending on the criteria used to define severe asthma).[85-87] In contrast, the 70% of asthmatics who can be classified as mild are responsible for only approximately 20% of the total asthma costs. When based on the use of emergency hospital facilities, the cost for patients with severe asthma has been estimated to be about five times greater than that for patients with mild asthma.[88]

The disproportionate cost of severe asthma has also been assessed by estimating the additional costs of treating a patient with uncontrolled asthma as opposed to a patient with controlled asthma.[89] This analysis identified that the cost of asthma care for patients with controlled symptoms was more than 100 times less than that for patients with uncontrolled symptoms. These differences clearly demonstrate that resources spent achieving control can potentially lead to major savings in the long term and serve to illustrate the importance of management approaches which have been shown to be cost-effective in the treatment of severe asthma.

4.C < Economic Burden in New Zealand

4.C1.1 < Cost of pharmaceuticals

PHARMAC data for the 1999/2000 financial year indicated that it spent $40.3 M on asthma prophylaxis, including corticosteroids, and $23.4 M on bronchodilators. Using data that indicate that about 60% of these prescriptions are for asthma, the drug expenditure on asthma can be estimated to be at least $38 M per annum. If the additional costs of oral and intravenous steroids, antibiotics and other related medication are included, this figure increases to around $50 M.[90]

In terms of trends in pharmaceutical costs, data from PHARMAC show that spending on anti-asthma medication has decreased progressively over recent years. In terms of prophylaxis medications and bronchodilators, spending has decreased from $102 M in 1995/1996 to $64 M in 1999/2000. Recent, more detailed data from PHARMAC show the latest trends for the different categories of asthma drugs (Table 25). These savings have not been reinvested in the funding of novel asthma medications, recommended in consensus guidelines, and available in other Western and in developing countries.

Table 25: *PHARMAC expenditure on anti-asthma and related medications*

	Ministry of Health cost ($ M)		Growth rate (%)
	1998/99	1999/00	
Allergic disorders	3.1	3.2	3.2
Prophylaxis (including inhaled corticosteroids)	47.6	40.3	-15.3
Bronchodilators	25.6	23.4	-8.6
Drugs acting on the nose	5.1	4.3	-15.7
Other	3.3	4.2	27.3
Total of above groups	84.7	75.4	-10.9

4.C1.2 < Cost of primary care

Asthma accounts for between 2.4% and 4.5% of general practice encounters.[91-93] Based on International Medical Statistics (IMS) data, it has been estimated that there are around 800,000 general practitioner consultations for asthma in New Zealand per year.[93] From this figure, the cost of general medical services (GMS) claims associated with asthma is estimated to be about $14.8 M. This is equivalent to 8.5% of the total GMS expenditure in primary care in 1998/1999 ($172.9 M).[94] If this proportion is also assumed to be valid for other areas of primary care expenditure for which a proportion would be asthma-related (i.e. benefits for practice nurses, the rural practice bonus, and capitation payments), the additional cost is $4.5 M.

4.C1.3 < Cost of specialist services

The cost of specialist services for asthma can be assessed from data stating that 2.6% of asthma consultations involve a referral to specialists in public or private employment.[92] From these figures a conservative estimate is that specialist costs due to asthma are about $0.77 M, out of a total Ministry of Health expenditure on specialists of $17.3 M, which excludes ACC.[94]

4.C1.4 < Cost of emergency department services

Based on a number of studies which found that between 27% and 39% of people with asthma attending the emergency department were admitted to hospital,[95,96] the total number of emergency department attendances for asthma is estimated to be around 35,000 per year. Based on the cost of emergency department attendances for asthma in New Zealand of around $190 per attendance,[97] this gives a national cost of $6.7 M per year associated with emergency department attendances for asthma.

4.C1.5 < Cost of inpatient hospital care

The total cost of hospital admissions for asthma in the late 1990s has been calculated to be $11.9 M (Table 26).[98] This figure is based on the over 10,000 hospital admissions per year, representing about 38,000 days in hospital. In addition, outpatient visits are estimated to cost around $2.1 M.

TABLE 26: *Cost for day patients and inpatients for asthma admissions to New Zealand public hospitals (1996/1997 year)*

Age group (years)	Total day & inpatients	Cost per inpatient (national average) ($)	Total cost of inpatients ($)	Total cost of day patients ($)	Total ($)
0-19	6,194	1,086	5,948,358	129,721	6,078,079
20-69	3,726	1,345	4,431,607	96,644	4,528,251
70+	572	2,449	1,238,742	27,014	1,265,756
	10,492		**$11,618,707**	**$253,379**	**$11,872,086**

4.C1.6 < Direct healthcare costs paid by consumers

If the cost of asthma to the consumer is proportionately similar to that of other health conditions, this would suggest a cost to the consumer of about $25.6 M.[90] The out-of-pocket component of this cost is based on the regular Household Economic Survey and includes expenditure by consumers on co-payments for general practitioner visits and medications.

The impact of such costs on asthmatic patients and their families is evident from the effect of the introduction of prescription charges. It has been reported that the cost of these charges may lead to a failure to fill a prescription in 1 in 3 patients and that this results in significant morbidity.[99] In contrast, patients are less likely to be concerned about the cost of medical consultations. It has been proposed that this may relate to the current health system in which medication must be paid for at the time of collection, whereas the doctor has greater discretion and may decide to limit reimbursement to the government subsidy for a patient who is economically disadvantaged.

4.C1.7 < Other costs

There are other costs for the Ministry of Health for which estimates have been made, as no firm data are available. These include direct medical costs where asthma complicates the management of other conditions (but is not the primary diagnosis for a general practitioner consultation or a hospital admission), costs associated with devices such as peak-flow meters, spacers and nebulisers, the cost of influenza immunisation (for which people with asthma on regular inhaled steroids are eligible), diagnostic and referral services other than specialist referral services and ambulance services. A conservative estimate of these costs is $8.8 M.

4.C1.8 < Total medical costs of asthma

This analysis estimates the total medical costs of asthma to be around $125 M per year in the late 1990s (Table 27). Given the various assumptions made, this is likely to be an underestimate of the true cost.

TABLE 27: *Summary of estimated annual direct medical costs of asthma in the late 1990s*

Area of expenditure	Estimated cost ($ M)
Pharmaceuticals	50.0
Hospital inpatient	14.0
Emergency department services	6.7
Primary care services	19.3
Specialist services	0.8
Patient costs	25.6
Others	8.8
Total direct costs	**$125.2**

4.D < Indirect Costs

Indirect costs arise from reduced productivity due to asthma and include the cost to employers of working days lost, reduced effectiveness at work, the consequences of days off school, loss of healthy life due to disability and premature death from asthma. These indirect costs are difficult to quantify in monetary terms, particularly measures based on quality of life. It is with these considerations in mind that the indirect costs of asthma are detailed.

4.D.2.1 < Days off school

The New Zealand Health Survey[100] found that 1 in 3 students with asthma had a day off school in the previous 4 weeks compared with 1 in 5 of those without asthma. Assuming that this difference is entirely due to asthma, it would suggest that 11% of students with asthma had a day off school in the last 4 weeks, and an average loss of 12 days per year of schooling among this group. It is difficult to put an economic value on this "lost educational experience"; however, it is likely to be significant.

4.D.2.2 < Work loss

Indirect costs attributable to lost productivity of those in the paid workforce have been estimated to be $95.2 M in 1996.[93] The assumptions on which this figure is based are that each asthmatic in the workforce loses 5 days of work through asthma per year,[101] the total employed workforce is around 1.7 million and the average weekly wage was $630. If productivity loss was evaluated on the basis of the total labour force and more recent data, the cost is likely to be at least 10% higher than these estimates. As a result, the total economic impact of work loss is probably around $105 M.

4.D.2.3 < Premature death from asthma

The only New Zealand study to date on the absolute value of statistical life in this country has been undertaken in the road safety area.[102] Using a "willingness-to-pay" approach, a life has been valued at $2 M in 1990 prices. This willingness-to-pay approach probably reflects a broader and more meaningful way to value life in considering the value of life only in terms of productivity in the formal economy.

Applying this $2 M figure to the average number of asthma deaths in the late 1990s (i.e. 127 deaths per annum) suggests a cost of around $254 M per year associated with premature death from asthma. This estimate is conservative in the respect that no account is made of the loss from premature deaths from asthma in preceding years.

4.D.2.4 < Disability-adjusted life years

The years lost to disability (YLD) adjusted for severity represent an integrated measure of the non-fatal burden of disease within a population. This measure can be used to evaluate the indirect costs of asthma, separate from premature mortality. Overall, asthma is the third ranked cause of YLD in New Zealand, responsible for about 17,000 years lost per year.[57]

Applying the willingness-to-pay approach to these YLD figures, it is possible to evaluate the economic costs of the non-fatal burden of asthma. Since the average number of years of life lost in a road traffic cost is around 30 years, this suggests a statistical value for a year of life in New Zealand of $100,000. If an arbitrary value of 20% is applied for non-fatal YLD compared with years lost to death (YLL), the economic cost of the non-fatal burden of asthma can be determined. In this way, it can be calculated that the 17,000 YLD represents a cost of $340 M.

4.D.2.5 < Other costs to society

There are other costs to society that have not been included in this analysis such as those detailed below:

Other costs to employers:

These include the adverse impact on work performance directly from asthma and from impaired sleep quality attributable to nocturnal asthma. There are also the costs of people with poorly controlled asthma leaving the workforce or taking early retirement.

Other costs to people with asthma:

- Time and travel costs associated with attendances to general practitioners and other health services.
- Child-care costs at home for children who are unable to attend child-care centres or school because of asthma exacerbations (including having to take time off work).
- The cost of extra housekeeping and heating measures to reduce dust mites and the use of humidifiers and house renovations (e.g. carpet removal) as part of asthma management.
- The loss of educational opportunities associated with missing school because of asthma.
- Impaired school and work performance associated with impaired sleep quality attributable to nocturnal asthma.

4.D.2.6 < Total indirect non-medical costs of asthma

This analysis indicates that total indirect non-medical costs of asthma were around $700 M per year in the late 1990s (Table 28). Given the various assumptions made, this is likely to be an underestimate of the true cost.

TABLE 28: *Summary of estimated annual indirect non-medical costs of asthma in the late 1990s*

Area	Estimated cost ($ M)
Work loss	105
Premature death	254
Years lost to disability	340
Total	**$699**

4.D.2.7 < Lack of access to medications

A related issue is the costs to individuals with asthma that result from the restriction in the availability of advances in medical treatment. This has been a particular problem in the management of asthma in New Zealand, where restricted access has held back the use of long-acting beta-agonist drugs. While it is accepted that there are severe financial restraints in terms of PHARMAC's total drug budget, these restrictions have not necessarily been based on international consensus guidelines or on the recommendations made by the Pharmacology and Therapeutics Advisory Committee (PTAC). Formal health economic assessments are particularly important in this regard in determining the cost-effectiveness and relative value of different pharmacological interventions as a basis for decisions in a limited resource environment.

4.D.2.1.I < Long-acting beta-agonist drugs

The major advance in asthma treatment over the last decade has been the availability of inhaled long-acting beta-agonist drugs. The addition of a long-acting beta-agonist drug such as salmeterol or formoterol to inhaled corticosteroid therapy leads to improved lung function, reduced symptoms and fewer severe exacerbations.[77,78,103] Their use in asthma has been recommended by consensus guidelines for 10 years, initially in patients with severe disease,[104] but with increasing evidence of their efficacy and safety in patients with less severe disease (Table 29 and figure 17).[105,106] As a result, the current recommendations are that for moderately severe asthma, not controlled with inhaled corticosteroids at a dose of 200–1000 µg/day or equivalent of beclomethasone dipropionate (BDP), a long-acting inhaled beta-agonist should be added to the treatment regimen.

TABLE 29: *International recommendations for the use of long-acting beta-agonist drugs in asthma*

International Consensus Report 1992 (1 to 4 stages of severity):	
Step 3 (Moderately severe)	Inhaled steroids 800–1000 µg/day plus long-acting beta-agonist
Step 4 (Severe)	Inhaled steroids 800–1000 µg/day plus long-acting beta-agonist
British Guidelines 1995 (1 to 5 stages of severity):	
Step 3	Inhaled steroids 200–800 µg/day plus long-acting beta-agonist
Step 4 & 5	Inhaled steroids 800–2000 µg/day plus long-acting beta-agonist
National Institutes of Health 1997 (1 to 4 stages of severity):	
Step 3	Inhaled steroids 200–1000 µg/day plus long-acting beta-agonist
Step 4	Inhaled steroids >1000 µg/day plus long-acting beta-agonist

Note: Recommended inhaled steroid dose, BDP or equivalent

Despite the considerable evidence on which this recommendation was made, and contrary to the advice received from the Pharmacology and Therapeutic Advisory Committee, there has been only very restricted access to long-acting beta-agonist drug therapy in New Zealand until 2001 (figure 17). Doctors were required to apply to Health Benefits Limited for special authority approval to prescribe a long-acting beta-agonist drug, and patients had to meet certain criteria including the use of at least 1500 µg/day of BDP or equivalent, before funding was granted. This inevitably resulted in an inappropriate restriction of this important therapeutic class, with resultant unnecessary burden of severe asthma to asthmatic patients in New Zealand in terms of preventable symptoms, limitation of activities, severe exacerbations, and side effects from high-dose inhaled corticosteroid therapy.

Ironically, these restrictions are likely to have led to greater overall pharmaceutical cost to PHARMAC, in view of the pharmacoeconomic studies that have shown that the addition of a long-acting beta-agonist is more cost-effective than the same or greater dose of inhaled corticosteroid when calculated as the cost per symptom-free day.[106-109] As patients with the most severe asthma account for a disproportionately large portion of the economic costs of asthma, PHARMAC has not benefited from the savings that would have been achieved if combined inhaled corticosteroid and long-acting beta-agonist therapy had been made available to this group of patients.

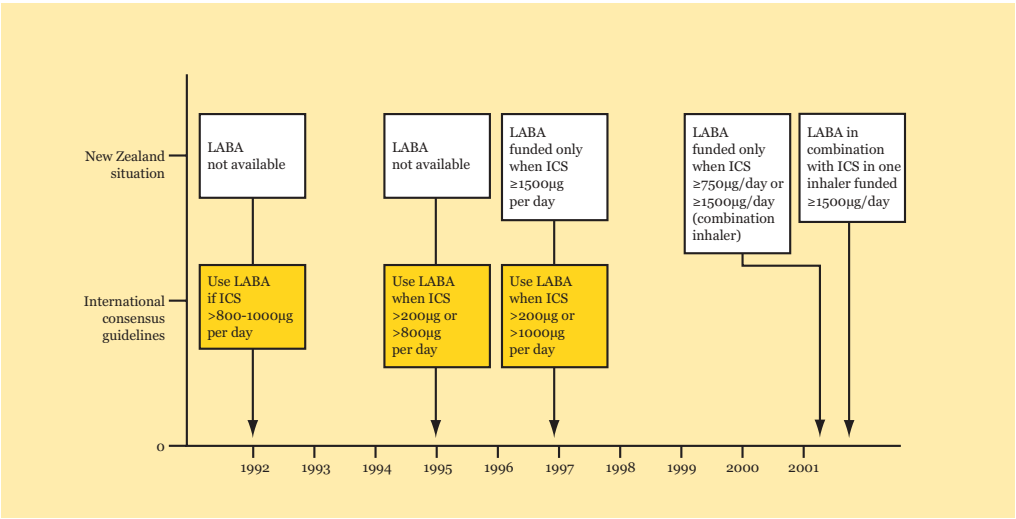

FIGURE 17: *Discrepancy between the availability of long-acting beta-agonists (LABA) in New Zealand and the recommendations of international consensus guidelines on their use.*

LABA = long-acting beta-agonists
ICS = inhaled corticosteroids

4.D.2.1.II < Combination long-acting beta-agonist/inhaled corticosteroid therapy

A more recent advance in asthma treatment has been the availability of long-acting beta-agonist drugs in combination with an inhaled corticosteroid in a single inhaler device. While their availability is currently severely restricted, it is likely that the greatest benefit will be achieved by their widespread use in disadvantaged groups, accessed through primary care from either general practice or nurse prescribers.

4.E < Summary of Economic Burden

Asthma in New Zealand in the late 1990s is conservatively estimated to have cost the Ministry of Health and the rest of society a total of about $825 million per year. The direct medical cost of asthma is estimated to be around $125 million per year, primarily because of the cost of pharmaceuticals and hospital care; the indirect costs to society can be conservatively estimated to be at least $700 million.

There is major potential to reduce the costs of asthma through the implementation of public health initiatives that involve the greater availability of cost-effective medications proven to reduce morbidity and mortality. The optimal use of these medications, especially by patients with severe or uncontrolled asthma, should result in a significant reduction in the personal and economic burden of asthma in New Zealand.

5. < RESEARCH OUTCOMES

There has been a huge research effort in the field of asthma in New Zealand. Key New Zealand research findings which have led to a greater understanding of asthma and advances in management resulting in major improvements in the quality of life of asthmatics in New Zealand and internationally include the following:

1. Identification of the beta-agonist fenoterol as the major cause of the second asthma mortality epidemic in New Zealand, leading to its withdrawal and associated marked and sustained reduction in asthma mortality rates in New Zealand.[59,60,64-66,68]
2. Development of the asthma self-management system of care based on the credit card plan, which has been shown to markedly reduce asthma morbidity and requirement for acute medical services.[110-113] This plan has now been promoted in many countries including Australia and the United Kingdom and is recommended in the WHO Guidelines for Asthma Management.
3. Identification of at-risk asthma patients through the New Zealand Asthma Mortality Survey, which is the largest descriptive survey of the circumstances of death from asthma.[73-75,79,80]
4. Identification that the regular high-dose use of the short-acting beta-agonist drug fenoterol increases chronic asthma severity, but that this does not occur with the long-acting beta-agonist drug salmeterol.[114,115]
5. The description of the natural history of asthma and identification of the risk factors for childhood asthma from the Dunedin Multidisciplinary Development Study.[2,116,117,118]
6. The recognition of the role of socio-economic factors and barriers to heath care in asthma morbidity and mortality.[25-27,36,38,44-50,52,53]
7. The marked increase in the occurrence of asthma in migrants from the Pacific Islands, due to the role of different environmental and lifestyle factors.[22]
8. Development of protocols for the assessment and management of asthma in Accident and Emergency departments, which are now widely implemented in New Zealand and overseas.[119,120]
9. Identification of the adverse effects of preservatives in asthma nebuliser solutions, which has led to the international production of nebuliser solutions, preservative-free nebuliser solutions in sterile unit dose vials.[121-124]
10. Determination of the therapeutic dose-response relationships of inhaled corticosteroids in the treatment of asthma, which has led to a reappraisal of the optimal doses of inhaled corticosteroids in asthma.[125]
11. Coordination of the ISAAC programme, the largest epidemiology asthma study ever undertaken in which the prevalence of asthma was measured in over 700,000 children from over 150 centres worldwide.[5-7]
12. Development of a mycobacterial-based vaccine which has been shown to reduce the risk of developing asthma in animals.[126]

6. < CONCLUSIONS & RECOMMENDATIONS

During recent decades, the burden of asthma has increased in New Zealand and in other countries with similar lifestyles and medical practice. There is an incomplete understanding of the underlying causative factors that are responsible for these international trends. Until there is a greater understanding of the factors that cause asthma, particularly severe asthma, and novel public health and pharmacological measures become available to reduce the prevalence of severe asthma, the emphasis needs to remain on cost-effective management approaches which have been proven to reduce morbidity and mortality.

This will require a number of public health strategies, including the greater availability of cost-effective medications and promotion of their use through proven methods such as the self-management plan system of care. It will also be crucial that financial and other barriers to primary health care are reduced through novel initiatives such as specialist nurse prescribing and restructuring of the partial government funding of primary care. Innovative systems such as the funding of the "3+ Visit Plan" in Australia, which enables patients to be regularly reviewed by their general practitioner for asthma, or the funding of one free general practitioner visit per year for individuals with diabetes in New Zealand represent models which could potentially be adapted for use in asthma management in New Zealand. The implementation of such measures, especially for patients with severe or uncontrolled asthma, should result in a significant reduction in the personal and economic burden of asthma in New Zealand. This warrants recognition of asthma, by the Ministry of Health, as a priority disorder in the New Zealand Health Strategy, and the formation of a medical advisory board. Finally, key New Zealand research findings have contributed to a greater understanding of asthma and its management, and led to an improvement in quality of life for asthmatics in New Zealand and overseas. Further progress in asthma will need to be based on a similar ongoing multidisciplinary research effort.

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< GLOSSARY

Airway obstruction A narrowing, clogging or blocking of the airways that carry air to the lungs

Allergen A substance which can induce an allergic response (e.g. plant pollens, animal dander, house dust mite faeces).

Asthma A medical disorder characterised by reversible airways obstruction. It is due to a form of airways inflammation which causes the airways to narrow too easily in response to a wide range of triggering factors.

Asthma symptoms Commonly reported symptoms of asthma including wheezing, chest tightness, shortness of breath and chronic/recurrent dry cough.

Atopy The ability to produce IgE (allergic) antibodies to common allergens, demonstrable by skin prick tests or blood tests.

Beta2-agonist A drug that stimulates the beta receptors in lung tissue and causes widening (dilation) of the airways.

Bronchial hyperresponsiveness The excessive airways response to provoking stimuli. A physiological marker of asthma severity.

Bronchodilator A drug that relaxes the smooth muscle in constricted airways.

Burden of disease A measure of the social impact of a disease on a population, including both fatal and non-fatal outcomes of the disease.

Corticosteroid A drug that stimulates corticosteroid receptors in lung tissue and reduces the severity of airway inflammation in asthma

Direct medical costs of asthma The cost of medical expenditure associated with asthma. Includes the costs of pharmaceuticals, hospitalisations, medical and allied treatment consultations, transport and community support services.

Disability Functional, activity or role limitation resulting from a health condition and lasting (or expected to last) for 6 months or more.

Disability-adjusted life expectancy (DALE) The average number of years an individual of a given age is expected to live, with the years of life weighted on a 0–1 scale according to the social preferences for the different states of disability into which the population is distributed, if current mortality and disability rates, and current disability state valuations, continue to apply.

Disability-adjusted life year (DALY) A health gap measure derived by adding YLD to YLL. One DALY thus represents the loss of one year of healthy life.

Disease severity The inherent severity of the disease independent of its management, including drug and other interventions.

Health gap The difference between the observed health status of a population and some standard or reference level of health.

Indirect costs of asthma The costs of lost productivity to society due to asthma. Includes the costs of invalidity, absenteeism, reduced effectiveness at work, work time lost from attending consultations, and premature mortality.

Morbidity Within a given population the number of sick persons or cases of disease recorded at a stated point in time or over a stated period. Any departure (subjective or objective) from a state of physiological or psychological wellbeing.

Mortality Death.

Mortality rate Death rate due to a disease in a given population at a stated point in time or over a stated period.

Nocturnal asthma Asthma symptoms of cough and wheeze at night that may impair sleep quality and result in wakening.

Peak flow meter Simple hand-held device which measures the flow of air that is breathed out and indicates the degree of airway obstruction

Poorly controlled asthma Occurs in asthmatics on sub-optimal treatment regimen for a given level of disease severity. May result in increased symptoms, greater need for medical care and a lower quality of life. Poor control may occur in asthmatics receiving inadequate treatment, inappropriate medication or people non-compliant with medication.

Premature mortality The social burden of fatal health outcomes, measured in terms of years of life lost.

Prevalence The total number of cases of the disease existing in the population at a specific time.

Quality of life The level of wellbeing and satisfaction associated with events or conditions in a person's life as influenced by disease, accidents or treatments. An individual's perception of their position in life in the context of the culture in which they live, and in relation to their goals, expectations and standards. The term incorporates concepts of physical and psychological wellbeing, levels of independence and autonomy, social relationships and support, and spirituality.

Relative risk The ratio of the risk (or rate, or odds) of a disease (or other health event or condition) among those exposed to a given risk factor to that among those unexposed.

Well controlled asthma Asthmatics receiving optimal treatment for a given level of disease severity. Results in fewer symptoms and disease exacerbations as well as a better quality of life.

Years of life lost (YLL) An indicator of the social burden of fatal health outcomes, calculated by subtracting the age at death from the life expectancy remaining at that age (as determined from a suitable standard or reference life table).

Years of life lost to disability (YLD) A measure of the burden of non-fatal health outcomes, used in the construction of the DALY. YLD represents the equivalent of years of life lost to severity-adjusted disability.