Asthma in Māori

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01/04/036 – Asthma in Māori adolescents

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Abstract

The research presented in this thesis arose out of work done by the Māori Asthma Review (Pomare et al, 1991). The Māori Asthma Review was undertaken because of concern regarding the excessive number of deaths and hospitalisations from asthma among Māori people, even though evidence at that time, was that asthma prevalence was similar between Māori and non-Māori children. One of the key findings from the review was that there were a combination of barriers for Māori when accessing asthma services, which were almost certainly reflected in more severe asthma and higher hospital admission rates.

This thesis has involved conducting three pieces of new research: (i) a series of reviews and analyses of descriptive data on asthma prevalence, hospitalisations and mortality in Māori and non-Māori; (ii) analyses of the ethnicity data from the International Study of Asthma and Allergies in Childhood (ISAAC) Phase III Wellington survey; and (iii) a follow-up study of Māori adolescents with asthma examining factors affecting asthma severity, access to health care and asthma quality of life in this adolescent population.

The mortality analyses showed that Māori were disproportionately affected by the asthma epidemics during the 1960s and 1970s and that while the asthma mortality rates have declined now, they remain higher in Māori than in non-Māori. Asthma hospitalisation rates continue to be higher in Māori compared to non-Māori across all age groups. Hospital admission rates are generally higher in rural areas for Māori whereas those for non-Māori are higher in urban areas. Analyses of the ISAAC Phase III data show that Māori children are experiencing both greater asthma symptom prevalence and increased asthma severity compared with non-Māori children and that this is not explained by risk factors such as smoking. In the follow-up study of Māori adolescents, baseline asthma severity and frequency of wheeze were important determinants of subsequent morbidity. Having an asthma action plan, a peak flow meter and having routine visits to the general practitioner were all associated with small improvements in asthma quality of life during the one year follow-up. The only significant predictor of access problems during the one year follow-up was having had access problems at baseline. Cost was the most significant barrier to accessing care for these families.

Asthma continues to be a significant health problem for Māori. The research conducted for this thesis supports and extends previous research indicating that asthma is more severe in Māori, because of problems of access to health care. It also indicates that differences in asthma prevalence between Māori and non-Māori are now being seen in children as well as adults, and that management and treatment issues underlie the emerging increase in asthma prevalence among Māori. Attention to access issues across mainstream health structures along with support for Māori provider organisations should continue. Additonally, active approaches to monitor differential treatment and barriers to effective interventions are needed.

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CHAPTER ONE

INTRODUCTION

General background

The Māori Asthma Review (Pomare et al, 1991) was undertaken in 1990 following a recommendation from the former Minister of Māori Affairs, the Hon. Koro Wetere. At the time, it was noted that there was an excessive number of deaths from asthma among Māori people and that many required hospital treatment even though available evidence at the time suggested asthma was no more common in Māori than non-Māori. There were a range of other issues identified in the review including asthma management problems, major difficulties in getting expert help when needed, and a serious lack of meaningful and clear information about asthma that was readily available to Māori asthma sufferers.

The review team made calls for oral and written submissions and a series of hui were held throughout New Zealand. The nature of the review allowed very important information regarding Māori experience of asthma, asthma services, asthma management and asthma information and education issues to be highlighted. Cost of health care was seen as a primary issue and strong support was expressed for reducing costs of general practitioner (GP) visits. A clear need for greater patient education emerged along with requests for the introduction and use of simple asthma management plans. Strong calls for Māori asthma educators and for more innovative approaches to asthma services, including marae-based services, were voiced. A significant concern became apparent during the review regarding Māori asthma sufferers who were hesitant in seeking medical help unless in an emergency situation. There were a combination of reasons for this relating to perceived attitudes of health workers and power issues associated with previous interactions with the health care system (Pomare et al, 1991).

The Māori Asthma Review team followed up on these issues with a number of recommendations including the need for more effective involvement of Māori people in the planning and delivery of asthma care, the need for improved access to health care, that Māori be involved in all aspects of the education process relating to asthma and asthma management, that appropriate information and education material about asthma be available, and that Cultural Safety education be included in the training of health workers (Pomare et al, 1991).

The majority of studies completed at the time of the Māori Asthma Review (Pomare et al, 1991) and subsequently, have reported asthma prevalence to be very similar between Māori and non-Māori schoolchildren in New Zealand (Mitchell, 1983; Shaw et al, 1991; Robson, 1993; Shaw et al, 1994). However, asthma severity and numbers of hospital admissions for asthma continue to be disproportionately greater in Māori (Mitchell & Borman, 1986; Pomare et al, 1995). Furthermore, there is an excess of asthma prevalence and morbidity in Māori adults compared with non-Māori adults, and asthma prevalence does not decrease with age in Māori as it does in non-Māori (Crane et al, 1994a). The reasons for this are unclear, but one possible explanation is that asthma symptoms are being prolonged or exacerbated in Māori because of environmental exposures, such as tobacco smoke. Passive exposure to tobacco smoke, however, can only partially account for the greater asthma severity seen in Māori children (Pearce et al, 1998).

There is a growing body of evidence to suggest that another possible reason for the increased severity of asthma among Māori is due to inadequate access to appropriate health care and asthma education (Pattemore et al, 1989; Pomare et al, 1991; Shaw et al, 1994). Issues relating to service access constituted a significant part of the findings from the Māori Asthma Review (Pomare et al, 1991), which recognised the need for strategies to address both practical asthma management and to work towards resolving complex issues around access to asthma health services for Māori people. The review identified some broad categories under which the issue of access to health services might be addressed. It was the complex interaction of these categories that contributed to Māori being less likely to access primary health care services for ongoing asthma management and preventative care (Pomare et al, 1991).

Socio-economic factors such as income, employment, housing and education have all been shown to be strongly related to health status (Pomare et al, 1995; National Health Committee, 1998). Socio-economic status can be viewed as a potentially modifiable environmental factor, in relation to asthma, which could impact on the severity or prolongation of symptoms. Using the specific concept of deprivation, one study found significantly higher rates of asthma prevalence among adults in the most deprived areas of New Zealand. After adjusting for area-defined deprivation, the prevalence rates were still 1.41 (95%CI 1.29-1.54) times higher amongst Māori compared with non-Māori (Salmond et al, 1999).

There is a significant financial cost due of asthma morbidity which has important implications for health resources and funding both here in New Zealand and overseas. An evaluation undertaken in the United Kingdom estimated that baseline 1996 costs for asthma were $148 million for direct medical costs, $18 million for non-medical direct costs and a further $95 million for lost productivity (Scott et al, 1997). In New Zealand, conservative estimates in the late 1990's for cost of asthma to the Health Funding Authority were around $77M per year. A much more significant figure relating to the cost of asthma borne by society, primarily due to uncontrolled asthma, was estimated at $290M per year (Wilson, 1999). A recent publication by the Asthma and Respiratory Foundation of New Zealand (2001) estimated both the medical and economic costs of asthma in New Zealand to be over $800 million every year.

Inequalities in healthcare and differential treatment/management have also been found to be significant structural barriers to both the provision and uptake of health services. The majority of studies undertaken in New Zealand have examined the issue of access in relation to utilisation of GP services (Gribben, 1992; 1993; Dovey et al, 1992; Barnett & Coyle, 1998). Malcolm (1996) concluded that despite known poor health status, and therefore expected higher rates of utilization, Māori and low-income populations have been seriously under-served with primary medical care and related services, compared with other New Zealanders. Māori have been found to experience excess mortality from diseases that ought not to be fatal. Smith and Pearce (1984) found that 30-40% of excess Māori deaths were due to diseases (including asthma) for which effective health care was available, and concluded that these problems reflected a serious failure by health services (Pomare et al, 1995). Overseas studies have found that people living in poorer areas experience inferior management of their asthma (Watson et al, 1996). Similarly, differences in medical management and the prescribing patterns of medical practitioners have been shown to result in higher hospital admission rates for Māori with asthma compared to non-Māori (Pattemore et al 1989; Mitchell, 1991). Geographic isolation and limited public transport were also documented in the Māori Asthma Review (Pomare et al, 1991) as being significant factors for Māori in their decision making about accessing health services.

Cultural barriers to accessing health services were also considered in the Māori Asthma Review (Pomare et al, 1991). Māori expressed feelings of unease in the communication approach and conscious or unconscious attitudes displayed by health professionals. These accumulated issues relating to power and control had the potential to affect ongoing or future interactions with health services to a point where a crisis might occur before medical help was sought (Pomare et al, 1991).

One study examining the long-term benefits for Māori of a community based asthma self-management programme identified a key benefit to be that of cultural affirmation (Ratima et al, 1999). This referred to the capacity of the service to not only be safe in cultural terms, but also to positively affirm Māori beliefs, values and practices. This was reflected in the delivery of services in Māori settings (such as marae-based clinics) and through adherence to Māori processes. Participants' comments indicated that benefits for them included an increased involvement in cultural and extended-family activities, and an interest in learning about things Māori. Almost half of the respondents said that taking part in the asthma self-management programme had strengthened their links with other Māori (Ratima et al, 1999).

Another consistent theme which emerged in the Māori Asthma Review (Pomare et al, 1991) was that many Māori people would prefer their education and service delivery to come from Māori, and that decision making powers should move to the community in which services were being provided. One example where Māori have been actively involved in the planning, establishment and maintenance of a self-management programme, showed improved access to health services and a reduced asthma morbidity for Māori, within that particular community (D'Souza et al, 1998).

Thesis organisation

The intention of this thesis is to update and extend the work of the Māori Asthma Review (Pomare et al, 1991) by examining subsequent trends and patterns in asthma prevalence, morbidity and mortality, and examining in more depth, the major risk factors for asthma prevalence and morbidity in Māori. These risk factors include environmental exposures which cause or may exacerbate asthma symptoms in Māori and issues of access to asthma health care and asthma education.

This thesis presents a series of reviews and new analyses of descriptive data on asthma prevalence, hospitalisations and mortality in Māori, the relationship between access to care and asthma morbidity, analyses of the ethnicity data from the Wellington International Study of Asthma and Allergies in Childhood (ISAAC) Phase III survey, and a follow-up study of Māori adolescents with asthma. The descriptive analyses were conducted because they were intended to show the magnitude of the problems of asthma morbidity and mortality in Māori. The analysis of the ISAAC Phase III survey was then conducted to explore the time trends and causes of asthma prevalence in Māori. The follow-up study was conducted to explore factors that affect the severity over time of asthma in Māori. The three sets of studies are therefore complementary and together provide a broad overview of the time trends and patterns of asthma prevalence, morbidity and mortality in Māori, and the extent to which these are explained by known asthma risk factors.

The work presented in this thesis is Māori centred research consistent with the definition offered by Cunningham (1998). This is the first time that Māori driven asthma research of this kind has been undertaken. Māori were involved at all levels of the research process as participants, advisory people, primary researchers and analysts of the data. Consultation and participation of Māori in the process of determining their priorities and needs in terms of asthma services and resources is critical if positive health gains are to be made in this important health area. This is further discussed in the 'Consultation' section presented in Chapter Seven for the study of asthma in Māori teenagers.

The thesis is presented in two parts. Part One (Chapters Two, Three and Four) provides the background information to the thesis presenting a broad overview of some of the key issues relating to Māori health in general, and the study of asthma prevalence and morbidity among Māori.Part Two (Chapters Five, Six and Seven) presents the new research conducted for this thesis.

The thesis begins by providing some background to the wider context of disparities in health between Māori and non-Māori in Chapter Two. The role of the Treaty of Waitangi in relation to Māori both historically and as a key component for addressing contemporary Māori health status is discussed. This is followed in Chapter Three by an overview of the findings and recommendations from the Māori Asthma Review (Pomare et al, 1991) to provide a specific context for the work relating to asthma prevalence and morbidity among Māori as the subject for this thesis.

Chapter Four identifies some of the key measurement issues relating to this work. The need for good quality data on ethnicity in order to monitor and understand differences and trends in outcomes between Māori and non-Māori is essential. The first part of this chapter presents a brief review of approaches to measuring ethnicity in New Zealand. The second part of the chapter discusses definitions of asthma and methods for measuring asthma prevalence and asthma morbidity, as they relate to the methods used in the studies presented in this thesis.

Chapter Five commences with a review of previous studies of asthma prevalence, morbidity and mortality in Māori; I then present new analyses of time trends, seasonal patterns, and regional differences in asthma hospitalisations and mortality between Māori and non-Māori. I acknowledge the work of the co-investigators who collaborated on the analyses presented in this chapter. These were: Neil Pearce, who assisted with data analysis and interpretation of the results in all three of the new studies; Soo Cheng, who ran the data programmes for the three studies and; Ron King, who mapped the data for the regional analyses study.

The analyses of the Wellington arm of the International Study of Asthma and Allergies in Childhood (ISAAC) Phase III survey, by ethnicity, are presented in Chapter Six. The ISAAC study uses a standardized methodology to measure the prevalence of asthma symptoms in school age (6-7 yrs, and 13-14 yrs) children. ISAAC Phase I was conducted in New Zealand during 1992-1993 and involved more than 700,000 children in 155 centres in 56 countries (Pearce et al, 1993a; ISAAC Steering Committee, 1998a; 1998b). ISAAC Phase III was conducted over 2000-2001 and involves a repeat of Phase I in order to assess trends over time. I would like to thank the co-investigators involved in this study including: Neil Pearce, for his assistance with analysis and interpretation of the data; Karen Blakey, who assisted with data management for the 6-7 year olds and; Catherine Cohet, who assisted with data management for the 13-14 year olds.

This is followed by a presentation of the follow-up study of Māori adolescents with asthma, who were identified from the Wellington ISAAC Phase III survey, in Chapter Seven. The assessment of risk factors for asthma severity in this young Māori population involved: (i) completion of more detailed questionnaires on asthma risk factors and asthma symptoms, asthma quality of life, and access to health services during the previous 12 months; and (ii) follow-up questionnaires to assess the severity of asthma, changes in quality of life and access to health services, one year after the initial survey. I acknowledge the work of the co-investigators for this study: Michelle Gray, who assisted with all of the data collection and follow-up contact with the students and their families; Neil Pearce, who assisted with the interpretation and analysis of the data; Soo Cheng, who ran the data analyses and; Aroha Webby, who assisted with data collection for the first half of the project.

The thesis concludes with a summary of the major findings and a discussion regarding the implications of this work in relation to health service provision, broader public health considerations and suggestions for future research in this area.

CHAPTER TWO

MĀORI HEALTH

Introduction

This chapter backgrounds the wider context within which this thesis is situated. I start by presenting a brief overview of Māori health in the context of New Zealand's colonial history and the role of the Treaty of Waitangi. I then discuss possible explanations for inequalities in health between Māori and non-Māori, including socio-economic factors, life-style factors, access to health care, cultural influences, and discrimination.

Māori health

Māori are the indigenous people of New Zealand. The United Nations have defined the concept of indigenous peoples as being a group of people with a distinct identity who want to maintain that distinctiveness, who are aboriginal to and express a special relationship with the territory and who have/do experience marginalisation, dispossession or discrimination (Daes as cited in Ratima, 2001). In terms of international law, distinction has been made between the rights of indigenous peoples and those of minorities in respect of indigenous peoples right to self-determination (Daes, 2000). Māori autonomy and self-determination alongside Māori interaction with the state and the state's responses to Māori have been the subject of much debate (Durie, 1994; 1998; Jackson, 1998; Kelsey, 2000; Te Rōpū Rangahau Hauora a Eru Pomare, 2000).

Kunitz (1994) discusses the importance of the historical and socioeconomic context in relation to death rates among Māori following the colonisation of New Zealand. The increases in mortality following pakeha settlement have been largely attributed to the introduction of infectious diseases. However, where the colonising populations did not acquire large territories of land (as in Samoa and Tonga) with the resultant disruption of the economic base, food supply and social networks, the impact and loss of life from disease, while potent, was much less devastating among the indigenous populations (Kunitz, 1994). A similar conclusion had been earlier reached by Sorrenson (1956) who wrote that "*. . . depopulation* [of Maori] *was largely a result of the social disorganisation accompanying the continued sale* [loss] *of land*" (p 184). This situation has also been witnessed in Eastern Europe more recently where a fall in life expectancy has occurred following the general devastation of the economy and the collapse of social networks and social services (Boback & Marmot, 1996; Men et al, 2003).

In discussing mortality trends among the indigenous peoples of New Zealand, Australia, Canada and the United States, Kunitz (1994) notes that while life expectancy has increased for all these indigenous populations since colonisation occurred (using available and acknowledged incomplete data from the earlier periods), at no time has it matched that of the non-indigenous populations. The historical context is important. It provides clues to the persistence of contemporary structural factors (for example in relation to institutionalised racism) many of which are a perpetuation of historical injustice (Jones, 1999; Smedley et al, 2003). In this case, the initial insult of Māori alienation from the land resulted in the laying down of systems and processes through successive governments which have ranged from acts of law enabling the confiscation of land (for example, the New Zealand Settlements Act 1863) and regulation of Māori rights (for example, the Fish Protection Act 1877, and the Water Power Act 1903) to "unwritten" policies, for example within the Department of Education which actively discriminated against Māori students and Māori language in schools (Durie, 1998). The effects of institutional racism as a contributing factor to health disparities are further discussed later in this chapter.

The Treaty of Waitangi

The Treaty of Waitangi was a formal agreement between Māori hapū and the Crown signed in 1840 which guaranteed Crown protection of Māori resources and control of those resources, confirmed Māori right to self-determination and guaranteed equity between Māori and other New Zealand citizens (Durie, 1994; Ramsden, 2002). The rights and obligations of the signatories to the Treaty have remained the most pressing constitutional debate in colonial New Zealand's brief history (Te Puāwai Tapu, 1995). Jackson (as cited in Ramsden, 2002) locates the agenda behind the signing of the Treaty as being very different for the two sovereign parties involved. While Māori saw the Treaty as a reaffirmation of Māori independence, the Crown viewed the Treaty as a tool to facilitate the dispossession of Māori. A comprehensive examination of the Treaty is beyond the scope of this thesis. However, some background is included as a starting point for discussion in terms of the application of the Treaty of Waitangi to Māori health and how this has been and is being addressed through government policies.

Health rights have been identified as being implicit in the Treaty (Durie, 1998), and poor health status among Māori can thus be considered a breach of the Treaty (Robson & Reid, 2001). The Waitangi Tribunal was created in 1975 to implement the provisions of the Treaty and while some Māori have identified health to be a major issue worthy to be taken before the Waitangi Tribunal, such a case has not yet been constructed (Durie, 1994; Ramsden, 2002). The election of a Labour government in 1984 would eventually lead to the sale of state owned assets and a major re-structuring of health and social services, including what has commonly been referred to as the "health reforms." The report of the Royal Commission on Social Policy (1988) discussed the relevance of the Treaty of Waitangi to all social policies including health. The Commission also translated the meaning of the guarantees of the Treaty into principles (partnership, participation and protection) which have been widely adopted by government and non-government agencies and organisations (Ramsden, 2002).

Te Urupare Rangapū (Wetere, 1989) gave structure to the government's early approaches of using the Treaty as a focus for Māori health policy. A later document detailed government response to Māori issues in the health sector (Department of Health, 1992) and identified the Treaty of Waitangi as the founding document of New Zealand. More recent government health documents have both recognised Māori as tangata whenua (indigenous peoples) and made acknowledgement of the Treaty as being fundamental to the relationship between Māori and the Crown. (Minister of Health, 2000; 2001; Ministry of Health, 2002a; Minister of Health & Associate Minister of Health, 2002).

Māori health status

While there has been an overall improvement in Māori health over the past four decades, compared to non-Māori, Māori continue to experience significant premature morbidity and mortality (Durie, 1994; National Health Committee, 1998). This thesis concentrates on the more conventional measures of health, however it has been recognised that concepts of health differ and that some commonly used indicators of health, such as mortality and morbidity data, while useful in themselves, do not always necessarily present the most comprehensive picture of Māori health status (Durie, 1994). In discussing indigenous worldviews on health, Durie (2002) states that:

"Alienation of people from their environment – from the natural world - may be as closely linked to the host of health problems that beset indigenous peoples as the more familiar life-style risks of modern living" (p 5).

Definitions of health, in order to be meaningful, cannot be confined to the absence of disease or survival alone. Definitions of what constitutes a healthy life are subject to the personal interpretations of a multitude of factors including culture, class, ethnicity, gender, age and employment. Māori continue to describe health within a broad definition, with reference to the term *"hauora"*. There is a generally accepted understanding that hauora is an encompassing concept which includes various life aspects such as the spiritual, mental, physical, familial and environment (Durie, 1994). Models such as Te Whare Tapa Wha (Durie, 1994), Te Wheke (Pere, 1984) and Nga Pou Mana (Royal Commission on Social Policy, 1988), have been developed which attempt to reflect this holistic understanding of health. At the same time, it has also been recognised that models may be restrictive and promote stereotypical and simplistic approaches to understanding health. Hauora needs to be appreciated within its own context:

> *'Health commentators find it useful to use a model of health that reflects the way in which health is integrated in society. Unfortunately, this is not as simple as it seems. It is essential for the commentator to understand the culture and value systems of a society in order that the relationship between health and society can be accurately explored'* (Pomare et al, 1995, p 25).

The earliest comprehensive overview of Māori health status used data for 1954-1975 (Pomare, 1980). At that time, higher rates for cause-specific deaths including respiratory infection, chronic obstructive respiratory disease, infectious disease (tuberculosis), cardiovascular diseases, diabetes, cancer, and unintentional injury (motor vehicle accidents) were found in Māori compared to non-Māori. There has been little change in these health disparities since then (Pomare & de Boer, 1988; Pomare et al, 1995). In fact, more recent information examining trends in mortality rates between 1980-1999 shows a widening gap in age-standardised mortality rates between Māori and non-Māori/non-Pacific people (Ajwani et al, 2003). Slight decreases were noted in cardiovascular, respiratory and unintentional injury mortality rates for Māori, during this period, but the relative inequalities between Māori and non-Māori/non-Pacific have increased. For example, over the last twenty years, there is evidence of an increase in cancer mortality rates among Māori and large increases in suicide mortality among Māori females and males (Ajwani et al, 2003).

Hospital data are a commonly used measure for the monitoring of trends in morbidity. The latest volume of *Hauora: Māori Standards of Health III* (Pomare et al, 1995) found ear disease (in children), unintentional injuries (all ages), heart disease, hypertension, acute rheumatic fever and chronic rheumatic heart disease (in children), diabetes and chronic renal failure to be the leading causes for hospitalisation of Māori. While overall hospital discharge rates for both Māori and non-Māori had increased in all age groups between 1970-1992, Māori rates continued to be 1.4 –2.3 times higher than non-Māori rates (Pomare et al, 1995). More recent data indicates that rates for most diseases and injuries resulting in hospitalisation are higher in Māori than European/Others (Te Puni Kokiri, 2000a; Ministry of Health, 1999a).

Māori and non-Māori health inequalities

A number of different explanations have been suggested for inequalities in health between Māori and non-Māori. It should be noted at the outset that, with a few exceptions, genetic factors can be excluded as a major explanation for differences in health status between Māori and non-Māori. Debate regarding the role of genetics in determining health outcomes has been vigorous over the last twenty years. For example, it has been suggested that Māori and Pacific Island people have a different metabolism from Europeans and hence a greater tendency towards obesity (Hall & Stewart, 1989). However, it now appears that if the "thrifty genotype" exists, everyone has it except Europeans. Thus, any discussion of "genetic tendencies" involves assumptions about who is "normal" and what is a "normal environment" (Pearce et al, 2004). More generally, about 85% of genetic variation occurs randomly and is not related to race or ethnicity, whereas the striking time trends in Māori mortality and morbidity during the 20th century demonstrate that environmental factors have played the major role (Pearce et al, 2004). Thus, although genetic factors may contribute to differences in health status between Māori and non-Māori for some specific conditions, they do not play a major role in population and public health terms.

In this section I will therefore focus on "environmental" explanations for differences in health status between Māori and non-Māori. These fall into five main groups: socio-economic factors, lifestyle factors, access to health care, cultural influences and discrimination. Obviously these explanations are not mutually exclusive, they are complementary, and they all relate to New Zealand's colonial history. However, it is useful to consider them separately in turn, while bearing in mind that they are inextricably linked.

Socio-economic factors

There are clear differences in socioeconomic status between Māori and non-Māori which primarily arise out of New Zealand's colonial history (Pomare et al, 1995) the dispossession of lands (Kunitz, 1994) and the subsequent socioeconomic evolution of New Zealand society (Pomare & de Boer, 1998; Public Health Association, 1992;

Pomare et al, 1995). The impact of macro-level government policies on health outcomes as a result of the widespread re-structuring of health and social services in New Zealand throughout the 1980s and 1990s has been well documented (Durie, 1994; Brown, 1999; Te Rōpū Rangahau Hauora a Eru Pomare, 2000; Ajwani et al, 2003).

These social and economic changes differentially affected Māori and non-Māori, with a widening gap in inequality evident in terms of key determinants of health such as education, employment and housing, and in terms of direct effects on health. A recent report (Blaiklock et al, 2002) has documented the extent of the impact borne by Māori children in particular during this period. Other studies looking at the effects of household crowding and health (Baker et al, 2003) have identified crowding (defined as a deficit of one or more bedrooms) to be unevenly distributed across the New Zealand population with low-income families with children, and Māori and Pacific households, more likely to experience crowding. Baker et al (2003) note that while crowding levels reduced between 1986 and 1996, the gaps between crowding among Māori and Pacific families and other groups increased.

The proportion of Māori in employment declined markedly between 1986 and 1991, from 58.5% down to 42.8%. By 1996 this had climbed to 53.9%. However this was still substantially lower than non-Māori rates of employment, for the same year, which were 61.4% (Statistics New Zealand, 1998). In 2001, 56.3% of those in the Māori ethnic group were employed compared with 64.2% in the European ethnic group. Between 1986 and 1991 Māori unemployment rates increased from 14.9% to 24.2%. Over the same period, non-Māori unemployment rates also increased, but with far less magnitude, from 5.8% to 9.0% (Statistics New Zealand, 1998). Unemployment rates have come down to 16.8% for Māori compared with 5.6% for Europeans for the year 2001 (Statistics New Zealand, 2004a), and more recently, for the year ended March 2003, unemployment rates for Māori were 11.3% compared with 3.8% for European/pakeha (Statistics New Zealand, 2004b).

Māori had a lower annual median income than non-Māori in 1996: $12,900 compared to $16,200. In the ten-year period between 1986 and 1996 the inflation adjusted median income of Māori fell from $16,300 to $12,900. Māori were more likely than non-Māori to work in lower paid occupations, for example, as sales and service workers and plant and machinery operators. However, despite the occupational differences, the annual median incomes of Māori in full-time employment were lower than those of non-Māori in each occupation. Additionally, 38.5% of Māori families lived in households with a household income in the bottom 25 percent of household incomes compared to 23.0% of non-Māori families (Statistics New Zealand, 1998). At the 2001 Census, the median annual income for Māori men was $18,600 compared with $24,900 for all New Zealand men. Māori women had a median annual income of $13,200 compared with $14,500 for all New Zealand women (Statistics New Zealand, 2004c).

Income disparity is clearly of relevance to Māori health status, since socio-economic factors have been shown to be strongly related to health status (Pearce et al, 1985; Pomare et al, 1995; National Health Committee, 1998; Howden-Chapman & Tobias, 2000; Pearce & Loschmann, 2001). Importantly, the differences in health inequalities are not simply a matter of comparison between 'rich' and 'poor'. They must take into account the socio-economic gradients of health which have shown that incremental improvements in socio-economic position are associated with incremental decreases in risk, particularly for mortality (Blakely, 2001). Alongside this is the increasing body of evidence that socio-economic disparities have an effect over the entire life-course, with childhood socio-economic status influencing health outcomes in adulthood (Williams & Collins, 1995; Davey Smith et al, 1997; Power et al, 1999; Davey Smith et al, 2000). Additionally, socio-economic disparities influence the health of indigenous populations over generations (Cunningham & Stanley, 2003).

While ethnic differences in health often involve different issues than socioeconomic differences in health, there is nonetheless convincing evidence of a link between ethnicity, socioeconomic position and health (Krieger et al, 1993; Williams, 1996; Davey Smith, 1998). Emphasis is also now being given to the need for better measurement and more sensitive indicators of socio-economic status in order to assess its contribution to ethnic group differentials in health status (Williams & Collins, 1995; Davey Smith, 2000).

Three measurement scales have commonly been used for studying ethnic differences in social class in New Zealand (Sporle, 2001; King, 2003). The Elley-Irving index has six groupings of occupation based on the average education and income levels for each occupational group in the census (Elley & Irving, 1976). The New Zealand Socioeconomic Index (NZSEI) is a linear scale of ranked occupations based on age, income and education also using information from the census (Davis et al, 1999). The New Zealand Deprivation index (NZDep96) enables an area-level measure of socio-economic deprivation using census data (Crampton et al, 2000a). Small area meshblocks (which contain an average of 90 people) are ranked on a decile score of 1-10 based on the average values of nine census variables. The lower the deprivation score the less deprived the neighbourhood with increasing scores indicating greater levels of deprivation. NZDep96 has the advantage that it can be applied to all New Zealanders whereas the two occupationally-based scales have primarily been used for studying social class differences in health for men of working age, although it may not always be the most valid measure because socioeconomic status correlates imperfectly with geographical area of residence (Blakely & Pearce, 2002).

The broad patterns of socio-economic status, ethnicity and health status are similar whichever measure of socio-economic status is used. The first studies to address these issues examined the association between occupational class and mortality among Māori and non-Māori men aged 15-64 years (Pearce et al, 1984; Pearce et al, 1993b; Sporle et al, 2002). The most recent analyses compared data based on measurements using the Elley-Irving index and the NZSEI (Sporle et al, 2002). The three key findings were that Māori men are more than twice as likely to die prematurely than non-Māori men; that Māori men have significantly higher mortality rates than non-Māori for each class grouping and for all men combined; and that social class mortality differences are greater within Māori than within non-Māori (Sporle et al, 2002). The authors concluded that lower Māori health status is only partially explained by relative socioeconomic disadvantage since there are persistently high Māori mortality rates even when controlled for social class (Sporle et al, 2002). Similarly, Smith and Pearce (1984) found that only about 20% of the difference in mortality rates was attributable to differences in socio-economic status.

A number of studies have also demonstrated increasing mortality and morbidity with increasing deprivation (McLoone & Boddy, 1994; Eachus et al, 1996; Salmond et al, 1999). Analyses using NZDep96 found that there is a nine year difference in life expectancy for males at birth between those in the least deprived and those in the most deprived deciles (Salmond & Crampton, 2000). Using population-weighted average life expectancies for the first seven deciles, the difference between Māori and European life expectancies at birth is 5.8 years for males and 5.3 years for females. This increased to 8.2 years and 10.1 years respectively when differences were measured for those in the most deprived decile. Deprivation profiles show that over half of the Māori population (56%) live in areas with the highest deprivation scores (deciles 8-10) compared with European and other ethnic groups (Salmond & Crampton, 2000).

Thus, differences in socioeconomic status clearly contribute to differences in health status between Māori and non-Māori. However, these socioeconomic differences, at least where they are measured by occupational class or deprivation score do not fully explain the differences in health status.

Lifestyle factors

Lifestyle or behavioural factors are often conceptualised in individual terms and have received increasing emphasis in the last few decades. However, they are not distinct from socioeconomic factors and it can be argued that lifestyle factors, such as smoking, represent one of the mechanisms by which socioeconomic factors affect health status (Pearce, 1996). However they are interpreted, it is important to consider the extent to which differences in lifestyle may account for differences in health status between Māori and non-Māori.

Eight modifiable risk factors for a range of chronic diseases were selected by the Ministry of Health (1999b) based on their potential scope for health gains if a reduction was achieved. These were divided into behavioural risk factors: smoking, alcohol consumption, fruit and vegetable consumption and physical activity; and biological risk factors: diabetes (type 2), obesity, hypertension and high cholesterol. At the same time, the Ministry of Health (2000) have also assessed the trends in health goals and objectives for the Māori population as a means for monitoring progress on public health targets.

Tobacco smoking is a well recognised risk factor for many cancers, respiratory and cardiovascular diseases (Ministry of Health, 2000). It remains the single greatest preventable cause of premature death among Māori (Pomare et al, 1995). Available time trend data shows a slight reduction in smoking prevalence among Māori adults from 51% to 49% between 1990 and 1998 (Ministry of Health, 2000). Overall, smoking rates among Māori are twice those of non-Māori (46% versus 23% respectively) with the smoking rate for Māori women being two and a half times greater than the rate for non-Māori women (53% versus 20%) (Te Puni Kokiri, 2000b).

Māori suffer excessive morbidity and mortality from alcohol related causes including death from motor-vehicle crashes (Pomare et al, 1995). Responses to the New Zealand Health Survey (NZHS) (Ministry of Health, 1999b) for 1996-97 indicated that Māori were considerably less likely to be moderate drinkers than non-Māori (46% versus 66 % respectively). In contrast, relatively higher proportions of Māori either don't drink at all or are 'hazardous drinkers'. More than one-quarter of Māori aged 15 years and over are hazardous drinkers (27%) compared to 16% of non-Māori adults. Young Māori aged between 15-24 years are the most likely to be hazardous drinkers (43%) in contrast with 32% of non-Māori in the same age-goup (Te Puni Kokiri, 2000b).

The role of diet and exercise as contributing factors for the development of a range of chronic diseases including diabetes, heart disease and cancer, have been well documented. Among Māori, deaths and hospital admissions related to obesity are higher than for non-Māori, and Māori have one of the highest death rates for diabetes in the world (Te Puni Kokiri, 2000a). Information from the National Nutrition Survey (Russell et al, 1999) indicates that over half of the Māori men and women surveyed were obese or overweight. Rates increased dramatically with age, with 81% of Māori men and 78% of Māori women being obese or overweight in the 45 years and over age group. Additionally, a similar pattern was seen in the prevalence of high blood pressure which increased substantially with age: 46% of Māori men aged 45 years and over and 50% of Māori women had high blood pressure compared with 43% and 38% respectively for non-Māori men and women in the same age group (Russell et al, 1999).

Results from the NZHS show that Māori are slightly less likely than non-Māori to be physically active (58% versus 61%) (Ministry of Health, 1999b). A differing pattern of physical activity between Māori and non-Māori was evident, with the proportion of

Māori who are physically active decreasing as their age increases while the proportion for non-Māori remains reasonably constant across the age groups (Ministry of Health, 1999b). The recently completed National Children's Nutrition Survey (Ministry of Health, 2003a), a cross-sectional population survey of 3275 children between the ages of 5-14 years, reported Māori children to be the most active of the three ethnic groups in the study (Māori, Pacific, New Zealand European and Others). However, 41% of Māori children were overweight or obese and this was of particular concern among girls (47%).

While health promotion activities aimed at an individual's health behaviour have had some success, it has been increasingly recognised that there are many external influences, for example, tobacco production, advertising and distribution, which require intervention at a structural level, taking into account health service delivery (Pearce, 1996). Furthermore, it has been shown that Māori experience high death rates from conditions (including asthma) that should not usually be fatal if there is good access to health care (Smith & Pearce, 1984). These issues are considered in the following section.

Access to health care

There is increasing evidence that Māori experience differential access to primary and secondary health care services (Health Funding Authority, 2000a; 2000b; Baxter, 2002). Māori have been found to experience excess mortality from diseases that ought not to be fatal. Smith and Pearce (1984) found that 30-40% of excess Māori deaths were due to diseases for which effective health care was available and concluded that these problems reflected a serious failing in the health services (Pomare et al, 1995).

This finding has been maintained in a more recent study of social class mortality differences in Māori and non-Māori men which concluded that improving the access to health services and their suitability for Māori health needs, could reduce the high rates of preventable Māori mortality (Sporle et al, 2002).

Primary health care services are the interface for people seeking either acute or chronic management of their health symptoms and conditions so access to these services are crucial. Accessibility is defined as "the ability of patients to access health services in a timely manner in response to their needs." (Parchman & Culler, 1994). Baxter (2002) describes the concept of 'access' in terms of both '*access to*' health care and '*access through*' health care which also takes into account the quality of the service being provided. Health care need and health care quality have been developed into a framework for measuring disparities in access to care in the United States which includes broader environmental and societal factors (e.g racism) that may impact on access (Lurie, 2002).

The Commonwealth Fund 2001 International Health Policy Survey telephone interviewed 1,400 adults in each of five countries: Australia, Canada, the United Kingdom, the United States and New Zealand, about their views and recent experiences with the health care systems in their country (Schoen & Doty, 2004). New Zealanders with incomes below the national average were more likely to call for a complete rebuilding of the health system (25%) than were adults with incomes above the average (18%). Compared to those with above-average incomes, adults with below-average incomes were more likely to report negative views of the health care system (18% versus 25% respectively), decreased access to care (12% versus

20%) and extreme difficulty in seeing a specialist (6% versus 21%) in the previous two years (1998-2001). Māori participants in this survey were more likely to report health care access problems than European adults, with 38% reporting problems in getting care when it was needed in the area where they lived compared with 16% of European adults. Māori were also about twice as likely to have gone without needed care in the past year because of cost (34%) than their European counterparts (18%). This adds to previous evidence (Pomare et al, 1991; Ministry of Health, 1999a) that cost is a significant barrier to Māori accessing health services mediated by socio-economic status (Baxter, 2002).

Alternative health services, such as union health centres, have emerged in direct response to the financial barriers of primary care services felt amongst low-income populations (Crampton, 1999). Baxter (2002) has identified the Community Services Card (CSC) as a form of targeted intervention aimed at reducing the impact of cost as a barrier. However, a review of the effectiveness of the CSC in reaching those in need found that financial barriers continued to prevent low income families from visiting their doctors and that about 21% of people eligible for a CSC did not have one (Ministry of Social Policy as cited in Baxter, 2002).

The emergence of Maori health providers has been an important step in terms of the provision and utilisation of primary health care services for Māori under Māori control. Crengle (1999) identifies two key philosophies which underpin Māori primary health care services. These are the use of Māori models of health as a basis for developing and delivering health services, and positive Māori development including social, economic and cultural factors within a framework of Māori selfsufficiency and Māori control (Crengle, 1999). Other examples include Ngāti Porou Hauora on the East Coast, and Hokianga Health and Te Hauora o te Hiku o te Ika in the Far North. These services have specifically identified access issues to be key factors for their base populations and utilise a range of strategies to address this, including extensive mobile services and outreach clinics, the provision of care for free or at low-cost, and employment of primarily Māori staff (Ministry of Health, 2002b). At the same time, it is also recognised that Māori provider organisations are an additional development which have opened up the range of health service choices available to consumers. However, if Māori are to have improved access to all health services, an increased responsiveness by mainstream services to Māori is necessary.

The New Zealand Health Strategy (Minister of Health, 2000) outlines the move to a population based approach to health services and the establishment of District Health Boards (DHB). The Primary Health Care Strategy released in February 2001 outlines the implications of this approach to primary health care where services are organised around defined populations enrolled with a Primary Health Organisation (PHO) (Minister of Health, 2001). One of the key priorities of the Primary Health Care Strategy is to reduce barriers (including financial barriers) and improve access to services. Some studies have identified enrolment-based, non-profit making health care services as being beneficial for low income and vulnerable populations (Crampton et al, 2000b; Crampton et al, 2001). However, there remains a fundamental problem that has occurred since the health reforms of the 1990s, and most recently with the introduction of DHBs and PHOs, that of coping with successive governments and the continual introduction of new policies which lack a sustained approach to health. There are currently no guaranteed funding sources to allow the full potential and development of services for Māori to take place and this vulnerability to government change and a lack of incentive for long-term policy and planning in a number of health areas continues to have important implications for both Māori provider development and primary health care services generally (Ellison-Loschmann & Pearce, 2000; Lavoie, 2003).

Cultural influences

The role of cultural influences as contributors to differential health status is an issue that has been less explored in the literature. 'Identity' is another term which is sometimes used in relation to ethnicity. The change from 'race' as a research variable to that of 'ethnicity' (Durie, 1995) has been explained as being as much about a closer alignment with social reality through recognising a person's right to self-identify (Robson & Reid, 2001) as it is with realising the limited scientific credibility of the term 'race' (Jenkins, 1977). The strength of 'identity' as a social construct is in its ability to accommodate change - it reflects a fluidity in how people see themselves or are 'seen' which may change over time. However, it is also recognised that identity is not entirely self-constructed and that:

> *"Individual decisions about who we are and our lifestyle choices, while appearing to be unbounded and therefore, solely a consequence of agency, are, in reality, made within social constraints."* (Karlsen & Nazroo, 2002, p 4)

Social structures, internal and external factors, national and international movements, have all influenced the consideration of ethnicity as identity which has also come to have important connotations in terms of the political process of ethnic affiliation

(Karlsen & Nazroo, 2002). This has definitely been a feature of Māori calls for self-determination and recognition of their rights as tangata whenua in New Zealand. The importance of ethnicity as identity on ethnic differences in health has been explored in the literature (Smaje, 1996; Nazroo, 1998). Important empirical work in this area is currently underway in New Zealand through Te Hoe Nuku Roa, a longitudinal study, aimed at understanding contemporary Māori values and identities using a range of social, economic and cultural indicators (Durie, 1995).

A recent evaluation of the smoking cessation pilot programme, *Aukati Kai Paipa,* (Ministry of Health, 2003b) which was designed, developed and delivered by Māori, found the programme to be effective for Māori women and their families. The quit rate by those on the programme was significantly higher than the quit rate recorded for Māori women smokers in the general population.

Acculturation and assimilation as positive outcomes which increase cultural capital have been explored in the literature (McLennan et al, 2000). It has been proposed that understanding the effects of culture on health may be beneficial in assisting reduce health inequalities, although it is acknowledged that the mechanisms for approaching this are poorly developed (Blakely & Dew, 2004). In relation to the health of Pacific peoples living in New Zealand, Blakely and Dew (2004) speculate:

> "*Whether and how Pacific culture has protected Pacific people from the full impact of lower socioeconomic position, and whether any such protection will be maintained into the future with their increasing acculturation.*" (p 1)

More information regarding this issue in relation to Māori health will become available over time with studies such as Te Hoe Nuku Roa (Durie, 1995) now in progress. Perhaps it is not the strength of culture *per se* which somehow promotes health but rather that culture and a sense of identity offer protection against the effects of discrimination and racism. This is considered more fully in the following section.

Discrimination

The role of discrimination and racism in the existence and maintenance of health disparities has been receiving increasingly more attention over the past twenty years, particularly with regards to access to health care. Studies examining the experience of minorities within health care systems have found that they are treated differently across a broad range of disease categories from those of the majority population (Geiger, 2003).

In the United States, local governments have conducted studies of discrimination in health care institutions in their local areas and congressional legislation has specifically addressed issues of discrimination in health care (Geiger, 2003). Recently the Institute of Medicine (IOM) in the United States was requested by Congress to assess the extent of racial and ethnic differences in healthcare (Smedley et al, 2003). They reported on the importance of historic and contemporary social and economic inequality in relation to the existence of racial and ethnic health disparities. Additionally, bias, discrimination and stereotyping at the individual, institutional, and health system levels, were identified as being important factors requiring intervention if health disparities were to be comprehensively addressed (Smedley et al, 2003).

In Britain, racism within the National Health Service has similarly been recognised (Kushnik, 1988; Judge & Solomon, 1993; Smaje, 1995) and its impact on access to health care for people from black and ethnic minorities has been identified (Hopkins & Bahl, 1993). In New Zealand, recent government documents have acknowledged the role of its colonial history in maintaining the discrimination of Māori, with racism being a contributing factor in the existence of Māori/non-Māori health disparities (Ministry of Health, 2001).

Jones (1999) has described three levels of racism: institutionalised racism, personally mediated racism and internalised racism. She defines institutional racism as differential access to the goods, services and opportunities of society by race including housing, education, employment opportunities and income which are all important factors impacting on health status. Additionally, the results of institutional racism are seen as:

> " *Reduced access to power and information (including information about one's own history), access to resources (both capital resources and organisational resources) and access to voice (including representation at decision-making levels and in the media).*" (p 15)

This may manifest in indirect ways making it extremely difficult for the individual to challenge what is sometimes referred to as "the system". Importantly, Jones (1999) stresses that institutional racism involves both acts of commission and omission.

Personally mediated racism is defined as:

> "*Differential assumptions about the abilities, motives and intents of others by race, and the differential actions that follow from these assumptions*" (Jones, 1999, p 17).

These are direct forms of discrimination which may be intentional or unintentional which can have resultant health effects. Findings from the Māori Asthma Review (Pomare et al, 1991) indicated that conscious or unconscious attitudes of health care workers had contributed to reluctance by Māori to seek appropriate medical care for their asthma until it was absolutely necessary.

Jones (1999) describes a third level of racism as internalised racism whereby one devalues their own abilities and worth based on the belief of the negative messages heard about one's own ethnic group. This can manifest as resignation, helplessness and hopelessness and includes self–destructive behaviours such as smoking and alcohol use.

Studying the health consequences of discrimination has been recognised as a major challenge for researchers with the need for development of instruments able to measure acute and cumulative exposure to different aspects of discrimination (Krieger, 1999; Geiger, 2003). It has also been recognised that individual bias specifically relating to the nature of ethnic stereotyping, may be more directly remediable to relatively rapid change, as opposed to addressing the wider societal patterns of persistent and entrenched racism (Geiger, 2003).

Important work in this area has been underway in New Zealand over the past 15 years which proposes a mechanism for addressing individual, provider and institutional discrimination. Cultural Safety education was initially impelled by the revelation of the poor health status of Māori people in the mid-1980s and the clear demand by Māori for improvement in health services (Ramsden, 1993). In 1992 the Nursing Council of New Zealand made Cultural Safety a requirement for nursing and midwifery undergraduate education programmes (Papps & Ramsden, 1996). In explaining the development of Cultural Safety, Ramsden (2000) notes that the attitudes perceived by Māori from, in this context, health professionals, are the result of a highly complex colonial, social and political history which has contributed to the evolution of particular Māori stereotypes. These stereotypes are deeply embedded in the wider society of which health services are just one part. They are hard to recognize and avoid. Cultural Safety is concerned with identification and explanation of such constructs in terms of their powerful positioning of people in society.

The introduction of Cultural Safety in nursing and midwifery education programmes has been a critical advance for health services in New Zealand. Nurses and midwives constitute the largest body of health professionals who are working across a range of areas and in a number of different settings, hence, their contact with people and their influence on health practices are substantial. Ramsden (1992) identified avoidance of primary care services as a protective action by people not feeling safe, for a range of reasons, to access services. The logical extension of Cultural Safety education is that it becomes a core component of all training programmes for health professionals including medical practitioners which has been advocated by other health commentators (Kearns, 1997).

Additionally, Ramsden (1994a) recognised the role of wider societal processes in maintaining health disparities of Māori through discrimination and racism. This has come about as a result of information *omission*, with most New Zealanders not being exposed to the true history of the country. While this is now being addressed through Cultural Safety education programme for nurses and midwives, there remains a significant information gap for the rest of society, and Ramsden consistently advocated for changes to the mainstream education curriculum to include content on the Treaty and its implications for all young New Zealanders, along with a national education campaign which would explain the Treaty of Waitangi to the general public (Ramsden, 1994a; 1994b; 2002).

Summary

In summary, disparities in health between Māori and non-Māori have been evidenced for all of the colonial history of New Zealand. While there have been significant improvements in life expectancy over the past 140 years, Māori currently have disproportionately high rates of respiratory infection, infectious disease, cardiovascular diseases, diabetes, cancer, and unintentional injury (motor vehicle accidents) compared with non-Māori. Furthermore, there is recent evidence indicating that the overall gap in life expectancy has been widening rather than narrowing (Ajwani et al, 2003). Explanations for these differences involve a complex mix of socioeconomic factors, lifestyle, access to health care, cultural influences and discrimination, all occurring in the context of New Zealand's colonial history and subsequent development.

CHAPTER THREE

THE MĀORI ASTHMA REVIEW

Introduction

As discussed in the previous chapter, differences in health status between Māori and non-Māori involve a complex mix of socioeconomic differences, lifestyle factors, problems of access to health care, cultural influences and discrimination. These form the context in which the Māori Asthma Review (Pomare et al, 1991) was undertaken in 1990. In the first half of this chapter I briefly outline the background to the review and it's key recommendations. The review gave particular emphasis to issues of access to asthma health care services for Māori, and I therefore discuss these in depth in the second half of this chapter both with regards to the findings of the review, and in relation to subsequent research and policy developments.

The Māori Asthma Review

The Māori Asthma Review (Pomare et al, 1991) was conducted because of concerns brought to the attention of the then, Minister of Māori Affairs, the Hon Koro Wetere, over a range of asthma health issues. It was noted that there was an excessive number of deaths from asthma among Māori people and that many required hospital treatment, even though current evidence at the time suggested that asthma was no more common in Māori than Pakeha. There were problems in the management of asthma in Māori, major difficulties in getting expert help when it was required, and a serious lack of readily available, clear information about asthma.

The Review team comprised six members: Professor Eru Pomare (Professor of Medicine, Wellington School of Medicine); Mr Hohua Tutengaehe (Kaumatua, Christchurch); Mrs Makere Hight (Asthma Education Officer, Auckland); Ms Irihapeti Ramsden (Nursing Advisor, Wellington); and Dr Neil Pearce (Epidemiologist, Wellington). Secretarial and administrative assistance to the Review team was provided by Ms Vera Ormsby from the Māori Health Unit, Department of Health.

The team was asked to advise the Minister of Māori Affairs on all aspects of asthma affecting Māori people. In particular, the review team was asked to prepare something practical for Maori people on asthma management and be able to highlight problems and make suggestions about access to health care. A literature review on current knowledge (for the time) of prevalence and causes of asthma, management of asthma and access to health care was conducted as background information to the review process itself, and to complement the oral and written submissions. Various hui were held throughout New Zealand and organized so as to hear views from both urban and rural Māori and those who were geographically isolated. More visits were held in the North Island because of the greater number of Māori living there. Māori people were the major participants at the hui, with most being either asthma sufferers themselves or having a family member with asthma.

The key issues

The Māori Asthma Review concluded that asthma prevalence was similar in Māori and non-Māori children (the evidence for this conclusion is presented in Chapter Five which considers the descriptive epidemiology of asthma in Māori), but that asthma severity is greater in Māori children and adults. The most likely explanation for this involved problems of access to asthma health care services.

The Māori Asthma Review recognised the need for strategies to address both practical asthma management as well as ways to work towards resolving issues concerning access to asthma health services for Māori. At the time of the review, it was becomingly increasingly recognised that the key person in the long term management of asthma is the informed patient, and a stronger emphasis was being placed on self-management of asthma and asthma education involving consumer participation. However, the findings from the Māori Asthma Review revealed that there was a huge gap in terms of Māori people's practical knowledge of their asthma condition and how to best manage both acute and chronic symptoms. Many Māori interviewed by the review team wanted to know more about asthma and what they could do for themselves, but experienced difficulties in the approach used by health professionals. This ranged from inappropriate use of terminology, to inadequate time allowed for asthma education. A consistent theme which emerged was that Māori people would prefer their education and service delivery to come from Māori, and that decision making powers should move to the community in which the asthma services were being provided.

The review team found that there was a complex interplay of factors contributing to Māori accessing health services. At a number of levels and in varying situations, Māori had experienced difficulties in the communication approach and conscious or unconscious attitudes displayed by people in positions of power, including health professionals. These accumulated issues relating to power and control had the potential to affect ongoing or future interactions with health services, to a point where a crisis might occur before medical help was sought. This was true not only for Māori seeking asthma health services, but occurred over a wide range of health areas. The need for more asthma education, delivered in a way that was understood and useful to those receiving it, also emerged as an important issue for Māori involved in the review.

Recommendations

Thirty-eight specific recommendations were made and the Māori Asthma Review team identified eight key areas through which the recommendations could be addressed. The key areas were that:

- A major improvement in Māori asthma would only occur through more effective involvement of Māori people in the planning and delivery of asthma care.

- Improved access to health care was vital if Māori asthma statistics were to improve.
- Education about all aspects of asthma and its management was vital for optimal treatment success. Māori people have expressed a strong desire to be involved in all aspects of the education process.
- Information and education material about asthma needs to be available and appropriate if management is to be optimised. Many Māori people favour oral and visual materials
- Pakeha health workers need to be aware of and sensitive to cultural factors which adversely affect Māori asthma management.
- Research is important if the causes of asthma are to be found and existing/new programmes are to be properly evaluated. Standardisation of classification for research and data-gathering purposes should be undertaken and Māori should be fully involved in these processes.
- Tobacco smoke is bad for asthma. The high prevalence of smoking among Māori must be reduced.
- An action plan for the management of asthma should be made available to the Māori community and be user-friendly.

Access to asthma health care services

As noted above, issues relating to service access constituted a significant part of the findings from the The Māori Asthma Review. Five key aspects of access to asthma health care services are discussed here in more detail. These are: (i) differential treatment; (ii) cost and location; (iii) education and self-management; (iv) attitudes of health workers; and (v) cultural barriers. In addition to these factors, the current structure of primary health care services in New Zealand is also considered both in terms of accessibility for Māori people with asthma and how the interface between primary and secondary services may be impacting on Māori asthma morbidity.

Differential treatment

Inequalities in healthcare and differential treatment/management have been found to be significant structural barriers to both the provision and uptake of asthma health services. Overseas studies have found that people living in poorer areas experience inferior management of their asthma (Watson et al, 1996). Differences in medical care and asthma treatment have been documented as possible reasons why people in poorer areas have higher rates of asthma morbidity and mortality (Poyser, 2000). In New Zealand, there is increasing evidence of differential access for Māori at all levels of care. Findings indicate that Māori receive less primary care than would be expected, are less likely to be referred for surgical care and specialist services, and receive lower than expected levels of hospital care than non-Māori given the disparities in mortality (Malcolm, 1996; Davis et al, 1997; Westbrook et al, 2001; Tukuitonga & Bindman, 2002). Doctors in New Zealand have been less likely to advocate for preventative measures for Māori patients compared to non-Māori patients (Mitchell, 1991; Pomare et al, 1995), and the quality of care for Māori patients has been questioned as possibly being systematically inferior (Health Funding Authority, 2000b).

In relation to asthma, one study found that Māori were less likely to have an action plan and less likely to use a peak flow meter (Garrett et al, 1989). A further study in Auckland found that 33% of Polynesian children (Māori and Pacific Island combined) were not receiving any asthma drugs in the 24 hours prior to a hospital admission compared with 14% of Europeans. It also found that fewer Māori children were taking preventative medications compared with European children (13% vs 25%). This was due not only to differences in medication use, but was also due to differential prescribing. The study concluded that rates of acute severe asthma, resulting in higher admission rates for Māori and Pacific Islanders, were primarily due to differences in medical management (Mitchell, 1991).

Garrett et al (1989) found that relative to the severity of their asthma, Māori with asthma lost more time from work or school and needed hospital services more. Thus, while clinically less severe, the poor management of their asthma meant that they suffered disproportionate morbidity and required more intervention at the secondary service level than would be expected given the severity of their asthma (Garrett et al, 1989).

Cost and location

Cost was a major factor related to access identified in the Māori Asthma Review (Pomare et al, 1991). Costs included travel to the doctor's surgery, doctor's fees and prescription charges. These costs might be further exacerbated for those living in isolated rural communities. There was also strong support expressed in the review (Pomare et al, 1991) for low cost health clinics such as union health clinics, but only as a "second best" option to the provision of free primary health care. Nearly ten years after the Māori Asthma Review, evidence suggests that cost continues to be a significant issue for people with asthma. The introduction of free consultations for under six year olds in 1997 (Newton-Howes et al, 1998) may have relieved some of the financial burden associated with visits to GPs within this age band. However prescription costs for medications remain a major issue and obviously, there are significant numbers of people with asthma who fall outside of the age parameter to qualify for the free consultation service. Similarly, in a 1998 study of 401 low-income households around New Zealand, 56% of participants had not visited a doctor in the previous year because of cost, and 17% identified asthma as a condition which had gone untreated as a result of this (Waldegrave et al, 1999).

Socioeconomic factors such as income, employment, housing and education have all been shown to be strongly related to health status (Pomare et al, 1995). Socioeconomic status can also be viewed as a potentially modifiable environmental factor, in relation to asthma, which could impact on the severity or prolongation of symptoms. Using the specific socioeconomic concept of deprivation, two complementary surveys carried out between 1991-1993, found significantly higher rates of asthma prevalence among adults in the most deprived areas of New Zealand. After adjusting for area-defined deprivation, the prevalence rates were still 1.41 (95% CI 1.29-1.54) times higher amongst Māori compared with non-Māori (Salmond et al, 1999).

A study of access and utilisation of primary health care amongst Māori and low income New Zealanders, using data collected during 1994-95, found cost to be a significant barrier in both population groups together with poor access to public transport and isolated populations in rural settings (Barnett & Coyle, 1998). Overseas studies have found that inaccessibility of acute hospital services may increase the risk of asthma mortality (Jones et al, 1999).

Geographic isolation and limited public transport were documented in the Māori Asthma Review as being significant factors for Māori in their decision making about accessing health services (Pomare et al, 1991). There was also the additional factor of cost associated with transport for those living in rural or isolated areas with very limited options available in terms of public transport. Findings from the Māori Asthma Information Review (Ellison-Loschmann, 2001) suggest there is little evidence of strong regional differences in Māori asthma prevalence and morbidity although there is some evidence of minor urban/rural differences with greater asthma hospitalisation rates for Māori in rural areas. The reasons for this are unclear but it has been suggested that people living in isolated areas are more aware of their distance from health services and seek care at an earlier stage than they might otherwise (Garrett et al, 1986). Alternately, it could be that people in rural areas have poorer access to primary care and hence a greater frequency of exacerbations requiring hospitalisation.

One study in Christchurch found that despite the removal of part charges for children under six, that financial burden was an important deterrent to care for low income adults and that housing conditions were important predictors of the use of health services where the disposable income of poor New Zealanders had been significantly reduced with the introduction of pro-market housing policies (Barnett & Coyle, 1998).

These findings were supported in a later study looking at the effects of high housing costs for low income families (Waldegrave et al, 1999).

Education and self-management

The need for more asthma education, delivered in a way that was understood and useful to those receiving it, emerged as an important issue for Māori involved in the Māori Asthma Review (Pomare et al, 1991). It has been increasingly recognised that the key person in the long term management of asthma is the informed patient, with stronger emphasis being placed on self-management of asthma and asthma education involving consumer participation. However, the findings from the Māori Asthma Review revealed a huge gap in terms of people's practical knowledge of their asthma condition and how to best manage both acute and chronic symptoms. Many Māori interviewed by the review team wanted to know more about asthma and what they could do for themselves, but experienced difficulties in the approach used by health professionals. This ranged from inappropriate use of terminology, to inadequate time allowed for asthma education. A consistent theme which emerged was that Māori people would prefer their education and service delivery to come from Māori.

A later consultation process undertaken with Māori and Pacific Island communities in the Napier and Hastings areas (Central Regional Health Authority, 1996) similarly identified lack of information and education resources, for Māori people with asthma, to be a major barrier to care, in line with the findings from the Māori Asthma Review (Pomare et al, 1991). Barriers included; a lack of access to information that was consistent, reliable and accurate; lack of information regarding asthma and self-management of the condition; and a lack of incentive among GPs to initiate prevention strategies and programmes with an emphasis instead on treatment services (Central Regional Health Authority, 1996).

An intervention trial of the efficacy of an asthma self-management plan was carried out in partnership with a rural, largely Māori community (Beasley et al, 1993; D'Souza et al, 1994). Study participants found the plan simple and easy to follow and the provision of marae-based clinics was met with a very positive response. The results showed improvements in asthma morbidity and lung function with an increase in peak flow rates by 12% ($p<0.001$) and reduction in night waking from 30% to 17% ($p<0.001$) (Beasley et al, 1993). At the one and two year follow-ups, rates of improvement continued, with increased GP visits for emergency and non-emergency consultations and a reduction in the number of people woken at night by asthma. In a community experiencing major health problems from asthma, the self-management plan was found to be an effective and acceptable system for self-managing asthma and maintainable at a two year period (D'Souza et al, 1998; Ratima et al, 1999). Six years on, the programme participants continued to experience reduced morbidity from their asthma, however, the benefits were less than those observed at two years. The findings suggest that a significant contributing factor to asthma morbidity in this community had been the under-recognition and under-treatment of asthma (Ratima et al, 1999).

While the effectiveness of action plans in childhood asthma (Gillies et al, 1996) and in adult asthmatics (D'Souza et al, 1994) have been proven, they are not necessarily routinely used by GPs and other primary care practitioners (Garrett et al, 1997; Marks et al, 2000). Findings from the Wairarapa Māori Asthma Project indicated that continued reinforcement of self-managing skills, as part of regular asthma care and ongoing education, was essential, if a self-management programme was to have continued benefits (Ratima et al, 1999). Other Māori community models have been successful in increasing levels of preventive care in the area of diabetes (O'Grady et al, 2001) and in establishing community development partnerships with Māori for health promotion and health services in South Auckland (Voyle & Simmons, 1999).

Attitudes of health workers and cultural barriers

The issues of attitudes and whakama raised by people taking part in the Māori Asthma Review (Pomare et al. 1991) largely related to a complex range of interactions which had occurred for Māori over their lifetime. In the context of health, Māori responses to these interactions may be wide ranging. Some would challenge the health system/workers to make improvements to the services they offered or question the health worker's basis for taking particular views, decisions or actions. Others would choose to have minimal contact with services unless absolutely necessary. It is the more common second response that may have had an important impact, historically, on Māori asthma mortality and morbidity rates. It was also considered to be a likely significant factor contributing to current hospital admission rates, severity and prolongation of asthma in Māori. It was concluded that the conscious or unconscious attitudes of health care workers had contributed to reluctance by Māori to seek appropriate medical care when it was required. This situation is not specifically linked to asthma alone, but is reflected in many health areas where disparities between Māori and non-Māori exist. It was argued that this is not only tragic in terms of statistically poorer measured health outcomes, but also because among many Māori there exists an element of self-blame for ill health and an acceptance of low health status as the norm (Pomare et al, 1991).

Martin (2000) describes the effects of misdiagnosis or a delay in diagnosis of asthma as having the potential to affect people's future interactions with health professionals and a resultant loss of confidence in the health profession generally. Martin (2000) outlines the experience of one mother in this situation who felt that:

> *". . . perceptions of the medical profession was a definite barrier to accessing care."* (p 21)

A recent British Medical Journal editorial (Krishnan et al, 2001) discusses results from studies suggesting that impaired patient-physician relationships, particularly among patients from minority groups, are an important contributing factor to ongoing disparities in disease outcomes from chronic diseases.

Some work examining cultural influences in relation to accessing health services has been undertaken in New Zealand. A study in South Auckland identified more existing barriers for Māori than for non-Māori receiving diabetes care and education (Simmons, 1998). The most common barriers included the limited range of services (which did not acknowledge the importance of spiritual health beliefs and promote the use of alternative medicine), past encounters with professionals, inappropriate methods of conveying information and experiences of disempowerment (Atlas et al, 2000).

A report from the Wairarapa Māori Asthma Project assessed the extent of long term benefits of an asthma programme, particularly in terms of cultural development, health service access and lifestyle (Ratima et al, 1999). The long term positive outcomes were most directly attributable to a process of collaboration implemented in the setting up of the original study, which recognised partnership at an organisational and local level to be critical. In conjunction with this, the authors concluded that the delivery of services consistent with the community's cultural processes was an essential contributing factor to the success of the programme (Ratima et al, 1999).

Primary health care services

The majority of studies undertaken in New Zealand to date have examined the issue of access in relation to utilisation of GP services (Gribben, 1992; Dovey et al, 1992; Barnett & Coyle, 1998) with a number of studies concluding that Māori access primary care services far less than what their health needs indicate (Pomare et al, 1995; Malcolm, 1996; Davis et al, 1997). One study measuring utilisation rates in capitated primary care organisations serving low-income populations found that utilisation rates among Māori were higher than those for non-Māori. However, the study also noted that three of the organisations were iwi-based and had low or no patient charges, factors that were likely to facilitate their access by Māori families (Crampton, 2000).

As was discussed in Chapter One, the establishment of alternative services such as union health centres emerged in direct response to the financial barriers felt amongst low-income populations seeking to access primary health care (Crampton, 1999).

Additionally, barriers to access have been a major factor influencing the emergence of Māori health providers and the subsequent approaches taken to their delivery of health care. Tu Kotahi Māori Asthma Society was established in 1995 following on the recommendations from the Māori Asthma Review (Pomare et al, 1991) specifically relating to the lack of effective asthma education resources and services to Māori and the need for training of Māori asthma educators. The membership of Tu Kotahi comprise Māori asthma providers and marae in the Wellington region and they are the only Māori Asthma Society in New Zealand. Tu Kotahi identified asthma among Māori to be a priority issue, and has worked steadily and consistently over the last ten years to ensure the development and delivery of comprehensive asthma education and training services to Māori communities. In the public health sector, most asthma education services are delivered to Māori communities via mainstream public health units attached to hospitals, or by the 25 independent asthma societies in New Zealand. Some of these units and societies have Māori staff and Māori asthma resources for working among Māori communities, but most units and societies have neither. Tu Kotahi Māori Asthma Society is currently the only organisation working across both the public health and primary health care sectors providing specialist asthma services to Māori and non-Māori organisations.

While the past two decades have been significant in terms of the development of Maori health and social services, the lack of incentive for long-term policy and planning development in health areas at a government policy level has had important implications. Most notable of these has been an environment that promotes the delivery of fragmented care and services through short-term contractual agreements. This has resulted in provider inability to plan for and monitor the impact of the services they are providing and to be less likely to offer comprehensive services given the 'Catch-22 situation' they find themselves in, where available funding determines the workload of the provider and providers respond to funding availability. While it may be true that Māori provider development has enabled more control over health services and delivery in some respects, fostered a more positive association with health services and health professionals for some Māori, and inspired a certain level of confidence related to seeing more Māori in the service provider role, shifting more responsibility for Māori health disparities onto providers who may be poorly resourced to meet those challenges is not realistic (Durie, 1994; Lavoie, 2003).

Subsequent policy developments

Asthma has been recognised by successive governments since the Māori Asthma Review was undertaken in 1991 to have a significant health impact on Māori. Asthma was highlighted as a public health issue by the Public Health Commission (PHC) (Public Health Commision, 1994) and named as a new PHC policy initiative of relevance to the government health gain priority areas of both Māori health and child health for the1994/95 year (Ministry of Health, 1994). The Ministry of Health guidelines to regional health authorities for 1996/7 promoted equity in terms of waiting times, geographical accessibility and affordability as a policy goal for health services (Ministry of Health, 1996). Asthma is one of the Māori population health and disability objectives and was a Māori health gain priority area established under the Health Funding Authority (Minister of Health & Associate Minister of Health, 2002). The existing health gain priority areas were carried forward under the new population based approach to health services however, they are now primarily the responsibility of individual DHBs who must prioritise resources and allocate funding for all health services within their regions.

The Asthma Working Group (AWG) is a Ministry of Health advisory group, which is developing a set of New Zealand best practice guidelines for asthma to ensure that national standards for asthma management and asthma services are in place (Asthma Working Group, 2000). More recently, as part of the New Zealand Guidelines Group, the AWG has been involved in the development of evidence-based guidelines for the management of adult asthma in primary care (New Zealand Guidelines Group, 2002). It is envisaged that these guidelines will set a consistent standard for PHO approaches to asthma treatment and management (New Zealand Guidelines Group, 2001). While the guidelines (New Zealand Guideline Group, 2002) are intended for use by primary care practitioners, they also include information relevant to the acute setting. The purpose of the guideline is to provide an evidence-based summary of the diagnosis and management of asthma in adults. Additionally, the guidelines have emphasised the need for education and self-management for people with asthma and identify education programmes for health practitioners to be priority areas. The importance of special intervention strategies for Māori and Pacific Island peoples with asthma are also highlighted (New Zealand Guidelines Group, 2002).

Martin (2000) reported confusion amongst health practitioners regarding best asthma treatment and management practice and there is some evidence that the recently developed asthma guidelines for adults have not yet been widely taken on board by GPs (Beasley & Masoli, 2003; Holt et al, 2003). One document examining barriers to access for people with asthma found that a number of GPs were unsure as to the most appropriate treatment/management practices for adults with asthma (Martin, 2000). More recently, Holt et al (2003) examined the appropriateness of treatment in relation to the level of asthma severity and control in a national study involving 29 general practices in New Zealand. The study found that one in seven children and adults in the survey (n=445) had asthma that was markedly out of control, and that almost all of the participants were under-treated according to WHO guidelines and the New Zealand guidelines (Beasley & Masoli, 2003).

Alongside the need for information and best practice guidelines for health professionals, it has also been suggested that consideration should be given the importance of community models of best practice (Ellison-Loschmann & Pearce, 2000). In this context, community guidelines may be useful, for example, provision for Māori community workers to attend asthma update programmes, ongoing training and have input/access to asthma educational materials. While a focus on the medical aspects of asthma is critical to ensure safe management and treatment of asthma, it has been shown that one of the key factors for health management within the Māori community is having Māori health workers who have access to those with illness (Ellison-Loschmann & Pearce, 2000). A Māori nurse working in a hospital situation or for a doctor's practice is only one end of the health continuum. In community settings, it may be the community workers, whom people know and have a previous relationship with, that are best placed to promote and deliver asthma education. While there is now increased choice for consumers in terms of the number of independent Māori providers, the range is still limited and realistically cannot meet the diversity of Māori health needs. Thus, continued effort is necessary to ensure access issues are addressed across all mainstream health services.

Recently the Asthma and Respiratory Foundation of New Zealand (2001) commissioned a report to highlight the burden of asthma in New Zealand calling for recognition by the Ministry of Health that asthma be considered a priority health objective in the New Zealand Health Strategy (Minister of Health, 2000). The Burden of Asthma Report (Asthma and Respiratory Foundation of New Zealand, 2001) reiterates the evidence showing that asthma disproportionately affects Māori and Pacific Island people and those in lower socio-economic groups. Emphasis was placed on eliminating barriers to access, providing culturally appropriate services, ensuring free access to relevant medications, providing an integrated approach to asthma management and the need for increased co-ordination between secondary and primary care services.

A community consultation undertaken in the Wellington area with local asthma providers reported that referral mechanisms for people discharged from hospital back into the community were inadequate (Ellison-Loschmann, 2002). In particular, a breakdown in referral services was noted to be occurring at the weekends. The AWG (New Zealand Guidelines Group, 2001) have recommended that an asthma management team be set up for every hospital and that appropriate follow-up procedures for discharged patients include attendance at an asthma outpatient clinic. The AWG have also identified a need to maintain a high level of communication between primary care providers and Emergency Departments and medical teams if referral for follow-up of all people who attend hospital with asthma is to be ensured (New Zealand Guidelines Group, 2001). The consultation document (Ellison-Loschmann, 2002) also reported that asthma service providers in the Porirua area had seen an improvement in asthma follow-up services over the past 12 months since the establishment of a joint venture between GPs and the Wellington Independent Practice Association (WIPA) to ensure follow-up of any person within three days of discharge from hospital. A universal referral form is used for the three asthma service providers based in Porirua who follow up people from the greater Wellington, Porirua East and greater Porirua areas. Providers are aware however, that there are other difficulties associated with follow-up for those people seen by after-hours services where referral systems back to the community are not necessarily in place. More commonly, people are advised to see their GPs for assessment once their asthma crisis has been stabilised, but a formal follow-up process from after-hours services is yet to be established (Ellison-Loschmann, 2002).

Summary

The Māori Asthma Review (Pomare et al, 1991) enabled some very important information regarding Māori experience of asthma, asthma services, asthma management and asthma information/education issues to be highlighted. Cost of health care was seen as a primary issue and strong support was expressed for reducing costs of GP visits. A clear need for increased patient education and information emerged along with requests for the introduction and use of simple asthma management plans. Strong calls for Māori asthma educators and for more innovative approaches to asthma services were voiced. Significant concerns became apparent during the review regarding Māori asthma sufferers who were hesitant in seeking medical help unless in an emergency situation. There were a combination of reasons

for this relating to perceived attitudes of health workers and power issues associated with people's past interactions and experiences with the health care system.
The Māori Asthma Review (Pomare et al, 1991) team followed up on these issues with a number of recommendations. These included the need for more effective involvement of Māori in the planning and delivery of asthma care; a need for improved access to health care; that Māori be involved in all aspects of the education process relating to asthma and asthma management; that appropriate information and education material about asthma be made available; and that Cultural Safety education be included in the training of health workers.

The Māori Asthma Review indicated that differences in asthma severity in childhood among Māori are due primarily to differential access to asthma health care and asthma services. Factors affecting and influencing access to asthma health services are varied and complex and include differential treatment, cost and location, education and cultural barriers (Pomare et al, 1991). It should be acknowledged that all of these factors are interacting within a particular macro-context of which the structure and deliver of health care (primary health care in particular) and specific government policies play a crucial role.

One of the recognised advantages of the recommendations outlined in the review was that they collectively contributed to the development of an asthma education workforce and facilitated a planned and co-ordinated approach to asthma services for Māori at both local and national levels (Pomare et al, 1991). Unfortunately, this approach did not fit well within a health reforms structure which came into being following the Review's completion (Ellison-Loschmann & Pearce, 2000). Now, more than ten years after the publication of the Māori Asthma Review, the recommendations remain largely unimplemented, and the promise offered by the review remains unfulfilled, despite evidence that the implementation of the review's recommendations would reduce morbidity from asthma in Māori, including hospital admissions and the need for emergency services. The issues raised by the review are relevant not only to asthma, but also more generally to health services and health education. While health care services may have undergone a number of changes in the last decade, Māori health disparities have stayed the same and for some health indices increased.

CHAPTER FOUR

MEASUREMENT ISSUES

Introduction

This chapter briefly reviews the methodological issues relevant to the studies that were carried out for this thesis. It is not intended as a comprehensive review of epidemiologic methods in general, or methods for asthma epidemiology in particular. Rather I focus on issues that are of specific relevance to studies of asthma in Māori, namely issues relating to the measurement of ethnicity and the measurement of asthma prevalence and morbidity. I start by presenting a brief review on approaches to measuring ethnicity in New Zealand, which is crucial in the calculation of health statistics and the ability to monitor change in health status over time. I then discuss definitions of asthma and methods for measuring asthma prevalence and asthma morbidity.

Measuring ethnicity

Inconsistency in the recording of ethnicity information in the census, in death registrations, and in various health data has raised questions regarding the past accuracy of statistical data for Māori, with indications of significant under-reporting of Māori ethnicity for deaths and hospital admissions (Graham et al, 1989; Pomare et al, 1995). The importance of standardisation in the classification of ethnicity was recognised by the Māori Asthma Review (Pomare et al, 1991).

There has been much debate about the status of ethnicity as an analytical variable in epidemiological studies. Some authors have argued that the past use of ethnicity as a proxy for socioeconomic position has been inadequate for a number of reasons including; ignoring socioeconomic differences in health status within ethnic populations (Smaje, 1996; Davey Smith, 2000), masking the impact of social roles and social support on health within ethnic groups (Smaje, 1996) and acting to reduce ethnicity wholly to the explanation of class disadvantage (Nazroo, 1998). Smaje (1996) further argues that to control for socio-economic status using standard indicators is to assume these indicators have the same meaning and operate in the same way uniformly across all ethnic groups which has been shown not to be the case (Williams & Collins, 1995; Davey Smith et al, 2000). Importantly, Smaje (1996) emphasizes the fact that the processes by which material factors affect the health of ethnic groups have both social and historical contexts which must be taken into account. This has implications for understanding contemporary Māori health status in light of historical factors which was previously discussed in Chapter Two.

Methods of data collection construct ethnicity. Davey Smith (1998) uses the example of the 1991 British census imposition of external categories which has lead to many people opting for the “any other ethnic group” or Black-other” choices, as opposed to the previous options of “Black-Caribbean” or “Black-African”. In the 2001 census, more "mixed" ethnicity categories have been used and will result in a marked change in the description of the ethnic composition in Britain. Similarly, in New Zealand, the wording of the census ethnicity question has been shown to affect the way people respond, particularly if there is disagreement about the question (Robson & Reid, 2001). When the Māori population did not accept the government definition of themselves based on degree of blood as a measure, a significant group still chose the Māori option irrespective of their actual blood quantum.

One of the approaches to measuring health status commonly used world-wide is the comparison of mortality and morbidity rates both over time between countries and across populations within countries. Population data is typically obtained from national census surveys, which for New Zealand, are carried out every five years.

Te Rōpū Rangahau Hauora a Eru Pomare (2000) have identified three key issues that underpin the collection of data on Māori using the census. The first relates to the change in 1986 from a biological (using 50% or more Māori blood) and ancestry (descendant of a Māori) definition, to one based on ethnicity. The second issue, relating to the change to self-identified ethnicity, concerns clarification of which group as 'Māori' are represented in statistics. There are three possibilities: those who give Māori as their only ethnic group (sole Māori); those who give Māori as only one of their ethnic groups (mixed Māori); and finally, these two groups can be combined under the category of "Māori ethnic group." The latter is also sometimes referred to as the "prioritized" Māori ethnic group. The third issue is that since 1986, there have been changes to the census ethnicity question itself and the options given for categories by which people may choose to self-identify. Thus, in each of the last four censuses, a different ethnicity question has been asked which has been particularly problematic in terms of interpreting time trend data and assessing the impact of policy changes which occurred through the major re-structuring of health and social services in New Zealand during the 1980s and 1990s (Te Rōpū Rangahau Hauora a Eru Pomare, 2000).

Misunderstandings about the difference between ethnicity and nationality have also been reported. Ethnicity has been defined by Statistics New Zealand (2001) as:

> *"A social group whose members have the following four characteristics: share a sense of common origins, claim a common and distinctive history and destiny, possess one or more dimensions of collective cultural individuality, feel a sense of unique collective solidarity"* (p 6).

A proportion of the New Zealand population has shown their dissatisfaction with the ethnicity question by writing "New Zealander" in the "other" option category. Statistics New Zealand (2001) has defined "New Zealander" as a nationality (the country to which a person belongs by birth or by citizenship) not an ethnicity. They go on to clarify that:

> *"People of the same nationality (eg New Zealanders) can belong to various ethnic groups"* (p 6).

Information from other national data sets is also used for the calculation of health statistics; thus consistency across data sets is also crucial. Mortality data is obtained from the New Zealand Health Information Service (NZHIS) national death registry. In 1995, a change in the methods for collecting ethnicity information for births and deaths occurred. As with the census, death registration forms before 1995 collected information based on a biological definition of Māori.

Information for the death certificate was frequently filled out by the funeral director and available evidence suggests that there has been considerable under-reporting of Māori ethnicity due to incomplete documentation on death certificates (Graham et al, 1989; Te Rōpū Rangahau Hauora a Eru Pomare, 2000). Also importantly, the changes to the recording of ethnicity information for the death certification process was based on the ethnicity question used in the 1996 census which has since been shown to be unreliable for analyses of Māori population time series. The consequent change back to the use of a modified 1991 ethnicity question for census purposes in 2001, while retaining the 1996 census questions on ethnicity for the registration of deaths, means that the two datasets are currently not standardized (C Fowler, personal communication, 3 May 2001).

The underestimation of Māori mortality rates due to the inconsistency in data collection methods between the census and death registration forms has been referred to as "numerator-denominator bias" by Blakely et al (2000). Their work on the New Zealand Census-Mortality Study has now allowed a quantification of the level of underestimation of Māori (and Pacific) death rates through linkage of census and mortality records. In this way, it has been possible to re-calculate mortality rates by ethnicity during the last two decades. This has re-established consistency in the ethnic mortality time series and enables a valid assessment of ethnic inequalities in mortality over the last twenty years to be made (Ajwani et al, 2003).

There is also evidence of significant under-reporting of Māori ethnicity in hospital discharge data (Carr et al, 2002). In hospitals in the early 1980s there was a move from the definition based on biological descent to one based on the concept of ethnicity. From July 1996, hospitals were supposed to be able to allow clients to identify with more than one ethnic group as in the census. Statistics New Zealand (1999) has reported that the recording of ethnicity on hospital admission forms was inconsistent throughout hospitals in New Zealand and that the use of the census question on hospital admission forms had not been implemented nationwide. Furthermore, there is evidence that the majority of hospitals may not be offering multiple ethnicity options to their clients (Statistics New Zealand, 1999).

The collection of ethnicity data in primary health care has been particularly difficult. With the move to population based health initiatives and the establishment of PHOs, the need for improved data quality has been identified, although few general practices have achieved high levels of data completeness with regard to ethnicity (Blakely et al, 2002). The lack of good primary health data for Māori has meant that the monitoring and measurement of access to primary health care services by Māori has been severely hampered as well as limiting the potential of many Māori health providers (Durie, 1994).

Measuring asthma prevalence

Definitions of asthma

Asthma can be loosely defined as "variable airflow obstruction" in contrast with chronic obstructive pulmonary disease which involves fixed airflow obstruction (Pearce et al, 1998). These clinical features were the basis of the WHO (1975) definition:

> *"... a chronic condition characterised by recurrent bronchospasm resulting from a tendency to develop reversible narrowing of the airway lumina in response to stimuli of a level or intensity not inducing such narrowing in most individuals."*

Even when a single definition is accepted, a fundamental problem is that the diagnosis of asthma essentially involves several elements including an overall assessment of the patient's medical history, physical examination, and laboratory test results. Additionally, there are no universally accepted rules for combining the information from these various sources. Thus, a number of problems arise with the use of "diagnosed asthma" in asthma prevalence studies, since the diagnosis of "variable airflow obstruction" usually requires several medical consultations over an extended period. It is therefore not surprising that studies have found asthma to be under-diagnosed in general practice (Mitchell & Asher, 1994) and that the prevalence of physician-diagnosed asthma is substantially lower than the prevalence of asthma symptoms (e.g. Pearce et al, 1993a). One way to address the differences in diagnostic practice would be to use a standardised protocol for asthma diagnosis in prevalence studies. However, in epidemiological studies, clinical examination and diagnosis is not a practical approach because of the time and cost involved. Thus, for practical reasons most epidemiological studies must focus on factors which are symptomatic of asthma but can be assessed on a particular day. The main options in this regard are symptoms and physiological measurements (Pearce et al, 1998). I will focus on symptom questionnaires because they are the most commonly used method of measuring asthma prevalence, and have good validity compared with clinical asthma diagnosis (Pearce et al, 1998).

Symptom questionnaires

Questionnaires on asthma symptoms have been described as the cornerstone of large-scale epidemiological surveys of asthma prevalence (Anderson, 1989). There are several advantages to symptom questionnaires including being inexpensive, being simple to administer to large numbers of participants on a single day and, the ability to discriminate those with variable airflow obstruction that causes noticeable symptoms.

The key issue is that questionnaires should obtain information in a standardised manner on symptoms which are directly related to "variable airflow obstruction". This definition of asthma implies a condition in which symptoms occur from time to time, as distinct from the presence or absence of symptoms on a particular day. Thus, operational definitions of asthma involve specification of the time period during which symptoms may have occurred. In particular "current symptoms" are usually defined as symptoms at any time in the previous 12 months.

A number of symptoms are recognised by physicians as being indicative of asthma including wheezing, chest tightness, breathlessness, and coughing, with or without sputum. Of these, wheezing is regarded as the most important symptom for the identification of asthma in epidemiological studies and most questionnaires have focused on this although it is only in the last decade that standardised questionnaires have been developed for asthma prevalence studies (Pearce et al, 1998)

Figure 4.1 shows the Phase I screening questionnaire for the European Community Respiratory Health Survey (ECRHS) in adults (Burney et al, 1994) which is based on the International Union Against Tuberculosis and Lung Disease (IUATLD) bronchial symptoms questionnaire. The questions relate primarily to asthma symptoms and medication use during the previous 12 months. While it was initially developed in English, the questionnaire has now been translated into many languages, using translation and back-translation.

A similar questionnaire (Figure 4.2) has also been developed for the International Study on Asthma and Allergies in Childhood (ISAAC). The ISAAC questionnaire is based on a number of questionnaires which had previously been used in studies in children in Australia, England, and New Zealand. Once again, the questions primarily relate to asthma symptoms during the previous 12 months i.e. “current symptoms.”

The potential problems of validity associated with the use of standard written questionnaires in studies including a number of populations speaking different languages, and from different cultural backgrounds have been recognised. To address this, a video questionnaire involving the audio-visual presentation of clinical signs and symptoms of asthma was developed as part of the ISAAC study (Shaw et al, 1992).

The video questionnaire involves five sequences of clinical asthma symptoms in young persons: wheezing at rest; wheezing after exercise; waking with wheezing; waking with cough; a severe asthma attack. After each sequence, participants are asked whether their breathing had ever been like that of the person in the video; if so they are asked whether this had occurred in the last year, and whether this had occurred one or more times a month (Figure 4.3). The term asthma or “wheezing” is not mentioned at any stage in the video questionnaire.

These various questionnaires have been used in international surveys of asthma prevalence in adults (Burney et al, 1994) and in children (Asher et al, 1995). I will now describe the latter study, the International Study of Asthma and Allergies in Childhood (ISAAC), in more detail since it is one of the studies that I have conducted in Wellington for this thesis (Chapter Six), and it serves as the basis for the selection of participants for the follow-up study of Māori adolescents with asthma (Chapter Seven).

Figure 4. 1: Phase I screening questionnaire for the European Community Respiratory Health Survey (ECRHS)

TO ANSWER THE QUESTIONS PLEASE CHOOSE THE APPROPRIATE BOX. IF YOU ARE UNSURE OF THE ANSWER PLEASE CHOOSE 'NO'

1. Have you had a wheezing or whistling in your chest at any time in the last 12 months?
   IF 'NO' GO TO QUESTION 2, IF 'YES'
   1.1 Have you been at all breathless when the wheezing noise was present?
   1.2 Have you had this wheezing or whistling when you did not have a cold?

2. Have you woken up with a feeling of tightness in your chest at any time in the last 12 months?

3. Have you been woken by an attack of shortness of breath at any time in the last 12 months?

4. Have you been woken by an attack of coughing at any time in the last 12 months?

5. Have you had an attack of asthma in the last 12 months?

6. Are you currently taking any medicine (including inhalers, aerosols or tablets) for asthma?

7. Do you have any nasal allergies including hay fever?

8. What is your date of birth?

9. What is today's date?

10. Are you male or female?

Figure 4. 2: ISAAC Phase I asthma symptom questionnaire

1. Have you ever had wheezing or whistling in the chest at any time in the past?
Yes [ ] No [ ]

IF YOU ANSWERED "NO" PLEASE SKIP TO QUESTION 6

2. Have you had wheezing or whistling in the chest in the last 12 months?
Yes [ ] No [ ]

IF YOU ANSWERED "NO" PLEASE SKIP TO QUESTION 6

3. How many attacks of wheezing have you had in the last 12 months?
None [ ] 1 to 3 [ ] 4 to 12 [ ] More than 12 [ ]

4. In the last 12 months, how often, on average, has your sleep been disturbed due to wheezing?

Never woken with wheezing [ ]
Less than one night per week [ ]
One or more nights per week [ ]

5. In the last 12 months, has wheezing ever been severe enough to limit your speech to only one or two words at a time between breaths?
Yes [ ] No [ ]

6. Have you ever had asthma?
Yes [ ] No [ ]

7. In the last 12 months, has your chest sounded wheezy during or after exercise?
Yes [ ] No [ ]

8. In the last 12 months, have you had a dry cough at night, apart from a cough associated with a cold or a chest infection?
Yes [ ] No [ ]

Figure 4. 3: ISAAC Phase I asthma video questionnaire

- **The first scene is of a young person at rest.**

(First scene comes on here)

- *Question 1.* Has your breathing been like this at any time in your life?
  If Yes, has this happened in the last year?
  If Yes, has this happened at least once a month?

- **The second scene is of two young people after exercise. One is in a dark shirt, and one is in a light shirt.**

(Second scene comes on here)

- *Question 2.* Has your breathing been like the boy's in the dark shirt following exercise at any time in your life?
  If Yes, has this happened in the last year?
  If Yes, has this happened at least once a month?

- **The third scene is of a young person waking at night.**

(Third scene comes on here)

- *Question 3.* Have you been woken at night like this at any time in your life?
  If Yes, has this happened in the last year?
  If Yes, has this happened at least once a month?

- **The fourth scene is also of a young person waking at night.**

(Fourth scene comes on here)

- *Question 4.* Have you been woken at night like this at any time in your life?
  If Yes, has this happened in the last year?
  If Yes, has this happened at least once a month?

- **The final scene is of another person at rest.**

(Fifth scene comes on here)

- *Question 5.* Has your breathing been like this at any time in your life?
  If Yes, has this happened in the last year?
  If Yes, has this happened at least once a month?

The International Study of Asthma and Allergies in Childhood (ISAAC)

The objectives of the International Study of Asthma and Allergies in Childhood (ISAAC) (Asher et al, 1995) were:

1. To describe the prevalence and severity of asthma, rhinitis, and eczema in children living in different centres, and to make comparisons within and between countries
2. To obtain baseline measures for assessment of future trends in the prevalence and severity of these diseases
3. To provide a framework for further etiologic research into lifestyle, environmental, genetic and medical care factors affecting these diseases

The ISAAC Steering Committee comprises 23 researchers from around the world including Regional Co-ordinators responsible for organising and administering the ISAAC survey, through national co-ordinators, in a large number of ISAAC collaborating centres throughout the world. The major regions are Europe, the Americas, Africa, South East Asia, Asia-Pacific, Eastern Mediterranean and Oceania. Countries within each of these regions may have one or more collaborating centres which apply to the Regional Co-ordinator to be part of the ISAAC collaboration. For each participating centre the survey was conducted within a specified geographical area (ISAAC Centre), for which a map was provided. The ISAAC centre was most commonly a city, but occasionally was a region within a country (e.g. in the United Kingdom), or a whole country (e.g. Costa Rica). Each ISAAC centre was responsible for obtaining their own funding, ethical approval, undertaking of the ISAAC survey and entering of the data for their centre. The ISAAC International Data Centre, based in Auckland, collates and checked all data submitted from the collaborating centres worldwide (ISAAC Steering Committee, 2000). The school selection within the sampling frame was either all schools with pupils within the age group (33% of centres) or a random sample of schools (67% of centres) (ISAAC Steering Committee, 1998a; 1998b)

The ISAAC design comprises three phases. Using core questionnaires, Phase I involved an initial assessment of the prevalence and severity of asthma and allergic disease in two age groups: 6-7 year olds; and 13-14 year olds. The younger age group was chosen to give a reflection of the early childhood years. This is a parent-completed questionnaire. Morbidity from asthma is relatively common among the 13-14 year age group, and at this age children are able to complete the questionnaire themselves and are still in school in most parts of the world. Standardised methods of translation and back-translation of questionnaires were used to attempt to ensure comparability of the findings across different populations and language groups.

ISAAC had a simple and inexpensive design so as to encourage maximum participation from as many centres as possible from around the world (Lai & Pearce, 2001). At the same time, the quality of data was ensured by standardisation of the investigative tools used and a uniform approach to sampling of subjects. Studying the 13-14 year age-group with the written questionnaire was compulsory, whereas additionally including the video questionnaire in this age-group, and studying the 6-7 year age-group with the written questionnaire were both recommended but not compulsory. ISAAC Phase I studied over 700 000 children worldwide involving 155 centres from 56 countries in the 13-14 year age group and 91 centres from 38 countries for the 6-7 year age group (ISAAC Steering Committee, 1998a; 1998b). Data collection for Phase I was carried out during 1992-1995.

Striking variations in the prevalence of asthma symptoms were observed between different populations, with up to 15-fold differences seen between countries and smaller differences within individual countries (ISAAC Steering Committee, 1998b). The prevalence of self-reported wheezing in the previous 12 months (current wheeze) ranged from 2.1-32.2% in the older age group and from 4.1-32.1% in the younger age group. English-speaking countries including Australia, New Zealand, the Republic of Ireland and the United Kingdom, tended to have the highest asthma prevalence in the world with little variation (29.1% - 32.2%) apparent within these countries. While differences in language or labelling of symptoms such as wheeze may contribute partly to the observed international differences, the fact that similar patterns were observed with the video questionnaire suggested that these differences are real. Furthermore, the European Community Respiratory Health Survey (ECRHS) also reported that asthma symptoms were most prevalent in adults of English-speaking countries (ECRHS, 1996). Even amongst populations of similar ethnic origins, the prevalence of asthma symptoms varied widely. Thus, Spanish-speaking children in some Latin American countries such as Peru, Costa Rica and Brazil had more than twice the 12-month period prevalence of wheeze than those in Spain, while Chinese schoolchildren in Hong Kong had 4 times as much the prevalence as their counterparts in Guangzhou, a city in mainland China just 150 miles north of Hong Kong using the same language and having similar climate. It was concluded that these findings strongly support an important role for environmental factors in the causation of asthma (Lai & Pearce, 2001).

In general, the prevalence of asthma symptoms is higher in the more affluent countries than in developing countries. In Europe, asthma prevalence in Western Europe is higher than that in the less affluent countries in Eastern and Southern Europe. A similar pattern was seen in Southeast Asia where the most affluent countries (Japan & Hong Kong) have higher prevalence rates of asthma symptoms than the least affluent countries (China & Indonesia) (Lai & Pearce, 2001).

However, within New Zealand, there was little difference in asthma symptom prevalence by region (Asher et al, 2001), or by ethnicity (Pattemore et al, 2004). Asher et al (2001) confirmed that children and adolescents in New Zealand, as in other English-speaking countries, have a high prevalence of asthma, allergic rhino conjunctivitis and atopic eczema symptoms. There were no differences found in symptom prevalence by region, with the exception of Nelson, which had significantly lower prevalences for all three conditions in the younger age group, compared with the other centres. The authors suggest that this may be a chance finding given that no difference was found between Nelson and the other centres for the older age group and that an earlier national survey of asthma symptom prevalence in adults (Lewis et al, 1997) had found little difference in the prevalence of current asthma in Nelson (12%) compared with other electorates (15%).

Analysis of the New Zealand ISAAC data by ethnicity (Pattemore et al, 2004) found that asthma symptom prevalence amongst 6-7 year olds was highest in Māori children

(27.6%), lowest in Pacific children 22.0%), and intermediate in European children (24.2%). In 13-14 year olds asthma symptom prevalence was similar in Māori and European (30.8% and 31.7% respectively) teenagers whereas Pacific teenagers continued to have a lower prevalence (21.1%). These differences were not as large as those seen across the world in the ISAAC study, but the pattern of differences (Māori greater than European greater than Pacific) were the same as that found in a previous New Zealand study conducted in 1985 (Pattemore et al, 1989).

ISAAC Phase II conducted more intensive investigations in 9-11 year old children. The study modules included standardised questionnaires, with detailed questions on the occurrence and severity of symptoms of asthma, allergic rhinitis and atopic eczema, on their clinical management, and on a broad range of previous and current exposure conditions. In addition, standardised protocols were developed for examination of flexural dermatitis, skin prick testing, bronchial challenge with hypertonic saline, blood sampling for IgE analyses and genotyping, and dust sampling for assessment of indoor exposures to allergens and endotoxin. It was conducted in 30 centres in 21 countries. The findings are not yet published, and Phase II will not be discussed further here since it is Phase I and Phase III that are most relevant to the work presented in this thesis.

ISAAC Phase III is a repeat of Phase I to assess trends in prevalence which is currently underway in a number of countries. Phase III has included two groups of centres; those that took part in Phase I and completed that in accordance with the ISAAC Phase I protocol, and those centres that are participating in ISAAC for the first time. The findings are currently in preparation for publication, and involve approximately 280 centres in 100 countries (N Pearce, personal communication, 1 March 2004). The data collection for the New Zealand arm of ISAAC Phase III was completed in December 2003.

Measuring asthma morbidity

Asthma prevalence studies usually involve a general population sample with asthma symptoms (e.g. wheezing) as the outcome under study. Such studies may also involve questions on asthma severity (e.g. frequency of attacks, waking at night with asthma, severe asthma attacks). Morbidity studies may involve a similar approach where the outcome is a severe event (e.g. a hospital admission for asthma) rather than simply having asthma itself at one point in time. Morbidity studies may also involve studying a group of people with asthma and examining changes in "asthma severity" over time (Pearce & Beasley, 1999). Such studies sometimes also involve other outcomes such as quality of life. The methods used for these various types of morbidity studies will be reviewed briefly here. Once again I will focus on the methods used in this thesis (symptom questionnaires, analyses of asthma hospitalisations and deaths, health service and medication use, quality of life questionnaires), and I will not discuss more invasive methods (e.g. bronchial responsiveness testing) which were not used in these studies either for practical reasons or for reasons of validity.

Severity and frequency of symptoms

The concept of asthma severity can relate to either chronic or acute severity and/or indicate both markers of (lack of) asthma control and markers of the underlying disease severity. Asthma severity has traditionally been defined using clinical features present only in the absence of therapy. With appropriate therapy, many of these features should be absent or minimal, and if they still occur they indicate a lack of asthma control (Cockcroft & Swystun, 1996).

Asthma morbidity studies differ from prevalence studies in that more detailed information regarding the intensity, duration and frequency of symptoms is needed. Pearce et al (1998) have identified symptom questionnaires to be the most straightforward method for assessing asthma morbidity. The questionnaires are repeated over time to measure changes in severity. Questionnaires on symptom frequency and severity generally have similar advantages and disadvantages as those of symptom questionnaires used in prevalence studies.

The key difficulty in using symptom questionnaires is the problem of recall, particularly since recall of symptoms may be affected by participation in a study. One solution is the use of daily asthma symptom diaries. While this may add considerably to the cost of a study, due to the need to monitor the participants and ensure that the diaries are being completed adequately, the use of diaries will nonetheless assist with minimizing the problems of recall (Pearce & Beasley, 1999). Another problem with studying symptoms such as breathlessness, wheezing and chest tightness is that they may be a poor guide to the severity of airflow obstruction in asthma. This is illustrated by studies which have shown that a significant proportion of chronic adult asthmatics may have minimal symptoms despite marked airflow obstruction as measured by the reduction in the FEV_1 from predicted to normal values (Rubinfeld & Pain, 1976).

The problems of recognition and recall of symptoms mean that it is usually preferable to study the frequency of clearly identified symptom "events" rather than more general symptoms such as "wheeze." Pearce et al (1998) propose one approach using the measurement of the frequency of common events such as "waking at night with coughing or wheezing" and "days absent from school due to asthma." While "attacks" of wheezing are also symptom events, they are more difficult to objectively interpret. It is also important to differentiate between nocturnal and daytime asthma symptoms, and these are usually recorded separately due to the marked diurnal variation in airflow obstruction, which characterises asthma. This is particularly important in unstable asthma, in which increasingly frequent and severe nocturnal asthma may develop, despite little change in daytime symptoms and lung function.

Asthma hospitalisations and deaths

Asthma hospitalisations have some advantages as outcome measures in morbidity studies, since they represent a well-defined outcome, and the data are usually available at national and local levels and can be uniformly coded throughout the world (Pearce & Beasley, 1999). Hospitalisation data is commonly used as a measurement of asthma severity which may indicate more a lack of asthma control and/or the severity of a particularly acute exacerbation rather than the underlying chronic severity which should be kept in mind. While they are imperfect measures of asthma morbidity, hospitalisation and mortality rates do nonetheless provide important information as markers of asthma severity (Pearce et al, 1998). However, much like the earlier discussed complexities involved in making a diagnosis of asthma, trends in asthma admission rates are difficult to interpret, being dependent on asthma severity, access to health care and individual patterns of medical practice. Thus, awareness of the potential consequences of a severe asthma attack may influence referral rates to hospitals (Pearce et al, 1998). Asthma mortality data may be similarly useful as an outcome measure in providing information on long term trends in asthma severity or as confirmation of epidemics, such as that which occurred in New Zealand during the 1960s and again in the late 1970s. The difficulty in identifying asthma deaths, as distinct from other obstructive respiratory diseases has been acknowledged (Jackson et al, 1982; Beasley et al, 1990) and for this reason, the use of asthma mortality data is usually confined to the age group 5 to 34 years.

Health service and medication use

Health care utilisation and medication use can be useful outcome measures that reflect both acute and chronic aspects of asthma morbidity. Worsening asthma symptoms requiring an emergency visit to a GP for stabilisation or hospital admission are normally a good indicator of asthma severity, to use the example of a symptom 'event' which was described earlier. Similarly, contact with asthma educators may be a useful outcome measure when considered together with other related information such as number of routine visits to the GP for ongoing medication prescriptions and use of an asthma self-management plan. However, Anderson (1989) has noted that small changes in either self-referral or GP referral patterns can greatly affect health service usage.

For studies of changes in asthma morbidity over time, medication use can also be a useful measure. In particular, the requirement for inhaled beta agonist therapy may be a useful marker of asthma severity if patients are instructed to use this drug treatment as required for the relief of symptoms. The frequency of use of beta agonist drugs can be recorded in a daily diary or in retrospective questionnaires. Other medications which are useful as markers of severe attacks of asthma are the requirement for nebulised bronchodilator and courses of oral steroids. While such medication usage may be influenced by interventions, which modify management, they are good markers of frequency and severity of attacks of asthma in studies of causative factors and pharmacological agents (Pearce & Beasley, 1999).

Information on medication usage and contact with the health services may also be useful when information can be obtained for the period prior to the start of the study and for the period following the formal end of the study. However, a key issue in studies using health service and medication usage as outcome measures is that increased contact with the health services is often an intended or unintended effect of participation in a study.

Quality of life

It has been proposed that, in a chronic disease such as asthma, there are four basic objectives of therapy (Jones et al, 1994): reduced mortality; modification of the natural history of the disease; fewer acute episodes; and a reduction in the impact of the disease on daily life. Quality of life measures are designed to quantify the latter (Pearce & Beasley, 1999). Quality of life questionnaires may also provide further validation of other measures of asthma morbidity, as well as providing an overall composite score that facilitates global consideration of a variety of morbidity measures.

Although general quality of life questionnaires have sometimes been successfully applied in asthma studies, asthma-specific questionnaires are usually considered to be of more value since they focus on areas of function that are of particular relevance to asthma, and they are therefore more responsive to small but important changes (Pearce & Beasley, 1999). Furthermore, most general measures of quality of life tend to produce scores which are severely skewed with a small subgroup of people having very poor scores, whereas in asthma the distributions are reasonably similar to those of the general population and measures developed primarily for life-threatening disease are unlikely to be relevant, since life-threatening asthma is uncommon.

Asthma-specific quality of life questionnaires include: the Asthma Quality of Life Questionnaire (Juniper, 1992) which was developed specifically for use in clinical trials in asthma; the St George's Respiratory Questionnaire (SGRQ) (Jones et al, 1991); the Asthma Quality of Life Questionnaire (Marks et al, 1992); the Living With Asthma Questionnaire (Hyland, 1991); and the Perceived Control of Asthma Questionnaire (PCAQ) (Katz et al, 1997).

The limitations of quality of life measures should also be considered (Jones, 1995). For example, assessing the statistical significance of changes in quality of life measures is relatively easy, but interpreting the magnitude of the observed changes may be more difficult. More importantly, it is possible for asthma patients with a "good quality of life" to experience severe exacerbations or even death. Thus, quality of life measures provide a complement to, rather than a substitute for, other measures of asthma morbidity.

Summary

This chapter has presented an overview of some of the measurement challenges in studying asthma in Māori. Firstly, a definition of asthma which can be practically applied in epidemiological studies examining asthma prevalence is required. Most commonly, symptom questionnaires, which specify the time period during which symptoms have occurred, have been used as they have been shown to have good validity compared with clinical asthma diagnosis. The presence of wheezing is the key symptom for the identification of asthma in prevalence studies. There are now standardised questionnaires which have been developed for prevalence studies which have enabled the collection of data on large numbers of people, with high response rates, that allow valid comparison within and between different population groups and countries.

Secondly, asthma morbidity studies involve studying people who have been identified as having asthma and examining what factors affect their levels of asthma severity. More detailed information regarding the intensity, duration and frequency of symptoms is needed than in asthma prevalence studies. Symptom questionnaires are, again, the most easily applied means, in a large-scale epidemiological study, of gathering information on asthma severity. However, there are problems of recognition and recall of symptoms. To overcome this, the use of symptom events enables a reasonable assessment of asthma morbidity to be made. Additionally, a number of other outcome measures may be used to complement the information gained through asking about symptom events including GP visits, medication use, hospitalisation data and quality of life questionnaires. Consideration must be given to the limitations of the data however, for example where participation in a study may influence the frequency of health service contact.

Finally, the classification of ethnicity underpins the measurement of disparities. There are two major issues which continue to affect the reliability of Māori health statistics. Firstly, a number of studies have concluded that past use of the biological definition of Māori for the collection of both numerator and denominator data, together with inadequate data collection systems, have almost certainly led to the under-estimation of Māori ethnicity on deaths and hospital admissions (Pomare et al, 1995; Te Rōpū Rangahau Hauora a Eru Pomare, 2000). Secondly, since the change in 1986 to the ethnicity definition and subsequent inconsistency in the ethnicity question asked in the census, there has been an interruption in the Māori population time series. Thus, data collected previous to 1986 and that collected since 1986 require the use of different denominators (sole Māori and Māori ethnic group respectively) in order to minimise problems of misclassification and non-comparability.

Some progress has been made in the ability to monitor health disparities by ethnicity through the work of the New Zealand Census-Mortality Study (Blakely et al, 2000). However, a comprehensive improvement to ensure consistent and complete ethnicity data collection both within and across data-sets is required along with quality audits of ethnicity data and a policy environment which demands and resources quality data (Te Rōpū Rangahau Hauora a Eru Pomare, 2000; Blakely & Dew, 2004).

Part One of this thesis has provided a broad overview of some of the key issues relating to Māori health in general, and the study of asthma prevalence and morbidity among Māori. In Part Two I will present the new research conducted for this thesis including studies of descriptive epidemiology on asthma prevalence, morbidity and mortality in Māori (Chapter Five), analyses of the Wellington ISAAC data by ethnicity (Chapter Six) and the follow-up study of asthma in Māori adolescents (Chapter Seven).

CHAPTER FIVE

DESCRIPTIVE EPIDEMIOLOGY OF ASTHMA IN MĀORI

Introduction

In this chapter I consider the descriptive epidemiology of asthma in Māori. There have been very few studies of asthma focussed specifically on Māori, with some earlier studies hampered not only by difficulties in standardisation of methods, but also by definitions of ethnicity, where New Zealand Māori and Pacific Islanders were combined under the category of 'Polynesians' (Pomare et al, 1991).

I first review previous studies of asthma prevalence, morbidity and mortality in Māori. I then present new descriptive studies that have been conducted for this thesis, namely studies of: (i) time trends in asthma mortality and hospitalisations; (ii) seasonal patterns in asthma mortality and hospitalisations; and (iii) regional differences in asthma hospitalisations between Māori and non-Māori (Ellison-Loschmann et al, 2002; Ellison-Loschmann et al, 2004).

Previous Studies

Prevalence

Time trends

Asthma prevalence has been increasing in New Zealand and other countries over the past few decades (Mitchell 1983; Burr 1987). There have been difficulties in both national and international comparisons of prevalence data due to the lack of a standardised approach (Pearce et al, 1998), and more recently developed prevalence surveys, undertaken throughout the 1990's, were designed to overcome this problem (Asher et al, 1995).

A few New Zealand studies conducted during the early eighties, and repeated over time, allow some assessment of time trends in asthma prevalence (Mitchell, 1983; Shaw et al, 1991; Kljakovic, 1991). These studies identified an increasing trend in asthma prevalence in New Zealand consistent with findings from similar studies undertaken overseas during the same period (Burr et al, 1989; Burney et al, 1990).

Children

Studies of asthma prevalence in Māori and non-Māori children and young adults are summarized in Table 5.1. The majority of asthma studies have been carried out amongst school-age children and overall study results indicate asthma prevalence to be

Table 5. 1: Studies of asthma prevalence in Māori and non-Māori children and young adults

Study	Measure of asthma prevalence	Māori prevalence		Non-Māori prevalence	
		%	*(N)*	%	*(N)*
Mitchell (1983)	Asthma questionnaire	12	(90)	14	(686)
Harrison et al (1986)	BHR and past/present symptoms: BHR test and questionnaire	11	(503)	14	(1062)
Pattemore et al (1989)	Wheeze in last year	22	(509)	16	(1084)
	BHR	13		20	
Barry et al (1991)	Wheeze in last year	19	(290)	17	(583)
Shaw et al (1991)	Wheeze in last year	31	(338)	23	(145)
	BHR	14		15	
Robson et al (1993)	Wheeze in last year (video)	38	(375)	36	(1170)
	Wheeze in last year (written)	29		30	
Shaw et al (1994)	Wheeze in last year	21	(428)	22	(247)
D'Souza (1997)	Wheeze in last year (6-7 yrs)	28	(3750)	24	(12193)
	Wheeze in last year (13-14yrs)				
	video	22	(3940)	18	(12392)
	written	31		32	

very similar between Māori and non-Māori. One study found a similar prevalence of asthma between Māori (12.2%), Pacific Islander (14.3%) and European (14.1%) school children using the question: "has this child suffered from asthma" to determine the presence or absence of asthma (Mitchell, 1983). Harrison et al (1986) used a combined bronchial hyper-responsiveness (BHR) test and questionnaire survey of past/present symptoms to measure asthma prevalence in 2000 children aged 8-9 years. Asthma (defined as BHR and past or present symptoms) was present in 13.5% of European children, 6.5% of Pacific Island children and 10.8% of Māori children.

A subsequent study measured the prevalence of asthma symptoms and bronchial reactivity in children using a combination of symptoms and bronchial hyper-responsiveness (BHR) to define asthma. When symptoms were used as the sole measure of asthma, Māori consistently had the highest prevalence rates; for example, for current wheeze, the prevalence for Māori was 22.2% compared with 16.1% and 16.3% in European and Pacific Island children. For prevalence of BHR, Europeans had the highest rate at 20% compared with 13% in Māori and 8.7% in Pacific Islanders (Pattemore et al, 1989).

Another study found no difference in asthma prevalence between 12-year-old European and non-European (predominantly Māori) school children (Barry et al, 1991). Prevalence rates for "current asthma" defined as having had asthma at any time in the past and having wheezed in the past 12 months, were 11.0% and 11.1% for non-European and European children respectively.

Among a population of 12-19 year olds the prevalence of 'current wheeze' (defined as that occurring in the last 12 months) in Māori was higher than that reported by non-Māori (9.8% versus 6.2%), but this difference disappeared when allowance was made for smoking. A similar prevalence for Māori and non-Māori was seen for both BHR and atopy (Shaw et al, 1991). In a repeated prevalence study in this same population comparing responses over a 14-year period between 1975 and 1989, Shaw et al (1990) found the proportion of Māori with asthma or wheeze increased from 27.1% to 36.2% ($p = 0.01$). The increase was less in the non-Māori population (from 24.2% to 27.4%) and was not statistically significant.

During the pilot study for ISAAC, using both written and video questionnaires, little difference was found between 12-15 year old Māori, Pacific Island and other children, in the prevalence of asthma symptoms or in the frequency of severe asthma attacks (Robson et al, 1993). Based on a combination of the first three questions of the video questionnaire, the reported prevalence of wheezing in the last 12 months in Māori was 38.0% compared to 29.0% for the written questionnaire. For the category of 'Other' children, the prevalences were similar, 36.0% and 30.0% respectively, but the rates were lower among Pacific Island students at 31.0% for the video questionnaire and 20.0% for the written questionnaire.

A later study examined risk factors for asthma prevalence in Kawerau children aged 8-13 years. There was no difference in the proportions of Māori and European children with current wheeze or with diagnosed asthma (21.3% versus 21.5% and 23.8% versus 24.3% respectively). Māori children were, however, more likely to have been admitted to hospital with asthma (Shaw et al, 1994).

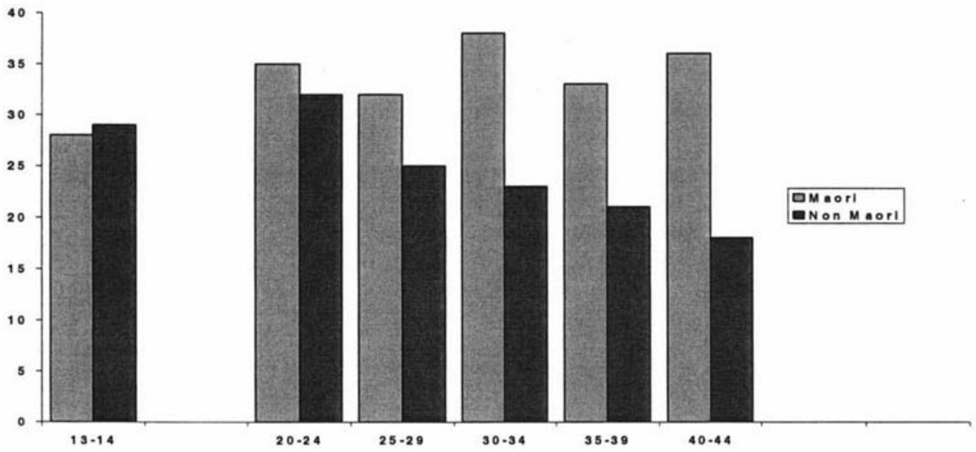
Phase I of the New Zealand arm of the ISAAC study examined the prevalence of asthma amongst two age groups of Māori and non-Māori children, 6-7 years, and 13-14 years (D'Souza, 1997). Prevalence was similar in Māori and non-Māori, but a greater prevalence was seen (although not statistically significant) for Māori and European, compared with Pacific Islanders, when using the video questionnaire. A higher prevalence for all reported asthma symptoms between Māori and Europeans in the younger age group was found, although the differences were small. The same pattern was observed in the older age group of children, for the video, but not for the written sequences.

Adults

One study examining the self-reported prevalence of asthma symptoms in a random population of New Zealand adults aged 20-44 years was undertaken as part of the European Community Respiratory Health Survey (ECRHS). Māori were more frequently symptomatic (35.2%) than European (24.8%), but were no more likely to report an attack of asthma (Māori 9.0% versus European 7.7%) or to be currently receiving treatment (Māori 10.0% versus European 8.6%) (Crane et al, 1994a). Asthma symptoms tended to decline with age in non-Māori, but increase with age in Māori (Figure 5.1).

The reasons for this are unclear, but one possible explanation is that asthma symptoms are being prolonged or exacerbated in Māori because of environmental exposures, such as tobacco smoke, or inappropriate management, for example, the under prescribing of corticosteroids (Pearce et al, 1998). It should be stressed that there is no definitive evidence that improved quality of asthma care will shorten the duration of the condition. However, this hypothesis is plausible since the prolongation or exacerbation of asthma symptoms is likely to extend the period during which a child

Figure 5. 1: Asthma prevalence by age in Māori and non-Māori New Zealanders (Pearce et al, 1998)



or adult is considered to have the condition, and to delay the time when they could be considered to have been relatively symptom free during the previous 12 months (Pearce et al, 1998). In this regard, it is important to stress that asthma symptoms represent a continuum, rather than a clear dichotomy between "having" and "not having" asthma, and if the average severity of the condition is increased (e.g. because of lack of treatment or inappropriate treatment), then it is plausible to expect this to also be reflected in an increase in prevalence (Pearce et al, 1988).

A later, expanded study, examined geographical variation in the prevalence of asthma symptoms in adults age 20-44 years (Lewis et al, 1997). An overall asthma prevalence of 22.1% in Māori compared with 14.3 % in non-Māori was reported. Age related prevalence in non-Māori showed a fall from 31.9% in 20-24 year olds to 21.8% in 40-44 year olds, compared with Māori.

Similar findings were reported in the 1996/97 New Zealand Health Survey amongst 687 people aged between 15 and 44 years who fulfilled the criteria for probable asthma. The survey reported that the rate of probable asthma decreased significantly with age for both non-Māori men and women (p<0.01). The highest asthma prevalence rate was among Māori women, one in five of whom had probable asthma (20.0%, 95% CI 15.9-24.1) followed by Pakeha women (18.7%, 95% CI 16.0-21.4). Around one in six Māori men had probable asthma (16.4%, 95% CI 10.3-22.5) (Ministry of Health, 1999b).

Thus, information from previous studies indicates that asthma prevalence is similar in Māori and non-Māori children, or that any differences were small. Among adults it appears that asthma may be more persistent into adulthood or that late onset asthma could occur more often in Māori. Asthma symptoms appear to be more common amongst adult Māori and to increase with age, in contrast to what occurs in non-Māori adults. This raises issues of possible differences in asthma severity in Māori and non-Māori.

Morbidity

There has been concern about possible increases in asthma severity in the last twenty years with higher admission rates reported in a number of countries (Mitchell, 1985). Trends in admission rates are more difficult to interpret, being dependent not only on asthma severity, but also on access to health care and individual patterns of medical practice. Thus, awareness of the potential consequences of a severe asthma attack may influence referral rates to hospitals (Pearce et al, 1998). Reviews of data on hospital admissions for children and adults both overseas and in New Zealand, however, indicate that the severity of asthma attacks increased throughout the 1980s and that the increases in hospital admissions could not be explained by changes in medical practice alone (Mitchell, 1985; Pomare et al, 1991).

While studies over the last twenty years have consistently reported findings of a similar asthma prevalence between Māori and non-Māori children, studies of asthma morbidity have found that a disproportionately greater number of Māori children experience excess asthma morbidity and a higher hospital admission rate compared to non-Māori (D'Souza, 1997; Pomare et al, 1995; Mitchell & Cutler, 1984; Mitchell & Borman, 1986; Garrett et al, 1989; Pomare et al, 1991).

Mitchell and Cutler (1984) reported paediatric asthma admission rates for Auckland Hospital during 1970-1980 to have significantly increased over that period, with an excess of admissions of Māori and Pacific Islanders. National data to examine hospital admission rates for asthma in 1981 found that the combined Māori and Pacific Islander age-race specific rates were twice as high as the European rates for the two youngest age groups (0-14 years and 15-24 years) and in the oldest age group (65+ years). In the intermediate age groups, the relative risk for Māori/Pacific Islanders was three times that for Europeans (Mitchell & Borman, 1986).

National data for hospital admissions in 1992 showed that asthma was the leading cause for admission of Māori in the 1-4 year age group, and the third leading cause in the 5-14 year age group (Pomare et al, 1995). The 1992 Māori discharge rates for asthma in the 15-24 year age group were reduced by 40.0% from the 1984 rates.

However, the Māori rates were still more than twice those for non-Māori. Māori rates for asthma in the 25-44 year age group were three times that of the non-Māori rate. Respiratory diseases in the 45-64 year and 65+ years age groups were the leading cause of admissions for Māori in 1992, with asthma accounting for 23.0% of those admitted in the 45-64 year age group.

The study by Garrett et al (1989) examining the characteristics of patients using Accident and Emergency (A&E) services and urgent medical services found that relative to the severity of their asthma, Māori and Pacific Island patients used hospital services more frequently than Europeans. They were also less likely to have a GP ($p < 0.01$) or to be referred to hospital by a GP ($p < 0.05$) and were less likely to be on prophylactic medications than European asthmatics. Europeans used urgent medical services three times more often than hospital Accident and Emergency services whereas Māori and Pacific Island people used both services at a similar rate. The authors concluded that deficiencies in medical care along with differing patterns in health system utilisation were contributing to the increased use of hospital services by Māori and Pacific Islanders (Garrett et al, 1989).

Compared with European children, Māori children were more likely to have current frequent nocturnal wheeze (2.8 versus 6.1, OR =2.2, 95% CI 1.0-5.1), current severe wheeze (3.6 versus 6.3, OR =1.8, 95% CI 0.8-3.7) or to have been admitted to hospital with asthma (4.0 versus 9.3, OR = 2.4, 95% CI 1.2-4.8) (Shaw et al, 1994). Cigarette smoking by the primary caregiver was more common for Māori than European. However, when passive smoking was controlled for in the analysis, the relative risk for Māori of current severe wheeze fell only from 1.8 to 1.5 (95% CI 0.7-3.4) and for hospitalisation for asthma, from 2.4 to 2.1 (95% CI 1.0-4.1). Thus, exposure to passive smoking could not entirely account for the differences in asthma severity seen in these children. While there was no difference in the proportion of children diagnosed with asthma taking medications, regular prophylactic medication use was less common in Māori than in European children (Shaw et al, 1994).

Findings from the New Zealand ISAAC Phase I study (D'Souza, 1997) indicated that in the 6-7 year age group, differences in prevalence between Māori and European were more marked for the symptoms reflecting severe asthma (severe wheezing limiting speech and waking with wheezing). This was also true for the 13-14 year age group when the video questionnaire was used as the measure. Thus, while the study found that observed prevalence differences for most asthma symptoms between Māori and European were small and not statistically significant, there were a disproportionate number of Māori children reporting severe asthma symptoms (D'Souza, 1997).

Mortality

International data suggests that during the first half of the twentieth century, asthma mortality rates were stable and asthma deaths relatively rare (Speizer and Doll, 1968; Bauman & Lee, 1990). New Zealand data on mortality rates over the same time period appears to have been similar to that of overseas countries. Beasley et al (1990) examined the trends in asthma mortality in New Zealand between 1908-1986 among non-Māori 5-34 years of age and found that from 1908 until 1940 the death rate was below 0.5 per 100 000 person-years.

During the 1940s and 1950s New Zealand experienced a steady increase in the number of deaths from asthma, again consistent with mortality data from other countries including England and Wales (Jackson et al, 1988; Beasley et al, 1990). This increase appears to have continued up to and throughout the 1980s, although there is some suggestion that the mortality rates are now declining (Beasley et al, 1997). A number of possible explanations for this gradual increase in deaths have been proposed such as changes in disease classification, death certificate validation or diagnostic fashion (Pearce et al, 1998). It has also been suggested that drugs developed to treat asthma over the last fifty years may actually be contributing to increased asthma severity (Sears et al, 1990), and therefore indirectly to asthma mortality. Attention has focussed on the possibility of a class effect of beta-agonists contributing to the gradual increase (Spitzer et al, 1992), but the findings have been inconclusive and debate continues regarding the specific role of fenoterol and isoprenaline in this increase as opposed to a class effect of beta-agonists (Pearce et al, 1998). The other possibility is that changes in environmental causes of asthma may be indirectly contributing to a rise in asthma mortality due to increased asthma prevalence and morbidity.

The New Zealand asthma mortality epidemics of the 1960s and 1970s

In addition to this gradual rise in deaths, New Zealand experienced two asthma mortality epidemics during the 1960s and 1970s. Asthma deaths also increased dramatically in at least five other countries during the 1960's and was linked to new methods of treatment and the introduction of high dose inhaled beta agonist aerosols in 1961 (Pearce & Hensley, 1998). The debate about the role of beta agonists in the 1960s epidemics was not fully resolved when a second asthma mortality epidemic occurred in New Zealand beginning in 1976. The most likely explanation was the introduction and widespread use of another high-dose inhaled beta agonist, fenoterol, and a series of case-control studies found that a high proportion of those people who had died had been prescribed fenoterol (Crane et al, 1989; Pearce et al, 1990; Grainger et al, 1991). Fenoterol was restricted in 1989 and the death rate immediately fell by two-thirds (Pearce et al, 1995).

One study undertaken in Auckland during the asthma mortality epidemic of 1976-1989, found an age standardised annual death rate in 1981-82 of 3.3 per 100 000 amongst Caucasians, 8.4 per 100 000 amongst Māori, and 12.7 per 100 000 in Pacific people (Sutherland et al, 1984). A two-year national asthma mortality study, undertaken in 1981-1983, found death rates for Māori to be considerably higher (18.9 per 100 000) than in Europeans (3.4 per 100 000) with Pacific Islanders in an intermediary position (9.4 per 100 000) (Sears et al, 1985).

Time trends

The first descriptive study that I have conducted for this thesis has involved updating and extending the time trend analyses presented in the Māori Asthma Review by examining data on asthma mortality for Māori and non-Māori between 1962-1998 and asthma hospitalisations during 1976-1998 (Ellison-Loschmann et al, 2002). Analyses are presented for the 5-34 and 35-74 year age groups however I focus on the findings for the 5-34 years since it is well established that the asthma mortality data is most valid for this age-range (Sears et al, 1986).

Methods

Calculation of Māori and non-Māori rates

As was discussed in Chapter Three, there are considerable problems in the calculation of Māori and non-Māori mortality and hospital admission rates, particularly when examining time trends because of changes in both the numerator and denominator information. Prior to 1986, both deaths and census data were based on a biological definition of Māori. From the 1986 census onwards the question became one of self-identification, and for the 1986 and 1991 censuses the "sole Māori" definition is the most appropriate in calculating mortality and hospitalisation rates because this provides reasonable consistency over time (Pomare et al, 1995; Te Rōpu Rangahau Hauora a Eru Pomare, 2000). Changes to ethnicity recording for death certificates in 1995, and further modification of the ethnicity question in the 1996 census means that for numerator and denominator data, the "sole Māori definition is most appropriate prior to 1995, whereas the "Māori ethnic group" definition is most appropriate from 1996 onwards (Sporle & Pearce, 1999).

Mortality and hospitalisation data

Mortality data for all asthma deaths during 1962-1998 were obtained from the New Zealand Health Information Service (NZHIS) national death registry. Mortality data were based on deaths classified using the International Classification of Diseases (ICD) for asthma as the underlying cause of death. Mortality statistics are considered unreliable for the transition period between the old and new death certification process in 1995 thus, no mortality data have been included for that year for either Māori or non-Māori. Asthma hospitalisation data were also obtained from NZHIS and includes all public hospital discharges (due to recovery or death) during 1976-1998. These comprised all discharges with ICD code 493 as the principle diagnosis.

Data analysis

Because the numbers of asthma deaths are small, and the age-specific rates for individual years are unstable, I calculated five-year moving averages for presentation of the mortality and hospitalisation data. Each year's estimate represents a weighted average of five years data (the year is given full weight, and the years ± one year either side are given 2/3 weight and the years at ± two years either side are given 1/3 weight). Weighted estimates were therefore not obtained for the first and last years in each series, and the estimates for the second and second-to-last year's data points are a weighted average of three years data.

Results

Mortality

Figure 5.2 shows time trends in asthma deaths in Māori and non-Māori in the 5-34 and 35-74 year age-groups during 1962-1998. In the 5-34 year age group Māori death rates increased markedly through the mid-1970's and in the peak year of 1979, were twice that of non-Māori (7.4 versus 3.7 per 100 000). The Māori Asthma Review reported these rates to be the highest in the world at that time (Pomare et al, 1991). A significant reduction in mortality rates is seen for both Māori and non-Māori from the late 1980s onwards with similar rates for both groups between 1992-1994. The most recent data for 1996/1997 indicates a rise in Māori death rates while non-Māori rates continue to decline.

In the older age group, the rates were disproportionately higher for Māori (17.22 per 100 000 person-years at risk) compared to non-Māori (7.9 per 100 000). After 1990 the rates reduced significantly for Māori and remained relatively stable between 1994-1997 for both Māori and non-Māori.

Hospitalisations

Figure 5.3 shows time trends in asthma hospitalisations for Māori and non-Māori between 1976-1998. For the 5-34 year age group, the peak hospitalisation year was 1987 with the Māori rate being 878 per 100 000, more than double the rate for non-Māori. In contrast with the fall in mortality rates for Māori after 1979, hospitalisation rates continued to increase up until 1987.

The most recent Māori hospitalisation figures for 1998 show 341 per 100 000, a drop of 61.2% from the 1987 rate. An increased hospitalisation rate was also seen in the 35-74 year age group for Māori, although these were less marked than rates in the younger age group. Comparatively, non-Māori hospitalisation rates, for both age groups, were less variable throughout the same period.

Figure 5. 2: Asthma deaths in Māori and non-Māori 1962-1998 (moving averages) (Ellison-Loschmann et al, 2002)

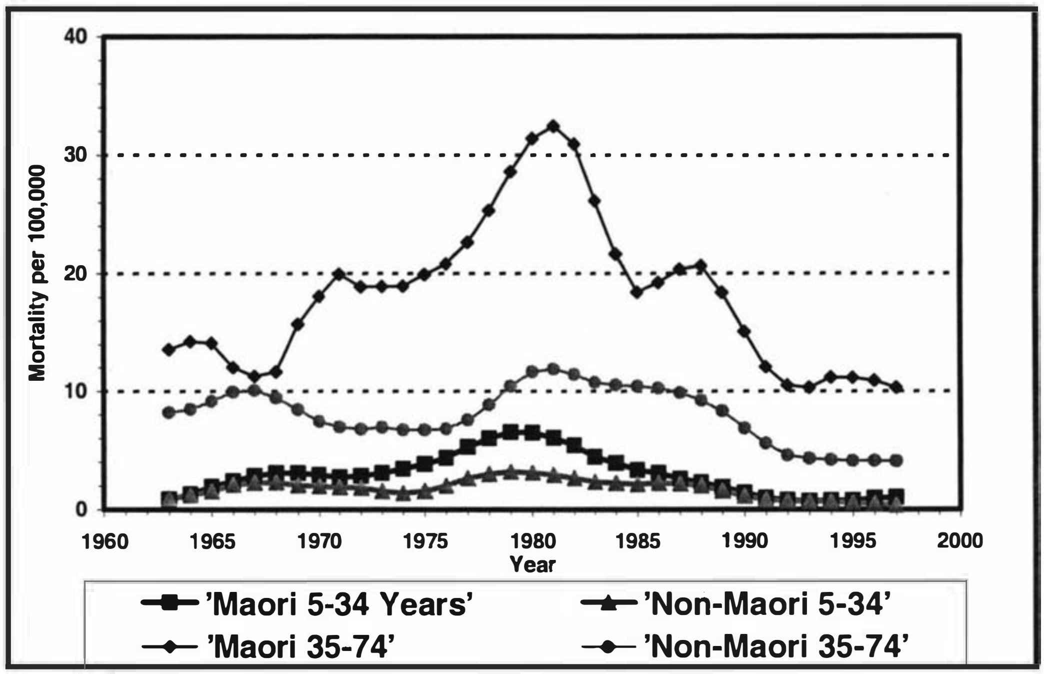
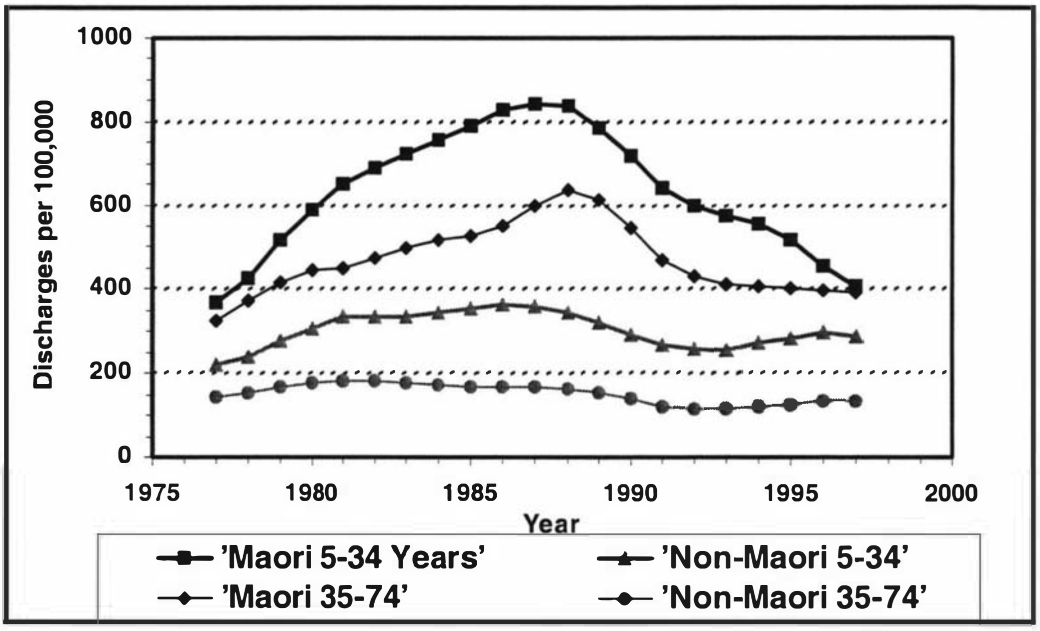


Figure 5. 3: Asthma discharges in Māori/non-Māori 1976-1998 (moving averages) (Ellison-Loschmann et al, 2002)



Discussion

Before discussing these findings, there are some limitations to the data that should be considered. Firstly, as mentioned earlier, the lack of standardized ethnicity data means that the monitoring of Māori health trends is not straightforward (Te Rōpu Rangahau Hauora a Eru Pomare, 2000). Secondly, the hospitalisation data represents episodes of care and may include people who have been hospitalised on more than one occasion. However, this is unlikely to have significantly affected the reported time trends or seasonal patterns for hospitalisations. Finally, the mortality data involves small numbers and age-specific rates for individual years are highly unstable, making analysis difficult. This is minimized to some degree through the presentation of the data as 5 year moving averages.

Despite these limitations, several conclusions can be drawn from the data. Mortality rates, while significantly reduced from the 1970-80s asthma epidemic years, continue to be higher for Māori than non-Māori. Mortality rates for Māori were similar to non-Māori between 1992-95, but diverge again in 1996 and 1997. It is unclear whether this represents a true increase or if it could be attributable to changes in the recording of ethnicity in 1995 which has led to an apparent overall increase in reported Māori mortality (Sporle & Pearce, 1999).

Hospitalisation rates remain disproportionately higher for Māori than for non-Māori. Using hospitalisation data as a measure of asthma severity these findings support previous reports that Māori experience excess asthma morbidity and higher admission rates (Garrett et al, 1989; Pattemore et al, 1989; Shaw et al, 1994). This is in contrast with evidence that asthma prevalence rates are similar in Māori and non-Māori children (Shaw et al, 1991; Robson et al, 1993).

Seasonal differences

The second descriptive study that I have conducted for this thesis involves seasonal patterns of asthma hospitalisations and deaths (Ellison-Loschmann, 2002). These are of interest particularly because it has been suggested that high asthma death rates in summer could be due to problems of access to health care during the holiday period (Weiss, 1990; Kimbell-Dunn et al, 2000).

Methods

Data were obtained from the New Zealand Health Information Service (NZHIS) using the same data sources and methods as previously described for the analyses of time trends. The annual populations at risk for Māori and non-Māori were summed separately for the 1978-1998 period, and multiplied by the fraction of days per year contributed by each month. This figure provided monthly totals of person-years at risk. The total numbers of deaths and hospitalisations for the whole period, for each month, was divided by the monthly person-years at risk to obtain monthly age-specific rates (Kimbell-Dunn et al, 2000).

Results

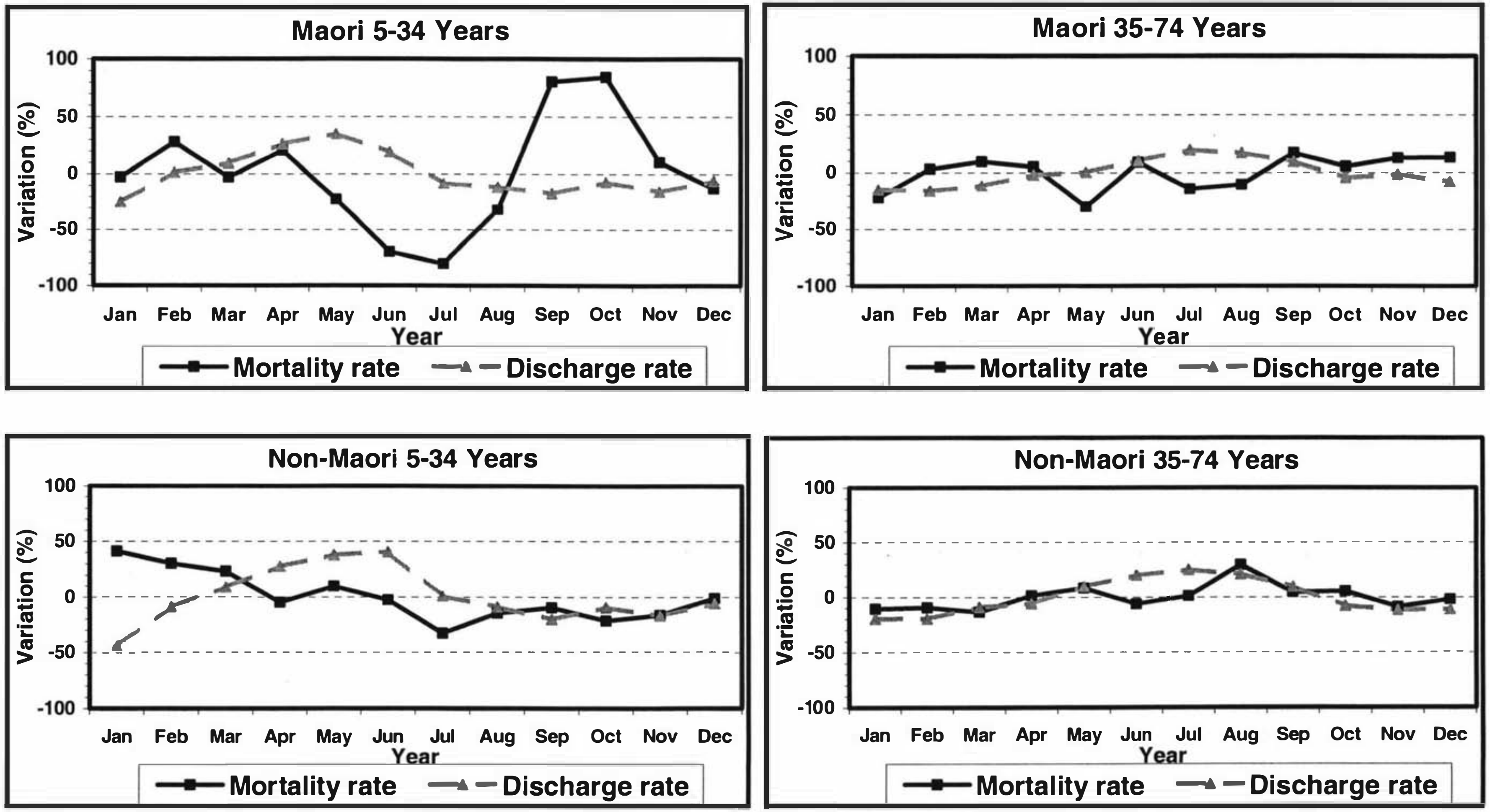
Figure 5.4 shows the seasonal variation of mortality and hospitalisations in Māori and non-Māori 5-34 and 35-74 year age groups between 1978-1998. In the younger age group, different seasonal patterns of mortality and hospitalisation are seen for both Māori and non-Māori. For Māori, deaths were highest in the spring months of September and October and lowest in winter (July) with May being the peak month for hospitalisations. For non-Māori, deaths were highest in summer (January) while hospitalisations peaked in the winter month of June. In the 35-74 year age group for both Māori and non-Māori, the seasonal pattern was less discernible than that found in the younger age groups.

Discussion

A different seasonal pattern in mortality and hospitalisation is seen for both Māori and non-Māori in the 5-34 year age-group. The results for non-Māori are similar to those presented in a previous New Zealand study (Kimbell-Dunn, 2000) and others undertaken overseas showing that asthma mortality peaks during the summer months while the greater number of asthma hospitalisations occur during the winter (Khot & Burn, 1984; Weiss, 1990). A number of reasons for these different patterns have been proposed including seasonal changes precipitating the 'triggering' of an asthma attack, or an altered routine, perhaps associated with holidays when there may be reduced access to health services (Khot & Burn, 1984; Weiss, 1990; Kimbell-Dunn, 2000).

The findings for Māori in the 5-34 year age-group are based on smaller numbers and show greater variation, with high mortality rates in September and October as well as during the summer months. Findings in the 35-74 year age group for both Māori and non-Māori show a similar seasonal pattern which is more consistent with the general increase in hospitalisations and mortality rates seen among older age groups during the

Figure 5. 4: Seasonal variation of mortality and hospitalisations in Māori and non-Māori 5-34 and 35-74 year age groups 1978-1998



winter months (Donaldson & Keatinge, 1997). Apart from the fact that the pollen season is in spring, little is known about the seasonality of other risk factors for asthma in New Zealand but it seems unlikely that seasonal patterns of exposure would differ between Māori and non-Māori.

Regional differences

The third descriptive study that I have conducted for this thesis involves regional differences in asthma hospitalisations between Māori and non-Māori. The Māori Asthma Review suggested that problems of access to health care and asthma education might be particularly acute in rural areas. More generally, there is widespread interest in regional differences and a common belief that asthma prevalence may be higher in rural areas (Holt & Pearce, 2000). Only a few studies have examined regional differences in asthma prevalence or severity in New Zealand, and those that have been conducted have found little evidence of regional differences. The New Zealand arm of ISAAC (Asher et al, 2001) was conducted in six New Zealand centres during 1992-1993. Three of these centres were urban (Auckland, Wellington, Christchurch) and three were "provincial" (Bay of Plenty, Hawke's Bay, Nelson). In general there were no regional differences in asthma symptom prevalence rates with the possible exception of Nelson which had slightly lower prevalence rates in the 6-7 years age-group.

Similar analyses for adults were conducted as part of the New Zealand arm of the European Community Respiratory Health Survey (ECRHS) (Lewis et al, 1997;

D'Souza et al, 1999). The 12 month period prevalence of asthma (defined as woken by shortness of breath, or an attack of asthma in the past year, or current asthma medication) was 15.2% overall but was 22.1% in Māori, 20.6% in Pacific people and 14.3% in "others". This study did not present the regional findings separately for Māori and non-Māori. However, overall there was little urban/rural difference in adult asthma prevalence: the prevalence of asthma was 15.5 % in urban areas, 14.7 % in provincial areas and 13.8 % in rural areas.

In North Island electorates, the highest age and ethnicity-standardised prevalences were found in some of the electorates in the Auckland and Wellington urban regions, although prevalence was also high in some rural electorates including Raglan (18.0%), Horowhenua (18.4%) and Wairarapa (18.4%); the lowest prevalences were found in other rural electorates including King Country (5.5%), Matamata (10.1%) and Rotorua (10.3%). In South Island electorates, the highest prevalences were found in some electorates in the Christchurch and Dunedin urban areas, and the lowest prevalences were again found in rural electorates including Clutha (11.3%), Rangiora (9.5%), and Wallace (9.4%).

Thus, previous studies of asthma prevalence in New Zealand children and adults show little evidence of systematic urban/rural differences in asthma prevalence. The small differences that may exist involve slightly lower prevalence in rural areas but these findings were not reported separately for Māori and non-Māori. I have therefore analysed regional differences in hospitalisations in Māori and non-Māori with particular reference to urban/rural differences. It would have been of interest to also examine regional differences in asthma mortality rates, but the numbers of deaths in the 5-34 year age-group were insufficient for this purpose.

Methods

Hospitalisation data

I studied asthma hospitalisations (defined here as the primary diagnosis, ICD-9 code 493) in Māori and non-Māori during 1994-2000. For the reasons discussed previously, census data using the 'sole Māori' definition have been used in the calculation of the population totals and hospitalisation rates for 1994 and 1995, while the 'Māori ethnic group' definition is used for the 1996-2000 data set. There were only a small number of hospitalisations for Pacific people in many areas, and therefore the Pacific data was excluded from the analyses. Hence, the term "Other" refers to hospitalisation rates for non-Māori/non-Pacific people.

Data analysis

I calculated hospitalisation rates for Māori and non-Māori for each age-group in each of the 73 Territorial Local/Land Authorities (TLA), commonly referred to as Territorial Authorities (TA). TA were chosen as the area unit for analysis because these provided reasonable numbers of hospitalisations, and it was possible to classify them as urban or rural. The boundaries of TA are defined according to "community of interest" considerations including the relevance of the community components to each other and the ability of the unit to effectively service its community (Department of

Statistics, 1992). The 73 TA are comprised of 15 cities and 58 districts. This classification provides a useful proxy for urban versus rural populations. The term "urban" relates to the city authorities whose populations are predominantly urban; the term "rural" relates to those district authorities which have a greater proportion of their population residing in rural and smaller urban areas. These TA-based hospitalisation rates are calculated using the spatially aggregated hospitalisation records which contain the patients resident domicile code (alternatively known as Census Area Units). However, there still remained some TA where hospitalisation or denominator numbers for particular age groups were too small to reliably calculate. The hospitalisation rates used for the map rankings have been standardised to the Māori population (all ages).

I analysed the data separately for Māori and non-Māori in the 0-4, 5-14, 15-34, and 35-74 years age groups. As previously noted analyses of deaths typically focus on the 5-34 year age range, because of the difficulty in confirming asthma diagnoses for deaths outside of these years (Sears et al, 1986). However, there are less problems with the accuracy of data for asthma hospital hospitalisations in other age-groups (Pearce et al, 1998), and I have therefore also included data for the 0-4 years and 35-74 years age-groups, although the focus is on the findings for the 5-34 years age-group.

Results

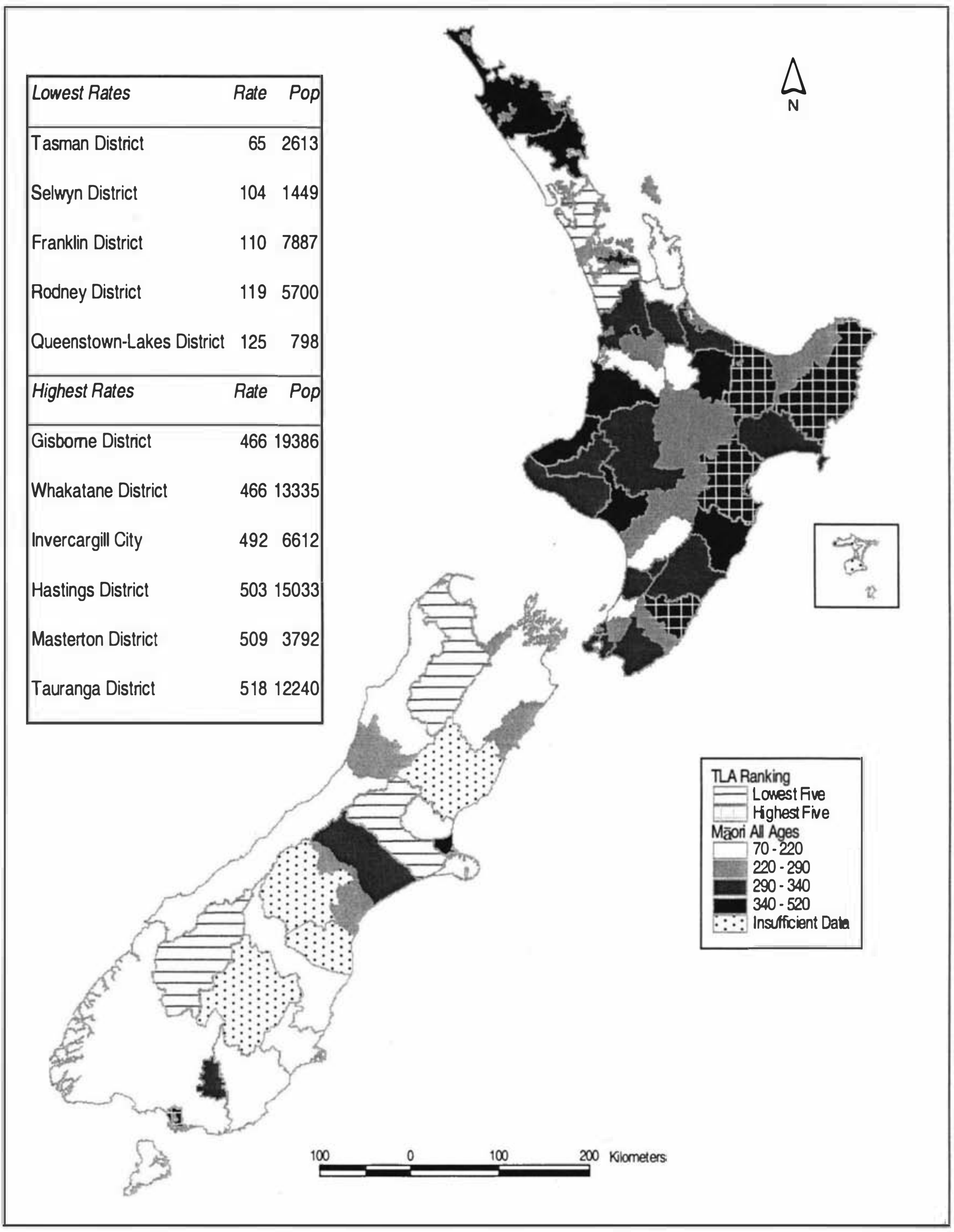
Each of the TA were ranked based on asthma hospitalisation rates for Māori and non-Māori. Figure 5.5 shows the map of overall age-standardized hospitalisation rates (per

10 000 per year) for Māori and lists the territorial authorities with the highest and lowest Māori hospitalisation rates. The highest rates were in Tauranga, Masterton, Hastings, Invercargill, Whakatane and Gisborne; the lowest rates were in Queenstown-Lakes district, Rodney, Franklin, Selwyn and Tasman. Figure 5.6 shows the corresponding patterns for non-Māori.

I also conducted regional analyses separately in Māori and non-Māori for the 0-4, 5-34, 35-74 and 75+ age-groups (not shown in figures). For Māori in the 0-4 years age group the highest rates per 10,000 per year were in Invercargill (1807), Hastings (1750), Masterton (1748), New Plymouth (1584) and Whakatane (1553). In the 5-14 years age group, Invercargill (576), Wanganui (496), Queenstown Lakes (454) and Gisborne (442) recorded the highest hospitalisation rates, for 15-34 year olds, South Wairarapa (338), Kaikoura (326) and Tauranga (325) had the highest rates. Stratford (648), Central Hawke's Bay (631) and Ashburton (476) had the highest asthma hospitalisation rates for the 35-74 year age groups and the Far North (370) and Gisborne (224) recorded the highest rates for 75 or more years age group.

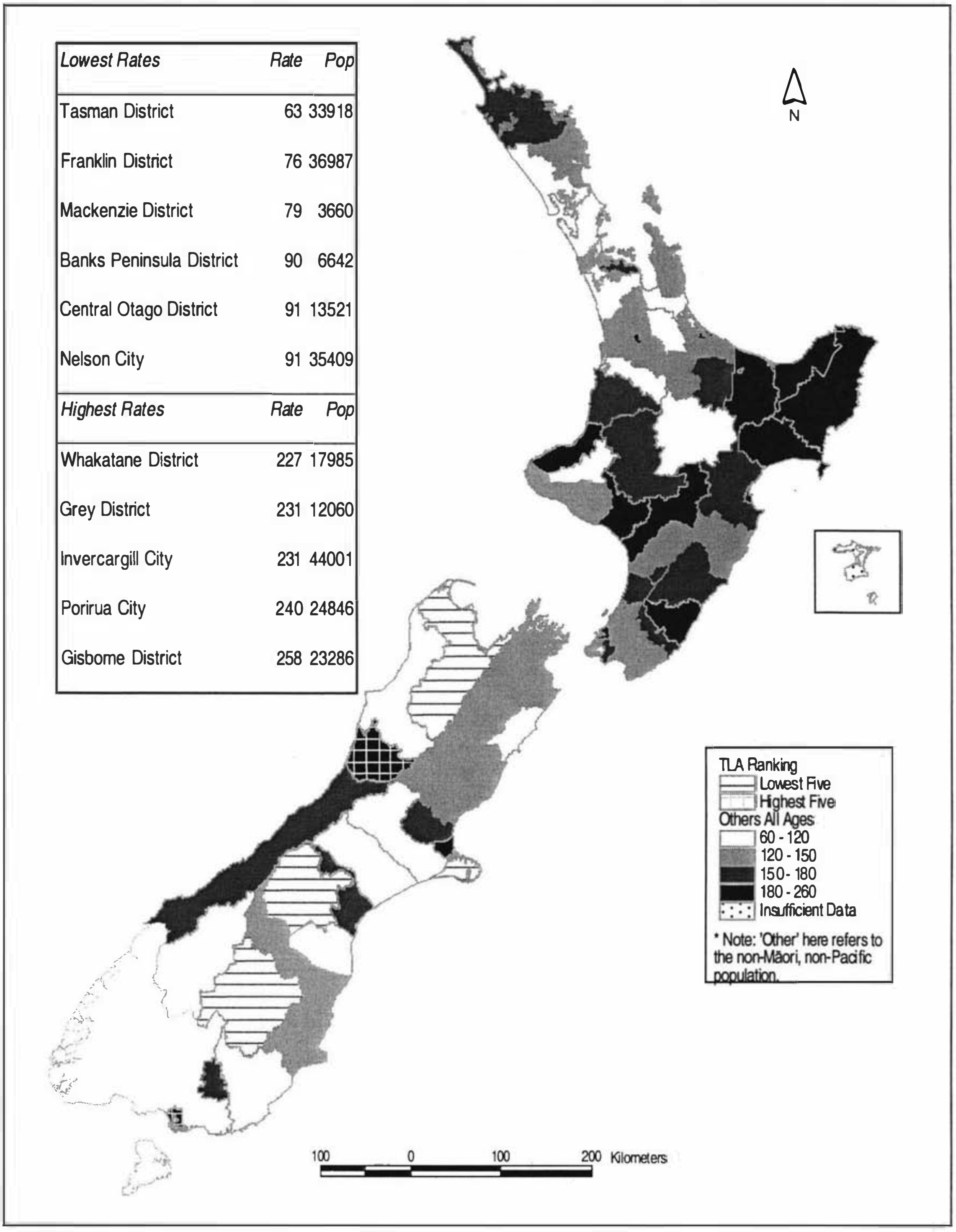
Table 5.2 shows the age-specific hospitalisation rates per 10 000 per year grouped into urban and rural areas. In each age-group the risk of hospitalisation for Māori was higher in rural TAs than in urban TAs whereas the inverse pattern was generally found for non-Māori with the risk of hospitalisation being higher in urban than in rural TAs.

Figure 5. 5: Regional variations in age-standardised Māori asthma hospitalisation rates (per 10 000 per year) 1994-2000



Lowest Rates	*Rate*	*Pop*
Tasman District	65	2613
Selwyn District	104	1449
Franklin District	110	7887
Rodney District	119	5700
Queenstown-Lakes District	125	798
Highest Rates	*Rate*	*Pop*
Gisborne District	466	19386
Whakatane District	466	13335
Invercargill City	492	6612
Hastings District	503	15033
Masterton District	509	3792
Tauranga District	518	12240

Figure 5. 6: Regional variations in age-standardised non-Māori asthma hospitalisation rates (per 10 000 per year) 1994-2000



Lowest Rates	*Rate*	*Pop*
Tasman District	63	33918
Franklin District	76	36987
Mackenzie District	79	3660
Banks Peninsula District	90	6642
Central Otago District	91	13521
Nelson City	91	35409
Highest Rates	*Rate*	*Pop*
Whakatane District	227	17985
Grey District	231	12060
Invercargill City	231	44001
Porirua City	240	24846
Gisborne District	258	23286

Table 5. 2: Hospitalisation rates by age and ethnicity for rural/urban Territorial Authorities (per 10 000)

Age Group			**Relative risk (RR)**	
0-4 yrs	**Māori**	**Other**	**Māori vs Other**	**95% CI**
Rural	1108.7	673.0	1.65	1.58-1.71
Urban	1003.8	805.3	1.25	1.20-1.30
Total	1064.7	745.0	1.43	1.39-1.47
5-14 yrs				
Rural	262.0	222.9	1.17	1.11-1.24
Urban	241.9	245.7	1.00	0.92-1.05
Total	254.1	234.8	1.08	1.04-1.13
15-34 yrs				
Rural	173.3	129.2	1.34	1.27-1.42
Urban	140.0	114.5	1.22	1.15-1.30
Total	157.7	120.1	1.31	1.26-1.37
35-74 yrs				
Rural	259.2	82.8	3.13	2.98-3.29
Urban	244.4	87.7	2.79	2.63-2.95
Total	253.4	85.4	2.97	2.86-3.08
75+yrs				
Rural	305.0	105.3	2.90	2.33-3.60
Urban	94.2	92.1	1.02	0.59-1.77
Total	236.2	98.2	2.40	1.97-2.94

Discussion

I have examined regional patterns of asthma hospitalisations in Māori and non-Māori. There are some limitations to the data that should be noted. Firstly, as with the earlier analyses of time trends in hospitalisation and mortality rates (Ellison-Loschmann et al, 2002), the lack of standardized ethnicity data means that the monitoring of Māori hospitalisation trends is not straightforward, although these problems are unlikely to be of major concern when making regional comparisons during the same time period. Secondly, the hospitalisation data represents episodes of care and may include people who have been hospitalised on more than one occasion. Similarly, many admissions in the 0-4 years and 35-74 years age groups that are classified as asthma will be due to viral infections and chronic obstructive pulmonary disease respectively. However, this is unlikely to have significantly affected the regional patterns presented here.

These analyses confirm previous evidence that asthma hospitalisation rates are higher in Māori than in non-Māori (Ellison-Loschmann et al, 2002), despite the fact that asthma prevalence is similar in Māori and non-Māori children (Ellison-Loschmann & Pearce, 2000). They further indicate that this excess of hospitalisations is higher in rural than in urban areas, although the difference is not large. Non-Māori hospitalisation rates were generally but not consistently higher in urban areas in contrast with the consistent pattern for higher rates in rural areas seen in the Māori population.

These findings are in contrast with previously published data on regional differences in asthma prevalence (Lewis et al, 1997; Asher et al, 2001). The earlier studies showed little or no urban/rural difference, and the small differences that did exist appeared to involve slightly lower prevalences in rural areas. These findings were not published separately for Māori and non-Māori, but it appears unlikely that there would be a significant rural/urban difference in asthma prevalence in Māori when there is no such difference in the population as a whole. Thus, differences in prevalence seem unlikely to account for the higher asthma hospitalisation rates for Māori in rural areas, and it appears more likely that the observed differences reflect differences in asthma exacerbations and disease severity. There were also relatively large differences in admission rates between individual TAs. Although some of these patterns may be due to real differences in prevalence, as noted above the analyses of individual TA often involved small numbers, and there is little evidence of a systematic rural/urban difference in admission rates in non-Māori, or in prevalence rates overall (D'Souza et al, 1999).

Summary

The descriptive analyses presented here, together with the previous research reviewed, indicate a number of key findings with regards to the descriptive epidemiology of asthma in Māori: (i) asthma prevalence is similar in Māori and non-Māori children; (ii) asthma prevalence is greater in Māori than in nonMāori adults; (iii) asthma morbidity is greater in Māori than in non-Māori for both children and adults; (iv) the two asthma mortality epidemics affected Māori disproportionately; (v) asthma mortality has now declined but continues to be higher in Māori than in non-Māori; (vi) for Māori aged 5-34 years, deaths are highest in the spring months of September and October and lowest in winter (July) with May being the peak month for hospitalisations, whereas for non-Māori, deaths are highest in summer (January) while hospitalisations peak in the winter month of June; (vii) Māori hospitalisation rates are generally higher in rural areas, whereas those for non-Māori are higher in urban areas.

These findings generally indicate that Māori are no more likely than non-Māori to develop asthma, but that once they develop the condition, it is more severe, of longer duration, and more likely to result in hospitalisation or death, particularly for Māori in remote areas that are less likely to have access to health care.

CHAPTER SIX

THE ISAAC PHASE III SURVEY

Introduction

As discussed in the preceding chapters, the International Study of Asthma and Allergies in Childhood (ISAAC) has provided valuable information regarding international prevalence patterns and potential risk factors in the development of asthma, rhino conjunctivitis and eczema. New Zealand had six centres participating in the Phase I study during 1992-1993: Auckland, Bay of Plenty, Hawkes Bay, Wellington, Nelson and Christchurch with an overall participation rate of 91% (n= 18, 569) in the 6-7 year age group and 93% (n=19,023) in the 13-14 year age group (Asher et al, 2001). This survey was repeated as ISAAC Phase III in five centres (Auckland, Bay of Plenty, Wellington, Nelson and Christchurch) in New Zealand during 2001-2003.

In the current chapter, the basic ISAAC Phase III findings for the Wellington region are presented and discussed. In particular, data comparing asthma symptoms in Māori and non-Māori 6-7 year olds and 13-14-year olds is presented. The findings of the

ISAAC Phase I and ISAAC Phase III data are also compared to assess trends over time, by ethnicity. An analysis of risk factors for asthma in Māori and non-Māori using data from the ISAAC Phase III environmental questionnaire is also presented.

Methods

The ISAAC Phase I methodology was earlier described in Chapter Four (Pearce et al, 1993a; Asher et al, 1995). Phase III involved repeating Phase I using essentially the same methodology (ISAAC Steering Committee, 2000) to examine trends in prevalence over time.

Questionnaires

As with Phase I, the ISAAC Phase III survey involved very simple one-page core written questionnaires on asthma, rhinitis and eczema symptoms, as well as an asthma video questionnaire (Asher et al, 1995). All questionnaires for 13-14 year olds were self-completed at school, and those for 6-7 year olds were completed by the child's parent or caregiver at home.

Ethnicity was self-determined (or parent/caregiver determined) by the question:

> *"To which ethnic group(s) do you (does your child) belong?"*
>
> *(European/Pakeha, Māori, Pacific Island/specify, Other/specify).*

This is the same question that was used in ISAAC Phase I and is based on the New Zealand 1991 Census question (Statistics New Zealand, 1999). In the analyses presented here, where more than one ethnic group was chosen, these have been classified into a single ethnicity, using a prioritised system of "Māori", then "Pacific", then "Other", and then "European/pakeha". Thus, a respondent ticking both "Māori" and "Pacific Island" would be classified as "Māori", a Pacific Island/Other would be classified as "Pacific Island" and an Other/European/Pakeha would be classified as "Other". The category of "non-Māori" relates to information from respondents who have ticked the "European/pakeha" category only and excludes data from the ethnic groups assigned as "Pacific Island" and "Other". Again, this is the same priority system which was used in the Phase I analyses of the New Zealand data (D'Souza, 1997).

For both age groups, the key question used for assessing asthma symptom prevalence ('current wheeze') (ISAAC Steering Committee, 1998b) was:

> *"Have you (has your child) had wheezing or whistling in the chest in the last 12 months?"*

Asthma severity was assessed by three questions relating to symptoms in the last twelve months: the number of attacks of wheezing; sleep disturbed due to wheezing; and wheezing severe enough to limit speech. The rhinitis questionnaire involved six questions. Allergic rhino conjunctivitis was defined by positive answers to two questions (ISAAC Steering Committee, 1998a).

> *"Have you (or your child) had problems with sneezing or a runny or a blocked nose when you (your child) did not having a cold or flu in the last 12 months"?*
> *If yes, "Was this problem accompanied by itchy-watery eyes"?*

Three key questions were used to assess the prevalence of atopic eczema (ISAAC Steering Committee, 1998a):

> *"Have you (has your child) ever had an itchy skin rash which was coming and going for at least six months"?*
> *If yes: "Have you (has your child) ever had this itchy rash at any time in the last twelve months"?*
> *If yes: "Has this itchy rash at any time affected any of the following places: the folds of the neck, elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes?"*

For the 13-14 year age group, the ISAAC asthma video questionnaire showed five scenes of young people with asthma symptoms: wheezing at rest, wheezing with exercise, waking with wheeze, waking with cough, and a severe asthma attack. For each of the scenes, students were asked whether their breathing had "ever" been like this. If yes: "In the last year?" If yes: "In the last month?"

Phase I only involved the basic symptom questionnaires (written questionnaires for asthma, rhinitis, and eczema as well as the asthma video questionnaire). However, Phase III involved an additional environmental questionnaire for each age group which was developed by the ISAAC Steering Committee (2000). This questionnaire was piloted in each ISAAC region that was represented in Phase I, including Auckland, New Zealand. For the 6-7 year olds the environmental questionnaire included questions on current weight and height, birth weight, breastfeeding, diet, physical activity, TV watching, gas heating and cooking, paracetamol use (in the first year of life and current), antibiotic use in the first year of life, numbers of older and younger siblings, number of people in the home, migration, maternal education, traffic exposure, cat in the home, exposure to farm animals in the first year of life and cigarette smoking. For the older age group, the environmental questionnaire is the same as that used in the younger age group but excludes those questions relating to the first year of life because the questionnaire is self-completed by the 13-14 year olds.

Selection of participants

The ISAAC New Zealand Phase III centres used the same methodology that was used for Phase I, namely:

- The centre should sample from the same sampling frame, but the exact same set of schools should not be aimed for (some schools may be reselected by the sampling process)
- The same age groups should be studied (6-7 year olds and 13-14 year olds)
- The same sample size should be used (3,000 per age-group)
- The same questionnaires should be used (plus the addition of the environmental questionnaire)
- The surveys should be conducted during the same time of year as for Phase I

Thus, the ISAAC Phase III Wellington survey was based on all schools with children in the relevant age-groups in the greater Wellington region (Wellington, Porirua and Lower Hutt). Sampling of each age group was done separately. Once a school had been chosen, using random numbers, all students in the relevant classes were included; e.g. for 13-14 year olds all students in Form III (Year 9) in the selected schools were included.

For the 6-7 year olds, the questionnaire was delivered to the school and distributed by the class teacher to the children who then took them home to be completed by their parent or caregiver. If the survey was not returned within one week, and if the school was agreeable, another questionnaire was sent home on up to two more occasions within one month. However, many schools would not agree to the questionnaire being sent out a second time, and consequently the response rates were relatively low (see 'Results'). The survey was carried out during April-October 2002.

For the 13-14 year olds, a letter and documentation were sent to the Board of Trustees and school principals requesting permission to conduct the survey. Pupils of the appropriate age group (i.e. third formers) were then identified and parents/caregivers sent an information letter offering them the opportunity to decline the participation of their son or daughter in the study. If any eligible students were absent on the day of the survey, the research team returned to the school on up to two more occasions in an attempt to include them where possible. Data collection was conducted during March 2001-March 2002. Ethical approval for the survey was obtained from the Wellington Regional Ethics Committee.

Quality control measures

The ISAAC Steering Committee required the ISAAC Phase III centres to follow all procedures described in the Phase Three Manual and to submit Phase III data to the ISAAC International Data Centre (IIDC) according to the Data Transfer and Coding Section in the Manual (ISAAC Steering Committee, 2000). In addition to data checks carried out by the IIDC, a Phase III Centre Report on all aspects of the methodology was completed by each centre and submitted to the IIDC with the data. The methodological details in the Phase III Centre Report were agreed upon between the IIDC and the collaborators (ISAAC Steering Committee, 2000). This report included information about the sampling frame, sampling methods, participation rates of schools and of children within schools, and the data entry method (and additionally for overseas centres, details of the translation of the questionnaires). A map showing the geographical boundaries of ISAAC was also supplied to ensure that the study areas for Phases I and III were comparable.

Data management and analysis

The information on the questionnaires was entered on to the computer exactly as recorded by the child or parent. The data was double entered, and the two files were compared with any discrepancies checked and corrected. The data was transferred to the ISAAC Phase III International Data Centre (Auckland) using the protocol described in the ISAAC Coding and Data Transfer section in the Phase III Manual (ISAAC Steering Committee, 2000). However, a corrected copy of the data was returned to Wellington and was used for the analyses presented here. The 6-7 year and 13-14 year age groups were analysed separately.

The data analysis used standard methods for analysing prevalence studies (Pearce et al, 1998). For the analyses presented in this chapter, the asthma, rhinoconjunctivitis and eczema symptom prevalences by ethnicity for the Wellington centre were calculated by dividing the number of positive responses to each question by the number of completed questionnaires for the written and video questionnaires separately.

The environmental questionnaire provided an opportunity to estimate the associations of various environmental exposures with symptom prevalence. I examined the association between environmental exposures and current asthma symptom prevalence in both age groups using prevalence odds ratios with adjustment for confounding using logistic regression (Pearce et al, 1998). The data was analysed using both STATA (STATA Statistical Software Release 7.0, 2001) and PC SAS.

Results

Response rates

For the survey in 6-7 year olds, all 153 primary schools in the Wellington region were approached and 85 (56%) agreed to take part in the survey. The participating schools included 5,375 students in the relevant classes of which 2,539 (47%) completed the survey.

For the 13-14 year olds, 19 schools (out of 34 secondary schools in the Wellington region) were selected at random, of which 13 (68%) agreed to participate in the study. The participating schools involved 3,146 third form students, of which 3,052 (97%) participated in the survey.

Participants

Table 6.1 shows the population characteristics for the 6-7 year olds (children); 84 children were outside of the 6-7 years age-range, but (as has been standard practice for ISAAC) they were included in the analyses because they were within 1-2 years of this age-range and they had completed the survey.

Five responders had information missing on gender and another nine responders had not supplied information on age. These respondents have been excluded from the analyses presented in Table 6.1 but are included in all other analyses.

The population characteristics for the 13-14 year olds (adolescents) are presented in Table 6.2. Four hundred and eighty-two respondents were outside of the age range but they had fully completed the questionnaire and their responses have been retained in these analyses.

Five responders did not include information on gender and have been excluded from the analyses presented in Table 6.2 but are included in all other analyses presented in this chapter.

Table 6. 1: Participant characteristics for 6-7 year old children by n (%)

	Non-Māori	Māori	Total
Gender:			
Male	1051(49.5)	200 (48.8)	1251 (49.4)
Female	1073 (50.5)	210 (51.2)	1283 (50.6)
Age (years)			
<6	23 (1.1)	8 (2.0)	31 (1.2)
6	1032 (48.7)	220 (53.8)	1252 (49.5)
7	1020 (48.1)	174 (42.5)	1194 (47.2)
>7	46 (2.2)	7 (1.7)	53 (2.1)
Total	2129	410	2539

Table 6. 2: Participant characteristics for 13-14 year old adolescents by n (%)

	Non-Māori	Māori	Total
Gender:			
Male	1142 (46.7)	291 (47.9)	1433 (46.9)
Female	1298 (53.1)	316 (52.1)	1614 (52.9)
Age (years)			
<13	59 (2.4)	28 (4.6)	87 (2.8)
13	968 (39.6)	285 (47.0)	1253 (41.1)
14	1073 (43.9)	244 (40.2)	1317 (43.2)
>14	345 (14.1)	50 (8.2)	395 (12.9)
Total	2445	607	3052

Table 6.3 and Table 6.4 present the findings for the prevalence of asthma, rhinitis and eczema symptoms in both age-groups. I will report primarily on the findings for asthma symptoms since asthma is the focus of this thesis, but I will refer to the other findings where these are relevant to the interpretation of the asthma findings.

Asthma symptoms

Children

In the 6-7 year age group, Māori had a higher prevalence of all asthma symptoms than non-Māori (Table 6.3). Parent reported prevalence of current wheeze (wheeze in the last 12 months) was 31.0% in Māori compared with 22.6% in non-Māori, and the prevalence odds ratio (POR) for Māori versus non-Māori was 1.42 (95% confidence interval (CI) 1.18-1.71). Māori also had a higher prevalence for severe asthma symptoms: e.g. in the last 12 months Māori children experienced waking at night from wheeze (POR 1.59, 95% CI 1.29-1.97) and severe wheeze (POR 1.29, 95% CI 0.87-1.91) more frequently than non-Māori. Lifetime risk of wheeze was 58.8% in Māori compared with 41.8% in non-Māori children (POR 1.76, 95% CI 1.47-2.11). Overall, there was little difference between the prevalence odds ratios for severe wheeze (range of 1.29 to 1.59) compared to the prevalence odds ratio for any current wheeze (1.42).

Adolescents

As with the younger age group, a higher prevalence for all asthma symptoms was found in Māori adolescents compared to non-Māori (Table 6.4). The prevalence of lifetime wheeze was 60.0% in Māori and 49.3% in non-Māori (POR=1.54, 95% CI 1.28-1.84). Self-reported prevalence of current wheeze (wheeze in the last 12 months) was 39.0% in Māori 13-14 year olds compared with 31.0% in non-Māori (POR=1.43, 95% CI 1.19-1.72). The prevalence of night wheeze was significantly higher in Māori with 21.6% reporting disturbed sleep from wheeze in the last 12 months compared with 13.7% for non-Māori (POR=1.73, 95% CI 1.38-2.16). Night cough was also significantly higher among Māori adolescents compared with non-Māori (41.9% versus 29.0%, POR=1.77, 95% CI 1.47-2.12). Generally the prevalence odds ratios were slightly stronger for severe wheeze (1.57 to 1.77) than for any current wheeze (1.43). For the asthma video questionnaire (Table 6.5) Māori adolescents had a higher prevalence of asthma symptoms than non-Māori in all categories although the differences were not significant. For both Māori and non-Māori, the video questionnaire showed lower prevalences than the written questionnaire for most comparable questions. Generally, the findings were not stronger for severe wheeze (1.28) than for current wheeze at rest (1.66), but they were much stronger for frequent wheeze (e.g. for the first video sequence, the prevalence odds ratio for any wheeze in the last year was 1.66, whereas for any wheeze in the last month the prevalence odds ratio was 2.24). Similar patterns were observed for the other video sequences.

The strongest findings in the younger age group for rhinitis and excema prevalences was for night waking from excema in the last 12 months (POR = 1.41, 95% CI 1.10-1.82). For adolescents, both activities limited by rhinitis symptoms in the last 12 months (POR = 162, 95% CI 1.35-1.94) and nose symptoms ever (POR = 1.54, 95% CI 1.28-1.85) were elevated in Māori teenagers as was night waking with excema in the last 12 months (POR= 1.55, 95% CI 1.16-2.07). Athough some of the PORs were increased, the overall findings were not as strong as for asthma. This lack of difference between Māori and non-Māori suggests that differential reporting is not the explanation for the observed prevalence differences in asthma.

Table 6. 3: Prevalence of asthma, rhinitis and eczema symptoms by ethnicity for 6-7 year olds.

	Māori % (n)	Non-Māori % (n)	POR	95% CI
Asthma symptoms				
Wheezing ever	58.8 (240)	41.8 (1206)	1.76	1.47 – 2.11
Wheezing in last 12 months	31.0 (127)	22.6 (483)	1.42	1.18 – 1.71
≥ 1wheezing attack in last 12 months	30.7 (126)	22.7 (484)	1.40	1.16 – 1.69
Night waking in last 12 months	21.2 (87)	13.2 (280)	1.59	1.29 – 1.97
Severe wheeze in last 12 months	5.1 (21)	3.8 (81)	1.29	0.87 – 1.91
Asthma ever	42.4 (174)	31.0 (659)	1.51	1.26 – 1.80
Exercise wheeze	22.9 (94)	15.7 (334)	1.47	1.19 – 1.80
Night cough in last 12 months	37.8 (155)	29.5 (627)	1.37	1.14 – 1.64
Rhinitis symptoms				
Nose symptoms ever	33.4 (137)	28.7 (611)	1.20	1.00 – 1.45
Nose symptoms in last 12 months	29.0 (119)	25.0 (433)	1.18	0.98 – 1.44
Eyes affected in last 12 months	11.0 (45)	11.7 (250)	0.94	0.71 – 1.25
Activities limited in last 12 months	17.3 (71)	15.6 (331)	1.11	0.88 – 1.40
Hayfever ever	16.4 (68)	17.5 (372)	0.94	0.75 – 1.20
Eczema symptoms				
Rash ever	28.5 (117)	26.7 (569)	1.08	0.88 – 1.31
Rash in last 12 months	23.9 (98)	21.7 (461)	1.11	0.90 – 1.37
Flexural areas ever	23.1 (95)	19.7 (419)	1.19	0.97 – 1.46
Rash cleared in last 12 months	17.3 (71)	15.3 (326)	1.13	0.89– 1.43
Night waking in last 12 months	13.4 (55)	9.2 (196)	1.41	1.10 – 1.82
Eczema ever	43.9 (180)	39.1 (833)	1.18	0.99 – 1.41

Table 6. 4: Prevalence of asthma, rhinitis and eczema symptoms by ethnicity for 13-14 year olds (written questionnaire)

	Māori % (n)	Non-Māori % (n)	POR	95% CI
Asthma symptoms				
Wheezing ever	60.0 (364)	49.3 (1206)	1.54	1.28 – 1.84
Wheezing in last 12 months	39.0 (237)	31.0 (756)	1.43	1.19 – 1.72
≥ 1 wheezing attack in last 12 months	35.9 (218)	28.1 (688)	1.43	1.18 – 1.73
Night waking in last 12 months	21.6 (131)	13.7 (336)	1.73	1.38 – 2.16
Severe wheeze in last 12 months	11.0 (67)	7.3 (179)	1.57	1.17 – 2.10
Asthma ever	43.5 (264)	34.5 (844)	1.46	1.22 – 1.75
Exercise wheeze	47.3 (287)	41.3 (1010)	1.27	1.07 – 1.52
Night cough in last 12 months	41.9 (254)	29.0 (708)	1.77	1.47 – 2.12
Rhinitis symptoms				
Nose symptoms ever	64.4 (391)	54.0 (1321)	1.54	1.28 – 1.85
Nose symptoms in last 12 months	52.2 (317)	45.2 (1104)	1.33	1.11 – 1.59
Eyes affected in last 12 months	28.7 (174)	23.1 (564)	1.34	1.10 – 1.64
Activities limited in last 12 months	41.4 (251)	30.4 (742)	1.62	1.35 – 1.94
Hayfever ever	41.7 (253)	40.3 (984)	1.06	0.89 – 1.27
Eczema symptoms				
Rash ever	24.2 (147)	21.8 (533)	1.15	0.93 – 1.41
Rash in last 12 months	20.4 (124)	16.0 (390)	1.35	1.08 – 1.69
Flexural areas ever	15.8 (96)	13.1 (319)	1.25	0.98 – 1.60
Rash cleared in last 12 months	18.0 (109)	13.6 (332)	1.39	1.10 – 1.77
Night waking in last 12 months	11.4 (69)	7.7 (187)	1.55	1.16 – 2.07
Eczema ever	35.4 (215)	31.4 (768)	1.20	0.99 – 1.44

Table 6. 5: Prevalence of asthma symptoms by ethnicity for 13-14 year olds (video questionnaire)

	Māori % (n)	Non-Māori % (n)	POR	95% CI
Wheezing (while at rest)				
Ever	29.8 (181)	21.7 (531)	1.53	1.26-1.87
In the last year	16.8 (102)	10.8 (265)	1.66	1.30-2.13
In the last month (one or more times)	8.4 (51)	3.9 (96)	2.24	1.58-3.19
Wheezing after exercise				
Ever	30.5 (185)	27.2 (665)	1.17	0.97-1.43
In the last year	18.6 (113)	16.7 (407)	1.15	0.91-1.44
In the last month (one or more times)	9.1 (55)	6.1 (149)	1.54	1.11-2.12
Waking with wheezing				
Ever	12.0 (73)	10.6 (258)	1.16	0.88-1.53
In the last year	6.9 (42)	5.0 (121)	1.43	0.99-2.05
In the last month (one or more times)	2.8 (17)	1.7 (42)	1.65	0.93-2.92
Waking with coughing				
Ever	41.9 (254)	35.0 (855)	1.34	1.12-1.60
In the last year	26.0 (158)	21.6 (528)	1.28	1.04-1.57
In the last month (one or more times)	9.7 (59)	5.5 (134)	1.86	1.35-2.56
Severe attack				
Ever	15.5 (94)	12.6 (307)	1.28	0.99-1.64
In the last year	8.6 (52)	6.4 (156)	1.37	0.99-1.91
In the last month (one or more times)	4.8 (29)	2.3 (55)	2.18	1.38-3.45

Time trends

Children

Table 6.6 presents the Wellington region time trends for ISAAC Phase I and ISAAC Phase III by ethnicity for both the 6-7 year olds and the 13-14 year olds (written questionnaire). For Māori children, there were was a slight increase in the prevalence of current wheeze (2.2%) and small increases in reported night waking, exercise-induced wheeze and night cough in the last 12 months (2.2%, 2.9% and 2.9% respectively). However, there was a marked increase in lifetime wheeze (8.0%) and in 'asthma ever' (3.4%). There was a small reduction in prevalence for all current asthma symptoms including wheezing (-1.7%), night waking (-0.7%), severe wheeze (-0.7%), exercise wheeze (-0.7%) and night cough (-1.0%) in non-Māori children.

Thus, the data generally indicate a slight increase in the prevalence of current wheeze, but a moderate increase in some markers of asthma severity (e.g. night waking) and a larger increase in 'asthma ever' in Māori children. Most measures showed small declines in prevalence in non-Māori children.

Adolescents

For the 13-14 year olds, there were consistent increases over time in the self-reported prevalence of all current asthma symptoms among Māori adolescents taking part in ISAAC Phase I and ISAAC Phase III including wheezing (6.8%), night waking (6.7%), severe wheeze (1.7%), exercise wheeze (5.3%) and night cough (2.6%). There were also marked increases in the prevalence of both 'wheezing ever' and 'asthma ever' (12.7% and 14.5% respectively). For non-Māori 13-14 year olds there was a small decline in the prevalence of current wheeze (-0.6%) and there were increases for 'wheeze ever' (3.6%) and 'asthma ever' (8.7%).

In general however, the changes in prevalence over time in non-Māori are less dramatic. In particular, for current wheeze, non-Māori experienced a decline of 0.6% whereas Māori experienced a substantial increase of 6.8%.

Quite different patterns were observed with the time trend data for the video questionnaire responses, which showed an overall reduction in asthma symptom prevalence (both lifetime and current) in Māori and non-Māori adolescents (Table 6.7). For symptoms of severe asthma there was a 7.0% decrease for Māori 13-14 year olds waking with wheezing and a similar reduction in severe attacks in the last 12 months (7.5%) reported. In non-Māori, the most dramatic differences are seen in the prevalence of symptoms for current exercise wheeze (14.2% decline) and severe asthma attacks (7.9% decline).

Table 6. 6: Wellington region time trends in asthma symptom prevalence by ethnicity comparing ISAAC Phase I findings and ISAAC Phase III findings for the written questionnaire.

Asthma symptoms	Māori 6-7yrs			Non-Māori 6-7 yrs			Māori 13-14 yrs			Non-Māori 13-14 yrs		
	ISAAC I	ISAAC III	CHANGE	ISAAC I	ISAAC III	CHANGE	ISAAC I	ISAAC III	CHANGE	ISAAC I	ISAAC III	CHANGE
	% (n)	% (n)	% (95% CI)	% (n)	% (n)	% (95% CI)	% (n)	% (n)	% (95% CI)	% (n)	% (n)	% (95% CI)
Wheezing ever	50.6 (316)	58.5 (240)	8.0 (1.8,14.2)	41.0 (1315)	41.8 (890)	0.8 (-1.9,3.5)	47.2 (332)	60.0 (364)	12.7 (7.4,18.1)	45.7 (1694)	49.3 (1206)	3.6 (1.1,6.2)
Wheezing in last 12 months	28.8 (180)	30.9 (127)	2.2 (-3.5,7.9)	24.4 (783)	22.6 (483)	-1.7 (-4.1,0.6)	32.2 (227)	39.0 (237)	6.8 (1.6,12.0)	31.5 (1167)	31.0 (756)	-0.6 (-2.9,1.8)
≥ 1 wheezing attack in last 12 months	28.2 (176)	30.7 (126)	2.6 (-3.1,8.3)	23.9 (768)	22.7 (484)	-1.2 (-3.5,1.1)	28.6 (201)	35.9 (218)	7.3 (2.3,12.4)	28.7 (1064)	28.1 (688)	-0.6 (-2.9,1.7)
Night waking in last 12 months	19.1 (119)	21.2 (87)	2.2 (-2.9,7.2)	13.8 (444)	13.2 (280)	-0.7 (-2.6,1.2)	14.9 (105)	21.6 (131)	6.7 (2.4-10.9)	11.7 (435)	13.7 (336)	2.0 (0.3,3.7)
Severe wheeze in last 12 months	6.1 (38)	5.1 (21)	-1.0 (-3.3,1.4)	4.5 (144)	3.8 (81)	-0.7 (-1.8,0.4)	9.4 (66)	11.0 (67)	1.7 -1.7,5.0)	8.1 (300)	7.3 (179)	-0.8 (-2.1,0.6)

Asthma ever	39.1 (244)	42.4 (174)	3.4 (-2.7,9.5)	29.2 (935)	31.0 (659)	1.8 (-0.7,4.3)	29.0 (204)	43.5 (264)	14.5 (9.3,19.7)	25.9 (959)	34.5 (844)	8.7 (6.3,11.0)
Exercise wheeze	20.0 (125)	22.9 (94)	2.9 (-2.2,8.1)	16.4 (525)	15.7 (334)	-0.7 (-2.7,1.3)	41.9 (295)	47.3 (287)	5.3 (-0.1,10.7)	41.1 (1524)	41.3 (1010)	0.2 (-2.3,2.7)
Night cough in last 12 months	34.9 (218)	37.8 (155)	2.9 (-3.1,8.9)	30.4 (976)	29.5 (627)	-1.0 (-3.5,1.5)	39.2 (276)	41.9 (254)	2.6 (-2.8,7.9)	28.6 (1059)	29.0 (708)	0.4 (-1.9,2.7)

Table 6. 7: Wellington region time trends in asthma symptom prevalence by ethnicity comparing ISAAC Phase I findings and ISAAC Phase III findings for the video questionnaire.

	Māori 13-14 yrs			**Non-Māori 13-14 yrs**		
	ISAAC I **% (n)**	**ISAAC III** **% (n)**	**CHANGE** **% (95% CI)**	**ISAAC I** **% (n)**	**ISAAC III** **% (n)**	**CHANGE** **% (95% CI)**
Wheezing (while at rest)						
Ever	36.5 (257)	29.8 (181)	-6.7 (-11.8,-1.6)	29.9 (1110)	21.7 (531)	-8.2 (-10.4,-6.0)
In the last year	23.2 (163)	16.8 (102)	-6.4 (-10,7,-2.1)	18.4 (683)	10.8 (265)	-7.6 (-9.3,-5.8)
In the last month (one or more times)	11.1 (78)	8.4 (51)	-2.7 (-5.9,0.5)	6.2 (231)	3.9 (96)	-2.3 (-3.4,-1.2)
Wheezing after exercise						
Ever	43.3 (305)	30.5 (185)	-12.9 (-18.1,-7.7)	42.3 (1570)	27.2 (665)	-15.2 (-15.5,-12.8)
In the last year	29.1 (205)	18.6 (113)	-10.5 (-15.1,-6.0)	30.9 (1145)	16.7 (407)	-14.2 (-16.3,-12.2)
In the last month (one or more times)	14.1 (99)	9.1 (55)	-5.0 (-8.5,-1.6)	12.9 (480)	6.1 (149)	-6.9 (-8.3,-5.4)
Waking with wheezing						
Ever	27.7 (195)	12.0 (73)	-15.7 (-19.9,-11.5)	19.4 (721)	10.6 (258)	-8.9 (-10.7,-7.1)
In the last year	13.9 (98)	6.9 (42)	-7.0 (-10.3,-3.8)	11.5 (428)	5.0 (121)	-6.6 (-7.9,-5.3)
In the last month (one or more times)	6.7 (47)	2.8 (17)	-3.9 (-6.2,-1.6)	3.8 (140)	1.7 (42)	-2.1 (-2.9,-1.3)

Waking with coughing						
Ever	42.3 (298)	41.9 (254)	-0.5 (-5.9,4.8)	34.6 (1282)	35.0 (855)	0.4 (-2.1,2.8)
In the last year	27.6 (194)	26.0 (158)	-1.6 (-6.4,3.2)	21.9 (812)	21.6 (528)	-0.3 (-2.4,1.8)
In the last month (one or more times)	10.2 (72)	9.7 (59)	-0.5 (-3.8,2.7)	4.4 (163)	5.5 (134)	1.1 (0.0-2.2)
Severe attack						
Ever	27.8 (196)	15.5 (94)	-12.4 (-16.8,-8.0)	23.3 (863)	12.6 (307)	-10.7 (-12.6,-8.8)
In the last year	16.1 (113)	8.6 (52)	-7.5 (-11.0,-4.0)	14.3 (531)	6.4 (156)	-7.9 (-9.4,-6.5)
In the last month (one or more times)	6.0 (42)	4.8 (29)	-1.2 (-3.6,1.2)	4.8 (177)	2.3 (55)	-2.5 (-3.4,-1.6)

Environmental risk factors

Table 6.8 shows the prevalences of various environmental exposures in Māori and non-Māori 6-7 year olds and Table 6.9 shows the corresponding findings for 13-14 year olds.

Children

Overall, the prevalences of the various environmental risk factors for Māori and non-Māori 6-7 year olds were reasonably similar except for the data relating to smoking. Māori children had a higher prevalence of smokers currently in the household than non-Māori with mother (45.0% versus 15.6%), father (45.0% versus 18.0%) and two or more smokers in the home (27.2% versus 8.4%). The prevalence of smoking among Māori women during the first year of their child's life was also high compared to non-Maori (45.7 % versus 15.8%). 73.4% of non-Māori and 40.7% of Maori parents/caregivers reported having no smokers in their households.

For the dietary questions, slightly more non-Māori children were eating meat three or more times per week compared with Māori (80.5% versus 72.9%). There were small differences in weekly seafood and margarine consumption between Māori and non-Māori children (61.2% versus 50.0% and 83.2% versus 68.1% respectively).

Adolescents

As with the younger age groups, the prevalences for most of the environmental factors were similar between Māori and non-Māori adolescents with some exceptions. 44.5% of Māori reported trucks passing by their homes frequently or almost all day compared with 29.0% of non-Māori. Māori adolescents reported that 56.3% of their mothers and 20.6% of their fathers currently smoke (versus 22.7% and 7.7% respectively for non-Māori). The prevalence of two or more smokers in the house for Māori was over twice that of non-Māori (48.4% versus 23.0%).

Associations of environmental risk factors with asthma prevalence

Tables 6.10 and 6.11 show the adjusted prevalence odds ratios for the associations of the various environmental factors with asthma symptoms in children and adolescents.

Children

In 6-7 year olds, the strongest findings for current wheeze in Māori were for: using paracetamol in the first year of life (POR=2.14, 95% CI 0.96-4.78) or currently (POR= 2.19, 95% CI 1.32-3.63); using antibiotics in the first year of life (POR=1.44, 95% CI 0.91-2.28); having two or more younger siblings (POR=0.43, 95% CI 0.22-0.82); and having been breastfed (POR=0.65, 95% CI 0.40-1.05). The strongest associations for non-Māori were for: using paracetamol in the first year of life (POR= 1.87, 95% CI 1.28-2.74) or currently (POR=1.87, 95% CI 1.47-2.39); using antibiotics in the first year of life (POR=2.03, 95% CI 1.60-2.58); and having two or more younger siblings (POR=0.76, 95% CI 0.54-1.08). Parental smoking generally showed only a weak association with current wheeze or lifetime asthma risk (the exception being the findings for Māori children with father smoking and 'asthma ever', POR=1.61, 95% CI 1.07-2.43).

Table 6. 8: Prevalence of environmental variables by ethnicity for 6-7 year olds

Variable	Frequency / Type	Māori %	Non-Māori %
Diet			
Meat	3 or more times/week	72.9	80.5
Seafood	1or more times/week	61.2	50.0
Fruit	3 or more times/week	85.5	86.9
Vegetables	3 or more times/week	76.1	78.7
Pulses	1or more times/week	63.0	64.0
Cereal	3 or more times/week	92.8	95.8
Pasta	3 or more times/week	13.1	9.5
Rice	1or more times/week	82.0	76.4
Butter	1or more times/week	64.0	57.8
Margarine	1or more times/week	83.2	68.1
Nuts	1or more times/week	31.2	28.8
Potato	3 or more times/week	56.4	42.4
Milk	3 or more times/week	83.9	85.9
Eggs	1or more times/week	80.2	74.5
Fastfood	1or more times/week	62.6	56.1
Risk factors			
Exercise	3 or more times/week	53.9	58.0
Television	3 or more hours/day	47.8	24.6
Electric cooking	Yes	89.0	81.9
Gas cooking	Yes	28.0	14.9
Open fire cooking	Yes	0.49	0.19
Electric heating	Yes	45.4	45.0
Gas heating	Yes	50.0	51.0
Fire heating	Yes	33.4	27.9
Antibiotics in first year	Yes	62.6	64.8
Paracetamol in first year	Yes	88.8	88.6
Paracetamol past year	At least once per month	20.1	19.6
Older siblings	0	35.4	33.2
	1	28.4	41.0
	2 +	36.2	25.9
Younger siblings	0	32.1	42.9
	1	45.1	42.4
	2 +	22.8	14.7
Born in New Zealand	Yes	97.3	88.6
Mother has tertiary qualification	Yes	37.8	55.3
Child was breastfed	Yes	76.9	76.9
Trucks pass house	Frequently or almost all day	38.3	24.7
Cat in first year	Yes	38.1	42.3
Dog in first year	Yes	30.9	24.3
Cat now	Yes	48.8	48.9

Variable	**Frequency / Type**	**Māori %**	**Non-Māori %**
Contact with farm animals in first year	Yes	6.7	4.5
Mother had contact with farm animals in first year	Yes	6.4	3.6
Smoking status			
Mother smokes now	Yes	45.0	15.6
Mother smoked in first year	Yes	45.7	15.8
Father smokes now	Yes	45.0	18.0
Smokers in house	0	40.7	73.4
	1	32.1	18.2
	2+	27.2	8.4

Table 6. 9: Prevalence of environmental variables by ethnicity for 13-14 year olds

Variable	Frequency	Māori %	Non-Māori %
Diet			
Meat	3 or more times/week	55.2	53.8
Seafood	1 or more times/week	44.7	45.9
Fruit	3 or more times/week	72.3	73.8
Vegetables	3 or more times/week	60.0	70.7
Pulses	1 or more times/week	64.9	72.6
Cereal	3 or more times/week	73.7	77.2
Pasta	3 or more times/week	62.3	70.5
Rice	1 or more times/week	60.8	76.9
Butter	1 or more times/week	70.0	62.1
Margarine	1 or more times/week	77.3	61.1
Nuts	1 or more times/week	25.5	33.4
Potato	3 or more times/week	59.5	54.0
Milk	3 or more times/week	77.8	72.1
Eggs	1 or more times/week	74.3	73.5
Fastfood	1 or more times/week	81.9	67.6
Risk Factors			
Exercise	3 or more times/week	42.2	41.2
Television	3 or more hours/day	70.8	55.7
Electric cooking	Yes	89.0	84.5
Gas cooking	Yes	23.4	32.6
Open fire cooking	Yes	4.0	3.0
Other fuel cooking	Yes	2.1	1.4
Electric heating	Yes	62.4	68.2
Gas heating	Yes	48.6	41.9
Fire heating	Yes	30.2	29.1
Other fuel heating	Yes	3.5	2.5
Paracetamol past year	At least once per month	55.0	51.5
Older siblings	0	21.1	27.5
	1	25.4	29.9
	2 +	53.5	42.5
Younger siblings	0	20.3	29.2
	1	27.4	35.3
	2 +	47.4	35.5
Born in New Zealand	Yes	96.5	80.0
	No	3.1	19.8
Years lived in NZ	Less than 5 years	0.7	8.9
	5-10 years	1.2	6.3
	More than 10 years	98.2	84.8
Trucks pass house	Frequently or almost all day	44.5	29.0
Mother has tertiary qualification	Yes	12.5	8.2
Cat now	Yes	65.1	58.1
Dog now	Yes	54.5	40.0

Variable	Frequency	Māori %	Non-Māori %
Smoking Status			
Mother smokes	Yes	56.3	22.7
Father smokes	Yes	20.6	7.7
Smokers in house	0	24.4	54.1
	1	27.2	22.9
	2+	48.4	23.0

Table 6. 10: Prevalence of symptoms of asthma in Māori and non-Māori children 6-7 years, and odds ratios for environmental factors that are relevant to asthma (adjusted for age and gender)

Variable	Freqency / Type	Māori						Non-Māori					
		Current wheezing			Asthma ever			Current wheezing			Asthma ever		
		%	OR	95% CI	%	OR	95% CI	%	OR	95% CI	%	OR	95% CI
Diet													
Eating meat past 12 months	Never-once or twice/week	34.2	1.00	-	55.7	1.00	-	23.4	1.00		29.4	1.00	-
	Three or more times/week	30.1	0.82	0.49-1.38	39.0	0.50	0.31-0.83	22.4	0.94	0.75-1.19	31.6	1.10	0.89-1.36
Eating seafood past 12 months	Never-occasional	28.4	1.00	-	45.7	1.00	-	23.0	1.00		30.0	1.00	-
	Once a week or more	32.5	1.21	0.79-1.87	38.1	0.72	0.48-1.08	22.8	0.98	0.80-1.21	31.9	1.09	0.90-1.32
Eating fruit past 12 months	Never-occasional	29.3	1.00	-	48.3	1.00	-	22.9	1.00		32.7	1.00	-
	Three or more times/week	30.2	1.08	0.58-2.00	41.4	0.78	0.44-1.37	22.8	1.01	0.75-1.37	30.8	0.93	0.71-1.23
Eating veges past 12 months	Never-occasional	28.4	1.00	-	42.1	1.00	-	20.9	1.00		29.4	1.00	-
	Three or more times/week	30.4	1.11	0.67-1.85	40.9	0.97	0.61-1.56	23.4	1.18	0.91-1.53	31.5	1.12	0.89-1.41
Eating pulses past 12 months	Never-occasional	30.3	1.00	-	52.8	1.00	-	24.6	1.00		32.3	1.00	-
	Once a week or more	29.3	0.95	0.61-1.49	35.6	0.48	0.32-0.74	22.0	0.89	0.72-1.09	30.1	0.91	0.75-1.10
Eating cereal past 12 months	Never-occasional	41.4	1.00	-	37.9	1.00	-	22.7	1.00		31.8	1.00	-
	Three or more times/week	30.9	0.56	0.26-1.23	42.5	1.10	0.51-2.37	22.7	1.05	0.62-1.77	31.0	0.96	0.61-1.53
Eating pasta past 12 months	Never-occasional	30.2	1.00	-	41.3	1.00	-	22.8	1.00		31.2	1.00	-
	Three or more times/week	30.2	0.95	0.50-1.79	45.3	1.12	0.62-2.02	21.4	0.80	0.63-1.29	30.1	0.96	0.69-1.32

Variable	**Freqency / Type**	**Māori**						**Non-Māori**					
		Current wheezing			**Asthma ever**			**Current wheezing**			**Asthma ever**		
		%	OR	95% CI	%	OR	95% CI	%	OR	95% CI	%	OR	95% CI
Diet													
Eating rice past 12 months	Never-occasional	37.9	1.00	-	46.3	1.00	-	23.7	1.00		35.6	1.00	-
	Once a week or more	28.3	0.66	0.41-1.08	40.7	0.82	0.52-1.31	22.5	0.96	0.73-1.25	30.0	0.78	0.62-0.99
Eating butter last 12 months	Never-occasional	33.8	1.00	-	43.7	1.00	-	24.6	1.00		31.7	1.00	-
	Once a week or more	28.2	0.80	0.51-1.24	41.3	0.97	0.63-1.48	21.4	0.85	0.69-1.05	30.7	0.96	0.79-1.16
Eating margarine last 12 months	Never-occasional	31.8	1.00	-	42.4	1.00	-	22.2	1.00		31.8	1.00	-
	Once a week or more	31.0	0.94	0.53-1.67	42.3	0.95	0.56-1.64	23.2	1.05	0.84-1.31	30.6	0.95	0.78-1.16
Eating nuts past 12 months	Never-occasional	31.0	1.00	-	42.1	1.00	-	23.6	1.00		32.6	1.00	-
	Once a week or more	30.9	1.01	0.63-1.61	42.3	1.02	0.66-1.57	21.0	0.87	0.69-1.10	27.9	0.81	0.65-0.99
Eating potatoes past 12 months	Never-occasional	31.8	1.00	-	47.4	1.00	-	22.7	1.00		30.6	1.00	-
	Three or more times/week	29.5	1.89	0.58-1.36	38.4	0.68	0.45-1.01	23.2	1.02	0.83-1.26	31.8	1.06	0.88-1.28
Drinking milk past 12 months	Never-occasional	46.2	1.00	-	46.2	1.00	-	21.3	1.00		28.0	1.00	-
	Three or more times/week	28.0	0.46	0.27-0.80	41.9	0.85	0.50-1.47	23.0	1.10	0.82-1.49	31.4	1.14	0.87-1.50
Eating eggs past 12 months	Never-occasional	38.0	1.00	-	50.6	1.00	-	23.7	1.00		32.8	1.00	-
	Once a week or more	27.6	0.64	0.38-1.07	39.2	0.66	0.40-1.08	22.4	0.94	0.75-1.19	30.3	0.89	0.72-1.10
Eating fastfood past 12 months	Never-occasional	32.7	1.00	-	44.7	1.00	-	22.9	1.00		31.0	1.00	-
	Once a week or more	29.1	0.83	0.54-1.29	41.0	0.84	0.55-1.27	22.9	1.00	0.81-1.23	31.3	1.00	0.83-1.21

Variable	**Freqency / Type**	**Māori**						**Non-Māori**					
		Current wheezing			**Asthma ever**			**Current wheezing**			**Asthma ever**		
		%	OR	95% CI	%	OR	95% CI	%	OR	95% CI	%	OR	95% CI
Risk factors													
Vigorous exercise	Never-once or twice/week	32.4	1.00	-	45.6	1.00	-	22.4	1.00	-	31.0	1.00	-
	Three or more times/week	27.7	0.78	0.51-1.21	38.5	0.72	0.48-1.08	22.7	0.98	0.80-1.21	31.3	0.99	0.82-1.20
Watching television	Less than 3 hours/day	29.2	1.00	-	39.7	1.00	-	21.9	1.00	-	30.1	1.00	-
	More than 3 hours/day	31.9	1.16	0.76-1.78	44.5	1.25	0.84-1.87	25.2	1.20	0.95-1.52	33.7	1.17	0.94-1.44
Electricity used for cooking	No	26.7	1.00	-	37.8	1.00	-	20.5	1.00	-	28.2	1.00	-
	Yes	31.5	1.24	0.62-2.49	43.0	1.19	0.63-2.25	23.2	1.17	0.89-1.54	31.6	1.16	0.91-1.49
Gas used for cooking	No	31.8	1.00	-	43.0	1.00	-	23.2	1.00	-	31.5	1.00	-
	Yes	26.2	0.78	0.42-1.43	39.3	0.89	0.51-1.55	21.3	0.89	0.71-1.12	29.5	0.91	0.74-1.12
Open fire used for cooking	No	31.1	1.00	-	42.7	1.00	-	22.7	1.00	-	31.0	1.00	-
	Yes	0	0		0.0	0		0	0		25.0	0.69	0.07-7.00
Electrical heating	No	29.0	1.00	-	38.4	1.00	-	22.2	1.00	-	30.8	1.00	-
	Yes	33.3	1.20	0.79-1.82	47.3	1.39	0.93-2.06	23.3	1.07	0.87-1.31	31.2	1.02	0.85-1.23
Gas/kerosene/paraffin heating	No	30.7	1.00	-	41.0	1.00	-	22.7	1.00	-	30.0	1.00	-
	Yes	31.2	1.06	0.70-1.62	43.9	1.20	0.81-1.79	22.7	1.00	0.82-1.23	31.9	1.09	0.91-1.32

Variable	Freqency/ Type	Māori						Non-Māori					
		Current wheezing			Asthma ever			Current wheezing			Asthma ever		
		%	OR	95% CI	%	OR	95% CI	%	OR	95% CI	%	OR	95% CI
Risk factors													
Wood/coal/oil heating	No	33.0	1.00	-	44.0	1.00	-	22.7	1.00	-	30.7	1.00	-
	Yes	27.0	0.76	0.48-1.20	39.4	0.84	0.55-1.28	22.8	1.01	0.80-1.26	31.5	1.04	0.85-1.28
Paracetamol in the first year	No	17.8	1.00	-	22.2	1.00	-	14.5	1.00	-	17.8	1.00	-
	Yes	32.4	2.14	0.96-4.78	45.0	2.65	1.27-5.52	23.7	1.87	1.28-2.74	32.7	2.22	1.57-3.13
Paracetamol in past year	Less than once/month	27.0	1.00	-	38.6	1.00	-	20.3	1.00	-	29.5	1.00	-
	At least once/month	45.0	2.19	1.32-3.63	58.8	2.24	1.36-3.70	32.3	1.87	1.47-2.39	37.4	1.48	1.18-1.86
Antibiotics in the first year	No	25.5	1.00	-	29.7	1.00	-	15.2	1.00	-	19.9	1.00	-
	Yes	33.3	1.44	0.91-2.28	50.2	2.31	1.49-3.58	26.4	2.03	1.60-2.58	36.9	2.33	1.88-2.89
Older siblings	0	28.6	1.00	-	40.5	1.00	-	22.3	1.00	-	32.3	1.00-	-
	1	29.7	1.05	0.59-1.88	33.7	0.75	0.43-1.29	20.9	0.93	0.72-1.20	29.6	0.89	0.71-1.11
	2+	31.0	1.12	0.66-1.92	47.3	1.33	0.81-2.19	24.5	1.16	0.88-1.53	30.5	0.94	0.73-1.22
Younger siblings	0	39.8	1.00	-	43.2	1.00	-	22.7	1.00	-	30.6	1.00	-
	1	26.5	0.56	0.34-0.93	36.8	0.80	0.49-1.29	23.7	1.06	0.84-1.33	31.6	1.05	0.85-1.29
	2+	23.8	0.43	0.22-0.82	47.6	1.19	0.67-2.12	19.2	0.76	0.54-1.08	30.1	0.96	0.72-1.30
Born in New Zealand	No	27.3	1.00	-	18.2	1.00	-	19.0	1.00	-	24.8	1.00	-
	Yes	30.7	1.24	0.33-4.75	42.8	3.71	0.77-17.86	23.1	1.27	0.90-1.78	31.8	1.43	1.05-1.94

Variable	Freqency/Type	Māori						Non-Māori					
		Current wheezing			Asthma ever			Current wheezing			Asthma ever		
		%	OR	95% CI	%	OR	95% CI	%	OR	95% CI	%	OR	95% CI
Risk factors													
Mother has tertiary qualification	No	32.6	1.00	-	45.0	1.00	-	23.6	1.00	-	31.9	1.00	-
	Yes	29.3	0.85	0.54-1.33	40.8	0.84	0.55-1.28	21.8	0.90	0.73-1.11	30.0	0.93	0.77-1.12
Child was breastfed	No	37.6	1.00	-	49.5	1.00	-	21.2	1.00	-	30.2	1.00	-
	Yes	28.4	0.65	0.40-1.05	40.7	0.66	0.42-1.06	23.0	1.12	0.84-1.50	31.1	1.04	0.80-1.34
Frequency of trucks passing	Seldom	29.7	1.00	-	39.0	1.00	-	22.2	1.00	-	31.0	1.00	-
	Most of the day	31.4	1.11	0.72-1.72	47.4	1.50	0.99-2.27	22.9	0.98	0.77-1.24	30.9	1.02	0.82-1.27
Cat in first year	No	32.8	1.00	-	48.8	1.00	-	23.1	1.00	-	31.6	1.00	-
	Yes	27.9	0.79	0.51-1.24	32.5	0.50	0.33-0.76	22.3	0.96	0.78-1.18	30.0	0.93	0.77-1.12
Cat now	No	27.9	1.00	-	42.3	1.00	-	22.9	1.00	-	32.0	1.00	-
	Yes	33.8	1.34	0.88-2.05	42.9	1.04	0.70-1.54	22.7	1.00	0.82-1.23	29.8	0.92	0.76-1.10
Dog in first year	No	35.0	1.00	-	43.9	1.00	-	22.2	1.00.	-	30.1	1.00	-
	Yes	21.6	0.51	0.31-0.84	40.0	0.84	0.55-1.30	24.3	0.14	0.90-1.44	33.5	1.16	0.94-1.44
Dog now	No	30.7	1.00	-	42.1	1.00	-	21.5	1.00	-	29.4	1.00	-
	Yes	31.0	1.00	0.62-1.59	44.0	1.04	0.67-1.62	26.4	1.32	1.05-1.67	35.9	1.33	1.07-1.64
Contact with farm animals in the first year	No	30.2	1.00	-	42.6	1.00	-	22.5	1.00	-	31.0	1.00	-
	Yes	40.7	1.64	0.74-3.66	44.4	1.12	0.51-2.45	28.4	1.39	0.88-2.20	30.5	0.99	0.64-1.56

Variable	Freqency/Type	Māori						Non-Māori					
		Current wheezing			Asthma ever			Current wheezing			Asthma ever		
		%	OR	95% CI	%	OR	95% CI	%	OR	95% CI	%	OR	95% CI
Mother had contact with farm animals	No	30.6	1.00	-	42.2	1.00	-	22.5	1.00	-	30.6	1.00	-
	Yes	38.5	1.46	0.64-3.35	50.0	1.48	0.65-3.35	30.3	1.51	0.91-2.49	34.2	1.18	0.73-1.92
Smoking status													
Mother smoked in first year	No	29.1	1.00	-	39.1	1.00	-	21.9	1.00	-	29.9	1.00	-
	Yes	33.0	1.18	0.77-1.80	46.0	1.30	0.87-1.93	27.6	1.36	1.04-1.77	35.8	1.32	1.03-1.70
Mother smokes now	No	30.2	1.00	-	40.1	1.00	-	22.3	1.00	-	30.4	1.00	-
	Yes	31.9	1.07	0.71-1.65	44.5	1.15	0.77-1.72	25.7	1.21	0.92-1.59	33.6	1.16	0.90-1.50
Father smokes	No	29.4	1.00	-	37.4	1.00	-	22.6	1.00	-	31.1	1.00	-
	Yes	34.1	1.25	0.81-1.93	48.6	1.61	1.07-2.43	23.7	1.08	0.83-1.41	30.1	0.96	0.75-1.23
No. of people in house who smoke	0	30.1	1.00	-	39.7	1.00	-	21.8	1.00	-	31.1	1.00	-
	1	32.5	1.14	0.68-1.91	45.5	1.19	0.90-1.57	25.1	1.30	0.80-2.10	29.5	0.91	0.70-1.18
	2+	31.7	1.08	0.63-1.85	43.3	1.14	0.77-1.68	23.6	1.14	0.69-1.89	33.8	1.16	0.81-1.65

Table 6. 11: Prevalence of symptoms of asthma in Māori and non-Māori adolescents aged 13-14 years, and odds ratios for environmental factors that are relevant to asthma (adjusted for age and gender)

Variable	Freqency / Type	Māori						Non-Māori					
		Current wheezing			Asthma ever			Current wheezing			Asthma ever		
		%	OR	95% CI	%	OR	95% CI	%	OR	95% CI	%	OR	95% CI
Diet													
Eating meat past 12 months	Never-once or twice/week	34.8	1.00	-	40.4	1.00	-	27.4	1.00	-	34.2	1.00	-
	Three or more times/week	42.1	1.34	0.96-1.88	46.0	1.26	0.91-1.74	34.1	1.38	1.16-1.64	35.1	1.04	0.88-1.23
Eating seafood past 12 months	Never-occasional	32.6	1.00	-	38.2	1.00	-	31.7	1.00	-	36.9	1.00	-
	Once a week or more	46.5	1.95	1.38-2.75	50.6	1.70	1.21-2.37	30.3	0.95	0.79-1.13	32.4	0.82	0.69-0.98
Eating fruit past 12 months	Never-once or twice/week	41.1	1.00	-	46.0	1.00	-	30.8	1.00	-	35.7	1.00	-
	Three or more times/week	38.3	0.91	0.63-1.32	42.6	0.86	0.60-1.24	31.2	1.01	0.83-1.24	34.2	0.93	0.77-1.13
Eating veges past 12 months	Never-once or twice/week	39.5	1.00		41.6	1.00	-	25.0	1.00	-	31.4	1.00	-
	Three or more times/week	39.0	0.96	0.68-1.34	44.8	1.13	0.81-1.58	33.4	1.49	1.22-1.82	36.0	1.22	1.01-1.47
Eating pulses past 12 months	Never-occasional	36.6	1.00	-	38.1	1.00	-	27.1	1.00	-	33.5	1.00	-
	Once a week or more	40.1	1.18	0.83-1.69	45.4	1.35	0.95-1.91	32.5	1.30	1.06-1.59	35.0	1.07	0.88-1.30
Eating cereal past 12 months	Never-once or twice/week	37.7	1.00	-	43.5	1.00	-	34.9	1.00	-	36.2	1.00	-
	Three or more times/week	39.7	1.10	0.75-1.62	43.5	0.99	0.68-1.44	30.0	0.81	0.66-0.99	34.3	0.92	0.76-1.13
Eating pasta past 12 months	Never-occasional	34.1	1.00	-	43.1	1.00	-	27.3	1.00	-	32.2	1.00	-
	Once a week or more	42.1	1.40	0.99-1.98	43.9	1.04	0.74-1.45	32.6	1.26	1.04-1.54	35.7	1.16	0.96-1.40

Variable	Freqency / Type	Māori						Non-Māori					
		Current wheezing			Asthma ever			Current wheezing			Asthma ever		
		%	OR	95% CI	%	OR	95% CI	%	OR	95% CI	%	OR	95% CI
Diet													
Eating rice past 12 months	Never-occasional	38.9	1.00	-	41.1	1.00	-	32.4	1.00	-	37.9	1.00	-
	Once a week or more	39.0	0.98	0.70-1.38	44.7	1.17	0.83-1.63	30.7	0.90	0.74-1.11	33.7	0.83	0.68-1.01
Eating butter last 12 months	Never-occasional	40.0	1.00	-	44.0	1.00	-	32.0	1.00	-	37.9	1.00	-
	Once a week or more	38.4	0.95	0.66-1.37	42.8	0.96	0.67-1.37	30.4	0.94	0.79-1.13	32.6	0.80	0.67-0.95
Eating margarine last 12 months	Never-occasional	39.4	1.00	-	47.7	1.00	-	31.1	1.00	-	36.3	1.00	-
	Once a week or more	38.8	0.96	0.65-1.44	42.0	0.80	0.54-1.18	30.9	1.00	0.84-1.19	33.6	0.89	0.75-1.06
Eating nuts past 12 months	Never-occasional	37.0	1.00	-	41.3	1.00	-	29.7	1.00	-	35.4	1.00	-
	Once a week or more	44.5	1.41	0.97-2.06	49.0	1.36	0.94-1.97	33.3	1.19	1.00-1.43	33.5	0.92	0.77-1.11
Eating potatoes past 12 months	Never-once or twice/week	37.8	1.00	-	42.9	1.00	-	27.2	1.00	-	32.6	1.00	-
	Three or more times/week	39.9	1.08	0.77-1.51	43.8	1.04	0.75-1.45	34.3	1.41	1.18-1.68	36.4	1.19	1.00-1.40
Drinking milk past 12 months	Never-once or twice/week	35.9	1.00	-	39.7	1.00	-	28.9	1.00	-	36.4	1.00	-
	Three or more times/week	40.0	1.24	0.82-1.87	44.7	1.23	0.82-1.83	31.8	1.17	0.96-1.42	34.0	0.91	0.75-1.09
Eating eggs past 12 months	Never-occasional	37.9	1.00	-	46.2	1.00	-	31.9	1.00	-	37.8	1.00	-
	Once a week or more	39.9	1.12	0.76-1.66	42.8	0.86	0.59-1.27	30.7	0.94	0.77-1.15	33.5	0.83	0.69-1.01
Eating fastfood past 12 months	Never-occasional	36.2	1.00	-	40.0	1.00	-	31.8	1.00	-	34.9	1.00	-
	Once a week or more	39.4	1.21	0.78-1.89	44.3	1.19	0.78-1.84	30.8	0.97	0.81-1.17	34.8	1.00	0.84-1.20

Variable	Freqency / Type	Māori						Non-Māori					
		Current wheezing			Asthma ever			Current wheezing			Asthma ever		
		%	OR	95% CI	%	OR	95% CI	%	OR	95% CI	%	OR	95% CI
Risk factors													
Vigorous exercise	Never-once or twice/week	35.7	1.00	-	45.0	1.00	-	28.3	1.00	-	33.2	1.00	-
	Three or more times/week	43.4	1.41	1.01-1.97	41.0	0.85	0.61-1.18	35.1	1.40	1.18-1.67	36.5	1.17	0.99-1.39
Watching television	Less than 3 hours/day	33.7	1.00	-	45.7	1.00	-	30.7	1.00	-	34.3	1.00	-
	More than 3 hours/day	41.4	1.42	0.98-2.05	42.8	0.89	0.62-1.26	31.5	1.05	0.88-1.25	35.1	1.04	0.88-1.24
Electricity used for cooking	No	40.3	1.00	-	43.3	1.00	-	29.2	1.00	-	34.0	1.00	-
	Yes	38.9	0.95	0.56-1.60	43.5	1.02	0.61-1.70	31.2	1.11	0.87-1.41	34.6	1.04	0.82-1.30
Gas used for cooking	No	38.3	1.00	-	42.8	1.00	-	31.0	1.00	-	34.9	1.00	-
	Yes	41.6	1.17	0.80-1.72	45.8	1.13	0.77-1.65	30.7	0.98	0.81-1.18	33.8	0.95	0.80-1.14
Open fire used for cooking	No	38.8	1.00	-	43.7	1.00	-	30.8	1.00	-	34.4	1.00	-
	Yes	45.8	1.33	0.58-3.05	37.5	0.77	0.33-1.81	32.9	1.14	0.69-1.89	38.4	1.19	0.74-1.93
Electrical heating	No	40.8	1.00	-	43.4	1.00	-	33.1	1.00	-	36.0	1.00	-
	Yes	38.0	0.89	0.63-1.24	43.5	1.01	0.72-1.41	29.9	0.85	0.71-1.03	33.8	0.90	0.76-1.08
Gas/kerosene/paraffin heating	No	35.3	1.00	-	43.3	1.00	-	27.7	1.00	-	32.7	1.00	-
	Yes	43.1	1.37	0.99-1.91	43.7	1.02	0.74-1.41	35.4	1.42	1.19-1.69	37.1	1.21	1.02-1.43
Wood/coal/oil heating	No	40.1	1.00	-	43.2	1.00	-	30.2	1.00	-	33.3	1.00	-
	Yes	36.6	0.87	0.61-1.25	44.3	1.05	0.74-1.49	32.7	1.14	0.94-1.37	37.5	1.20	1.00-1.44
Paracetamol in past year	Less than once/month	28.3	1.00	-	40.0	1.00	-	22.9	1.00	-	28.7	1.00	-
	At least once/month	46.7	2.17	1.53-3.08	45.8	1.29	0.92-1.80	38.4	2.09	1.75-2.51	39.7	1.65	1.39-1.97

Variable	Freqency / Type	Māori						Non-Māori					
		Current wheezing			Asthma ever			Current wheezing			Asthma ever		
		%	OR	95% CI	%	OR	95% CI	%	OR	95% CI	%	OR	95% CI
Risk factors													
Older siblings	0	39.1	1.00	-	41.4	1.00	-	32.0	1.00	-	40.9	1.00	-
	1	35.7	0.86	0.53-1.41	43.5	1.10	0.68-1.78	31.4	0.98	0.78-1.23	35.0	0.78	0.63-0.97
	2+	41.4	1.09	0.70-1.68	44.7	1.16	0.75-1.77	30.2	0.94	0.75-1.17	29.7	0.61	0.49-0.76
Younger siblings	0	43.9	1.00	-	48.0	1.00	-	33.2	1.00	-	33.7	1.00	-
	1	35.5	0.69	0.43-1.12	44.0	0.84	0.53-1.35	30.6	0.90	0.73-1.12	38.1	1.21	0.99-1.49
	2+	40.5	0.86	0.56-1.32	40.1	0.74	0.49-1.14	29.2	0.84	0.67-1.05	31.6	0.91	0.73-1.14
Born in New Zealand	No	31.6	1.00	-	47.4	1.00	-	23.1	1.00	-	23.1	1.00	-
	Yes	39.4	1.45	0.54-3.90	43.3	0.87	0.35-2.19	32.8	1.68	1.33-2.12	37.4	2.02	1.60-2.55
Years lived in New Zealand	Less than five	50.0	1.00	-	75.0	1.00	-	18.4	1.00	-	15.6	1.00	-
	Five to ten	71.4	2.94	0.22-38.68	71.4	0.87	0.52-14.4	28.6	1.83	1.12-3.00	29.9	2.37	1.43-3.93
	Ten+	38.6	0.68	0.09-4.96	43.0	0.26	0.27-2.56	32.4	2.21	1.54-3.16	36.9	3.24	2.21-4.73
Mother has tertiary qualification	No	38.9	1.00	-	46.0	1.00	-	23.1	1.00	-	30.8	1.00	-
	Yes	36.8	0.91	0.49-1.67	36.8	0.67	0.36-1.23	27.0	1.33	0.84-2.09	33.5	1.14	0.75-1.74
Frequency of trucks passing	Seldom	38.0	1.00	-	45.4	1.00	-	30.7	1.00	-	35.2	1.00	-
	Most of the day	40.4	1.08	0.77-1.51	41.5	0.85	0.61-1.18	32.1	1.07	0.88-1.29	33.4	0.92	0.77-1.11
Cat now	No	35.7	1.00	-	41.9	1.00	-	28.0	1.00	-	31.7	1.00	-
	Yes	40.8	1.24	0.88-1.76	44.3	1.10	0.78-1.55	33.0	1.26	1.06-1.51	36.7	1.25	1.05-1.48

Variable	**Freqency / Type**	**Māori**						**Non-Māori**					
		Current wheezing			**Asthma ever**			**Current wheezing**			**Asthma ever**		
		%	**OR**	**95% CI**	**%**	**OR**	**95% CI**	**%**	**OR**	**95% CI**	**%**	**OR**	**95% CI**
Dog now	No	35.2	1.00	-	42.1	1.00	-	28.6	1.00	-	31.9	1.00	-
	Yes	42.6	1.37	0.98-1.90	44.7	1.11	0.80-1.53	34.5	1.33	1.12-1.59	38.8	1.36	1.14-1.61
Smoking status													
Mother smokes	No	39.0	1.00	-	39.0	1.00	-	29.7	1.00	-	33.0	1.00	-
	Yes	39.2	0.99	0.71-1.38	46.8	1.39	1.00-1.94	35.0	1.30	1.06-1.59	39.5	1.34	1.10-1.63
Father smokes	No	33.3	1.00	-	40.2	1.00	-	22.4	1.00	-	29.2	1.00	-
	Yes	38.4	1.21	0.69-2.10	41.6	1.08	0.63-1.85	26.6	1.26	0.83-1.92	34.6	1.26	0.86-1.86
No. of people in house who smoke	0	41.2	1.00	-	42.6	1.00	-	29.1	1.00	-	33.6	1.00	-
	1	32.1	0.64	0.40-1.03	42.4	0.99	0.63-1.55	32.5	1.17	0.95-1.45	37.7	1.20	0.97-1.47
	2+	41.8	0.97	0.65-1.46	44.6	1.09	0.73-1.63	33.6	1.24	1.00-1.53	33.5	1.00	0.81-1.23

Table 6. 12: Prevalence odds ratios for symptoms of asthma in Māori and non-Māori children 6-7 years adjusted for age and gender and for various environmental risk factors

Variable	Frequency / Type	Current wheeze				Asthma ever			
		Adjusted for age and gender		Adjusted for age, gender and all other variables in the table		Adjusted for age and gender		Adjusted for age, gender and all other variables in the table	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Ethnicity	Māori	1.55	1.23-1.96	1.54	1.19-1.98	1.67	1.34-2.07	1.65	1.30-2.10
Paracetamol in the first year	At least once/month	1.93	1.37-2.71	1.48	1.04-2.12	2.32	1.70-3.16	1.75	1.27-2.42
Paracetamol in past year	Yes	1.93	1.55-2.39	1.82	1.46-2.27	1.59	1.30-1.96	1.43	1.16-1.77
Antibiotics in the first year	Yes	1.88	1.52-2.31	2.23	1.35-3.68	2.31	1.91-2.80	2.13	1.75-2.60
Older siblings	0 1 2+	1.00 0.92 1.17	- 0.73-1.16 0.91-1.49	1.00 0.82 0.99	- 0.64-1.05 0.76-1.29	1.00 0.85 1.03	- 0.69-1.05 0.83-1.29	1.00 0.80 0.93	- 0.64-1.00 0.73-1.19
Younger siblings	0 1 2+	1.00 0.97 0.74	- 0.79-1.19 0.55-1.00	1.00 0.85 0.59	- 0.67-1.06	1.00 1.02 1.08	- 0.84-1.24 0.84-1.40	1.00 0.89 0.87	- 0.72-1.10 0.66-1.15
Child was breastfed	Yes	0.95	0.74-1.21	1.04	0.81-1.34	0.91	0.73-1.14	1.01	0.81-1.28
Mother smokes	Yes	1.29	1.04-1.61	1.10	0.85-1.42	1.31	1.07-1.60	1.08	0.85-1.37
Father smokes	Yes	1.24	1.00-1.54	1.08	0.84-1.38	1.21	0.99-1.48	1.07	0.85-1.34

Table 6. 13: Prevalence odds ratios for symptoms of asthma in Māori and non-Māori children 13-14 years adjusted for age and gender and for various environmental risk factors

Variable	Frequnecy/ Type	Current wheeze				Asthma ever			
		Adjusted for age and gender		Adjusted for age, gender and all other variables in the table		Adjusted for age and gender		Adjusted for age, gender and all other variables in the table	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Ethnicity	Māori	1.47	1.22-1.77	1.40	1.14-1.72	1.47	1.23-1.77	1.43	1.17-1.74
Meat	Three or more times a week	1.37	1.18-1.60	1.33	1.13-1.56	1.09	0.94-1.26	1.07	0.92-1.25
Seafood	Once a week or more	1.09	0.93-1.27	1.09	0.92-1.28	0.96	0.82-1.11	0.97	0.83-1.13
Vigorous exercise	Three or more times a week	1.40	1.20-1.64	1.35	1.15-1.59	1.10	0.94-1.27	1.06	0.91-1.24
Gas/kerosene/paraffin heating	Yes	1.43	1.23-1.67	1.31	1.12-1.54	1.19	1.02-1.38	1.10	0.94-1.28
Paracetamol in past year	Yes	2.12	1.81-2.50	2.06	1.75-2.43	1.57	1.35-1.83	1.53	1.31-1.79
Older siblings	0	1.00	-	1.00	-	1.00	-	1.00	-
	1	0.96	0.78-1.18	0.91	0.74-1.13	0.83	0.68-1.01	0.79	0.64-0.97
	2+	1.01	0.83-1.22	0.95	0.77-1.17	0.73	0.60-0.88	0.67	0.55-0.82
Younger siblings	0	1.00	-	1.00	-	1.00	-	1.00	-
	1	0.87	0.71-1.05	0.86	0.70-1.05	1.15	0.95-1.39	1.09	0.90-1.33
	2+	0.94	0.74-1.10	0.88	0.71-1.09	0.94	0.77-1.34	0.82	0.67-1.01
Mother smokes	Yes	1.32	1.12-1.55	1.18	0.98-1.41	1.45	1.23-1.70	1.36	1.15-1.62
Father smokes	Yes	1.38	1.00-1.92	1.33	0.95-1.86	1.28	0.94-1.74	1.18	0.86-1.63

Adolescents

In 13-14 year olds the strongest findings for current wheeze in Māori related to: eating meat three times a week or more (POR=1.34, 95% CI 0.96-1.88); eating seafood once a week or more (POR=1.95, 95% CI 1.38-2.75); vigorous exercise (POR=1.41, 95% CI 1.01-1.97); using gas, kerosene or paraffin heating (POR=1.37, 95% CI 0.99-1.91); using paracetamol at least once a month (POR=2.17, 95% CI 1.53-3.08); and being born in New Zealand (POR=1.45, 95% CI 0.54-3.90). The strongest findings in non-Māori adolescents were: eating meat three times a week or more (POR=1.38, 95% CI 1.16-1.64); vigorous exercise (POR=1.40, 95% CI 1.18-1.67); gas, kerosene or paraffin heating (POR=1.42, 95% CI 1.19-1.69); using paracetamol at least once a month (POR=2.09, 95% CI 1.75-2.51); and being born in New Zealand (POR=1.68, 95% CI 1.33-2.12). Both groups showed weak positive associations of asthma symptoms with current cat or dog ownership and parental smoking.

Do the environmental risk factors explain the prevalence differences between Māori and non-Māori?

Table 6.12 shows the adjusted prevalence odds ratios for ethnicity (Māori versus non-Māori) and for environmental factors that were found to be associated with asthma symptoms in the "univariate" (adjusted only for age and gender) analyses presented in Table 6.10. The prevalence odds ratio for current wheeze in Māori 6-7 year olds compared to non-Māori was 1.55, adjusted for age and gender, and changed to 1.54 when also adjusted for the environmental variables.

Similarly, Table 6.13 shows the adjusted prevalence odds ratios for ethnicity (Māori versus non-Māori) and for environmental factors that were found to be associated with asthma symptoms in the "univariate" (adjusted only for age and gender) analyses presented in Table 6.11. The prevalence odds ratio for current wheeze in Māori 13-14 year olds (compared to non-Māori) was 1.47 (adjusted for age and gender) and changed to 1.40 when adjusted for the environmental variables.

Discussion

Before discussing the findings of the ISAAC Phase III survey, consideration should first be given to the potential limitations of the data.

The survey is based on self-reported (or parental-reported) asthma symptoms. However, as discussed in Chapter Four, the ISAAC questionnaires have previously been validated in New Zealand and elsewhere, and appear to have good validity for measuring the prevalence of current asthma symptoms. The absolute prevalence levels in the two age-groups cannot be directly compared because the data for 6-7 year olds is parental reported whereas that for the 13-14 year olds is self-reported. This may account for the consistently lower level of prevalence in 6-7 year olds found in the ISAAC studies (ISAAC Steering Committee, 1998b) since parents are unlikely to observe all episodes of wheezing in their children (e.g. occasional wheeze after exercise). Thus, the findings in 6-7 year olds and 13-14 year olds cannot be directly compared, but their trends over time can be compared because the same methodology has been used in each age-group in the Phase I and Phase III surveys.

The response rate for the survey in 13-14 year olds was extremely good (97%), but the 6-7 year olds survey had a very low response rate (47%). These response rates would have been lower if we had taken account of the fact that not all schools that were contacted agreed to participate. However, the response rate was based on the percentage of eligible children who participated in the schools that agreed to take part in the survey. This is standard practice in ISAAC and it is known from previous surveys that there is little difference in prevalence between schools in the Wellington region (Robson et al, 1993) and the findings are therefore unlikely to have been biased by non-response at the school (rather than the individual) level. Taking this into account, the response rate for the 13-14 year olds was extremely good whereas that for the 6-7 year olds was poor. Thus, the prevalence findings for 6-7 year olds may not be comparable over time, or between Māori and non-Māori.

A low response rate will not introduce bias in itself unless the response rates differ by asthma symptom status (e.g. asthmatics are more likely to participate than non-asthmatics) and also by the subgroups being compared (e.g. Māori and non-Māori). Unfortunately I was unable to estimate response rates separately in Māori and non-Māori since we did not know the ethnicity of the children who did not participate. The main concern is that children and/or parents may be more motivated to participate if they have asthma, and that when the response rate is low, the observed asthma prevalence may be too high. However, if this were the case we would have expected to see particularly large "increases" in asthma prevalence in the 6-7 year old age-group, but this was not the case and the increases were generally all smaller than those in the 13-14 year age-group. Furthermore, the analyses for environmental exposures involved comparisons within the group of children who responded and these are unlikely to have been biased by the low response rates. This is reflected in the fact that the findings for the environmental variables (e.g. the POR for paracetamol use) were reasonably similar in the two age-groups.

Prevalence in Māori and non-Māori

The overall findings from these analyses indicate a higher prevalence of asthma symptoms in Māori compared to non-Māori for both the 6-7 years age group and 13-14 years age group. In some cases these differences are quite marked, as in 'current wheeze' for both age groups (31% versus 22.6%, and 39% versus 31% respectively).

This is in contrast with findings from previous studies where any differences have generally been minimal (see Chapter Five). For example, Robson et al (1993) in their pilot study for ISAAC, also conducted in the Wellington region, surveyed 1,863 third formers and found a self-reported prevalence of wheeze in the last 12 months of 29.0% for Māori 13-14 year olds compared with 30.0% for 'Other'. D'Souza (1997) analysed the New Zealand ISAAC Phase I data by ethnicity, and reported that the prevalence of current wheeze in 6-7 year olds was 27.6% for Māori (n=3,750) and 24.2% in European (n=12,193); among 13-14 year olds, the prevalence of current wheeze was lower in Māori teenagers than non-Māori, being 30.7% (n=3,940) versus 31.8% (n=12,392) using the written questionnaire responses but 21.7% for Māori versus 17.7% for non-Māori for the video questionnaire. Overall however, the prevalence differences were small.

A few previous New Zealand studies have reported ethnic differences in asthma prevalence. One study measured the prevalence of asthma symptoms and bronchial hyperresponsiveness (BHR) in children using a combination of symptoms and BHR to define asthma (Pattemore et al, 1989). When symptoms were used as the sole measure of asthma, Māori consistently had the highest prevalence. However, Europeans had the highest prevalence of BHR. Among a population of 12-19 year olds the prevalence of 'current wheeze' among Māori was higher than that reported by non-Māori, but this difference disappeared when allowance was made for current smoking (Shaw et al, 1991). A similar prevalence in Māori and non-Māori was seen for BHR.

In the current study, using the video questionnaire indicated that although Māori adolescents had a higher prevalence of asthma symptoms than non-Māori in all the categories (including lifetime prevalence of wheeze, current symptoms for wheeze and severe asthma risk factors), the differences were not as marked as for the findings from the written questionnaire. The earlier analysis of ISAAC Phase I data (D'Souza, 1997) measured the concordance between the written and video questionnaire responses in the 13-14 year olds and discussed the fact that while the questions used for the comparisons between the written and video questionnaires could be considered similar, they are not exactly the same. D'Souza uses an example of the first video sequence measuring 'any wheezing' against the comparative written question of 'wheezing ever' which yielded a much lower prevalence rate in the Phase I survey (29.1% versus 45.3%). The explanation given is that students have interpreted the video scene as reflecting 'wheezing at rest' rather than the broader interpretation of 'any wheezing' (D'Souza, 1997). However, D'Souza (1997) does note that the use of the video questionnaire enables greater comparability across populations which is the key issue in this survey rather than the specific prevalence level within a particular population.

For those symptoms relating to asthma severity, the current study found Māori children and teenagers to have significantly higher prevalences for some indicators, including night waking with wheeze in the last 12 months, and for the 13-14 year olds, night cough in the last 12 months. They were also relatively more likely to report recent symptoms in responding to the asthma video questionnaire, indicating a greater frequency of symptoms. This is consistent with previous New Zealand studies which have reported similar results relating to differences in markers of asthma severity between Māori and non-Māori children (D'Souza, 1997; Pomare et al, 1995; Mitchell & Cutler, 1984; Mitchell & Borman, 1986; Garrett et al, 1989; Pomare et al, 1991). The results from these studies were discussed in depth in the previous chapter.

Time trends in prevalence

Initial analyses of world-wide time trends in asthma prevalence using ISSAC Phase I and Phase III data (N Pearce, personal communication, 29 April 2004) indicate a reduction internationally in asthma symptom prevalence and specifically, decreases in areas with a previously high asthma prevalence (English speaking countries and Western Europe) and a corresponding increase in regions which showed a low prevalence when surveyed during ISAAC Phase I. The overall prevalence of current wheeze has remained relatively stable over time, but there has been a significant increase in children diagnosed with asthma.

In the current study, the time trend data for Māori children indicate a slight increase in the prevalence of current wheeze, but a large increase in 'wheezing ever' (8.0%) with some symptoms of asthma severity having an intermediate rise in prevalence of between 2.2 - 2.9%. For Māori adolescents there were marked increases in the prevalence of both 'wheezing ever', 'asthma ever' and current wheeze. An overall increase in all markers of asthma severity ranging from 1.7% for severe wheeze to 6.7% for night waking with wheeze in the last 12 months was also seen.

In general, the results for non-Māori 6-7 year olds over time indicate a decline in current asthma symptom prevalence with small increases in lifetime prevalences from 0.8% for 'wheezing ever' to 1.8% for 'asthma ever'. Similarly, among non-Māori adolescents, the time trend differences indicate small declines in current wheeze and severe wheeze, but there are significant increases in the prevalence of 'wheezing ever' and 'asthma ever'.

Thus, at least for the 13-14 year olds, it appears that the higher prevalence in Māori in the ISAAC Phase III survey is real, and is due to a true increase in prevalence in the decade since the ISAAC Phase I survey was conducted. The data are less reliable for 6-7 year olds, because of the low response rate, but if these data are accepted as valid then it appears that the increases in asthma symptom prevalence are relatively small in this age-group (with the exception of the findings for 'wheeze ever') whereas they are much larger in the 13-14 year age-group. One possible explanation for this is that environmental exposures between ages 6-7 years old and 13-14 years old account for the marked increases in asthma prevalence in Māori adolescents. An alternative, and perhaps more plausible, hypothesis is that the increase in prevalence in the 13-14 years age-group, in part, represents an increase in the duration of the condition, rather than an increase in incidence. As discussed in Chapter Three, issues of access to health care in Māori children with asthma may lead to the prolongation of symptoms, and hence to an increase in prevalence at older ages. However, while this hypothesis is consistent with the greater prevalence increases over time in the 13-14 year olds, it is less consistent with the fact that asthma prevalence is also higher in Māori 6-7 year olds compared with non-Māori.

Mitchell and Asher (1994) suggest that asthma is under diagnosed in general practice and several studies have found the prevalence of physician diagnosed asthma to be substantially lower than the prevalence of asthma symptoms in the community. It is possible that the increases in reported asthma and/or wheezing for both Māori and non-Māori children and adolescents found in the current study may reflect greater awareness and changing patterns of medical practice with regard to diagnosis in conjunction with improved access to health services (Pearce et al, 1998).

The time trend data confirms, however, that asthma severity for Māori continues to be disproportionately greater than that for non-Māori. While this is also true of the video questionnaire time trend data, there is a marked overall reduction for both Māori and non-Māori 13-14 year olds and the differences in both current and lifetime asthma symptom prevalence are small compared with those seen in the written questionnaire.

Environmental exposures

There were few differences in environmental exposures between Māori and non-Māori children and adolescents (Tables 6.8 and 6.9) and those exposures that did differ (e.g. parental smoking) were not strongly related to asthma risk. Thus, when the analysis was adjusted for various environmental exposures there was little change in the prevalence odds ratios for ‘current wheeze’ or ‘asthma ever’ in Māori compared with non-Māori. As the focus of this thesis is on asthma, I will not discuss the findings for environmental exposures in depth, since these do not generally seem to be relevant to the Māori/non-Māori differences. However, some consideration should be given to their potential impact, and I will therefore consider them briefly here.

Most environmental factors showed only a weak association with asthma symptom prevalence. In the current study having two or more younger siblings was protective against current wheeze in both Māori and non-Māori children and adolescents, but the findings for older siblings were less consistent. In general, there is increasing evidence, including studies from New Zealand, that a small family size is associated with an increased risk of developing asthma (Shaw et al, 1994; Moyes et al, 1995; Wickens et al, 1999a). The reasons for this are unclear, but the same relationship for atopy has been observed in several studies (Strachan, 1989; Von Mutius et al, 1994; Matricardi et al, 1997; Olesen et al, 1997). The most commonly hypothesized explanation is that small family size could reduce infections in infancy and that this could in turn increase the risk of atopy and asthma at older ages (Martinez, 1994). However, if this hypothesis were correct then having older siblings would be protective whereas having younger siblings would not be (Pearce et al, 2002). In fact many studies, including the current one, find protective associations with the number of younger siblings indicating that if the association is due to increased childhood infections then this effect is not confined to exposures during infancy.

With regards to indoor exposures, these generally showed at most a weak association with asthma symptoms, with the exception of gas/kerosene/paraffin heating which was associated with current wheeze in both Māori and non-Māori, but only in the 13-14 year olds. This is consistent with some previous studies which have indicated that nitrogen dioxide from burning fossil fuels may increase asthma symptoms (e.g. Florey et al, 1979; Dodge, 1982; Dijkstra et al, 1990; Neas et al, 1991) as may sulphur dioxide from burning sulphur-containing coal or gas (Koo & Ho, 1994). However, the findings are not particularly strong or consistent.

There were generally only weak associations seen between parental smoking and asthma symptom prevalence. Overall, it appears that environmental tobacco smoke may be a co-factor provoking attacks of wheezing, rather than an underlying cause of asthma (Strachan & Cook, 1998).

In terms of associations between current wheeze and dietary factors, the strongest findings related to eating meat three times a week or more (for both Māori and non-Māori teenagers), and eating seafood once a week or more (for Māori teenagers only). The association between dietary factors and the increasing prevalence of asthma, rhinitis and eczema symptoms have been examined in a number of previous studies. Specifically, changes in diet related to decreased antioxidant intake of vitamins C and E and trace elements of selenium (most commonly found in fresh fruits and vegetables) and an increasing prevalence of asthma symptoms have been reported

(Soutar et al, 1997; Burney, 1995; Seaton et al, 1994) although the findings have been inconsistent. Woods et al (2003) recently reported the findings of their community-based study in Melbourne, Australia, involving 1601 young adults which examined both food and nutrient intake in relation to adults with asthma and those without asthma. The study found the consumption of whole fruit did appear to offer some protection against asthma (although the findings were not significant) whereas antioxidant nutrients (in the form of dietary supplements) were not associated with asthma. An ecological analysis of the ISAAC data has shown a consistent decrease in current and severe wheeze symptoms associated with increased per capita consumption of vegetables and vegetable nutrients for 53 of the 56 countries which took part in ISAAC Phase I (Ellwood et al, 2001).

The effects of other dietary factors have also been studied including seafood and margarine intake both of which had a higher consumption rate among Māori compared to non-Māori children in the current study. The available evidence is inconclusive however ranging from results supporting a protective association (Hodge et al, 1996) to findings of no association (Schwartz & Weiss, 2000; Woods et al, 2003) between eating fish and asthma. Takemura et al (2002) conducted a case-control study of 1,673 students with current asthma and 22,109 controls between the ages of 6-15 years to investigate the relationship between fish intake and the prevalence of asthma in this school age population. This study found a higher prevalence of asthma (adjusted OR=1.12, 95% CI 1.01-1.24, $p= 0.04$) among those students who ate fish once or twice a week compared with those eating fish once or twice a month (adjusted for age, gender, parental history of asthma and vegetable/fruit intake).

In the current study, although margarine consumption was elevated in Māori compared to non-Māori, for both age-groups, there was no association found between this dietary component and 'current wheeze' or 'asthma ever'. While some previous studies have reported an association between margarine consumption and allergic sensitization in children (Weiland et al, 1999; Bolte et al, 2001) the results are inconsistent with a recent study finding no relationship between the intake of polyunsaturated fatty acid margarine and asthma (Woods et al, 2003).

The most striking finding in the current study was that there was a more than two-fold increased risk of current wheeze associated with taking paracetamol, both for the first year of life and recent use, found in both Māori and non-Māori 6-7 year olds. A strong association for current wheeze relating to recent paracetamol use was also observed in both Māori and non-Māori adolescents. Shaheen et al (2000) reported similar findings in a study of adults in which recent frequent paracetamol use was associated with an approximately two-fold increased risk of asthma. One possibility is simply that health professionals encourage their asthmatic patients to take paracetamol rather than aspirin because the latter may worsen asthma severity, but Shaheen et al (2000) argued that this was unlikely to explain their findings. They subsequently reported an association between frequent paracetamol use in late pregnancy and risk of wheezing in the offspring (Shaheen et al, 2002). Lesko et al (2002) in a randomized trial of children with current asthma and a febrile illness found that short-term use of paracetamol (in comparison with ibuprofen) increased subsequent asthma morbidity. An ecological analysis reported a positive association between paracetamol sales and the prevalences of wheeze, asthma, rhinitis and atopic eczema in 13-14-year old children from the ISAAC study, as well as in young adults participating in the

European Community Respiratory Health Survey (ECRHS) (Newson et al, 2000). Possible underlying mechanisms involve increased oxidative stress due to the ability of paracetamol to reduce levels of the anti-oxidant glutathione in immune cells, thus depleting anti-oxidant defences and promoting TH_2 allergic inflammation (Shaheen et al, 2000) as well as increased viral loads as a side-effect of paracetamol use, possibly leading to asthma (Balzer, 2000). Thus, there is some preliminary evidence linking paracetamol use to current asthma in both children and adults but the possibility cannot be excluded that the association is due to reverse causation.

In the current study, a strong association between use of antibiotics in the first year of life and current wheeze was also seen in both Māori and non-Māori children with a stronger effect observed for non-Māori children. A number of recent studies have reported associations between antibiotic use early in life and subsequent risk of asthma (e.g. Farooqi & Hopkin 1998; Alm et al, 1999; Droste et al, 2000; McKeever et al, 2002; Celedon et al, 2002; Wjst et al, 2001) including previous studies in New Zealand (Crane et al, 1994b; Wickens et al, 1999b). For most of these studies the authors raised the possibility that their findings may be due to reverse causation in that frequent upper respiratory infections, often an early symptom of asthma, are usually treated with antibiotics. The findings of the current study are therefore generally consistent with other evidence that antibiotic use in the first year of life increases the subsequent risk of asthma or that such an association exists because of "reverse causation". However, whatever the explanation for these associations, they did not explain the differences in prevalence between Māori and non-Māori children.

Summary

In summary, the ISAAC Phase III survey has shown marked increases in asthma symptom prevalence in Māori adolescents (13-14 year olds) with smaller increases in Māori children (6-7 year olds). These increases have resulted in a greater asthma symptom prevalence in Māori than in non-Māori children, a pattern that was not observed in the ISAAC Phase I survey conducted ten years previously. There was also some evidence of greater asthma severity in Māori, particularly in the adolescents. The ISAAC Phase III environmental questionnaire findings indicated that there were few differences in environmental exposures between Māori and non-Māori. The few differences that did exist (e.g. for parental smoking) were for factors that were not strongly associated with asthma symptom prevalence. On the other hand, the factors that were associated with asthma symptom prevalence (e.g. paracetamol and antibiotic use, family size) did not differ markedly between Māori and non-Māori. Thus, the environmental exposures addressed in the ISAAC Phase III survey explained little of the difference in prevalence between Māori and non-Māori. The finding that the increase in prevalence was strongest for 13-14 year olds is partly, but not completely, consistent with the hypothesis that differences in asthma prevalence and severity in Māori adolescents (and adults) are not due to a higher incidence of asthma, but are rather due to a longer duration of the condition in Māori children with asthma. As discussed in Chapter Five, this could in part be due to environmental exposures (e.g. both passive and active smoking), but could also be due to greater severity and frequency of exacerbations of the condition in Māori children with asthma due to problems of access to health care. This latter hypothesis is addressed in the study presented in the next chapter.

CHAPTER SEVEN

FOLLOW-UP STUDY OF ASTHMA IN MĀORI ADOLESCENTS

Introduction

As discussed in previous chapters, there is a growing body of literature indicating the importance of access issues for asthma and other chronic disease. In particular, issues relating to service access constituted a significant part of the findings from the Māori Asthma Review (Pomare et al, 1991). The available evidence shows that overall asthma morbidity, as reflected in hospital admission rates, remains disproportionately greater among Māori. A number of reasons for this increased morbidity have been proposed including lack of appropriate management (Garrett et al, 1989; Mitchell, 1991), cost of medications (Waldegrave, 1999), and inadequate information at a primary care level (Central Regional Health Authority, 1996; Ratima et al, 1999) which may all be contributing factors to Māori requiring increased intervention at a secondary care level.

The results from the ISAAC Phase III analyses presented in the last chapter have confirmed a greater asthma severity among Māori adolescents consistent with previous studies of asthma morbidity. Additionally, there was also evidence of increased asthma prevalence among both Māori children and adolescents (but particularly in the 13-14 year olds) which is in contrast with previous studies which have generally reported little difference in asthma prevalence between Māori and non-Māori children (Chapter Five). While the reasons for this are unclear, it may be that the apparently greater prolongation and exacerbation of asthma symptoms in Māori are occurring at an earlier age (i.e. during the early adolescent years) than has been previously seen, resulting in differences in asthma prevalence between Māori and non-Māori children as well as adults. However, no New Zealand studies to date have specifically examined risk factors for asthma severity in Māori. I therefore conducted a follow-up study of asthma in Māori adolescents in order to examine factors affecting asthma severity in this population.

The study had four objectives:

- To estimate the proportion of Māori adolescents, with asthma or asthma symptoms, who were receiving asthma medication, asthma education and using asthma management plans
- To identify what factors affect asthma severity in Māori adolescents
- To identify and describe barriers to accessing asthma health care in this population
- To identify factors contributing to asthma quality of life in this population

The ISAAC Phase III survey for the Wellington region provided the source population of participants enrolled in this follow-up study of Māori adolescents with asthma. The detailed methods for the ISAAC Phase III survey were presented in the previous chapter. Thus, for the 'Methods' section in the current chapter, only the information relevant to the follow-up study will be described.

This is followed by the 'Results' section which includes analyses for the baseline data and one year follow up data relating to asthma severity and quality of life and factors affecting access to care. A discussion of the significance of the study's findings concludes the chapter.

Methods

General study design

This study was designed to examine determinants of asthma severity in Māori adolescents identified from the ISAAC study. Data was collected from the students and their parents/caregivers at the beginning of the study to assess baseline asthma severity, and to gather information on risk factors that could affect the severity of asthma experienced by the student during the follow-up period. Data was also then collected at one year to assess any changes in asthma severity during that time.

In order to more fully measure the impact of asthma on these adolescents' lives, a quality of life questionnaire was also completed at baseline and at the one year follow-up. Additionally, students or parents/caregivers who identified any access issues in the written questionnaire completed at baseline or at the one year follow-up data collection stages, were asked to complete a more in-depth questionnaire regarding their use of primary and secondary health care services. The information from this additional access to care questionnaire is presented as semi-structured interviews which concludes the 'Results' section of this chapter.

Consultation

A process of consultation was initiated with people involved in asthma service provision and asthma education in the Wellington region prior to the current study being undertaken. These included tangata whenua and iwi representative groups working with people who either utilise asthma services and/or were themselves providers of asthma health services. As discussed in Chapter Three, Tu Kotahi Māori Asthma Trust is an umbrella organisation of Māori providers from throughout the Hutt Valley, Wellington and Kapiti Coast regions who have been involved in the development and delivery of comprehensive asthma education and training services to Māori communities since 1995. A process to discuss the strengths and weaknesses of current asthma service provision within their regional areas was initiated with Tu Kotahi Māori Asthma Trust. Key organisations involved in the delivery of asthma health care and asthma education services were also consulted, including representatives from the Asthma and Respiratory Foundation of New Zealand (ARFNZ), the Health Funding Authority, Public Health Units in the Porirua/Horowhenua regions and the Wellington Asthma Society. Details of this consultation process were compiled in a discussion document (Ellison-Loschmann, 2002) and informed the development of the adolescents and parents questionnaire which was used for the current study.

Consultations have also taken place with the Māori Committee of the ARFNZ. This is a national committee comprising eight members whom I initially worked with in a consultative capacity when the Committee was developing a national strategy for asthma services and education, specifically for Māori. One component of the strategy was to identify research priorities and develop a plan for asthma research among Māori over the next ten years. My involvement with the Māori Committee (now as a Committee member) has been particularly valuable in providing a national overview and direction for the development of policy strategies regarding asthma in Māori. Both the Māori Committee and Tu Kotahi Māori Asthma Society have acted as advisory groups for this study throughout all phases of its progress.

It has been a priority that Māori have access to information from this research through reporting back to Wellington iwi groups, principally through the forum of Tu Kotahi Māori Asthma Trust monthly meetings. Additionally, ongoing dissemination and discussion of results, on a national basis, have been facilitated through the community and professional networks of the Māori Committee of the ARFNZ.

Ethnicity

Ethnicity of participants in the follow-up study was determined through self-identification by students undertaking the Phase III ISAAC survey. As has been previously discussed, the question relating to ethnicity was the same one as that used in ISAAC Phase I: *"To which ethnic group(s) do you belong?"*

Where multiple ethnic groups have been selected by a student, a priority system for 'Māori' has been used as previously described. Thus, the analyses presented in this chapter include both those students who ticked only the single ethnic group, 'Māori', and those who selected more than one ethnic group including the option 'Māori'.

Questionnaires

There were three basic interviewer-administered questionnaires used in this study which all participants and their parents/caregivers completed on entering the study and at a one year follow-up interview.

- An asthma questionnaire for students (Appendix 1)
- An asthma quality of life questionnaire for students (Appendix 2)
- A questionnaire for parents/caregivers (Appendix 3)

If either the student or their parent/caregiver gave a positive response to the question relating to accessing health care services, (at the baseline data collection or at the one-year follow-up) an additional questionnaire was completed with the parent/caregiver (Appendix 4).

Asthma questionnaire for students

As discussed in Chapter Four, asthma morbidity studies differ from prevalence studies in that more detailed information regarding the intensity, duration and frequency of symptoms is needed. Pearce et al (1998) have identified symptom questionnaires to be the most straightforward method for assessing asthma morbidity. In the current study, questions on asthma severity (Appendix 1) were based on those asked in the Wairarapa Māori Asthma Project (Te Hauora Rūnanga o Wairarapa/ Te Pūmanawa Hauora ki Manawatu/ Wellington Asthma Research Group, 1999). This included information about the numbers of emergency and non-emergency GP visits, visits to after-hours clinics, any visits to A&E departments and/or hospital admissions for asthma in the previous 12 months. Asthma morbidity was also assessed using symptom events such as 'nights disturbed by wheezing in the last 12 months' and 'days off school because of asthma'.

In the current study I was interested in identifying whether or not the participants had received any asthma education and if this was updated or reviewed in an ongoing way over their period of enrolment in the study. Questions related to use of a peak flow meter, use of an asthma action plan and attending education sessions about asthma. Thus, the data collected was not providing a direct measurement of change in knowledge as a result of an intervention, but being used as an overall assessment of what constitutes 'usual' care for the participant to complement the other morbidity measures being undertaken in the study.

Asthma quality of life questionnaire for students

The use of quality of life questionnaires as a complement to other asthma morbidity measures has been previously discussed. The Adolescent Asthma Quality of Life Questionnaire (AAQLQ) (Appendix 2) is a self-administered 32-item instrument specifically developed for adolescents (target age 12-17 years) with asthma

(Rutishauser et al, 2001). It covers six domains including symptoms (6 items), medication (5 items), physical activities (6 items), emotional challenges of having asthma (5 items), social interaction (5 items) and the positive effects of having asthma (5 items). Participants rate each item as they have experienced them during the previous 2 weeks using a 7-point scale of bother (1 – extremely bothered to 7 – not bothered at all) and a 7-point scale of frequency (1 – all of the time to 7 – none of the time).

The questionnaire is analysed directly from the scores of the 7-point scale. The mean scores for the items in each domain can be calculated and an overall quality of life score can be estimated from the mean score for all the items. No weighting of scores is carried out. Rutishauser et al (2001) reported high internal consistency for the six domains (alpha = 0.70-0.90) and for the total score (alpha = 0.93). Test-retest reliability was also high for all domain scores and the total score indicating high reproducibility of the AAQLQ.

None of the previous asthma-specific quality of life instruments (discussed in Chapter Four) consider the possible positive effects of having asthma on health-related quality of life. However, these items were included in the AAQLQ (e.g. 'How often has your asthma brought you closer together as a family?") because of the high rate of importance given to them by adolescents during the development and validation of the questionnaire. However, Rutishauser et al (2001) note that the "positive effects" domain does not contribute to the AAQLQ's total score because of the difficulty in assessing construct validity for these items against other health-related quality of life instruments or clinical parameters of asthma severity.

Questionnaire for parents/caregivers

Socio-economic factors such as income, employment, housing and education have all been shown to be strongly related to health status (Pomare et al, 1995). In the current study, questions relating to parents/caregivers income and employment, health service subsides and use of GP services for the previous 12 months (Appendix 3) were based on those used in the New Zealand Health Survey 1996-97 Adult Questionnaire (Statistics New Zealand, 1996).

Accessing health care questionnaire

One of the questions in the asthma questionnaire for students asks about use of health services:

> *"In the last 12 months have there been times when you needed to see the doctor (or practice nurse) for your wheezing/asthma but you weren't able to?"*
>
> If yes: "*What were some of the reasons for not getting to see your doctor?"*

This question was also asked in the questionnaire for parent/caregivers but was not specifically related to seeking asthma care:

> *"In the last 12 months has there been a time when you needed to see the doctor (or practice nurse) for advice but you weren't able to?"*

> If yes: *"The last time this happened, what was the reason for not getting to see your doctor?"*

Both questions are adapted from the New Zealand Health Survey 1996-97, Adult Questionnaire (Statistics New Zealand, 1996). If either the adolescent or their parents/caregivers answered this question, then the parents/caregivers were asked to complete an additional questionnaire comprising eight questions. These generic questions had previously been validated for the Survey of Minority Health conducted in the United States (Hogue et al, as cited in Wagner & Guendelman, 2000). Wagner and Guendelman (2000) detailed their findings in relation to health care utilisation among 1001 self-identified Hispanic adults who participated in this survey.

For the current study, the same root questions relating to five dependent variables representing utilisation in the last 12 months was asked with the addition of 'asthma' included in the stem of the question:

> *"Altogether, how many times have you visited the doctor or health professional (includes self and family, for asthma or any other reason)".*
> If yes, *"Have you received any outpatient care at a hospital emergency or after-hours clinic? If yes, how many times? (for asthma or anything else)"* and *"Have you (or any family member) been hospitalised at all (how many times, for asthma or any other reason)."*

A question on preventive care was also included:

> *"Have you received any preventive care (such as blood pressure checks, pap smears, cholesterol readings, lung function tests, asthma education, diabetes checks) at clinics, community health days (at the local mall) or while on a doctor's visit?"*

Three types of independent measures of utilisation of health services, described by Andersen et al (as cited in Wagner & Guendelman, 2000) as need related, enabling and pre-disposing variables, were also assessed. Health need was assessed by perceived health status:

> *"How would you describe your (family's) health overall? (Excellent, good, okay, poor). Any disabilities?"*

Enabling variables included financial and structural factors. Financial status was assessed in the parent/caregivers questionnaire given to all participants with additional questions on structural factors relating to availability and choice of services also asked:

> *"Do you have a regular GP?*
> *Are there other health care facilities (marae based clinics) in your area that you are aware of or use regularly?*
> *Do you use any asthma health care/education services for your child through the GP or clinics in your area?*
> *Are there any asthma services you know of but don't use for any reason?"*

The last set of questions in the accessing health care questionnaire related to discrimination as a barrier to care:

> *"Have you ever felt uncomfortable for any reason when visiting a doctor or clinic? Did you ever feel the quality of care was not as high as it should /could have been for any reason?"*

Selection of schools

In order to ensure comparability of information over time, ISAAC Phase III in Wellington involved selecting schools from the same sampling frame as that which was used for Phase I. The sampling frame was representative of the Wellington geographical area (Porirua, Lower Hutt and Wellington city), without selection by urban or rural residence or variations in socio-economic status. Each secondary school within the Wellington area (i.e. those with students in the 13-14 year age group), were allocated a number and the schools were selected using a table of random numbers. If a school refused participation it was replaced by the next randomly chosen school. To increase the numbers of students participating in the study, other schools (outside of the ISAAC sampling frame) located on the Kapiti Coast and in Upper Hutt were also approached to take part. This enabled me to supplement the numbers by randomly sampling more students from the additional schools for inclusion in the current study. This was done using the ISAAC Phase III questionnaire, with the same approach as that used for ISAAC Phase III itself, but in this instance, the additional schools were not part of the formal ISAAC Phase III survey reported in Chapter Six, but were solely used to identify more participants for the follow-up study.

Selection of participants

The source population comprised those secondary school students who self-identified as Māori, had completed the ISAAC Phase III survey and had ticked "yes" in answer to both of the following two questions:

> *(1) "Have you had wheezing or whistling in the chest in the last 12 months?"*
> and *(2) "Have you ever had asthma?"*

These are core questions from the ISAAC survey and were identified as the inclusion criteria for the current study because a positive response to both questions provided a reasonable indication of current asthma morbidity which is what this study was attempting to assess.

Māori students meeting the eligibility criteria for inclusion in this study and their parents/caregivers were contacted via an introductory letter through the school which included an information sheet about the study. A phone call was made to the potential participant and their parent/caregiver approximately one week after sending out the introductory letter to talk about the study and seek consent for their participation. Up to three attempts were made to contact the potential participant either by phone or in person. For those without contact phone numbers, a visit to their home address was made.

Because the study involved collecting information from both the student and the parents/caregivers, a separate consent form was required for each party and students could not participate in the study unless their parents/caregivers also consented to take part. Ethical approval for the study was obtained from the Wellington Ethics Committee (WGT/01/04/036).

During the time that participants were being recruited for the current study, there were significant changes occurring in curriculum structure and implementation throughout the majority of New Zealand secondary schools. This meant that there were long periods of uncertainty in terms of whether teachers would go on strike over the proposed changes, and some upheaval regarding timetabling and classes for students. Consequently, there would sometimes be an extended delay between students completing the ISAAC survey and being approached to participate in the current study as making contact with students and their parents/caregivers relied first on communication with the schools. This may have affected the participation rates for the study and will be further addressed in the 'Discussion' section of this chapter.

Data collection

All data was collected in a location of the participant's choice which in most cases was their home. However, some of the students, preferred to complete their questionnaires at school. Thus, once consent was given by the student and parent/caregiver, and the school had been approached to request permission for this to occur, one of the research assistants would come into the school to complete the questionnaires with those students. Parents/caregivers of these students were then followed up separately by phone or in person to complete their parent/caregiver questionnaire.

While most of the interviews were conducted face-to-face, this was not always possible and so in some instances, questionnaires were completed by phone, or a questionnaire was posted to the student and their parent/caregiver with an enclosed self-addressed envelope for return of the information. Recruitment was undertaken during November 2001 – January 2003. Participants were enrolled progressively over this period and remained in the study for one year following their initial enrolment. Thus, the last participants to come onto the study were recruited in January 2003 and their final follow-up data collection was completed a year later in January 2004.

Study size and power

The study's power calculations were based on recruiting approximately 125 Māori adolescents with current asthma symptoms. Assuming that one half of them were exposed to a particular factor (e.g. passive or active smoking) then the study would have 80% power to detect a 25% difference in the change in a dichotomous measure of asthma morbidity (e.g. if 45% of one group and 20% of the other group experienced an increase in nights woken). The study would have much greater power (or similar power for a smaller effect size) for the analyses using continuous variables (e.g. asthma quality of life score).

Data entry and analysis

All data was entered on Microsoft Access 2000 for Windows and then manually checked against the original questionnaire. Inconsistencies in the data (missing values, inconsistent responses) were corrected if there were found to be entry errors.

The data analysis for assessing asthma severity involved comparing those exposed and those not exposed to particular risk factors. In each instance, I compared their asthma morbidity (or problems of access or asthma quality of life) over the one-year follow-up period, controlling for their asthma morbidity (or problems of access or asthma quality of life) at baseline.

Continuous outcome variables (e.g. change in quality of life score) were analysed using standard regression methods (Armitage & Berry, 1987), whereas dichotomous outcome variables (e.g. four or more attacks of wheezing during the one year follow-up) were analysed using logistic regression to estimate (period) prevalence odds ratios (Pearce et al, 1998).

The data analysis for "problems of access" was similar to that of the analysis of asthma severity. A 'combined' measure of problems of access was used because there were insufficient numbers to analyse specific problems individually (e.g. running out of medication). This was based on: (i) running out of medication; (ii) or requiring an emergency GP visit; (iii) or requiring a hospital admission for asthma; (iv) or needing to see the doctor but being unable to.

It should be recognised however that these markers of problems of access are also markers of asthma severity. For this reason although this combination of markers were used for some analyses, I also looked at each of the markers individually.

Results

Pre-baseline information on source population

Table 7.1 presents the population characteristics for participants and non-participants. From the ISAAC survey responses, 188 students were selected to take part in the study. Of these, 20 (10.6%) were considered ineligible and excluded from the analyses (nine who had not wheezed in the past 12 months, four who were not Māori, two who had not had a previous asthma diagnosis and five who had left school in the time between completing the ISAAC survey and being approached to take part in the current study). A further 20 (10.6%) students could not be contacted to request their participation in the study.

Of the 148 remaining students, 88 took part in the study, giving an overall response rate of 52.4% of the 168 eligible teenagers. Among the respondents, there were more males than females and the overall age range of respondents was slightly younger compared to that of the non-respondents.

Table 7.2 presents the prevalence of asthma symptoms in the ISAAC survey for subsequent participants and non-participants in the follow-up study. Based on the ISAAC survey questionnaire, inconsistent responses were noted in two participants who had answered negatively to the question on current wheezing, but positively to the other stem questions on sleep disturbed due to wheezing and severe wheezing attacks. Following confirmation from their parent/caregiver that they had experienced

Table 7. 1: Characteristics of participants and non-participants

	Participants % (n)	Non-participants % (n)	Total % (n)
Gender:			
Male	54.5 (48)	48.0 (48)	51.1 (96)
Female	45.5 (40)	52.0 (52)	48.9 (92)
Age (years)			
12	5.7 (5)	4.0 (4)	4.8 (9)
13	44.3 (39)	36.0 (36)	39.9 (75)
14	42.0 (37)	46.0 (46)	44.1 (83)
15	6.8 (6)	13.0 (13)	10.1 (19)
16	1.1 (1)	1.0 (1)	1.1 (2)
Total	46.8 (88)	53.2 (100)	100 (188)

wheezing in the past 12 months, their responses to the initial wheezing in the last 12 months question were recoded to "yes".

Inconsistent responses were similarly noted in another two participants who had answered negatively to the question on 'ever had asthma' but whose responses to all the other stem questions for asthma symptoms in the ISAAC survey were positive. When contacted for the current study, confirmation from their parent/caregiver was sought regarding a previous asthma diagnosis and their responses to the original 'asthma ever' question were recoded as "yes".

Overall, there was little difference in the prevalence of self-reported asthma symptoms for participants and non-participants. For symptoms relating to asthma severity, just over half of both the participants and non-participants (52.3% and 54.0%

respectively) had experienced waking at night with wheezing in the past 12 months. Similarly, about one quarter from both groups reported severe wheeze in the last 12 months. Participants reported a higher prevalence (65.9%) of night cough in the last 12 months compared to non-participants (51.0%).

For the asthma video questionnaire (Table 7.3) the prevalence of asthma symptoms was similar for participants and non-participants for most categories. There were no statistically significant differences found between participants and non-participants, but non-participants were more likely than participants to have been woken at night one or more times with coughing in the past month (23.2% versus 11.5%, p=0.06).

Table 7.4 presents the prevalences of various environmental exposures in participants and non-participants. With a few exceptions, the prevalences were similar between participants and non-participants. Participants were less likely than non-participants to have gas heating in their homes (43.7% versus 64.6%, p=0.01) and to have a smoking parent (48.2% versus 76.3%, p<0.01). Participants were also more likely than non-participants to have no one in the household who smoked (38.1% versus 17.3%, p=0.01).

Table 7. 2: Prevalence of self-reported asthma, rhinitis and eczema symptoms for participants and non-participants

	Participants % (n)	Non-participants % (n)	P-value
Asthma symptoms			
Wheezing ever*	100.0 (88)	100 (100)	1.00
Wheezing in last 12 months*	100.0 (88)	100 (100)	1.00
≥ 1 wheezing attack in last 12 months	84.1 (74)	84.0 (84)	1.00
Night waking in last 12 months	52.3 (46)	54.0 (54)	0.88
Severe wheeze in last 12 months	23.9 (21)	27.0 (27)	0.74
Asthma ever	96.6 (85)	100 (100)	0.10
Exercise wheeze	78.4 (69)	84.0 (84)	0.35
Night cough in last 12 months	65.9 (58)	51.0 (51)	0.05
Rhinitis symptoms			
Nose symptoms ever	77.3 (68)	75.0 (75)	0.74
Nose symptoms in last 12 months	71.6 (63)	62.0 (62)	0.22
Eyes affected in last 12 months	47.7 (42)	45.0 (45)	0.77
Activities limited in last 12 months	56.8 (50)	60.0 (60)	0.77
Hayfever ever	58.0 (51)	63.0 (63)	0.55
Eczema symptoms			
Rash ever	36.4 (32)	29.0 (29)	0.35
Rash in last 12 months	30.7 (27)	31.0 (31)	1.00
Flexural areas ever	25.0 (22)	26.0 (26)	1.00
Rash cleared in last 12 months	28.4 (25)	27.0 (27)	0.87
Night waking in last 12 months	18.2 (16)	21.0 (21)	0.71
Eczema ever	44.3 (39)	55.0 (55)	0.19

*Potential participants were selected on the basis of these two variables

Table 7. 3: Prevalence of self-reported asthma symptoms for participants and non-participants by % (n) (video questionnaire)

	Participants % (n)	**Non-participants** % (n)	**P-value**
Wheezing (while at rest)			
Ever	64.1 (50)	56.1 (46)	0.34
In the last year	39.7 (31)	31.7 (26)	0.32
In the last month (one or more times)	23.1 (18)	15.9 (13)	0.32
Wheezing after exercise			
Ever	55.1 (43)	48.8 (40)	0.43
In the last year	41.0 (32)	31.7 (26)	0.25
In the last month (one or more times)	14.1 (11)	20.7 (17)	0.30
Waking with wheezing			
Ever	34.6 (27)	23.2 (19)	0.12
In the last year	24.4 (19)	14.6 (12)	0.16
In the last month (one or more times)	11.5 (9)	7.3 (6)	0.42
Waking with coughing			
Ever	56.4 (44)	65.9 (54)	0.26
In the last year	39.7 (31)	48.8 (40)	0.27
In the last month (one or more times)	11.5 (9)	23.2 (19)	0.06
Severe attack			
Ever	41.0 (32)	34.1 (28)	0.42
In the last year	21.8 (17)	19.5 (16)	0.85
In the last month (one or more times)	11.5 (9)	15.9 (13)	0.50

Table 7. 4: Prevalence of environmental exposures for participants and non-participants by % (n)

Exposures	Frequency / type	Total % (n= 188)	Participant % (n=88)	Non-participant % (n= 100)	P-value
Exercise	3 or more times/week	44.3 (74)	44.8 (39)	43.8 (35)	1.00
Television	3 or more hours/day	71.4 (120)	72.1 (62)	70.7 (58)	0.87
Cooking	Electric	87.0 (147)	85.1 (74)	89.0 (73)	0.50
	Gas	25.4 (43)	27.6 (24)	23.2 (19)	0.60
	Open fire	4.1 (7)	3.4 (3)	4.9 (4)	0.71
	Other fuel	1.8 (3)	3.4 (3)	0.0 (0)	0.25
Heating	Electric	61.5 (104)	65.5 (57)	57.3 (47)	0.34
	Gas	53.8 (91)	43.7 (38)	64.6 (53)	0.01
	Fire	32.0 (54)	33.3 (29)	30.5 (25)	0.74
	Other fuel	3.0 (5)	2.3 (2)	3.7 (3)	0.68
Paracetamol last year	At least once a month	62.6 (102)	60.7 (51)	64.6 (51)	0.63
Older siblings	0	24.0 (37)	23.4 (18)	24.7 (19)	1.00 none vs 1+
	1	27.3 (42)	29.9 (23)	24.7 (19)	
	2 +	48.7 (75)	46.8 (36)	50.6 (39)	
Younger siblings	0	25.6 (41)	27.2 (22)	24.1 (19)	1.00 none vs 1+
	1	26.3 (42)	28.4 (23)	24.1 (19)	
	2 +	48.1 (77)	44.4 (36)	51.9 (41)	
Born in NZ	Yes	98.2 (165)	98.8 (85)	97.6 (80)	1.00
Years lived in NZ	13 years or less	50.9 (85)	51.2 (44)	53.1 (43)	1.00
Trucks pass house	Frequently or almost all day	46.7 (77)	50.0 (42)	43.2 (35)	0.52
Cat now	Yes	70.1 (117)	72.9 (62)	67.1 (55)	0.39
Dog now	Yes	60.1 (101)	58.1 (50)	62.2 (51)	0.88
Mother smokes	Yes	61.8 (102)	48.2 (41)	76.3 (61)	<0.01
Father smokes	Yes	60.7 (34)	51.7 (15)	70.4 (19)	0.18
Smokers in house	0	27.9 (46)	38.1 (32)	17.3 (14)	0.01 none vs 1+
	1	23.0 (38)	19.0 (16)	27.2 (22)	
	2 +	49.1 (81)	42.9 (36)	55.6 (45)	

Baseline and one year follow-up information on study participants

Adolescents

Table 7.5 presents the baseline information on asthma severity, and associated asthma morbidity measures relating to management and education, for the study participants and the corresponding findings for the same variables at the one year follow-up. At baseline, for current symptoms (occurring in the last 12 months), over half of the students (58.1%) had experienced between 1-3 attacks of wheezing with 20.9% of participants reporting between 4-12 attacks. More than half of the participants reported episodes of sleep disturbed by wheeze (58.0% for less than one night per week) and 22.7% of participants had experienced wheeze severe enough to limit speech. A high proportion of students reported wheeze during or following exercise (83.9%). Just over a third of participants had had 1-6 days off school in the last 12 months due to their asthma.

The findings were generally similar at the one year follow-up although a reduction in the prevalence of some asthma symptoms was evident. A slight increase in "four or more attacks of wheezing per year" was reported, but there was also an increased number of participants experiencing no attacks of wheezing during this time. There was a reduction overall in the prevalence of night waking among participants, no change in the prevalence of severe wheeze and minimal changes in the prevalence of exercise wheeze. There was a reduction from one third at baseline, down to one fifth at one year follow-up, of participants who had taken between 1-6 days off during the year due to asthma.

About one in five students reported having taken no asthma or wheezing medications in the past year at baseline. For those on medication (79.3%) just over two fifths of them had run out on up to two occasions, and for 10.3% of participants, this had occurred on more than three occasions during the past year.

In terms of action taken when their medications ran out, 23.9% of participants went to their GPs, 20.5% used someone else's medications and 13.6% reported using no medications. There was little difference in the prevalence of medication use overall at one year follow-up with just over one third of study participants having not taken any medications during the year.

In terms of asthma management and asthma education, at baseline 43% of participants reported having a peak flow meter, but only 8.2% reported having a written asthma action plan. The majority of participants had been shown at some stage how to use their inhalers with most of this teaching being done by doctors. Ongoing asthma education (updated in the last 12 months) had occurred for nearly half of the students with a similar proportion of the education being delivered by a doctor (19.3%) or teacher (18.2%). However, 54.7% of study participants reported receiving no asthma education in the last 12 months.

There was very little difference in the responses at one year follow-up regarding asthma management and education, however a slightly higher proportion of students reported using a peak flow meter or having a written asthma action plan during the follow-up year compared to at baseline.

At baseline, 22.7% of participants had not visited their doctor in the past year for a routine asthma visit, 60.2% had been 1-2 times, and 17.0% had been more than twice. In the previous 12 months, nearly half of the students had made emergency visits to a doctor for their asthma either once, twice, or 3-5 times (34.1%, 9.1% and 4.5% respectively) and 7% of the study participants had been admitted to hospital for their asthma in the past year.

Compared to the baseline responses, there was an overall decrease in the frequency of visits to the GP for a routine check-up, in the frequency of emergency visits to the GP, and the frequency of hospital admissions for asthma during the follow-up year.

At baseline, 53% of participants reported having smoked at some time in their lives with 38.6% having smoked in the previous year. Less than a quarter of study participants (23.9%) were currently smoking. There was a high proportion of students living in households with one or more than two smokers (24.4% and 42.7% respectively).

There was little change to household smoking status at one year follow-up. However, slightly more study participants reported having smoked in the previous 12 months (46.6%) and were currently smoking (31.8%) compared with the baseline results.

Table 7. 5: Prevalence of asthma symptoms and risk factors at baseline and one-year follow-up

	Frequency	Baseline % (n)	One year follow-up % (n)
Asthma severity			
Attacks of wheezing last 12 months	0	14.0 (12)	21.2 (18)
	1-3	58.1 (50)	48.2 (41)
	4-12	20.9 (18)	22.4 (19)
	More than 12	7.0 (6)	8.2 (7)
Night waking last 12 months	Never	26.1 (23)	47.7 (42)
	< one night/week	58.0 (51)	34.1 (30)
	> one night /week	15.9 (14)	18.2 (16)
Severe wheeze last 12 months	Yes	22.7 (20)	22.7 (20)
	No	77.3 (68)	77.3 (68)
Exercise wheeze last 12 months	Yes	83.9 (73)	79.5 (70)
	No	16.1 (14)	20.5 (18)
Night cough last 12 months	Yes	67.8 (59)	54.5 (48)
	No	32.2 (28)	45.5 (40)
Days off school due to asthma/wheezing in last 12 months	None	59.3 (51)	76.2 (64)
	1-6 days	33.7 (29)	21.4 (18)
	1-2 weeks	2.3 (2)	2.4 (2)
	2-4 weeks	3.5 (3)	0.00
	More than 4 weeks	1.2 (1)	0.00
Asthma medications			
Taken any medications for asthma/wheezing in last 12 months	Yes	79.3 (69)	67.9 (57)
	No	20.7 (18)	32.1 (27)
Run out of asthma medications in last 12 months	Never	48.3 (42)	63.4 (52)
	1-2 times	41.4 (36)	29.3 (24)
	More than 3 times	10.3 (9)	7.3 (6)
If you did run out, what did you do?	Used no medication	13.6 (12)	14.8 (13)
	Used someone else's medication	20.5 (18)	14.8 (13)
	Went to the GP	23.9 (21)	12.5 (11)
Asthma management			
Has a peak flow meter	Yes	43.0 (37)	53.4 (47)
	No	41.9 (36)	37.5 (33)
	Not sure	15.1 (13)	9.1 (8)
If yes, have used the meter for my asthma/wheezing in the last 12 months		25.3 (21)	31.7 (26)
Has a written asthma action plan	Yes	8.2 (7)	9.2 (8)
	No	71.8 (61)	75.9 (66)
	Not sure	20.0 (17)	14.9 (13)
If yes, have used the plan for my asthma/wheezing in the last 12 months		7.6 (6)	7.2 (6)
Asthma education			
Has anyone ever shown you how to use your inhalers?	Yes	94.3 (82)	89.8 (79)
	No	5.7 (5)	10.2 (9)
If yes, who?	Doctor	73.9 (65)	69.3 (61)
	Nurse	17.0 (15)	15.9 (14)

	Asthma educator	3.4 (3)	8.0 (7)
	Maori health worker	0.0	4.5 (4)
Have you received education about asthma in last 12 months	Yes	45.3 (39)	45.3 (39)
	No	54.7 (47)	54.7 (47)
If yes, who gave the education?	Asthma educator	11.4 (10)	9.1 (8)
	Nurse	6.8 (6)	5.7 (5)
	Maori health worker	3.4 (3)	2.3 (2)
	Doctor	19.3 (17)	14.8 (13)
	Teacher	18.2 (16)	18.2 (16)
	Family member	8.0 (7)	11.4 (10)
Use of health services			
Do you have a family doctor?	Yes	88.5 (77)	89.5 (77)
	No	1.1 (1)	4.7 (4)
	Don't know	10.3 (9)	5.8 (5)
In the last 12 months, how may times have you seen a doctor because of your asthma/wheezing for a routine visit/check-up?	None	22.7 (20)	40.9 (36)
	1 time	34.1 (30)	25.0 (22)
	2 times	26.1 (23)	20.5 (18)
	3-5 times	14.8 (13)	12.5 11)
	6-11 times	1.1 (1)	1.1 (1)
	More than 12 times	1.1 (1)	0.0
In the last 12 months, how many times have you seen a doctor as an emergency visit for your asthma or wheezing?	None	52.3 (46)	76.1 (67)
	1 time	34.1 (30)	18.2 (16)
	2 times	9.1 (8)	3.4 (3)
	3-5 times	4.5 (4)	1.1 (1)
	6-11 times	0.0	1.1 (1)
In the last 12 months, how many times have you been admitted to hospital for your asthma/wheezing?	Never	93.0 (80)	95.3 (82)
	1-2 times	7.0 (6)	4.7 (4)
Smoking status			
Ever smoked cigarettes	Yes	53.5 (46)	62.1 (54)
	No	46.5 (40)	37.9 (33)
Smoked cigarettes in last 12 months	Yes	38.6 (34)	46.6 (41)
	No	61.4 (54)	53.4 (47)
Currently smoking	Yes	23.9 (21)	31.8 (28)
	No	76.1 (67)	68.2 (60)
No. of people in house who smoke	0	32.9 (27)	29.6 (24)
	1	24.4 (20)	27.2 (22)
	2+	42.7 (35)	43.2 (35)

Table 7. 6: Adolescent Asthma Quality of Life Questionnaire (AAQOL) participant scores at baseline and one year follow-up

AAQOL			Baseline scores				One-year follow-up scores			
	n	No. of questions.	Median	Mean	Lower 95% CI	Upper 95% CI	Median	Mean	Lower 95% CI	Upper 95% CI
Total score	88	32	143.5	142.8	138.1	147.5	152.0	150.9	147.0	154.8
Symptom	88	6	28.5	28.9	27.5	30.3	31.5	30.9	29.5	32.2
Medication	88	5	29.0	28.4	27.4	29.5	30.0	29.6	28.7	30.4
Physical	88	6	32.0	31.3	29.9	32.7	32.0	32.3	31.2	33.4
Emotional	88	5	27.5	26.1	24.8	27.3	29.5	28.6	27.5	29.7
Social life	88	5	30.0	28.1	26.9	29.2	30.0	29.6	28.6	30.6
Positive effect	88	5	20.5	20.0	18.3	21.6	21.5	21.9	20.5	23.2

Table 7.6 presents the student's summary scores at baseline (for the previous two weeks) and one year follow-up (for the previous two weeks) in the six domains measured and as a total score (excluding the 'positive effects' domain score) using the AAQLQ. Any missing values were recoded as the maximum value of 7 (not bothered at all/none of the time). A higher score indicates a higher quality of life.

At baseline, the mean scores in each of the domains indicated that most of the study participants assessed their asthma condition to have had a moderate impact on their daily lives during the previous two weeks. However, for some of the domains, including asthma symptoms and physical activity, individual scores suggested that the impact of asthma in a high proportion of students was severe. For example, under the asthma symptom domain, in response to the question:

> *"How bothered have you been by wheezing?"*

15.9% of participants self-rated their level of impairment from wheezing to be severe. Additionally, 18.2% had experienced shortness of breath, 18.2% had had difficulty taking a deep breath and 14.8% had felt tightness in the chest, either all of the time, most of the time or quite often, and 26.1% had been bothered by coughing, either; extremely bothered, very bothered, or quite bothered. Their responses in one of these three categories indicate severe impairment of quality of life for the symptom domain.

The mean scores at one year follow-up were very similar to those at baseline indicating little change in the participants' quality of life over that period. The score for the positive effects domain at baseline indicated that just under a quarter of participants (n= 18) gave a high rating for the positive impact that asthma had on their daily lives (not shown in table). Overall, however, the total score for this domain at baseline and follow-up indicates that asthma was having a moderate impact on their daily lives.

Parents/caregivers

At baseline more than three quarters of parents/caregivers taking part in the study were employed, with 63.5% of these working more than 30 hours per week and 36.5%

working less than 30 hours per week (Table 7.7). 17.1% of parents/caregivers reported being unemployed. For those not in the labour force, the largest proportion of these reported being at home with children (42.3%) as the reason. Nearly half of the parents/caregivers held a Community Services Card (CSC) with 59.5% having prescription subsidy cards and 37.8% having a high user health card. While all of the parents/caregivers had a family doctor, nearly 20% reported having had at least one occasion in the past year when they were unable to see a doctor.

Overall, employment status was similar for parents/caregivers at the one year follow-up with a slightly higher proportion of parents/caregivers employed. There was a reduction in the proportion of those holding a CSC (37.1%) and the proportion of those who reported not being able to see a doctor during the year had reduced by more than half compared with the responses at baseline.

Factors affecting asthma morbidity

Table 7.8 presents the unadjusted prevalence odds ratio for the associations between baseline asthma morbidity, medication and health service usage, asthma education and self-management, and environmental factors on the frequency of wheezing attacks and the occurrence of severe attacks during one-year follow-up period.

As expected, the strongest risk factor for experiencing 4+ attacks of wheezing during the one-year follow-up period was having experienced 4+ of wheezing in the year prior to baseline, with a prevalence odds ratio (POR) of 2.48 (95% CI 0.92-6.71, p = 0.07).

Table 7. 7: Employment status and primary health service usage for participants (parents/caregivers questionnaire)

	Factors	Baseline % (n)	One year follow-up % (n)
Employment status			
How have you spent your time in last 12 months?	Employed	78.6 (55)	81.9 (59)
	Full time (> 30 hours)	63.5 (33)	68.5 (37)
	Part time (< 30 hours)	36.5 (19)	31.5 (17)
	Unemployed	17.1 (12)	12.5 (9)
	Available for work	41.7 (5)	28.6 (2)
	Actively seeking work	58.3 (7)	71.4 (5)
	Not in the labour force	4.3 (3)	5.6 (4)
	Student	34.6 (9)	23.5 (4)
	Home with children	42.3 (11)	35.3 (6)
	Retired	15.4 (4)	0.0
	Benefit (invalid, sickness)	7.7 (2)	41.2 (7)
Health service subsidies			
Do you have a community services card?	Yes	47.7 (41)	37.1 (26)
	No	52.3 (45)	62.9 (44)
What type of card is it?	High user health card	37.8 (14)	26.1 (6)
	Prescription subsidy card	59.5 (22)	61.5 (16)
	Other	2.7 (1)	3.8 (1)
Use of health services			
Do you have a family doctor?	Yes	100.0 (88)	95.3 (82)
	No		4.7 (4)
In the last 12 months, has there been a time when you needed to see the doctor but you were unable to?	Yes	19.5 (17)	8.3 (7)
	No	80.5 (70)	91.7 (77)

Other factors that were associated with 4+ attacks of wheezing during the one-year follow-up period included (for the year prior to baseline) waking at night with wheezing (POR=2.74, 95% CI 0.85-8.83, p = 0.09), current smoking (POR=2.11, 95% CI 0.82-5.41, p = 0.12), using paracetamol at least once a month (POR=2.55, 95% CI 0.89-7.36, p = 0.08) and experiencing problems of access (i.e. running out of medication, an emergency GP visit, a hospital admission for asthma, or needing to see a doctor but being unable to) (POR=1.84, 95% CI 0.60-5.66, p=0.29). Having an asthma action plan was weakly negatively associated with the risk of having 4+ attacks during the one-year follow-up period (POR=0.85, 95% CI 0.15-4.70, p=0.85).

The strongest findings for severe asthma in study participants related to having experienced severe wheeze in the year prior to baseline (POR=4.24, 95% CI 1.42 – 12.64, $p = 0.01$) and having problems of access in the year prior to baseline (POR = 4.02, 95% CI 0.86-18.9, $p = 0.08$).

The findings in Table 7.8 are univariate and are not adjusted for potential confounders. It was decided to run a multivariate logistic regression model including variables that were of *a priori* interest or which had shown strong associations in the univariate analyses. However, it was found that these variables were all strongly correlated with each other and there were major problems of multi-collinearity and the regressions coefficients had high standard errors. Even the findings for basic demographic variables such as gender were unstable because these were strongly associated with smoking and other variables of interest (e.g. problems of access).

It was therefore decided to run a reduced model including the following variables: (i) a single measure of asthma severity at baseline (this differed according to which outcome variable was being considered); (ii) the summary "problems of access" at baseline variable; (iii) having an asthma action plan at baseline (as a summary measure of having received asthma education and/or good asthma care); (iv) paracetamol at least once a month in the 12 months prior to baseline (this being the strongest "asthma risk factor"); (v) currently smoking at baseline; and (vi) having a community services card (as a marker of socioeconomic status). The analyses were

Table 7. 8: Factors affecting asthma morbidity during one-year follow-up period

Baseline variables (at start of follow-up)	Frequency / Type	Asthma morbidity during one-year follow-up					
		4+ attacks of wheezing			Severe wheeze		
		%	POR	95% CI	%	POR	95% CI
Gender	Male	30.4	1.00		25.0	1.00	
	Female	30.8	1.02	0.40 – 2.56	20.0	0.75	0.27 – 2.07
Asthma severity							
4+ attacks of wheeze past 12 months	No	25.4	1.00		21.0	1.00	
	Yes	45.8	2.48	0.92 – 6.71	29.2	1.55	0.53 – 4.53
Waking at night past 12 months	No	26.8	1.00		23.0	1.00	
	Yes	50.0	2.74	0.85 – 8.83	21.4	0.91	0.23 – 3.66
Severe wheeze past 12 months	No	26.2	1.00		16.2	1.00	
	Yes	45.0	2.31	0.82 – 6.54	45.0	4.24	1.42 – 12.6
Days off school past 12 months due to asthma	No	28.6	1.00		17.6	1.00	
	Yes	35.3	1.36	0.53 – 3.48	31.4	2.14	0.78 – 5.89
Exercise wheeze past 12 months	No	15.4	1.00		0.0	1.00	
	Yes	33.8	2.81	0.58 – 13.70	–	–	–
Coughing at night past 12 months	No	25.9	1.00		21.4	1.00	
	Yes	33.3	1.43	0.51 – 3.97	23.7	1.14	0.39 – 3.37
Asthma management							
Has a peak flow meter	No	34.0	1.00		22.4	1.00	
	Yes	27.0	0.72	0.28 – 1.84	24.3	1.11	0.41 – 3.04
Has an asthma action plan	No	32.0	1.00		21.8	1.00	
	Yes	28.6	0.85	0.15 – 4.70	28.6	1.44	0.26 – 8.06
Asthma education							
Ever shown how to use inhalers	No	20.0	1.00		20.0	1.00	
	Yes	31.6	1.85	0.20 – 17.4	23.2	1.21	0.13 – 11.5
Asthma education in past 12 months	No	28.9	1.00		40.0	1.00	
	Yes	34.2	1.28	0.51 – 3.24	60.0	2.17	0.78 – 6.01
Asthma medications							
Taking asthma medication in the past 12 months	No	29.4	1.00		0.0	1.00	
	Yes	31.3	1.10	0.34 – 3.51	–	–	–
Run out of medication in the past 12 months	No	22.0	1.00		21.4	1.00	
	Yes	39.5	2.33	0.89 – 6.07	24.4	1.19	0.44 – 3.23

Use of health services							
Seen GP for asthma in past 12 months for routine visit	No	25.0	1.00		5.0	1.00	
	Yes	32.3	1.43	0.46 – 4.47	27.9	7.37	0.92 – 58.9
Seen GP for asthma in past 12 months as an emergency	No	25.0	1.00		11.1	1.00	
	Yes	36.6	1.73	0.68 – 4.40	34.9	4.29	1.40 – 13.2
Admitted to hospital in past 12 months for asthma	No	0.0	1.00		0.0	1.00	
	Yes	–	–	–	–	–	–
Has a GP	No	0.0	1.00		0.0	1.00	
	Yes	–	–	–	–	–	–
Has a Community Services Card	No	31.0	1.00		17.8	1.00	
	Yes	31.7	1.04	0.41 – 2.62	29.3	1.91	0.69 – 5.30
Needed to see GP in past 12 months but was unable to	No	31.3	1.00		20.0	1.00	
	Yes	29.4	0.91	0.29 – 2.92	35.3	2.18	0.69 – 6.92
Problems of access	No	21.7	1.00		8.7	1.00	
	Yes	33.9	1.84	0.60 – 5.66	27.7	4.02	0.86 – 18.9
Asthma risk factors							
Vigorous exercise	Never-once or twice/week	28.9	1.00		12.5	1.00	
	Three or more times/week	33.3	1.23	0.49 – 3.11	35.9	3.92	1.34 – 11.5
Watching television	Less than 3 hours/day	47.8	1.00		20.8	1.00	
	More than 3 hours/day	25.0	0.36	0.13 – 0.99	24.2	1.21	0.39 – 3.81
Electricity used for cooking	No	38.5	1.00		23.1	1.00	
	Yes	29.6	0.67	0.20 – 2.30	23.0	0.99	0.25 – 4.03
Gas used for cooking	No	26.7	1.00		23.8	1.00	
	Yes	41.7	1.96	0.73 – 5.30	20.8	0.84	0.27 – 2.64
Open fire used for cooking	No	30.9	1.00		22.6	1.00	
	Yes	33.3	1.12	0.10 – 12.9	33.3	1.71	0.15 – 19.9
Electrical heating	No	27.6	1.00		20.0	1.00	
	Yes	32.7	1.28	0.47 – 3.44	24.6	1.30	0.44 – 3.83
Gas/kerosene/paraffin heating	No	30.4	1.00		24.5	1.00	
	Yes	31.6	1.06	0.42 – 2.67	21.1	0.82	0.30 – 2.27
Wood/coal/oil heating	No	28.1	1.00		24.1	1.00	
	Yes	37.0	1.51	0.57 – 3.98	20.7	0.82	0.28 – 2.42
Paracetamol in past 12 months	Less than once/month	19.4	1.00		18.2	1.00	
	At least once/month	38.0	2.55	0.89 – 7.36	25.5	1.54	0.52 – 4.56
Older siblings	0	41.2	1.00		22.2	1.00	
	1	27.3	0.54	0.14 – 2.06	30.4	1.53	0.37 – 6.35
	2+	30.6	0.63	0.19 – 2.08	16.7	0.70	0.17 – 2.88
Younger siblings	0	33.3	1.00		36.4	1.00	
	1	27.3	0.75	0.20 – 2.77	13.0	0.26	0.06 – 1.17
	2+	37.1	1.18	0.38 – 3.69	22.2	0.50	0.16 – 1.61

Born in New Zealand	No	0.0	1.00		0.0	1.00	
	Yes	–	–	–	–	–	–
Years lived in New Zealand	Less than five years	-	-		-	-	
	Five to ten years	0.0	1.00	–	0.0	1.00	–
	Ten+ years	–	–	–	–	–	–
Frequency of trucks passing	Seldom	35.7	1.00		26.2	1.00	
	Most of the day	25.6	0.62	0.24 – 1.62	21.4	0.77	0.28 – 2.11
Cat now	No	40.9	1.00		21.7	1.00	
	Yes	28.3	0.57	0.21 – 1.58	22.6	1.05	0.33 – 3.34
Dog now	No	20.0	1.00		25.0	1.00	
	Yes	39.6	2.62	0.95 – 7.20	22.0	0.85	0.31 – 2.32
Smoking Status							
Smoking ever	No	20.5	1.00		25.0	1.00	
	Yes	38.6	2.44	0.91 – 6.54	21.7	0.83	0.31 – 2.27
Smoking in past 12 months	No	24.5	1.00		22.2	1.00	
	Yes	40.6	2.11	0.82 – 5.41	23.5	1.08	0.39 – 2.99
Currently smoking	No	26.2	1.00		22.4	1.00	
	Yes	45.0	2.31	0.82 – 6.54	23.8	1.08	0.34 – 3.45
Number of cigarettes smoked	None	34.6	1.00		55.0	1.00	
	One or more	30.2	0.82	0.30 – 2.22	45.0	0.29	0.10 – 0.81
Mother smokes	No	35.7	1.00		27.3	1.00	
	Yes	27.5	0.68	0.27 – 1.75	19.5	0.65	0.23 – 1.79
Father smokes	No	42.9	1.00		35.7	1.00	
	Yes	13.3	0.21	0.03 – 1.28	20.0	0.45	0.09 – 2.40
Number of smokers in the house	None	32.3	1.00		31.3	1.00	
	1	37.5	1.26	0.36 – 4.45	31.3	1.00	0.27 – 3.65
	2+	26.5	0.76	0.26 – 2.21	13.9	0.36	0.11 – 1.18

adjusted for area (the Hutt Valley or Porirua/Wellington), but not for age or gender because these introduced significant multi-collinearity and made the model unstable. The findings are shown in Table 7.9.

None of the associations were statistically significant in the multivariate model, perhaps because of the small numbers involved, but the findings are nevertheless of interest. Having 4+ attacks during the one-year follow-up period was associated with having had 4+ attacks in the year prior to baseline (POR=2.66, 95% CI 0.85-8.27, *p*=0.09), problems of access in the year prior to baseline (POR=2.45, 95% CI 0.69-8.71, *p*=0.17), and having used paracetamol at least once a month in the year prior to baseline (POR=2.18, 95% CI 0.68-6.98, *p*=0.19). Having an asthma action plan showed a weak protective effect (POR=0.68) and having a community services card (POR=1.27) showed a weak positive association. In contrast with the univariate model, there was only a weak association between current smoking and the risk of having 4+ attacks of wheezing during the one-year follow-up (POR=1.35).

For the outcome of severe wheeze during the one year of follow-up, this was associated with severe wheeze in the year prior to baseline (POR=3.05, 95% CI 0.86-10.79, *p*=0.08), problems of access in the year prior to baseline (POR=3.13, 95% CI 0.59-16.66, *p*=0.18), and paracetamol use (POR=2.16, 95% CI 0.62-7.49, *p*=0.23). Having a community services card (POR=1.33) showed a weak positive association.

Table 7. 9: Adjusted prevalence odds ratios for factors associated with increased frequency of wheezing and increased asthma severity

		Asthma morbidity during one-year follow-up			
Baseline variables (at start of follow-up)		**4+ attacks of wheezing**		**Severe wheeze**	
		POR	**95% CI**	**POR**	**95% CI**
Severe wheeze (baseline)	No			1.00	-
	Yes			3.05	0.86 – 10.79
4+ attacks (baseline)	No	1.00	-		
	Yes	2.66	0.85 – 8.27		
Access problems	No	1.00	-	1.00	-
	Yes	2.45	0.69 – 8.71	3.13	0.59 – 16.66
Action plan	No	1.00	-	1.00	-
	Yes	0.68	0.11 – 4.35	1.23	0.17 – 8.79
Paracetamol in past 12 months	No	1.00	-	1.00	-
	Yes	2.18	0.68 – 6.98	2.16	0.62 – 7.49
Current smoking	No	1.00	-	1.00	-
	Yes	1.35	0.44 – 4.15	0.77	0.23 – 2.61
Community services card	No	1.00	-	1.00	-
	Yes	1.27	0.43 – 3.73	1.33	0.41 – 4.32

Factors affecting asthma quality of life

The asthma quality of life score is a continuous variable and I therefore conducted regression analyses of the change in the quality of score as a continuous variable. The univariate regression analyses are presented in Table 7.10.

Various markers of having severe asthma at baseline (severe wheeze, days off school, night cough) were associated with a subsequent increase in asthma quality of life; the findings for "days off school" at baseline were statistically significant (p=0.04), but the magnitude of the effect was similar for severe wheeze. Having a peak flow meter was associated with an improvement in asthma quality of life (p=0.08), as was having seen a doctor for asthma on a routine visit during the previous 12 months (p=0.06) or having seen a doctor for an emergency visit (p=0.06). Having a family doctor was associated with an improvement in asthma quality of life (p=0.06) but there was only one participant who reported not having a family doctor.

The baseline asthma quality of life score was significantly negatively associated with the subsequent change in the score (p<0.001). Thus, those who had a low score at baseline showed a significant increase in score, whereas those with a high score at baseline showed a decrease. This is consistent with a "regression to the mean" effect which is also evident in the improvement in asthma quality of life scores in those with more severe asthma at baseline.

Table 7.11 shows the findings of the corresponding multivariate analysis. Only the baseline asthma quality of life score was significantly (negatively) associated with the subsequent change in asthma quality of life score ($p<0.01$), but there were non-significant associations for gender (females showed a greater increase in quality of life score) and having seen a family doctor for a routine visit in the previous 12 months. In contrast with the univariate findings, having seen a family doctor for an emergency, or having a community services card were both (non-significantly) associated with a decrease in the asthma quality of life score.

Table 7. 10: Factors affecting change in asthma quality of life (QoL)

Baseline variables (at start of follow-up)	**Frequency / Type**	**Change in asthma QoL during one-year follow-up**		
		Mean Change	**Difference**	**95% CI**
Gender	Male	2.3		
	Female	15.1	12.9	3.2, 22.5
Asthma severity				
4+ attacks of wheeze past 12 months	No	7.0		
	Yes	11.4	4.4	-7.0, 15.8
Waking at night past 12 months	No	8.4		
	Yes	6.5	-1.9	-15.6, 11.8
Severe wheeze past 12 months	No	6.4		
	Yes	13.8	7.3	-4.5, 19.2
Days off school past 12 months due to asthma	No	4.2		
	Yes	14.8	10.7	0.7, 20.6
Exercise wheeze past 12 months	No	1.1		
	Yes	9.4	8.3	- 5.4, 22.0
Coughing at night past 12 months	No	4.6		
	Yes	9.8	5.2	-5.6, 16.0
Asthma management				
Has a peak flow meter	No	3.8		
	Yes	12.8	9.1	-0.9, 19.1
Has an asthma action plan	No	8.7		
	Yes	10.6	1.9	-16.5, 20.2
Asthma education				
Ever shown how to use inhalers	No	-5.0		
	Yes	8.8	13.8	-7.7, 35.3
Asthma education in past 12 months	No	10.6		
	Yes	6.1	-4.5	-14.5, 5.6
Asthma medications				
Taking asthma medication in the past 12 months	No	7.1		
	Yes	8.5	1.4	-11.1, 13.9
Run out of medication in the past 12 months	No	7.9		
	Yes	8.5	0.6	-9.5, 10.7
Use of health services				
Seen GP for asthma in past 12 months for routine visit	No	-0.7		
	Yes	10.7	11.3	-0.4, 23.0
Seen GP for asthma in past 12 months as an emergency	No	3.5		
	Yes	13.0	9.5	-0.3, 19.3
Has a GP	No	-37.0		
	Yes	8.3	45.3	-1.4, 92.0
Has a Community Services Card	No	12.2		
	Yes	4.3	-7.9	-18.0, 2.2
Needed to see GP in past 12 months but was unable to	No	6.4		
	Yes	11.4	4.8	-7.5, 17.1
Problems of access	No	1.0		
	Yes	10.6	9.7	-1.5, 20.9
Quality of Life Score				
	1-135	25.2		
	136-152	5.9	-19.2	-29.3, -9.1
	152-189	-7.2	-32.4	-42.7, -22.0
Asthma risk factors				
Vigorous exercise	Never-once or twice/week	11.6		
	Three or more times/week	3.9	-7.7	-17.7, 2.4
Watching television	Less than 3 hours/day	11.6		
	More than 3 hours/day	7.0	-4.6	-16.0, 6.7
Electricity used for cooking	No	8.4		
	Yes	8.1	-0.2	-14.5, 14.0
Gas used for cooking	No	8.6		
	Yes	7.0	-1.7	-13.0, 9.6
Open fire used for cooking	No	8.5		
	Yes	-1.7	-10.2	-37.8, 17.5

Electrical heating	No	13.3		
	Yes	5.5	-7.8	-18.3, 2.7
Gas/kerosene/paraffin heating	No	8.8		
	Yes	7.4	-1.3	-11.5, 8.9
Wood/coal/oil heating	No	7.4		
	Yes	9.7	2.3	-8.5, 13.0
Paracetamol in past 12 months	Less than once/month	4.8		
	At least once/month	10.8	6.0	-4.6, 16.6
Older siblings	0	16.7		
	1	4.8	-11.9	-27.1, 3.3
	2+	10.0	-6.6	-20.6, 7.3
Younger siblings	0	5.5		
	1	13.8	8.3	-5.9, 22.5
	2+	7.3	1.8	-11.1, 14.6
Born in New Zealand	No	-16.0		
	Yes	8.6	24.6	-22.9, 72.0
Years lived in New Zealand	Less than five years	-9.0		
	Five to ten years	20.0	29.0	-38.2, 96.2
	Ten+ years	8.4	17.4	-30.4, 65.2
Frequency of trucks passing	Seldom	9.6		
	Most of the day	7.2	-1.5	-11.8, 8.8
Cat now	No	9.6		
	Yes	7.2	-2.4	-13.9, 9.1
Dog now	No	6.1		
	Yes	9.9	3.7	-6.6, 14.1
Smoking status				
Smoking ever	No	8.2		
	Yes	8.2	-0.2	-10.4, 10.1
Smoking in past 12 months	No	8.0		
	Yes	8.2	0.2	-10.1, 10.5
Currently smoking	No	7.7		
	Yes	9.4	1.7	-10.0, 13.5
Mother smokes	No	5.9		
	Yes	10.8	-1.0	-20.5, 18.5
Father smokes	No	13.9		
	Yes	12.9	-1.0	-20.5, 18.5
Number of smokers in the house	None	7.3		
	1	5.6	-1.7	-15.5, 12.2
	2+	8.2	-0.9	-10.1, 12.0

Table 7. 11: Adjusted analyses for factors affecting change in asthma quality of life (QOL)

Baseline variables (at start of follow-up)		**Change in asthma QoL during one-year follow-up**	
		Difference	**95% CI**
Baseline QoL score	1 unit	-0.7	-0.9, -0.5
Female	Female	5.3	-2.7, 13.3
Access problems	Yes	-2.8	-13.6, 8.0
Severe wheeze (baseline)	Yes	3.6	-12.9, 7.2
Peak flow meter	Yes	2.5	-7.5, 11.6
Action plan	Yes	1.9	-12.2, 16.0
Seen GP for asthma in last 12 months for routine visit	Yes	4.5	-5.9, 14.8
Seen GP for asthma in last 12 months for emergency visit	Yes	-5.6	-16.2, 5.0
Community services card	Yes	-6.4	-15.6, 14.4

Factors affecting access to care

Table 7.12 presents the unadjusted prevalence odds ratios for the associations between baseline asthma morbidity, medication and health service usage, asthma education and self-management, environmental factors, socio-economic factors and smoking status on access to care.

Problems of access to care were associated with problems of access at baseline (POR=5.07, 95% CI 1.68-15.33, p <0.01) and having two or more younger siblings (POR=2.27, 95% CI 0.77-6.70, p=0.14). Having a community services card was associated with a reduced risk of having problems of access (POR=0.63, 95% CI 0.27-1.47, p=0.28).

As with the analyses of asthma morbidity, the multivariate analyses of risk factors for access problems suffered from severe problems of multi-collinearity and a reduced model was therefore run, adjusting for area, with the following variables: (i) access problems at baseline; (ii) severe wheeze at baseline; (iii) having an asthma action plan; (iv) number of younger siblings and (v) having a community services card. Table 7.13 shows the findings. As in the univariate analysis, having access problems in the year prior to baseline was associated with experiencing problems of access at the one year follow up (POR=5.06, 95% CI 1.48-17.37, p=0.01). Having two or more younger siblings was also associated with problems of access (POR =2.29). Having a community services card (POR=0.72) and having an asthma action plan (POR=0.72) showed weak protective effects.

Table 7. 12: Factors affecting access to care

Baseline variables (at start of follow-up)	**Frequency / Type**	**Problems of access during one-year follow-up**		
		%	**POR**	**95% CI**
Gender	Male	50.0	1.00	
	Female	47.5	0.91	0.39 – 2.10
Asthma severity				
4+ attacks of wheeze past 12 months	No	46.8	1.00	
	Yes	54.2	1.35	0.52 – 3.46
Waking at night past 12 months	No	50.0	1.00	
	Yes	42.9	0.75	0.24 – 2.37
Severe wheeze past 12 months	No	48.5	1.00	
	Yes	50.0	1.06	0.39 – 2.88
Days off school past 12 months due to asthma	No	49.0	1.00	
	Yes	51.4	1.10	0.47 – 2.60
Exercise wheeze past 12 months	No	64.3	1.00	
	Yes	46.6	0.48	0.15 –1.59
Coughing at night past 12 months	No	39.3	1.00	
	Yes	54.2	1.83	0.73 – 4.57
Asthma management				
Has a peak flow meter	No	51.0	1.00	
	Yes	48.6	0.91	0.39 – 2.14
Has an asthma action plan	No	50.0	1.00	
	Yes	42.9	0.75	0.16 – 3.57
Asthma education				
Ever shown how to use inhalers	No	0.0	1.00	
	Yes	52.4	14.2	–
Asthma education in past 12 months	No	44.7	1.00	
	Yes	56.4	1.60	0.68 – 3.77
Asthma medications				
Taking asthma medication in the past 12 months	No	27.8	1.00	
	Yes	55.1	3.19	1.02 – 9.92
Run out of medication in the past 12 months	No	31.1	1.00	
	Yes	66.7	4.46	1.81 – 10.99
Use of health services				
Seen GP for asthma in past 12 months for routine visit	No	35.0	1.00	
	Yes	52.9	2.09	0.74 – 5.88
Seen GP for asthma in past 12 months as an emergency	No	37.8	1.00	
	Yes	60.5	2.24	0.92 – 5.50
Admitted to hospital in past 12 months for asthma	No	0.0	1.00	
	Yes	48.8	–	–
Has a GP	No	0.0	1.00	
	Yes	–	–	–
Has a Community Services Card	No	55.6	1.00	
	Yes	43.9	0.63	0.27 – 1.47
Needed to see GP in past 12 months but was unable to	No	45.7	1.00	
	Yes	58.8	1.70	0.58 – 4.97
Problems of access	No	21.7	1.00	
	Yes	58.5	5.07	1.68 – 15.33
Asthma risk factors				
Wood/coal/oil heating	No	53.4	1.00	
	Yes	37.9	0.53	0.21 – 1.32
Paracetamol in past 12 months	Less than once/month	42.4	1.00	
	At least once/month	51.0	1.41	0.58 – 3.41
Older siblings	0	38.9	1.00	
	1	43.5	1.21	0.34 – 4.25
	2+	52.8	1.76	0.56 – 5.56
Younger siblings	0	40.9	1.00	
	1	39.1	0.93	0.28 – 3.06
	2+	61.1	2.27	0.77 – 6.70
Born in New Zealand	No	0.0	1.00	
	Yes	–	–	–

Years lived in New Zealand	Less than five years	-	-	
	Five to ten years	1.0	1.00	–
	Ten+ years	–	–	–
Frequency of trucks passing	Seldom	54.8	1.00	
	Most of the day	40.5	0.56	0.24 – 1.34
Cat now	No	52.2	1.00	
	Yes	46.8	0.81	0.31 – 2.10
Dog now	No	50.0	1.00	
	Yes	48.0	0.92	0.39 – 2.18
Smoking status				
Smoking ever	No	55.0	1.00	
	Yes	43.5	0.63	0.27 – 1.48
Smoking in past 12 months	No	51.9	1.00	
	Yes	44.1	0.73	0.31 – 1.74
Currently smoking	No	52.2	1.00	
	Yes	38.1	0.56	0.21 – 1.53
Number of cigarettes smoked	None	51.9	1.00	
	One or more	47.3	0.83	0.33 – 2.09
Mother smokes	No	52.3	1.00	
	Yes	46.3	0.79	0.34 – 1.85
Father smokes	No	50.0	1.00	
	Yes	80.0	4.00	0.77 – 20.67
Number of smokers in the house	None	50.0	1.00	
	1	37.5	0.60	0.18 – 2.05
	2+	52.8	1.12	0.43 – 2.90
Quality of Life Score				
	1-135	62.1	1.00	
	136-152	45.2	0.50	0.18 – 1.41
	152-189	39.3	0.13	0.14 – 1.15

Table 7. 13: Adjusted prevalence odds ratios for factors associated with access to care

Baseline variables (at start of follow-up)	Frequency / Type	Access problems during one-year follow-up	
		POR	**95% CI**
Access problems	Yes	5.06	1.48-17.37
Severe wheeze	Yes	0.70	0.21-2.37
Action plan	Yes	0.72	0.09-5.59
Younger siblings	0	1.00	-
	1	0.69	0.18-2.62
	2+	2.29	0.67-7.89
Community services card	Yes	0.72	0.26-2.04

Semi-structured interviews

As described at the beginning of this chapter, all those parents/caregivers (or their child) who had responded positively to the question regarding "needing to see a doctor in the past 12 months but being unable to do so" were asked to take part in a semi-structured interview using the questionnaire on accessing health care (Appendix 4). Although the numbers were small for this section and involved only sixteen interviews, it was considered that the information provided a useful complement to the quantitative data.

Eight parent/caregivers were identified from their first interview, five from their second interview and six responded positively to this question at both the first and second interviews. Of these, three were unable to be contacted to take part in the follow-up interview, thus there were a total of 16 additional parents/caregivers interviews undertaken. The findings from the semi-structured interviews are presented in four categories: dependent variables (representing health service utilisation in the last 12 months), health need (assessed by perceived health status), structural factors (measuring availability of care) and subjective experiences (including perceived barriers to care).

Dependent variables

The number of visits to a doctor or health professional in the last 12 months varied widely among participants. Two of the interviewees had visited a doctor only once during the one year period. Several interviewees had seen the GP on up to six occasions for non-asthma related care including colds, flu, migraines and sports injuries affecting various family members. Seven interviewees had visited the doctor ten or more times for a range of ailments.

In terms of after hours care or visits to accident and emergency for any reason, five participants had not needed any emergency visits in the last 12 months. Eight interviewees had used after hours care. The most common reason related to sports injuries and care needed for elderly relatives. Three interviewees commented on needing after hours care for asthma. A number of parents/caregivers noted that cost of after hours care was a significant issue but that there were no other options.

> *"My husband went to after hours because he couldn't get in during the normal time."*

> *"Yes, we have visited the after hours clinic for asthma which was also very expensive."*

The majority of interviewees (or any of their family member) had not had a hospital admission in the last 12 months. Two participants had had older family members hospitalised due to complications from diabetes and cellulitis. Members from the remaining three interviewee families had been admitted for sports injuries and a dog attack.

Preventative care related to any education sessions or health checks attended by the interviewees at any venue, including community health days held in local shopping malls. Two thirds of the participants had received some form of preventive care including pap smears, breast checks and asthma education. Most of these interviewees had received the health checks through their doctor.

> *"I have had all of my checks done through the medical centre, they are excellent."*

> *"I received pap smears, blood pressure and diabetes check from my doctor who is a woman and a very thorough doctor."*

> *"Yes, I have had most of the checks visiting, mainly through my doctor."*

The other one third of interviewees had not received any preventive care in the previous 12 months.

Health need

Interviewees were asked to assess the overall health status of their family described as either *excellent, good, okay* or *poor*. The question also made provision for noting a disability of any member of the household which might prevent them from taken part fully in any activity (including school, housework, job) as well as potentially increasing the burden on other family members in terms of finance or physical requirements.

Only one interviewee perceived the health status of their family to be 'poor'. Five of the participants described their family's health as being 'okay' while the remaining interviewees described their health status in terms of either good or excellent. One interviewee felt her health to be excellent "*despite being on a disability benefit*." Some of the comments did suggest that the perception of health status was dependent on a number of factors. One interviewee commented that:

> *"Generally we are in good health however this year we have had a pretty dismal year."*

Another interviewee considered their family health to be 'excellent' even though "*my husband had pins in his spine and my son has severe asthma.*"

Structural factors

The availability of health care services and having a choice about where to get care were assessed. Interviewees were also asked about any asthma services they were aware of but did not use for any reason. All of the interviewees had a family doctor or general practice which they used. A couple of the interviewees were not aware of any health services available other than their GP practice. Most of the interviewees did know of marae-based clinics in their areas and had used them at some time in the past but for various reasons now used the GP as their main primary care provider.

> *"Yes, we used to use the marae health services but they're no longer available and so we have to go to the GP which is more expensive."*

> *"The marae-based service was not suitable for our working hours otherwise we would have used them. We would prefer to go there, we need marae based after hours services."*

The majority of participants also used their GPs for asthma care although a number of them were aware of marae-based asthma clinics in their areas.

Subjective experiences

Perceived barriers to care were assessed as subjective experiences including such things as not being able to get an appointment, having transportation problems or being nervous or afraid. Two of the participants expressed feelings of nervousness in approaching health services however, the most common reason given for not going to the doctor was lack of finances.

> *"We didn't have enough money. Our doctor use to be a free doctor but now he isn't."*

> *"Sometimes I find it hard to pay for prescriptions when needing it. I have to wait a few days for pay day before I can get it."*

Availability of appointments when needed, together with lack of transportation, were also commonly expressed reasons for not getting to a doctor.

> *"I wanted to see my female Māori doctor but so did every other wahine. My doctor is in high demand because she is Māori."*

> *"Booked out 'til the following week which is often."*

> *"I had no way of getting to the doctor anyway."*

Participants were also asked about any experiences of discrimination using the two questions: " *Have you ever felt uncomfortable for any reason when visiting a doctor or clinic?*" and *"Did you ever feel the quality of care was not as high as it should have/could have been for any reason*?"

Just under half of the interviewees found the quality of the care to be consistently good overall and had never experienced feeling uncomfortable when coming into contact with health services or health professionals. The remaining interviewees described a range of scenarios which they or a family member had experienced. Most of these situations related to issues around quality of care which had affected interviewees confidence in doctors and the health services.

> *"My husband injured himself badly, the family doctor misdiagnosed him. This affected our family income, the doctor should have done more and didn't follow up with a specialist. The specialist picked up the damage months later."*

"I was angry with my doctor for not doing anything about the lump on my breast, he didn't listen to me. He should have treated my lump on my breast more seriously."

"My mother was misdiagnosed for colic. She was very sick and had to be aggressive before anyone would listen to her including the doctor. She was chronically ill and gave up work for 18 months so we lost the income."
" Sometimes they hurry when talking, health providers, they rush you and don't listen to your whole story, they just give you the medicine or pills."

Discussion

This study has addressed three specific areas for Māori adolescents with asthma: (i) factors that affect the severity of asthma; (ii) factors that affect asthma quality of life; and (iii) factors that affect access to health care. Before discussing the study findings, there are acknowledged difficulties in assessing and measuring asthma morbidity and several limitations to the study which should be considered.

Limitations of the data

Selection bias

The primary limitation for this study related to the low response rate for the study and the resulting potential for selection bias. The ISAAC Phase III survey in 13-14 year olds had a response rate of 97% (Chapter Six), but the response rate for this "add on" study was much lower. Despite intensive efforts we were unable to recruit more than 88 participants out of 168 potential participants, a response rate of 52.4%. This is of concern, but the comparisons of the ISAAC Phase III data for participants and non-participants is reassuring in this respect.

There was little difference between responders and non-responders apart from a higher reported prevalence of night cough in the past 12 months among responders compared with non-responders (65.9% versus 51.0%) for the written questionnaire. This pattern was reversed for the video questionnaire with non-responders being more likely to report waking at night with coughing in the past month than responders (23.2% versus 11.5%).

The prevalence of environmental exposures in responders and non-responders was similar except for household smoking status where responders were less likely to have a smoking parent and more likely to live in a smoke free household than non-responders.

Although information was available for all non-responders through the ISAAC Phase III survey, this information was not available for their parent/caregivers. Given that few differences were found between the student responders and non-responders, it would be reasonable to assume the same was true for the parent/caregiver responders and non-responders, but the possibility of selection bias in this instance cannot be excluded.

A further consideration is that for the variables under study, e.g. exposure to environmental risk factors, use of health services and assessment of baseline quality of life, the analyses involved comparisons within the group of responders and are therefore unlikely to have been seriously biased by the low response rates. Furthermore, for some key outcome variables (e.g. change in quality of life score), the participants in the current study have acted as their own controls.

Precision

Of greater concern is that the low response rate meant that the overall participant numbers were small. The study power had been based on recruiting 125 participants, however we were only able to recruit 88 participants within the time frame and funding available. This meant that many of the comparisons had relatively low power and few of the findings were statistically significant despite the presence of relatively strong associations. For this reason, the findings presented here should be regarded as preliminary rather than definitive.

Validity of the data

A further consideration is the validity of the data that was collected from those who did participate in the study. Questionnaires have been found to have good validity and reproducibility with regard to current exposures in measuring asthma risk factors (Pearce et al, 1998). Thus, construction of the questionnaire for identifying potential risk factors included the participant's responses from the ISAAC Phase III Environmental Questionnaire and some additional questions which were developed, primarily as a result of the consultation phase (described earlier in this chapter). However, the two key difficulties associated with using symptom questionnaires are recall of symptoms which can be affected by participation in a study and recognition of symptoms (Pearce et al, 1998). An indirect consequence of participating in the study may have been to alter the student's 'usual' management of their asthma condition by increasing the frequency of their use of health care services or their use of medications. Because information was obtained relating to the 12 month period prior to the start of the study as well as the 12 month period 'during' the study, some confidence in the comparability of the information over time is possible. Administering a standard questionnaire using symptom events acted to minimise the potential for information bias in the study. Additionally, more than one data instrument was used to collect information for adolescents (asthma symptom/health service utilisation questionnaire and a validated quality of life questionnaire) and parent/caregivers (parent questionnaire, additional semi-structured interview on accessing health services).

While most of the interviews were conducted in person, due to the timetable of the students (work after school, sports participation, shared living arrangements between parents) and the work situation (shift workers) of a number of the parents/caregivers, this was not always possible and so some interviews were carried out over the phone or questionnaires were posted with return stamped envelopes. Because the overall study numbers were small, it was not realistic to consider analysing the data separately by method of collection.

Time frames are a potential problem with quality-of-life questionnaires and issues of reliability for responses have been raised for both adults and children with reduced time frames of 1-4 weeks having been utilised in children (Streiner & Norman, 1995; Juniper et al, 1996). Information on quality of life was collected at both entry to the study and at the one year follow-up and related to only the previous two weeks minimizing the impact of recall bias. It should also be emphasized that regression to the mean (Armitage et al, 2002) is always an issue in studies of this type, since asthmatics may be more likely to agree to participate if they are currently experiencing problems with their asthma. It is therefore not surprising that almost all of the symptoms declined in prevalence (Table 7.5). However, this is unlikely to be a major source of bias since participants were compared with themselves over time, and I adjusted for baseline asthma severity.

Study findings

Factors affecting asthma morbidity

The findings of this study must be treated with caution, particularly because of the low response rate and small numbers involved which has meant that very few findings were statistically significant. Nevertheless, the findings, are of interest. Risk factors for 4+ attacks of wheezing over a one-year period in this adolescent Māori population included previous asthma severity (e.g. previously experiencing 4+ attacks of wheezing) (POR=2.66), problems of access (POR=2.45), using paracetamol at least once a month (POR=2.18) and currently smoking (POR=1.35). Having an asthma action plan was weakly associated with having a decreased risk for frequent wheezing attacks (POR=0.68). Severe wheeze was associated with having experienced severe wheeze in the previous year (POR=3.05), problems of access (POR=3.13) and using paracetamol (POR=2.16).

The 'problems of access' variable comprised information from four categories: (i) running out of medication; (ii) an emergency GP visit; (iii) a hospital admission for asthma; (iv) needing to see a doctor but being unable to. These were combined because of the small numbers involved, but they will be considered separately here with reference to the findings from previous studies.

In the current study running out of medication was associated with increased episodes of wheezing (POR=2.33). Māori and Pacific Island people have been found to be less likely to be on prophylactic medications than European asthmatics (Garret et al, 1989; Pattemore et al, 1989). One study found that 33.0% of Polynesian children (Māori and Pacific Island combined) were not receiving any asthma drugs in the 24 hours prior to a hospital admission compared with 14.0% of Europeans. It also found that fewer Māori children were taking preventative medications compared with European children (13.0% vs 25.0%) (Mitchell, 1991). Under treatment of asthma (i.e. underprescribing and underuse of inhaled corticosteroids) has been recognised as being more common among poor populations (Mitchell et al, 1989; Bauman et al, 1992; Gottlieb et al, 1995; Watson et al, 1996). Gottlieb et al (1995) conducted a small area analysis of asthma hospitalisation rates in Boston where rates were highest in poor, non-white neighbourhoods. They concluded that the under-use of inhaled anti-inflammatory medication was an important contributing factor to the excess hospitalisation rates seen in this population. More generally "running out of medication" indicates that regular asthma care and asthma education is not being accessed, and it is therefore not surprising that this variable is associated with an increased frequency of asthma attacks. Thus, "running out of medication" may have a relatively direct causal association with asthma severity and the occurrence of asthma attacks.

Wanting to see a doctor in the past 12 months but being unable to was associated with increased asthma severity (POR=2.18) in the current study. Additional information was obtained through the semi-structured interviews with parents/caregivers with financial difficulties and problems with transport being the most common concerns expressed. As was discussed in Chapter Three, previous studies have found that income and cost of doctor visits were the primary reasons for people not accessing health services. New Zealand studies have found that financial burden is an important deterrent to care (Barnett & Coyle 1998; Waldegrave et al, 1999) and that people with lower incomes and increased health need may still use health services less than what their health status would suggest is necessary (Gribben 1996; Malcolm, 1996; Davis et al, 1997). Telephone interviews with 750 New Zealand adults (18 years or older) for the Commonwealth Fund 2002 International Health Policy Survey (Shoen & Doty, 2004) found that due to cost, 26% did not see a doctor when sick, 20% did not fill a prescription and 15% did not get a recommended test, treatment or follow-up care. 41% expressed dissatisfaction with long waiting times for specialist/hospital care, however, only a few people reported difficulties in accessing their GP. This was contrary to the findings from the current study where a lack of available appointments on the day required was a common occurrence among those parents/caregivers interviewed.

Having an asthma action plan showed a weak protective effect for increased wheezing attacks and having a community services card was negatively associated with severe wheeze in the current study. It has been previously noted that asthma action plans have been found to improve health outcomes for adults with asthma including reducing morbidity and a reduction in night waking (Beasley et al, 1993; Gibson et al, 2000). It has also been noted that the use of asthma action plans by doctors in the management of childhood asthma is low (Garrett et al, 1997; Marks et al 2000), an observation which was supported by the findings for this study. The reasons for this are unclear but it has been proposed that confusion among doctors regarding optimum treatment (including medications, use of peak flow meters and use of asthma action plans) in the primary care setting is common (Martin, 2000).

A hospital admission for asthma in the previous 12 months has been identified as a marker of chronic asthma severity which is strongly associated with subsequent asthma severity, including an increased risk of death (Pearce et al, 1999). Additionally, a number of studies have shown that poorer patients experience higher rates of hospitalisation (Halfon & Newachek, 1993). Mitchell and Cutler (1984) reported paediatric asthma admission rates for Auckland Hospital between 1970-1980, to be significantly increased in Māori and Pacific patients. Shaw et al (1994) found that hospitalisation for asthma was more frequently reported among Māori than European children (OR=2.4, 95% CI 1.2-4.8). National data for hospital admissions in 1992 showed asthma was the leading cause for admission of Māori in the 1-4 year age group, and third leading cause in the 5-14 year age group (Pomare et al, 1995). More recent analyses (Ellison-Loschmann, 2001) for the year 1998 show Māori hospitalisation rates continue to be higher than those for non-Māori with a nearly 50% higher rate of asthma admission in Māori 5-34 year olds (341/100 000) compared with non-Māori (246/100 000) of the same age-group. The findings presented here are therefore consistent with those of previous studies, and the findings on asthma mortality and hospitalisations for asthma presented in Chapter Five.

Studies examining the association between current wheeze and use of paracetamol relate primarily to asthma prevalence and were discussed in the previous chapter. In particular, Lesko et al (2002) in a randomized trial of children with current asthma and a febrile illness found that short-term use of paracetamol (in comparison with ibuprofen) increased subsequent asthma morbidity. Possible underlying mechanisms involve increased oxidative stress due to the ability of paracetamol to reduce levels of the anti-oxidant glutathione in immune cells, thus depleting anti-oxidant defences and promoting TH_2 allergic inflammation (Shaheen et al, 2000) as well as increased viral loads as a side-effect of paracetamol use, possibly leading to asthma (Balzer, 2000). Thus, the findings of the current study are consistent with other preliminary evidence linking paracetamol use to current asthma severity in both children and adults.

Factors affecting asthma quality of life

In the current study, a number of factors were associated with change in quality of life scores in this adolescent population. From the multivariate analyses, having an action plan and a peak flow meter, and having routine doctors visits for asthma in the previous 12 months were all associated with small (non-significant) improvements in asthma quality of life during the one year follow-up. The main determinant of asthma quality of life during the one year follow-up was the participant's baseline score.

Most of the previous research examining changes in quality of life have used an intervention study design rather than assessment of quality of life with participants acting as their own controls as was done in the current study. Additionally, few studies have evaluated the impact of quality of life on adolescents with asthma. The Adolescent Asthma Quality of Life Questionnaire (AAQOL) (Rutishauser et al, 2001) recognised the need for an instrument specific to the transitional period of adolescence when physical, cognitive, emotional and social changes are occurring which are unique to that life-stage and which had not been adequately captured by previous quality of life instruments developed for children or adults.

One study conducted in Australia to determine the effect of a peer led programme for asthma education on quality of life and related morbidity in adolescents with asthma (Shah et al, 2001) found that mean total quality of life scores showed significant improvement in those students taking part in the programme compared with those in the control group. Students in the intervention group reported a lower number of reported asthma attacks and days off school compared to their control group counterparts.

A few studies have examined quality of life measures in relation to asthma education. Ringsberg et al (1990) measured the effect of an education intervention programme on a small group of adult asthma patients (n=38) with regard to knowledge of asthma and its treatment, and quality of life, defined as self-assessed leisure activities, social interaction, physical activities and emotional adjustment. While there were no significant differences, the self-assessments showed that those in the intervention group felt better than those in the control group.

The Cochrane Database of Systematic Reviews (Gibson et al, 1998) identified self-management education involving self-monitoring by either peak expiratory flows or symptoms, regular medical review and a written action plan, to improve health outcomes for adults with asthma. Patient asthma education was defined as that which could be written, verbal, visual or audio, and related to asthma and its management. The education could be delivered using an interactive or non-interactive and structured or unstructured approach. Minimal education was characterised by the use of written material only or a short unstructured verbal interaction aimed at patient knowledge and understanding of asthma. Maximum education was structured and used both interactive and non-interactive modes of information transfer (Gibson et al, 1998).

The National Institute of Health (1995) report on asthma management in minority children concluded that education in the community or schools alone is not sufficient and that primary care providers must be involved in the provision of asthma care. Education interventions should address attitudes, beliefs, behaviours and skills of the intended population, not just knowledge, and recognise the importance of context and cultural values. Additionally reinforcement of self-managing skills has been found to be necessary, sometimes via a number of avenues including educators, doctors and practice nurses, if self-management programmes are to have continued benefits (Yoon et al, 1991; D'Souza et al, 2000).

Factors affecting access to care

In the current study, the main risk factors associated with problems of access to care included having access problems prior to baseline, and having two or more younger siblings. Holding a Community Services Card (CSC) slightly reduced the risk of experiencing problems of access.

Inequalities in healthcare and differential treatment/management have been found to be significant structural barriers to both the provision and uptake of health services. Socio-economic status can be viewed as a potentially modifiable environmental factor, in relation to asthma, which could impact on the severity or prolongation of symptoms. As has already been discussed, socio-economic status has been found to be a significant barrier to care in previous studies and was identified as being a major influencing factor for parents/caregivers using health services in the current study. It is reasonable to assume that a larger family size equates to an increased financial burden on family's, therefore affecting their ability to access care. The effect of employment status and family composition on general practice and secondary health care utilisation rates was investigated by Dovey et al (1992). They found that families of four people or more on a government benefit had a lower primary care cost per person than equivalent families where an adult was in paid employment, but higher costs in secondary care. This is supported by findings from other studies suggesting that primary health care utilisation rates by low income New Zealanders is less than expected (Pomare et al, 1995; Davis et al, 1997; Crengle, 2000).

Other factors relating to barriers to care found in the current study were specific service factors such as availability of appointment times and location of services. In theory, the use of mobile clinics such as the Māori Mobile Disease State Management Service, and satellite clinics should improve access and reduce the cost of accessing services. However, it is also recognised that Māori provider organisations cannot solely address problems of access and that increased responsiveness from mainstream services to Māori is required (Durie, 1998).

The role of discrimination and racism in the existence and maintenance of health disparities has been receiving increasingly more attention over the past twenty years. Recent work examining access *to* care and access *through* care as related factors, takes into account the wider health care system and the potential role of institutions and governments in maintaining disparities (Lurie, 2002; Baxter, 2002). Studies examining the experience of minorities within health care systems have found that they are treated differently across a broad range of disease categories from those of the majority population (Geiger, 2003). The findings from the Māori Asthma Review (Pomare et al, 1991) indicated that attitudes of health care workers had contributed to a reluctance by Māori to seek appropriate medical care when it was required. The interviews with parents/caregivers in the current study did not indicate this to be a strong barrier to care although some participants did comment on the quality of care which had affected their confidence in the doctor and the health service. This has been found in other work examining the effects of impaired patient-physician relationships as an important contributing factor to ongoing disparities in disease outcomes (Martin, 2000; Krishnan et al, 2001).

Summary

This study has examined factors associated with asthma severity, access to care and quality of life in a small sample of Māori adolescents. The results indicate that, as expected, baseline asthma severity and frequency of wheeze are important determinants of subsequent morbidity. Once baseline asthma severity was controlled for in a multivariate analysis, few other variables were risk factors for subsequent asthma morbidity. Having had previous problems of access to care was associated with experiencing increased asthma severity during the one-year follow-up. There was some evidence to suggest that paracetamol use may be associated with asthma severity in addition to its association with asthma prevalence (Chapter Six). Current smoking and having a community services card (a marker of low socioeconomic status) were weakly associated with the frequency of attacks, and having an asthma action plan showed a weak protective effect.

The main determinant of asthma quality of life was the asthma quality of life score at baseline. Once this was controlled for in a multivariate analysis, having an asthma action plan and a peak flow meter, and having made a routine visit to the GP for asthma in the previous 12 months were all associated with small (non-significant) improvements in asthma quality of life during the one-year follow-up. Having had to see the GP for an emergency visit, and having a community services card were weakly associated with (non-significant) declines in asthma quality of life.

The only significant predictor of access problems during the one-year follow-up was having had access problems in the year prior to baseline. Having two or more-younger siblings was non-significantly associated with experiencing access problems. Cost was described as being the most significant barrier to accessing care, and while the emergence of Māori health providers has been an important step in terms of the provision and utilisation of primary health care services, access issues still need to be addressed generally by the healthcare system. Another important issue is the lack of consistency among health providers in using asthma management plans with their clients. This may however be indicative of the difficulty for GPs and other professionals working in the area of asthma to keep up with current best practice combined with a noticeable lack in a national co-ordinated approach to asthma treatment and management which was noted in Chapter Three. This is considered in more depth in the following chapter which summarizes and discusses the overall findings from the new research conducted for this thesis.

CHAPTER EIGHT

CONCLUSIONS

Introduction

This thesis has involved conducting three pieces of new research: (i) a series of reviews and new analyses of descriptive data on asthma prevalence, hospitalisations and mortality in Māori and non-Māori; (ii) analyses of the ethnicity data from the Wellington International Study of Asthma and Allergies in Childhood (ISAAC) Phase III survey; and (iii) a follow-up study of Māori adolescents with asthma. This chapter summarises the findings from the new research conducted for this thesis. The collective findings are then considered as a whole in terms of their implications for future research, the provision of health services and public health more generally.

The research presented in this thesis validates and supports the findings from the Māori Asthma Review (Pomare et al, 1991) and importantly provides for the first time, epidemiological evidence that problems of access to asthma services for Māori continue to be relevant. A number of new findings have also emerged from this work. The descriptive analyses have identified significant patterns in asthma hospitalisation rates, with Māori being are higher in rural areas and non-Māori hosptialisation rates being generally higher in urban areas. This was the first time that seasonal patterns of asthma hopsitalisations and deaths among Māori have been investigated and while the findings were unclear, they provide a starting point for future research. The findings from the ISAAC Phase III analyses have identified an increase in asthma in prevalence amongst Māori children which has not been observed previously. Additionally, this increase, and the emerging differences in prevalence between Māori and non-Māori children could not be explained by known environmental risk factors for asthma. Finally, although the numbers were small, the follow-up study of asthma in Māori adolescents showed for the first time in a random sample of participants that a significant number experienced access problems and that this impacted on their asthma severity.

Summary of major findings

Descriptive epidemiology of asthma in Māori

Until the ISAAC Phase III Wellington survey was conducted the available evidence indicated that: (i) asthma prevalence is similar in Māori and non-Māori children; (ii) asthma prevalence is greater in Māori than in non-Māori adults; and (iii) asthma morbidity is greater in Māori than in non-Māori for both children and adults. Generally, the findings indicated that Māori are no more likely than non-Māori to develop asthma, but that once they develop the condition, it is both more severe and of longer duration.These findings from previous studies were investigated further in a series of descriptive studies of time trends and seasonal patterns in asthma mortality and hospitalisations in Māori and non-Māori, and regional differences in asthma hospitalisations.

The analyses of time trends in asthma mortality in Māori and non-Māori showed that the two asthma mortality epidemics of the 1960s and 1970s affected Māori disproportionately, with the peak rates in 1979 being twice that of non-Māori. Asthma mortality has now declined but continues to be higher in Māori than in non-Māori. For Māori aged 5-34 years, deaths are highest in the spring months of September and October and lowest in winter (July) with May being the peak month for hospitalisations, whereas for non-Māori, deaths are highest in summer (January) while hospitalisations peak in the winter month of June.

While there has been a reduction in asthma mortality and hospitalisation rates for Māori over the last 38 years, Māori across all age groups, continue to have a higher number of hospital admissions than non-Māori. The hospitalisation rates for Māori are generally higher in rural areas, whereas those for non-Māori are higher in urban areas. It is likely that the increased asthma hospitalisation rates among Māori reflect differences in asthma exacerbations and disease severity as a result of reduced access to asthma health services which may be particularly acute for those people living in rural areas.

Although the observed differences were not strong, they are generally consistent with other evidence that asthma severity is greater in Māori due to problems of access to health care. The exact relationship between access issues and asthma prevalence and severity is difficult to establish however, the available evidence indicates overall asthma morbidity to be disproportionately greater in Māori people. It has been proposed that in a significant number of cases, differential treatment, cost of medications and attitudes of health professionals at a primary care level may be all contributing factors to Māori requiring greater intervention at a secondary or tertiary level.

ISAAC Phase III, Wellington

While previous studies have consistently found asthma prevalence to be similar amongst Māori and non-Māori children, the Wellington ISAAC Phase III survey results indicate that this pattern appears to have changed and that Māori are now experiencing greater asthma symptom prevalence compared to non-Māori children. There was also evidence of increased asthma severity in Māori, particularly in adolescents, which is consistent with findings from previous studies. Environmental exposures addressed in the ISAAC Phase III survey, while yielding findings that are of interest in themselves, appear to explain little of the differences in asthma prevalence or severity between Māori and non-Māori. The increase in prevalence was strongest for 13-14 year olds and could, in part, be indicative of a condition which is more severe, has a greater frequency of exacerbations, and is lasting longer in Māori children with asthma compared with non-Māori children as a result of problems in health care access.

Asthma in Māori adolescents

This follow-up study was examining factors affecting asthma severity in Māori adolescents and the relationship between asthma severity, asthma quality of life and access to health care in this teenage population. A key finding was that baseline asthma severity and frequency of wheeze were important determinants of subsequent morbidity. After controlling for baseline asthma severity, problems of access to care (at baseline) was associated with experiencing increased asthma severity during the one-year follow-up. Use of paracetamol was associated with both asthma severity and asthma prevalence (from the ISAAC Phase III analyses). Current smoking and having a community services card were weakly associated with the frequency of wheezing attacks, and having an asthma action plan showed a weak protective effect.

The asthma quality of life score at baseline was the main determinant of asthma quality of life. Once this was controlled for, improvements in asthma quality of life during the one-year follow-up were associated with having an asthma action plan and a peak flow meter, and having made a routine visit to the GP for asthma in the previous 12 months.

Having had access problems in the year prior to baseline was the only significant predictor of access problems during the on-year follow-up. Having two or more-younger siblings was non-significantly associated with experiencing access problems. Cost was described as being the most significant barrier for study participants to accessing care. The low numbers of participants with an asthma action plan suggests they are not widely used despite the available evidence of their effectiveness.

In summary, the new research presented in this thesis both supports and extends previous research indicating that asthma is more severe in Māori because of problems of access to asthma health care and asthma education. It should be stressed that the evidence is not definitive, but where I was able to assess other determinants of asthma severity these did not explain the observed patterns, and the evidence is generally consistent with access to care playing a significant role. It also indicates that differences in asthma prevalence between Māori and non-Māori children have now emerged. Māori are experiencing barriers to health services which is reflected in high mortality and morbidity rates from amenable conditions. For asthma, this is seen in the disproportionate mortality and hospitalisation rates for Māori. If mortality and morbidity can be considered an indicator of need, then neither primary care utilisation nor secondary care utilisation reflects meeting this need when compared with utilisation in non-Māori (Baxter, 2002; Harris, 2003).

Implications

Future research implications

There are a number of areas to consider for future research as a result of this thesis. Ethnic analyses of the New Zealand dataset for ISAAC Phase III will be undertaken in the near future. Those analyses will provide more information regarding whether the apparent increase in asthma symptom prevalence among Māori adolescents, seen in the Wellington analyses, is a national phenomenon.

The follow-up study conducted for this thesis has further emphasized the importance of issues of access to care for Māori with asthma. However, because this study was observational, and because the numbers were relatively small, few specific factors emerged that would explain the greater asthma severity in Māori. Addressing the issue regarding differential treatment as a contributory factor to asthma morbidity amongst Māori is important. Additionally, investigating the effects of discrimination upon health requires clear concepts, methods and measures. This area of research is still in its relative infancy but development of such epidemiological research methods should be considered a priority given the persistence of health inequalities between Māori and non-Māori. The government has stated its commitment to reducing the health inequalities between Māori and other New Zealanders (Minister of Health, 2001). It has also identified the need to address determinants of health at a comprehensive level including education, income, employment and housing alongside recognising the specific role that health services and health providers may play in the existence and continuation of disparities (Ministry of Health, 1999a; Howden-Chapman & Tobias, 2000).

Health service implications

Primary health care services remain the first point of contact for many people with health needs and asthma is no exception. What is critical in terms of asthma is the need for both management and monitoring of chronic asthma as well as the ability to manage acute symptoms requiring immediate intervention. In Chapter Four it was noted that the diagnosis and subsequent management of asthma is dependant on a number of factors including recognition of symptoms by the patient, physician practice and availability of health services. Thus, it is crucial that all three areas are addressed in terms of client education, the development of primary care asthma guidelines for health professionals (including a means for monitoring their implementation) and improved access to services.

Reducing barriers (including financial barriers) and improving access to first-contact services has been identified as being a key priority of the Primary Health Care Strategy (Minister of Health, 2001). In its 2000 Annual Report, the Asthma Working Group (AWG) identified the major issues to include those of access and training along with a need for community based respiratory educators in many areas of New Zealand (Asthma Working Group, 2000). The AWG has developed an asthma strategy for District Health Boards (DHB) with a number of key recommendations based on ensuring access to primary health care services and the provision of asthma education including the use of self management skills, appropriate use of inhaled corticosteroids and written asthma plans (New Zealand Guidelines Group, 2001).

The Ministry of Health are updating a general practice database which will give some indication of general practice numbers and facilities nationwide (R King, personal communication, 7 August 2001). This may provide more information in terms of examining associations between the location and availability of primary care services and hospital admission rates, particularly in relation to geographic location and urban/rural situation. Similarly, there are issues in obtaining good location data on public hospitals and after-hours facilities which is also important in terms of assessing the impact on local hospitalisations rates and monitoring trends over time.

The development and growth of Māori providers has facilitated access for Māori to primary and preventive care services. Māori health providers have adopted a range of strategies in order to make their services accessible and have shown that it is possible to design and deliver services in ways which reduce the barriers to care for many Māori (Baxter, 2002). Additionally, Māori-led community programmes have been shown to reduce asthma morbidity and hospitalisation rates. If maximum benefit is to be obtained from such programmes then adequate provision must be built in to enable the further development and continuation of services which have been proven to be effective such as Tu Kotahi Māori Asthma Trust and the Wairarapa Māori Asthma Project (Te Hauora Rūnanga o Wairarapa/ Te Pūmanawa Hauora ki Manawatu/ Wellington Asthma Research Group, 1999).

While there is now increased choice for consumers in terms of the number of independent Māori providers, the range is still limited and realistically cannot meet the diversity of Māori health needs. Thus, continued effort is necessary to ensure access issues are addressed across all mainstream health services. Initiatives for primary care provision taking into account the needs of low-income populations have been important for reducing cost barriers (Baxter, 2002). Whilst the Primary Health Care Strategy (Minister of Health, 2001) is aimed at continuing such initiatives, the need to comprehensively address access issues for Māori remains.

The quality of ethnicity data from health services is of ongoing concern with undercounting of Māori in hospital data and currently limited available data by ethnicity from primary care (Harris, 2003). Guidelines for the collection of ethnicity data have been developed based on self-identification by patients and the use of standardised questions and methods for eliciting information and must be promoted by all government sectors to ensure quality and consistency across data sets (Health Utilisation Research Alliance, 2001; Harris, 2003).

Public health implications

Asthma is a common chronic disease of significant public health concern for New Zealand. The financial cost due to asthma has important implications for both the allocation of health resources and funding of services. Additionally, there may be significant costs to families in terms of lost wages, days absent from school and social isolation. The findings from previous studies and the new research conducted for this thesis indicates that asthma morbidity remains disproportionately greater among Māori.

The AWG's asthma strategy for DHB focuses on access to care, agreed standards for providers, integration of services, effective patient/professional partnerships to promote self-management skills and cost-effective care (New Zealand Guidelines Group, 2001). While these are all necessary and important factors in considering how to reduce asthma morbidity, an approach dependent on the priorities and resources of individual DHBs is problematic because the evidence points to increased asthma severity among Māori as a general phenomenon which is not linked to any particular geographic region. In order to be effective at a population level, a national asthma strategy needs to be considered. However, the current structuring of health services with the establishment of area-based DHBs and PHOs, makes the implementation of a national strategy very difficult without the Ministry of Health taking a leading role.

One of the recognised advantages of the strategy outlined in the Māori Asthma Review (Pomare et al, 1991) was that it made provision for the development of an asthma education workforce and facilitated a planned and co-ordinated approach to asthma services for Māori at both local and national levels. Such an approach has been similarly supported by more recent reviews on Māori asthma (Central Regional Health Authority, 1996; Health Funding Authority, 2000a).

Te Taumata Mate Ha o Aotearoa is presently negotiating with the Ministry of Health to consider the development of a national Māori strategy for asthma services and education resources that would follow closely on the recommendations from the Māori Asthma Review (Pomare et al, 1991). It has already been noted that a key factor in the success of programmes for Māori is having Māori health workers, who are known to their communities and have access to those in need. Additionally, one of the key strengths in considering a national strategy is that a Māori governance structure already exists in Te Taumata Mate Ha. This national committee of Māori asthma specialists have key links to people currently working in the asthma area throughout New Zealand.

A relatively small initiative but one with potential to reduce access barriers for Māori is the Māori Mobile Disease State Management (DSM) project which was piloted in 2000. This initiative combines a post-graduate nursing qualification with the delivery of a clinical service based on the management of diabetes, respiratory and cardiovascular diseases. The concept of 'continuity of care' has been more often associated with GP practices and the suggestion that people with a regular doctor have better access to primary care than those without a regular doctor (Martin, 2000). However, the concept could easily extend to that of the DSM nurses and the establishment of ongoing relationships with those people entering the service. This would facilitate some assessment on the effect and /or changes to patterns of Māori utilisation of primary health care services in the regions where the DSM service is operating, particularly in locations where, in the case of asthma, there is some evidence to suggest that higher hospitalisation rates in some age-groups for Māori may be associated with problems of access to care being more acute in rural areas (Ellison-Loschmann et al, 2004).

Another major public health implication relates to the monitoring of asthma education and knowledge of management and treatment practices amongst health professionals. The Māori Asthma Review identified the Royal New Zealand College of General Practitioners (RNZCGP) as having the potential to develop a leadership role in this area as far as providing continuing asthma education programmes and ensuring GPs ongoing competency in asthma management (Pomare et al, 1991).

GP knowledge regarding asthma management is not subject to regular update although it has been suggested that a process be established similar to that which is in place for GP's annual review of diabetes knowledge (Ellison-Loschmann, 2002). RNZCGP has designed a diabetes review (audit) which GPs can choose to do although some Independent Practitioner Associations (IPAs) have compulsory diabetes audits (and other audits) for their members. At this time there is no compulsory national audit for GPs on diabetes management or any other health area however all vocationally registered GPs have to undertake two audits every three years on some aspect of their practice (L Saul, personal communication, 24 July 2001).
One of the reasons for the development of the evidence-based guidelines for the management of adult asthma in primary care (New Zealand Guidelines Group, 2002) was to provide information for practitioners (primary and secondary care physicians, nurses, educators, health workers and pharmacists) regarding diagnosis and

management and to set a consistent standard for PHO approaches to asthma treatment and management (New Zealand Guidelines Group, 2001). However, evidence from a recent study suggests that asthma continues to be under treated in primary care contexts in a significant number of cases (Holt et al, 2003). Thus, monitoring by the RNZCGPs and allied organisations such as the Asthma and Respiratory Foundation of New Zealand, should be undertaken to ensure that primary health care practitioners are implementing the asthma management and treatment practices consistent with the recommendations published by the New Zealand Guidelines Group (2002). Paediatric guidelines are still in the process of being developed.

Identification of structural and service barriers relating to the culture of health services, the attitudes of health professionals and the ability to measure and monitor services by ethnicity were all identified as key areas affecting Māori access to asthma services during the Māori Asthma Review (Pomare et al, 1991). These issues are equally relevant to a range of other areas where disparities in Māori and non-Māori health exist. Some studies have concluded that discrimination against Māori within the health system exists for example, Māori may be less likely to be referred for surgical care (Westbrook et al, 2001; Tukuitonga & Bindman, 2002) and the quality of care for Māori patients has been questioned as being systematically inferior (Health Funding Authority, 2000b; Harris, 2003)

In summary, the evidence from this thesis suggests that rates of acute, severe asthma, resulting in higher admission rates for Māori are in part due to differences in medical management and access to care. This is consistent with previously published evidence that Māori children are less likely than non-Māori children to have preventive measures in place for their asthma including action plans, peak flow meters (Garrett et al, 1989) and medications (Mitchell, 1991). In this context, it is possible that the increase in asthma prevalence observed in the ISAAC Phase III analyses presented in Chapter Six is due to the prolongation of symptoms in Māori children resulting in an increased prevalence over time, a pattern that has previously been observed amongst Māori adults. This hypothesis was supported by the observation that known asthma risk factors for asthma did not explain the observed differences. Thus, asthma management and treatment issues may underlie the higher asthma prevalence and greater asthmas severity in Māori teenagers compared to non-Māori teenagers. Active approaches to monitor differential treatment and barriers to effective interventions are needed.

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Appendix 1

Date:

ASTHMA QUESTIONNAIRE

We are interested in how your asthma has been in the last year. I am going to ask you the following questions. If you don't understand the questions please ask me.

Please tick the boxes that apply to you.

1. Have you had wheezing or whistling in the chest in the last 12 months?

☐ Yes

☐ No

2. **If YES**, how many attacks of wheezing have you had in the last 12 months?

☐ None

☐ 1-3

☐ 4-12

☐ more than 12

3. In the last 12 months, how often on average has your sleep been disturbed due to wheezing?

☐ Never

☐ Less than one night per week

☐ One or more nights per week

4. In the last 12 months, has wheezing ever been severe enough to limit your speech to only one or two words at a time between breaths.

☐ Yes
☐ No

5. In the last twelve months has your chest sounded wheezy during or after exercise?

☐ Yes
☐ No

6. In the last twelve months have you had a dry cough at night apart from a cough associated with a cold or chest infection?

☐ Yes
☐ No

7. Do you have a peak flow meter?

☐ Yes
☐ No
☐ Not sure

If YES,

8. In the last 12 months, did you EVER use your peak flow meter to help you with your asthma?

☐ Yes
☐ No
☐ Not sure

9. Do you have a written asthma action plan?

☐ Yes

☐ No

☐ Not sure

If YES,

10. In the last 12 months, have you ever used your asthma action plan to help you with your asthma?

☐ Yes

☐ No

☐ Don't know

11. Do you have a family doctor?

☐ Yes

☐ No

☐ Don't know

12. In the last 12 months, how many times have you seen a doctor (GP or specialist) because of your wheezing or asthma, other than as an emergency visit to a GP, A&E or hospital admission?

☐ 1 time

☐ 2 times

☐ 3-5 times

☐ 6-11 times

☐ 12 times or more

13. In the last 12 months, how many times have you gone to a GP as a **emergency** for your wheezing or asthma?

☐ 1 time

☐ 2 times
☐ 3-5 times
☐ 6-11 times

☐ 12 times or more

14. In the last 12 months, how many times have you been admitted to hospital because of wheezing or asthma?

☐ Never
☐ 1-2 times
☐ 3-4 times
☐ More than 4 times

14. Have you been taking any medication for your wheezing or asthma in the last 12 months?

☐ Yes

☐ No

15. **IF YES,** Please list **ALL** your asthma medications.

A) INHALERS (PUMPS, PUFFERS, SPRAYS)

	Name	**Usual number of puffs**	**Times per day**
1			
2			
3			
4			

B) TABLETS (PILLS)

Name	**Dose**	**Times per day**

1			
2			

C) OTHER

	Name	Dose	Times per day
1			
2			

16. Has anyone ever shown you how to use your inhalers?

☐ Yes

☐ No

17. If YES, who showed you?

☐ Doctor

☐ Nurse

☐ Maori health worker

☐ Asthma educator

18. In the last twelve months have you ever run out of your asthma medication?

☐ Never

☐ 1-2 times

☐ More than 3 times

19. If you did run out, what did you do?

☐ Used no medication

☐ Used family/friend's medication

☐ Went to the GP

☐ Other

If 'Other' please specify:

20. In the last 12 months, how many days have you been "out of action" (eg off school, stayed home, etc) because of your asthma?

☐ Never

☐ 1-6 days

☐ 1-2 weeks

☐ 2-4 weeks

☐ More than 4 weeks

21. In the last 12 months, have you received any education or teaching about asthma?

☐ Yes

☐ No

22. If YES, who gave you the asthma education?

☐ Asthma educator

☐ Nurse

☐ Maori health worker

☐ Doctor

☐ Teacher
☐ Family member

23. Have you ever smoked cigarettes?

☐ Yes
☐ No

24. Have you smoked cigarettes in the last 12 months?

☐ Yes

☐ No

25. Are you currently smoking?

☐ Yes

☐ No

26. **If YES**, how many cigarettes would you smoke in one week?

☐ Cigarettes per day
☐ Cigarettes per week

27. Please write down the number of people living in your house who smoke cigarettes?

☐

Thank You Very Much!

Appendix 2

Date:

Adolescent Asthma Quality of Life Questionnaire

This questionnaire asks about your asthma symptoms and how asthma affects your daily life and well-being. There are no right or wrong answers. Answer each question by thinking about the last two weeks. Choose the answer that is best for you and tick the appropriate box.

A. We are interested in your symptoms of asthma:

In the last two weeks:

1. How bothered have you been by wheezing?

extremely bothered	very bothered	quite bothered	somewhat bothered	bothered a bit	hardly bothered	not bothered at all
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

2. How often have you been short of breath?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

3. How bothered have you been by coughing?

extremely bothered	very bothered	quite bothered	somewhat bothered	bothered a bit	hardly bothered	not bothered at all
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

4. How often have you had difficulty taking a deep breath?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

5. How often did you feel tightness in your chest?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

6. How often did you experience asthma symptoms (or symptoms became worse) because of weather changes or air pollution?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

B. Now some questions about any concerns you may have about your asthma medication:

In the last two weeks:

7. How bothered or concerned have you been about taking medication for your asthma?

extremely bothered	very bothered	quite bothered	somewhat bothered	bothered a bit	hardly bothered	not bothered at all
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

8. How bothered did you feel about having to carry your inhaler with you?

extremely bothered	very bothered	quite bothered	somewhat bothered	bothered a bit	hardly bothered	not bothered at all
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

9. How often did you feel dependent on your asthma medication?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

10. How often did you feel afraid because of not having your asthma medication with you?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

11. How often did you experience side effects when taking your asthma medication (e.g. shivering, feeling shaky)?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

☐ I did not take any asthma medication during the last two weeks

C. Some questions about how asthma affects your physical activities:

In the last **two weeks**:

12. How often have you been restricted in sports, hobbies or other recreational activities because of your asthma?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

13. How bothered did you feel by your asthma when walking uphill or upstairs?

extremely bothered	very bothered	quite bothered	somewhat bothered	bothered a bit	hardly bothered	not bothered at all
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

14. How often did running make you cough or wheeze?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

15. How often did you have difficulty participating in long distance sports activities (e.g. cross-country running, long-distance swimming)?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

☐ I did not have the opportunity to participate in long distance sports during the last two weeks

16. How bothered have you been about missing school or work because of your asthma?

extremely bothered	very bothered	quite bothered	somewhat bothered	bothered a bit	hardly bothered	not bothered at all
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

☐ I was on holidays for the last two weeks

17. How often did you have to avoid things that make your asthma symptoms worse?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

D. Some questions about how you feel about asthma and your daily life:

In the last two weeks:

18. How often did you feel frustrated because of your asthma?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

19. How often did you feel worried or concerned because of your asthma?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

20. How often did you feel frustrated or angry because you couldn't keep up with others because of your asthma?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

21. How often did you feel uncomfortable because of your asthma?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

22. How often has your asthma been a burden for you in your daily life?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

E. Now for some questions about your social life:

In the last **two weeks**:

23. How often did you feel worried or embarrassed when taking asthma medication in front of other people?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

☐ I did not take any asthma medication during the last two weeks

24. How often have you been annoyed by your asthma when going to a party?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

25. How often have your parents been overprotective because of your asthma?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

26. How often did you feel that you had to avoid a situation or a place because of cigarette smoke?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

27. How often did your asthma affect your social life?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

F. Now some questions about any positive effects that asthma may have on your daily life:

In the last two weeks

28. With regard to your asthma, how often have your friends been helpful and understanding?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

29. With regard to your asthma, how often has your family been helpful and understanding?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

30. With regard to your asthma, how often have your teachers been helpful and understanding?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

☐ I have left school

31. How often has your asthma brought you closer as a family?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

32. How often has your asthma motivated you to live a healthy lifestyle (e.g. not to smoke)?

all of the time	most of the time	quite often	some of the time	once in a while	hardly any of the time	none of the time
☐	☐	☐	☐	☐	☐	☐
1	2	3	4	5	6	7

Thank you very much!

☐☐☐☐

Appendix 3

Date:

QUESTIONS FOR PARENTS/CAREGIVER

1. How have you been spending your time in the last 12 months?

☐ Employed
- ☐ Full time (more than 30 hours)
- ☐ Part time (less than 30 hours)

If employed, what is your occupation?

☐ Unemployed
- ☐ Available for work (but not actively seeking)
- ☐ Actively seeking work

☐ Not in the labour force - *What is your main activity?*
- ☐ Student
- ☐ Home, looking after children
- ☐ Retired
- ☐ Time worker (meat worker, fruit worker)
- ☐ Benefit (Invalid, Disability, etc)

2. Do you have a community services card?
- ☐ Yes
- ☐ No

3. What type of card is it?

☐ High user health card

☐ Prescription subsidy card

☐ Other

If other, please specify:

4. Do you have a family doctor?

☐ Yes

☐ No

5. In the last 12 months has there been a time when you needed to see the doctor (or practice nurse) for advice but you weren't able to?

☐ Yes

☐ No

If YES,
The last time this happened, what was the reason for not getting to see your doctor:

Appendix 4

Date:

Interview Guideline

1. **Altogether, how many times have you visited a doctor or health professional? (includes self and family, for asthma or any other reason) (Last 12 months)**

2. **Have you received any outpatient care at a hospital emergency or after-hours clinic? If yes, how many times? (for asthma or anything else) (Last 12 months)**

3. **Have you (or any family member) been hospitalised at all? (how many times, for asthma or any other reason) (Last 12 months)**

4. **Have you received any preventive care (such as blood pressure checks, pap smears, cholesterol readings, lung function tests, asthma education, diabetes check) at clinics, community health days (at the local mall) or while on a doctors visit? (Last 12 months)**

5. **How would you describe your (family's) health overall? (Excellent, good, okay, poor) (Any disabilities)**

6. Do you have a regular GP? Are there other health care facilities (marae based clinics) in your area that you are aware of or use regularly? Do you use any asthma health care/education services for your child through the GP or clinics in your area? Are there any asthma services you know of but don't use for any reason?

7. (Following on from their response to Q. 5) are there any other reasons why you have not been able to get to visit the doctor or clinic when you wanted to?

8. Have you ever felt that uncomfortable for any reason when visiting a doctor or clinic? Did you ever feel the quality of care was not as high as it should have/could have been for any reason?