North West Adelaide Health Study

Summarised findings and implications 2000-2008

March 2009

Acknowledgements

This report forms part of the North West Adelaide Health Study (NWAHS), a collaborative project of SA Health, the University of South Australia, The University of Adelaide, the Institute of Medical and Veterinary Science, The Queen Elizabeth Hospital and the Lyell McEwin Hospital.

It is an initiative of the Population Research & Outcome Studies, SA Health, and was produced by Andrew Vickers, the SA Health 2008 Public Health Graduate trainee.

It is a compilation of a range of journal publications, reports and conference presentations from the North West Adelaide Study Team, including Prof Richard Ruffin, Assoc Prof Anne Taylor, Prof David Wilson, Dr Pat Phillips, Assoc Prof Robert Adams, Dr Kay Price, Catherine Chittleborough, Dr Tiffany Gill, Eleonora Dal Grande, Janet Grant, Sarah Appleton, Katherine Baldock and Alicia Montgomerie.

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CHAPTER 1: Introduction

1.1 Purpose of this report

Results from the North West Adelaide Health Study (NWAHS) have been published in a wide variety of reports, peer-reviewed journal articles, conference presentations and posters, and health professional newsletters and magazines. The aim of this report is to summarise these findings in order to provide health care providers, policy makers and consumers with an overview of what the study has examined about chronic conditions and risk factors thus far, as well as some of the policy implications. The full details of the publications from where the information in this report was sourced, are included in the reference section at the end of this report.

Copies of these publications are available upon request through the Study Co-ordinator, Janet Grant on (tel) 8226 6054 or email via janet.grant@health.sa.gov.au.

The overall aim of this report is to stimulate further changes to policy and practice to improve the health of the community.

1.2 Background

The NWAHS is a collaborative project between the South Australian Department of Health (SA Health), The University of Adelaide, the University of South Australia, The Queen Elizabeth Hospital and Lyell McEwin Hospital campuses of the Central Northern Adelaide Health Service, and the Institute of Medical and Veterinary Science.

The primary purpose of the study is to investigate the stability, progression or regression of study participants along a potential disease continuum using both self-reported and biomedical data. These data will allow future interventions to be targeted at those who will benefit most in terms of better health outcomes and most efficient use of resources. The better those with specific health problems, diseases, or risk factors are described, the more precisely they can be targeted for policies and interventions that are based on a range of appropriate evidence-based characteristics. Further information about the NWAHS can be downloaded via the SA Health website (<www.health.sa.gov.au/pros>) and NWAHS website (<http://www.nwadelaidehealthstudy.org/>).

The chronic diseases included in the study explain a great deal of the overall burden of chronic disease and some rank high as national priorities.[1,2,3] Most are also diseases where considerable progress can be made through primary and secondary prevention strategies, especially if these are coordinated as part of a public health response to the conditions. Each of the chronic conditions has stages of development when patients have different prevention, management and treatment needs. This chronic disease continuum is shown in Figure 1.1.[4]

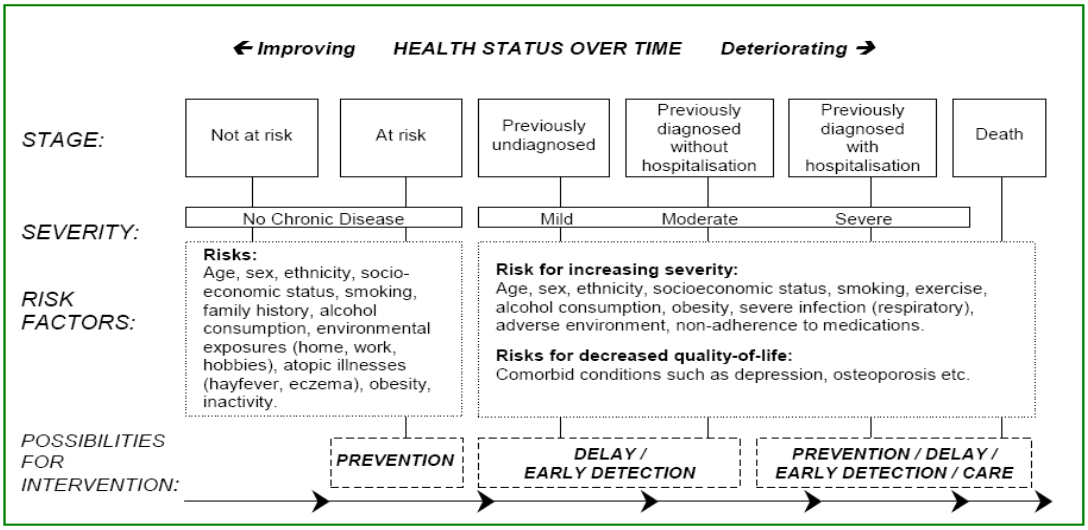

Figure 1.1: The chronic disease continuum

1.3 Study methodology

The participants in the NWAHS are a representative sample aged 18 years and over (at the time of initial recruitment) of the north west region of Adelaide, randomly selected from the Electronic White Pages (EWP). The north west region of Adelaide stretches geographically from Glenelg to Gawler. Biomedical information was obtained from participants at clinic appointments and self-reported data were collected via telephone interviews and self-completed questionnaires.[5,6]

The Stage 1 sample for the study (n=4060) was recruited in two phases. Phase 1A (n=2523) was recruited between November 1999 and December 2000, and Phase 1B (n=1537) was recruited between August 2002 and July 2003. Each randomly selected respondent within the household was asked a number of health-related and demographic questions via a telephone interview, and invited to attend a clinic for a 45 minute appointment at either The Queen Elizabeth Hospital or the Lyell McEwin Hospital. Study participants were sent an information pack about the study, including a self-report questionnaire about a number of chronic conditions and health-related risk factors. During the clinic visit, height, weight, waist and hip circumference, and blood pressure were measured. Lung function and allergy skin prick tests were conducted, and a fasting blood sample was taken to measure glucose, triglycerides, total cholesterol, high density lipoprotein (HDL), low density lipoprotein (LDL), and glycated haemoglobin (HbA_{1c}). Consent was obtained from participants to link to their Medicare Australia data. In Stage 1 there were 4060 participants who attended the clinic.[7]

The main objective of Stage 1 of the cohort was to establish representative self-reported and biomedically measured information on diabetes, asthma and chronic obstructive pulmonary disease (COPD), and health-related risk factors in terms of those who were at risk of these conditions, those who had these conditions but had not been diagnosed, and those who had previously been diagnosed. One of the strengths of NWAHS is the ability to determine the undiagnosed rates of common chronic diseases in the community.

Participants were invited to attend the clinic for Stage 2 via a telephone interview that also obtained demographic and health-related information. Of the original living cohort, 3564 (90.1%) participants provided some Stage 2 information, and 3206 (81.0%) attended the clinic between 2004 and 2006 for their second visit. In addition to the measurements taken at Stage 1 (except skin prick tests), musculoskeletal tests were conducted including hand grip strength, hand photographs, shoulder range of movement and foot pain. A urine sample was also supplied by the participant, which was tested for albumin and creatinine as one measure of kidney function. Participants aged 50 years and over were offered a dual-energy x-ray absorptiometry (DEXA) scan to measure their bone density, and fat and lean body mass.

The longitudinal nature of the cohort study means that following Stage 2, valuable information was obtained about the number of people in the cohort who had developed chronic conditions over time, and the factors that may have increased their risk of developing chronic disease. For the first time in South Australia (SA), annual incidence figures for these major chronic diseases was determined.

The data were weighted by region (western and northern health regions), age group, gender, and probability of selection in the household, to the Australian Bureau of Statistics 1999 Estimated Residential Population and the 2001 Census. Probability of selection of the adult in the household was calculated from the number of adults in the household, and the number of telephone listings in the EWP that reach the household. Weighting was used to correct for the disproportionality of the sample with respect to the population of interest. The weights reflect unequal sample inclusion probabilities and compensate for differential non-response. The data were weighted using the ABS data so that the health estimates calculated would be representative of the adult populations of the north west area of Adelaide. Each stage of the study is weighted separately with the initial population as the foundation figure. Stage 3 of the study has now started in with all respondents again being asked to attend the clinic for assessment. Results in this report are limited to Stages 1 and 2.

1.4 Ethics

Ethics approval for the each stage of the NWAHS was granted by the Ethics of Human Research Committee of The Queen Elizabeth and Lyell McEwin Hospitals.

1.5 Prevalence and incidence

Stage 1 data provided the prevalence of chronic conditions, risk and preventive factors, and health outcomes. In this report, prevalence is a measure of the number, or proportion, of people with a certain chronic condition in the population. Other prevalence estimates relate to lifetime prevalence, which is the proportion of people who have ever had a chronic condition.

Incidence is the number of new cases of a certain condition in a population within a period of time. Annual Incidence was calculated after the completion of Stage 2.

1.6 Health-related quality of life

Health-related quality of life is discussed throughout this report. The mean scores for each dimension of health-related quality of life were calculated from a set of questions asked in the self report questionnaire. This set of questions makes up the Short Form 36 (SF-36), which provides a generic indicator of health status, and assesses the impact of various health conditions in the population. There are eight dimensions of the SF-36, including Physical Functioning (PF), Role Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role Emotional (RE) and Mental Health (MH).[8,9] Brief descriptions of the meanings of the eight dimensions are listed in Table 1.1.

Table 1.1: Brief descriptions of SF-36 health-related quality of life dimensions

	Dimension	Description
PF	Physical functioning	Limitations in physical activities because of health problems
RP	Role physical	Limitations in normal role activities because of physical health problems
BP	Bodily pain	Intensity of bodily pain or discomfort
GH	General health	General health perceptions
VT	Vitality	Energy and fatigue
SF	Social functioning	Limitations in social activities due to physical or emotional problems
RE	Role emotional	Limitations in usual role activities because of emotional problems
MH	Mental health	Psychological distress and well-being

1.7 Format of this report

The main body of the report is divided into two chapters. Chapter Two includes sections relating to the chronic conditions investigated by the NWAHS, particularly asthma, chronic obstructive pulmonary disease (COPD), and diabetes. Chapter Three contains information relating to a range of chronic disease risk factors. A discussion of why each issue is important is followed by findings and proposed implications.

There are strong links between various chronic diseases, outcomes and risk factors covered within NWAHS. As such, some of the topics discussed in this report would be appropriately located in more than one section. In instances where this is the case, readers are referred to the location of related topics in other sections of this report. Again, readers are reminded that NWAHS has produced many methodological, epidemiological and scientific reports. If more detail is required on any aspect covered in this summary document, the reader is encouraged to reference these additional reports.

CHAPTER 2: Chronic Conditions

2.1 Asthma

Related sections: *3.4.7 Undiagnosed asthma*
3.4.8 Gender differences in asthma associated with obesity

2.1.1.1 Why is it important?

Asthma is identified as a National Health Priority Area[2] because of the significant burden that it places on the community in terms of health, social, economic and emotional costs. Over two million Australians have asthma, and it is a leading cause of hospitalisation.[10] Asthma affects people of all age groups, and indirectly, all those who care for people with asthma.[11] Effective treatment is available, but successful health outcomes are generally dependent on patient self-management, using a written asthma management plan.[4]

Asthma is a complex respiratory disorder characterised by chronic inflammation of the airways, recurrent episodes of wheezing, breathlessness, tightness of the chest, and reversible airways obstruction. Asthma causes many emergency department visits and hospitalisations. The population prevalence of asthma has increased in recent decades. The reasons for this are not clear and could be explained by lifestyle, environment, diet, genetics, or combinations of these. The diagnosis of asthma is based on measurement of reversibility of airflow obstruction, in addition to an appropriate clinical history. Doctor awareness of asthma and change in diagnostic criteria over time can affect prevalence. In some patients, particularly the elderly, it can be difficult to discriminate between asthma and chronic obstructive pulmonary disease (COPD). The reversible airway obstruction component in these patients may be difficult to diagnose.

2.1.1.2 Investigation and findings

The NWAHS results indicated that 12.5% (one in eight) of study participants had asthma, representing approximately 142,700 adults in SA.[5,7]

The annual incidence of developing asthma was 24.6 incident cases per 1000 in the adult population. Of those who did not have asthma at Stage 1, 5.7% developed asthma by stage 2 (3.2% diagnosed, 2.5% undiagnosed). The incidence of developing asthma was highest among people who were 75 years and over, physically inactive or on a low annual household income (≤$20,000).[12]

The prevalence of asthma was higher in females, people undertaking home duties, retired people and students, and lower in people with an educational level of bachelor degree or higher, or an annual gross household income higher than $40,000 per annum.[5] The association of socio-economic factors such as education and employment status with asthma varied by gender.[13] Those with current asthma scored worse than those without asthma on the quality of life dimensions of Physical Functioning, Role-Physical, Bodily Pain, General Health, Vitality and Social Functioning. People with asthma were more likely to have used general practitioner, day surgery, hospital accident and emergency department, hospital clinic, podiatrist, and eye specialist/ophthalmologist health services than people without asthma in the last 12 months in South Australia.

2.1.1.3 Implications

The quality of life of people with diagnosed asthma was impaired in terms of their general health. This highlights the need for improved management strategies for asthma to improve quality of life. The identified demographic and socio-economic subgroups where the prevalence and/or incidence of asthma were found to be higher should be targeted by health professionals for urgently needed intervention programs and strategies.

2.1.2 Undiagnosed asthma

Related sections: *2.2.2 Undiagnosed asthma*
2.3.2 Undiagnosed diabetes

2.1.2.1 Why is it important?

The goals of the National Asthma Strategy[14] include delaying the progression of asthma, improving quality of life, reducing hospitalisation and complications, reducing the social and economic impact of the condition on the community, and optimising asthma management. In order to achieve these goals it is crucial that all individuals in Australia with asthma are identified, diagnosed and provided with the appropriate treatment, assistance and advice.[15]

2.1.2.2 Investigation and findings

The NWAHS results indicated that the prevalence of previously undiagnosed asthma was 2.9% (one in 34) of the participants. Of the people with current asthma, 23.7% did not know they had asthma prior to participating in the study. For approximately every three people previously diagnosed with asthma, one person had current asthma but did not know it, representing approximately 34,700 people with undiagnosed asthma in South Australia.[5,7]

The prevalence of previously undiagnosed asthma was higher among people aged over 50 years, born outside of Australia, widowed, retired or undertaking home duties, and lower among people in the northern region, those with an annual gross household income above $40,000 and people who had never been married. Undiagnosed asthma was more common in males 50 years and older (48%) and females 50 years and over (34%).[16] People with undiagnosed asthma were less likely than people with diagnosed asthma to have used general practitioner, hospital accident and emergency department, chiropractor, alternative therapist and other health services. Those with previously undiagnosed asthma scored better than those with previously diagnosed asthma on the quality of life dimensions of Physical Functioning and General Health. Compared to those without asthma, those with undiagnosed asthma scored lower on the Physical Functioning and Role Physical health-related quality of life dimensions.[17]

2.1.2.3 Implications

People with previously undiagnosed asthma represent over one-fifth of the asthma population. Detection and diagnosis of this group remains a priority so that people with undiagnosed asthma can be in a position to control and manage their condition, and reduce their risk of hospitalisation and health service use.[18] Spirometric screening in primary care should be considered for all smokers and ex-smokers and anyone with chest symptoms.[19]

There is a need to put in place research strategies to understand reasons for lack of asthma diagnosis and impaired quality of life in diagnosed asthmatics. This means exploring:

- patients' perceptions of symptoms;
- access to medical care and drug availability;
- patients' attitudes towards medicines; and
- medical practitioners' awareness of issues in diagnosing asthma.

A significantly lower proportion of people with undiagnosed than diagnosed current asthma saw a general practitioner in the last 12 months, which may partly explain why they remain undiagnosed. This supports the need to promote annual health checks and screen for asthma in annual health checks. As undiagnosed asthma was found to be more prevalent in the older age groups (particularly men), this is an important target population group for general practitioners.

If the progress and impact of asthma education and policies are to be measured and evaluated, it is important to improve asthma detection and diagnosis rates.

2.1.3 Asthma in older people

2.1.3.1 Why is it important?

It has been recognised that there is a higher prevalence of asthma in older people, and that older people with asthma have higher death rates than their peers. It is also known that asthma in some older people is undiagnosed, meaning that it is not treated, resulting in poorer than necessary health and wellbeing outcomes (refer section 2.1.2).

2.1.3.2 Investigation and findings

Data were analysed to determine the rates of diagnosed and undiagnosed asthma in older people (≥55 years), compared to those younger than 55 years.[20] Some of the findings of the study included:

- Asthma prevalence was 14.7% in people aged 55 years and over compared to 13.6% in those less than 55 years of age.
- Of those with asthma, it was undiagnosed in 46% of older men, compared to 33% of older women, 30% of younger men and 29% of younger women.
- Of the older people with asthma, both the diagnosed and undiagnosed groups visited their general practitioner an equal mean number of times per year (8.5).
- There was a higher proportion of current and ex-smokers in the diagnosed group.

2.1.3.3 Implications

The higher rates of undiagnosed asthma in older people (particularly men) suggested that improved screening practices need to be devised and implemented for general practice. This is particularly evident when considering that the undiagnosed group visited their general practitioner as frequently as the diagnosed group. A particular target group for such screening would be men aged 55 years and over, and more specifically those who have never smoked. The potential for undiagnosed asthma in older people needs to be highlighted to the GP profession and promoted to the target audience using health promotion techniques.

In addition, promotion of the use of spirometry based on agreed guidelines for the diagnosis of asthma in general practice would be likely to reduce the prevalence of undiagnosed asthma in all age groups, in turn delivering improved population health outcomes.

2.1.4 Asthma perceptions, outcomes and management

Related section: 2.8.2 Experiences and perceptions of people with a chronic condition

2.1.4.1 Why is it important?

It has been demonstrated that self-management, written action plans and regular medical review are effective in improving health outcomes and reducing hospital admissions for people with asthma. Therefore, it is important to understand the perceptions of people with asthma regarding their condition, and to quantify the proportion of people with asthma that have current asthma management plans.

2.1.4.2 Investigation and findings

Following the Stage 1 clinic, a follow up interview was conducted of NWAHS participants with current asthma to determine their perceptions of the severity of their condition, their asthma management, and any specified negative outcomes arising from their condition in the previous 12 months.[21] Some of the findings of the study included:

- Of the participants interviewed, 48% thought their asthma was not a problem, 32% thought is was mild, 15% said it was moderate and 5% perceived their asthma to be severe.

- Those who thought their asthma was moderate or severe were more likely to have been woken from sleep in the last month, lost days from usual activities in the last year and been admitted to hospital in the last 12 months as a result of their asthma.
- However, of those that thought their asthma was mild or not a problem, 6% had been woken by their asthma, 4% had been admitted to hospital and 11% had lost days from usual activities.
- Of those that had been admitted to hospital as a result of asthma, 44% considered their asthma to be mild or not a problem.
- Only 24% of people with self-perceived moderate to severe asthma and 21% of people who thought that their asthma was mild or not a problem had a written action plan.
- Of those who believed that their asthma was moderate or severe, 25% had seen more than one GP for their asthma in the past year.

2.1.4.3 Implications

Some people with asthma, who have detrimental outcomes including hospital admission, consider their asthma to be mild or not a problem. This suggests that awareness programs should highlight the seriousness of the condition and the importance of coordinated management. Despite the proven benefit of written action plans, over three quarters of those with asthma (including those with self-perceived severe asthma) did not have one. This is an area that needs to be urgently addressed by health professionals and awareness programs. It is a concern that one quarter of those with self-reported moderate to severe asthma are not receiving continuity of care as indicated by the fact that they used more than one GP in a year. This has implications for the successful long term management of their condition and the reduction of adverse complications.

2.2 Chronic obstructive pulmonary disease (COPD)

2.2.1 Prevalence and incidence

2.2.1.1 Why is it important?

COPD (including emphysema, chronic bronchitis and chronic obstructive bronchitis) is a serious health problem in Australia, being the fourth leading cause of death and accounting for 5.0% of total deaths.[22] COPD and asthma are the third and ninth leading causes of overall disease burden in Australia, accounting for 6.3% of the total burden in terms of disability-adjusted life years (DALYs).[3] Chronic lung disease (COPD and asthma) accounts for the majority of the burden of chronic respiratory diseases, being responsible for 88% of chronic respiratory disease DALYs.

COPD is characterised by a single physiological feature: the limitation of expiratory airflow. It is, however, a constellation of diseases embracing emphysema and bronchitis. Cigarette smoking is the main cause of COPD, resulting in an 80–90% risk of the disease developing at some level.[23] Other factors that increase the risk of COPD include exposure to occupational dust, environmental air pollution or tobacco smoke. Clinical manifestations of COPD include one or more of dyspnea (shortness of breath), wheeze, coughing and sputum (mucus from the respiratory tract) production. These symptoms are less common and less severe in the early stages of the disease. As the disease progresses it produces extremely disabling effects on physical and mental health.[24] COPD poses a significant and increasing cost to society and the health system as a result of associated direct and indirect costs.[25]

2.2.1.2 Investigation and findings

The NWAHS results indicated that 3.9% (one in 26) of study participants had COPD, representing approximately 41,500 adults in South Australia.[5,7]

The annual incidence of developing COPD was 6.1 incident cases per 1000 in the adult population.

The prevalence of COPD was higher among those aged 50 years or over, born in the UK or Ireland, widowed, or undertaking home duties or retired, and lower among those who had undertaken post-secondary education, had an annual gross household income of more than $20,000 per annum, or who had never been married. The prevalence of COPD was higher among people who were smokers, ex-smokers, or had high blood pressure, and lower among those who were physically active and people who were obese. The prevalence of COPD was higher among people with cardiovascular disease (heart attack, stroke, and angina). Those people with COPD scored statistically significantly lower on the Physical Functioning, Role Physical, General Health and Vitality quality of life dimensions. People with COPD were more likely than people without COPD to have had day surgery, visited a hospital clinic, or seen an eye specialist or ophthalmologist, and less likely than people without COPD to have seen a physiotherapist or chiropractor in the last 12 months.

2.2.1.3 Implications

The prevalence of COPD was higher for smokers and ex-smokers (also refer to section 2.2.3). This knowledge provides specific targeting information and highlights the importance of continuing anti-smoking and quit smoking campaigns to reduce the prevalence of smoking, as well as the development of campaigns that specifically target the smoking/COPD relationship. COPD specific programs should target those demographic groups where smoking is more prevalent. In addition, because smoking is more prevalent in lower income groups, nicotine replacement therapy should be considered for addition to the Pharmaceutical Benefits Scheme (PBS). Additional research is needed to explore progression along the continuum of COPD and the factors associated with people progressing from mild to moderate or severe COPD, and the impact this will have on health services.

2.2.2 Undiagnosed COPD

Related sections: *2.1.2 Undiagnosed asthma*
2.3.2 Undiagnosed diabetes

2.2.2.1 Why is it important?

Many people at an early stage of COPD are unaware of their condition and fail to consult their doctor for respiratory symptoms. Consequently, they do not receive appropriate counselling and treatment which would prevent or slow their transition along the disease continuum. The airflow obstruction in COPD is generally progressive over a period of years and is largely irreversible. However, quality of life can be improved by physical fitness and pulmonary rehabilitation programs. Early identification and treatment of COPD can lead to substantial declines in mortality and morbidity and improvements in quality of life.

2.2.2.2 Investigation and findings

The NWAHS results indicated that the prevalence of previously undiagnosed COPD was 2.8% (one in 36) of participants. Of the people who had COPD, 80% did not know they had it prior to participating in the study. For every person previously diagnosed with COPD, approximately four people had COPD but did not know it, representing approximately 32,900 adults with undiagnosed COPD in South Australia.[5,7]

The prevalence of previously undiagnosed COPD was higher among those with an income between $20,001 and $40,000 per annum, and lower among those aged 60 years and over. The prevalence of previously undiagnosed COPD was lower among people with a mental health illness (anxiety, depression, stress related disorder, or other). As a group, people with previously undiagnosed COPD scored higher than those with diagnosed COPD on the Physical Functioning, Role Physical, General Health, and Vitality quality of life dimensions.

2.2.2.3 Implications

Almost 3% of the North West Adelaide adult population has COPD but has not been diagnosed. Early detection of COPD is important, and guidelines are required for primary care to identify those with early symptoms and those at risk. The largest proportion of undiagnosed COPD patients suffered mild COPD, but this is the group who would benefit most from early detection and intervention. It is possible to stop further deterioration by good management at an early stage of COPD. People with undiagnosed COPD were hardly impaired in terms of quality of life, compared to people with diagnosed COPD. The development of COPD is one of progressive airflow deterioration. Simple spirometric measures should occur in all people at risk (smokers and others at occupational risk) to detect early stage COPD and to act to prevent further deterioration and complications.

2.2.3 COPD and smoking

Related sections: *3.6 Smoking*

2.2.3.1 Why is it important?

Smoking is the main causal risk factor for COPD, and smoking cessation campaigns are the dominant public health strategy used to prevent COPD or reduce further loss of lung function in those already diagnosed. While it has been demonstrated that a large proportion of smokers develop COPD, it is uncertain to what extent environmental and genetic factors are involved in the burden of COPD. To further complicate the issue, there are at least five different sets of respiratory guideline criteria used to diagnose COPD, resulting in different prevalence rates depending on the criterion used. This means that depending on the guideline values used, many individuals may not be diagnosed and therefore treated.

2.2.3.2 Investigation and findings

Data from the NWAHS were analysed to determine the population burden of COPD due to smoking, based on the various diagnostic criteria. The aims were to determine the fraction of the population that are not targeted by the current quit smoking campaigns, and to investigate possible strategies for earlier case finding.[26] Some of the findings of the study included:

- There was substantial disagreement in the prevalence of COPD between the different criteria; however, the European Respiratory Society (ERS) one residual standard deviation (1RSD) criterion captured most of the cases identified by all of the other criteria guidelines.
- Using the ERS 1RSD values, an estimated 78% of the COPD burden was attributable to current or previous smoking history (current 40% and ex-smokers 38%).
- ERS 1RSD criterion suggested that 22% of the COPD needs to be explained by other genetic and environmental risk factors; however this figure was as high as 40% using other diagnostic methods.

2.2.3.3 Implications

The high proportion of COPD burden attributable to ex-smoking and the observed inclusiveness of cases identified by the ERS 1RSD guidelines suggested that general practice should adopt an approach of asking about smoking history followed by spirometric screening according to ERS 1RSD criterion. Such practice would be likely to capture the majority of COPD cases in the population, enabling the instigation of treatment to reduce progression of COPD in the large proportion of COPD sufferers who currently remain undiagnosed. Specific health promotion campaigns that target smokers and ex-smokers should be established to increase awareness and screening, in order to reduce the long term burden of COPD. Further research is required to identify the other potentially preventable risk factors that are involved in the development of a substantial proportion (20-40%) of COPD (including passive smoking, diet, respiratory infections and occupational and environmental exposures).

2.2.4 COPD association with physical activity

Related sections: *3.5 Undiagnosed asthma*

2.2.4.1 Why is it important?

It is recognised that people diagnosed with COPD are limited in their exercise capacity, yet physical activity is important in the management of chronic disease and complications to maintain function. As such it is important to understand the physical activity behaviour of people across the COPD continuum.[27]

2.2.4.2 Investigation and findings

Data from the NWAHS were analysed to determine the exercise behaviour of participants classified as not having COPD, having undiagnosed COPD and those with diagnosed COPD. Some of the findings of the analysis included:

- Participants classified as having COPD (diagnosed or undiagnosed) were more likely to be sedentary than those without COPD.
- Participants with undiagnosed COPD were less likely to have walked in the last two weeks and more likely to be sedentary than those with diagnosed COPD.

2.2.4.3 Implications

COPD has a significant impact on exercise behaviour, with those with COPD more likely to be inactive. However, people with undiagnosed COPD are most likely to be sedentary, perhaps due to their reduced exercise capacity resulting from their unmanaged condition. Early identification and diagnosis of those with COPD will enable action and treatment to be taken to increase their capacity to exercise, which in turn may assist in delaying or halting disease progression and improving health-related quality of life. Promotion of physical fitness is an important community activity.

2.3 Diabetes

Related sections: *3.4.3 Undiagnosed asthma*

2.3.1 Prevalence and incidence

2.3.1.1 Why is it important?

Diabetes is recognised as a State and National Health Priority Area because of the significant burden that it places on the community in terms of health, social, economic and emotional costs.[1] The National Diabetes Strategy[28] and the Strategic Plan for Diabetes in South Australia[29] identify the need to prevent or delay the progression of diabetes and related complications, improve the quality of life of people with diabetes, and reduce the social and economic impact of diabetes on the community.

2.3.1.2 Investigation and findings

The NWAHS results indicated that 6.6% (one in 15) of study participants had diabetes, representing approximately 79,700 adults in South Australia.[5,7]

The annual incidence of developing diabetes was 6.8 incident cases per 1000 in the adult population, meaning that approximately 7,500 South Australian adults develop diabetes each year.

The prevalence of diabetes was higher among people who were 50 years or over, had an annual gross household income lower than $20,000, were born outside of Australia, widowed, retired or undertaking home duties, and lower among those who had never been married, or had an education level of bachelor degree or higher. Further investigation of the association between income and diabetes prevalence indicated that even when controlling for the effects of age, the prevalence of diabetes is higher among those with lower income.[30] When adjusted for age and sex, low annual gross household income (<$20,000) remained associated with diabetes among those aged 65 years and older, but not in the younger age groups.[31] The prevalence of diabetes was higher among people who were ex-smokers, overweight or obese or had a high waist-hip ratio, high blood pressure, a family history of diabetes, or a high haemoglobin (HbA_{1c}) level, and lower among those who were low risk alcohol drinkers or physically active. Glycosylated haemoglobin (HbA_{1c}) is a measure of the amount of glucose-bound haemoglobin, and provides information on long-term glucose control. Men with diabetes were more likely to be an ex-smoker and less likely to have high cholesterol. Women with diabetes were more likely to have a high waist-hip ratio, high blood pressure, and a history of mental or cardiovascular illness.[32] Those with diabetes scored worse than those without diabetes in all of the health-related quality of life subscales of the SF-36. People with diabetes scored lower on the Physical Functioning, General Health and Role emotional quality of life dimensions than those with asthma, and lower on all quality of life dimensions than those with COPD.[33]

The prevalence of diabetes was higher among people with cardiovascular disease (including heart attack, stroke or angina) or mental health illness (including anxiety, depression, and stress related problem or any other mental health problem). NWAHS data have also indicated that lung function is increasingly impaired along the diabetes continuum (refer section 2.3.4).[34] This has raised suggestions of some as yet unexplained association between diabetes and some cases of COPD.

2.3.1.3 Implications

The quality of life of people with diabetes is severely affected, and many people with diabetes have multiple risk factors for complications, indicating that diabetes is not being managed as well as it could be. To address this and prevent or delay the development and progression of complications would involve:

- improved programs for tracking people with diabetes in the primary health care system (eg. diabetes centres, GPs), and providing them with regular care. Links between GPs and other health services will need to be promoted; and

- improved use of required health services by people with diabetes and improved client-related data collection and analyses to improve health outcomes.

It is also evident that a number of factors associated with diabetes differ between men and women, a fact which should be considered when developing targeted health promotion, prevention and management programs and policies.

The observed inverse income gradient effect in the prevalence of diabetes suggests that prevention and management strategies for diabetes must include a focus on income inequalities. This is particularly evident in older people, and prevention and management strategies for diabetes among older people should include a focus on income inequalities.

These recommendations will have implications for the diabetes health services workforce. Audits have shown that the health services workforce is already under-resourced for the functions that it is required to perform. Successful implementation of any policy recommendations will require optimal working relationships between health funders, providers and the community, as well as increased health system resources and support.

2.3.2 Undiagnosed diabetes

Related sections: *2.1.2 Undiagnosed asthma*
2.3.2 Undiagnosed diabetes

2.3.2.1 Why is it important?

In order to achieve the goals of the National Diabetes Strategy[28] and the Strategic Plan for Diabetes in South Australia,[29] it is crucial that all individuals in Australia with diabetes are identified, diagnosed and provided with the appropriate treatment, assistance and advice. It is possible to stop further deterioration by good management at an early stage of diabetes, especially if the undiagnosed have not yet developed complications. People who are unaware that they have diabetes may already be progressing towards complications.[35]

2.3.2.2 Investigation and findings

The NWAHS results indicated that the prevalence of previously undiagnosed diabetes was 1% of participants. This means that for approximately every five or six people with diagnosed diabetes, there was one person with undiagnosed diabetes, representing approximately 11,600 adults with undiagnosed diabetes in South Australia.[5,7]

This finding differed from previous national data, which estimated that there was one undiagnosed case for every diagnosed case of diabetes in Australia.[36] Explanations for this difference may include variations in glucose measurement, sampling strategies, and response rates across the studies.

People with undiagnosed diabetes were more likely to be aged 50 years or over than those without diabets, reflecting the increased prevalence of diabetes in older age groups. When compared to people with diagnosed diabetes, those with undiagnosed diabetes were more likely to have an income greater than $60,000, an education level of trade, apprenticeship, certificate or diploma, or be a current smoker or low risk alcohol drinker, and less likely to be aged 60 years or over, or employed part-time. Those with diagnosed diabetes scored worse than those with previously undiagnosed diabetes on the General Health quality of life dimension. There were no other significant differences in quality of life between those diagnosed with diabetes compared to those with undiagnosed diabetes.

2.3.2.3 Implications

The large number of people with undiagnosed diabetes can be identified as an important target group for detection and care, and a group who are likely to affect future health system costs. Identification of these

people is a high priority, as in the absence of diagnosis they are unlikely to be taking steps to reduce their risk of developing complications.

A more aggressive approach to case finding would involve:

- public education programs on the importance of early detection and those who are at risk;
- improved education of health professionals on the importance of early detection and management;
- ongoing monitoring of the study cohort to identify more clearly the population with undiagnosed diabetes and how they may be effectively targeted for health policy initiatives; and
- improved health promotion and service programs dealing with diabetes associated risk factors.

2.3.3 Pre-diabetes (impaired fasting glucose) and the metabolic syndrome

Related sections: *2.6 Kidney disease*
2.7 Cardiovascular disease

2.3.3.1 Why is it important?

Impaired fasting glucose (IFG) and the metabolic syndrome are recognised as significant risk factors for diabetes and cardiovascular disease. Impaired fasting glucose is a particularly significant pre-cursor in the development of diabetes. People with IFG were defined as those who had a fasting plasma glucose (FPG) level of ≥6.1 mmol/L and <7.0 mmol/L.[37] Metabolic syndrome was defined as having central obesity according to waist circumference plus any two of the following: triglyceride >1.7mmol/L, HDL (good) cholesterol <0.9mmol/L, high blood pressure and fasting plasma glucose ≥5.6mmol/L.[38,39]

It is important to understand the prevalence and distribution of pre-diabetes and metabolic syndrome to enable the effective targeting of health promotions and interventions towards those at greatest risk of developing diabetes.

2.3.3.2 Investigation and findings

The NWAHS data indicated that the prevalence of IFG was 4.3% of participants, representing approximately 52,300 adults in South Australia.[5] However, using the lowered diagnostic criteria (FPG ≥5.6 mmol/L and <7.0 mmol/L) suggested by the American Diabetes Association, the prevalence of IFG was 13.8%.[40]

The prevalence of IFG was higher among ex-smokers, males, people aged 50 years or over, people living in the northern suburbs, those born in the United Kingdom or Ireland, widowed, retired or undertaking home duties, and lower among low risk alcohol drinkers, those with an income over $40,000 per annum, people who had never been married, people who were physically active and those part time or casually employed. People with IFG were more likely than people without IFG to be overweight or obese, or to have a high waist hip ratio, high blood pressure or high cholesterol. Males and females with IFG had similar demographic and risk factor profiles. However, high blood pressure and high cholesterol were associated with IFG among males but not females. Also, in males obesity according to BMI was associated with IFG, whereas in females IFG was associated with a high waist hip ratio.[41] The prevalence of IFG was higher among people with cardiovascular disease (including heart attack, stroke or angina).

With regards to quality of life, those with IFG scored worse than those with normal glucose levels on the Physical Functioning, General Health and Bodily Pain health-related quality of life dimensions, but higher than those with diabetes on the Physical Functioning, General Health, Vitality, Social Functioning and Role Emotional dimensions.[42] Those with metabolic syndrome scored worse than those without metabolic syndrome on all quality of life dimensions except for Role Emotional and Mental Health.[43, 44]

Analysis of NWAHS data indicated that the incidence of diabetes was almost 10 times greater among those with IFG than those with normal glucose.[45]

In addition, it was found that people with IFG are more likely to have impaired kidney function than those with normal blood glucose as indicated by protein concentrations in urine (microalbuminuria).[46]

The prevalence of metabolic syndrome was 22.9%, but was also higher among men (26.4%) than women (19.5%). In men, metabolic syndrome was more likely in those with secondary education or less. In females, metabolic syndrome was more likely in those with an annual gross household income under $60,000 and in those with a work status of unemployed, retired, home duties or student.[47]

2.3.3.3 Implications

Pre-diabetes and metabolic syndrome have a significant impact on quality of life even before the development of diabetes (refer section 2.3.4), and as such, interventions to improve glucose metabolism and metabolic syndrome risk factors will have benefits beyond the prevention of diabetes.

The different risk factor profiles for IFG that were observed between males and females provide general practice with information regarding those individuals where investigation of pre-diabetes is important. That people with IFG were ten times more likely to develop diabetes, indicates that screening those at risk of IFG followed by effective management of those identified with IFG has the potential to reduce the incidence and burden of diabetes in the population. That kidney damage was found to be more likely in those with IFG suggest that microalbuminuria screening and/or prevention therapies should be considered for all people found to have IFG. Based on the increased prevalence of pre-diabetes among men, it may be worth designing and implementing health promotions and interventions that specifically target men in high risk groups. The socio-economic factors associated with metabolic syndrome vary by gender, with education level significant for males, and household income and employment status significant for females. This should be taken into consideration from a policy perspective, particularly when aiming to minimise and reduce health inequalities.

2.3.4 Quality of life along the diabetes continuum

Related sections: *2.8.1 Undiagnosed asthma*

2.3.4.1 Why is it important?

Diabetes has a substantial effect on functioning, premature mortality and health service use, and requires day to day management in order to maintain good metabolic control. Poor management of diabetes can result in impaired health-related quality of life. However, there is limited research on quality of life impairment at various stages along the diabetes continuum (no diabetes –> impaired fasting glucose –> undiagnosed diabetes –> diagnosed diabetes with good metabolic control –> diagnosed diabetes with poor metabolic control). Increasing understanding of the stages of diabetes where quality of life is diminished will enable the prioritisation of interventions to improve health outcomes and reduce related health service costs.

2.3.4.2 Investigation and findings

NWAHS data were analysed in several studies to describe the health-related quality of life at various stages of the diabetes continuum.[48,49,50,51,52] Some of the findings of the studies included:

- People with impaired fasting glucose scored significantly lower than those with normal glucose with regards to Bodily Pain, Physical Functioning and General Health perceptions.
- People with undiagnosed diabetes were further impaired in Physical Functioning than those with IFG.
- People with diagnosed diabetes scored less than those with normal glucose in all quality of life dimensions (physical, social, and vitality) with the exception of mental health.
- Of the people with diabetes, 41% had poor glycaemic control.

- Those with diabetes with poor metabolic control scored lower than people with diabetes under good metabolic control in all quality of life dimensions except Role Emotional.
- Poor glycaemic control in those with diabetes had a moderate impact on Physical Functioning and a large effect on General Health perceptions.
- Females with diabetes scored lower than males with diabetes in all quality of life dimensions except General Health perceptions and Vitality.

2.3.4.3 Implications

Diabetes has a significant effect on health-related quality of life which increases as people progress along the continuum. This provides support for interventions that improve glycaemic control to delay or prevent the progression of diabetes and improve quality of life. That quality of life reduces after diagnosis, suggests that management of newly diagnosed diabetes should consider quality of life. The results also indicate the importance of considering gender in diabetes management, given that diabetes has a greater effect on the health-related quality of life of females compared to males.

2.3.5 Achieving diabetes management targets

2.3.5.1 Why is it important?

Assessing how successfully people with diabetes manage their condition against clinical management targets provides valuable information about their diabetes-related health status and their risk for future diabetes-related complications. By quantifying the demographic groups and specific target goals where improvements can be made gives health professionals the opportunity to direct targeted interventions that have the potential to deliver improved health outcomes for people with diabetes.

2.3.5.2 Investigation and findings

Data from the NWAHS were analysed to determine the achievement of diabetes management targets by people with diagnosed diabetes using the clinical management guidelines for type 2 diabetes developed by the South Australian Divisions of General Practice and the South Australian Department of Health.[53] The nine targets investigated were: glycosylated haemoglobin (HbA_{1c}) level, fasting plasma glucose, plasma triglycerides, total, HDL (good) and LDL (bad) cholesterol, blood pressure, waist circumference and body mass index.[54] Some of the findings of the investigation included:

- The proportion of participants achieving the target levels ranged from a maximum of 64.6% who had HDL levels of >1.0mmol/L, to a minimum of 12.8% who had a BMI in the normal range (see Table 2.1).
- No socio-demographic differences were noted between people who achieved few (0-2) targets and those who achieved three or more targets.
- Over 50% of participants achieved only 2-4 targets.
- Approximately 19% of participants achieved 0-1 targets.
- Approximately 13% of participants achieved 5 targets.
- Approximately 12% of participants achieved 6-7 targets.
- Only 1% of participants achieved 8 targets.
- No participants achieved all 9 targets.

Table 2.1: Proportion of participants (%) who achieved each of the diabetes management targets

Management target	Target value	Proportion who achieved target
HDL (good) cholesterol	>1.0mmol/L	64.6%
Plasma triglycerides (fats)	<2.0mmol/L	60.7%
Glycosylated haemoglobin (HbA_{1c})	<7.0%	53.3%
LDL (bad) cholesterol	<2.5mmol/L	34.4%
Waist circumference (WC)	Men <100cm; women <90cm	32.2%
Fasting plasma glucose (FPG)	3.5 – 6.0mmol/L	28.6%
Blood pressure (BP)	<130/85mmHg	26.1%
Total cholesterol	<4.0mmol/L	18.5%
Body mass index (BMI)	≥18.5 and <25kg/m^2	12.8%

2.3.5.3 Implications

The proportion of people with diabetes meeting multiple management targets is low. Given that effective treatment options exist for high blood pressure and high cholesterol, the results of this investigation indicate that there is substantial room for improvement in the long term health outcomes of the majority of people with diabetes through the implementation of effective management. Of particular concern was the small proportion of people with diabetes who achieved acceptable weight, indicating that appropriate dietary intake and adequate physical activity are important health promotion and intervention areas in the long term reduction of complications and co-morbidities in people with diabetes.

2.3.6 Prevalence and management of diabetes-related complications

2.3.6.1 Why is it important?

Diabetes-related complications, including impaired eyesight and pain or loss of feeling in the lower legs, feet and toes can reduce a person's quality of life and their capacity to function independently. As such it is important to know the prevalence of such complications, and to ensure that health care professionals are providing the relevant follow-up, management and advice.

2.3.6.2 Investigation and findings

A follow-up telephone interview was conducted of NWAHS participants with diagnosed diabetes which included questions on feet, lower limbs and toes being affected by diabetes. They were also asked questions regarding eyesight and if they had had an eye examination at diagnosis and every one to two years thereafter, as recommended by current clinical guidelines.[55] Some of the findings of the study included:

- Of the participants interviewed, 39% reported regularly experiencing tingling, pins and needles, burning, pain or loss of sensation in their feet, toes or lower limbs.
- Overall, 59% of participants had had their eyes checked as per clinical guidelines.
- Overall, 31% of participants had affected vision, laser therapy or cataract surgery as a result of diabetes complications.

2.3.6.3 Implications

Over one third of people diagnosed with diabetes were found to have diabetes related eye complications and slightly more had issues with their lower extremities. Of concern was over 40% of participants had not had their feet and/or eyes examined as per clinical guidelines, particularly with respect to routine referrals of people with diabetes for podiatry and ophthalmological check-ups. This is important for the prevention and management of diabetes complications.

2.3.7 Coronary heart disease risk in people with diabetes

2.3.7.1 Why is it important?

It has been demonstrated in various studies that people with diabetes have an increased risk of coronary heart disease (CHD).[56] Subsequently, the UK Prospective Diabetes Study (UKPDS) developed a risk engine[57] which can be used to estimate the risk of a person developing CHD within five, ten and twenty years of diagnosis of type 2 diabetes using a variety of factors, including glycated haemoglobin (HbA_{1c}), blood pressure, cholesterol, and smoking status. The risk engine can also be used to estimate reductions in risk of CHD in response to changing risk factors through therapy and behaviour change.

2.3.7.2 Investigation and findings

NWAHS data were analysed to determine the risk of developing CHD within the study population with diabetes and to examine the effects of modelling changes in risk factors.[58,59,60] Some of the findings of the study included:

- The mean estimated risk for CHD within five years of diabetes diagnosis was 6.7%.
- The mean estimated risk for CHD within ten years of diabetes diagnosis was 15.3%.
- The mean estimated risk for CHD within twenty years of diabetes diagnosis was 37.8%.
- However when analysed by gender, males were found to have over double the risk of females in all instances.
- Those at high risk of CHD within ten years were more likely to be 55 years and over and to have low HDL (good) cholesterol.
- Reduction in total cholesterol had the greatest single effect on CHD risk in the short, medium and long term.
- The greatest effect on the risk of developing CHD in the short, medium and long term resulted from a reduction in all four risk factors (glycated haemoglobin (HbA_{1c}), blood pressure, cholesterol, and smoking).

2.3.7.3 Implications

Meeting key management targets for people with diabetes can have a significant effect on the risk of CHD. Using a priority approach, reduction in total cholesterol will have the greatest effect of the four risk factors examined. However, a multifactor approach can deliver the greatest risk reduction outcome. Males and people 55 years and older have the highest risk, and therefore people with diabetes in these groups should be a particular focus of practitioners in order to reduce the incidence of CHD in people with diabetes.

2.3.8 Education and information issues among people with diabetes

2.3.8.1 Why is it important?

The South Australian Diabetes Study identified that risk factors for complications, particularly behavioural and self-care factors are not yet well managed in people with diabetes.[61] The provision of education and information forms a major part of chronic disease management strategies. People with chronic disease who receive relevant education are presumed to be in a better position to take responsibility for their own health, participate in their own health care and management, and maximise their health outcomes.[62] In line with the National Diabetes Strategy, for people with diabetes to effectively manage their diabetes and prevent diabetes-related complications, they need to understand the condition, its effect on their health, and the practicalities of management.[63] For this to occur, it is necessary to know about the educational resource requirements of people with diabetes, and in what form they would prefer these resources.

2.3.8.2 Investigation and findings

Qualitative focus groups and a telephone interview were used to investigate diabetes-related education and information issues and needs of a selection of NWAHS participants with diabetes.[64] Some of the findings of the study included:

- Almost 20% of people with diabetes reported that they were generally not getting enough information about their diabetes.
- The issue that the most people (12.3%) with diabetes would like more information on was diet followed by long-term effects of diabetes on eyes (10.7%), kidneys (10.7%), heart (10.5%) and feet (8.9%).
- Only approximately 10% of respondents had talked to a dietitian, podiatrist, optometrist or ophthalmologist in the past year and 10% had not talked to any health professional about their diabetes in the past year.
- Of participants diagnosed over 12 months ago, 52% felt that their diabetes related information needs had changed since they were diagnosed.
- It was noted that there was a need for systematic follow-up on the education and information being provided by health care professionals, in order to meet the constantly changing information needs of people with diabetes.
- Diabetes support groups or group sessions were considered helpful by those who had attended them.
- General practitioners were identified as the major source of referral to other information sources.
- Almost half of the participants (47%) thought that the general community was not aware of the risk factors involved in developing diabetes.[65]

2.3.8.3 Implications

It was found that while sufficient educational resources exist, there was a need to find ways to promote existing information and how to access and use it. As the primary point of information provision and referral, general practitioners will continue to recognise the importance of specialists such as dieticians, podiatrists and optometrists in preventing and delaying diabetes complications, and direct their patients accordingly. GPs should also be systematically provided with up-to-date details on information sources.

A system is needed to follow-up people with diabetes to ensure that they have the necessary information to meet their changing needs. Due to their perceived effectiveness, it is important to maintain, continue, promote and develop group sessions and networks for people with diabetes. Health promotion campaigns are required to inform the general community of diabetes risk factors, lifestyle impacts, testing, and how to respond to diabetes related health emergency situations.

2.3.9 Perceptions and costs of diabetes risk factors

Related sections:
3.4 Obesity
3.5 Physical activity
3.7 Risk factors overall

2.3.9.1 Why is it important?

There are a number of recognised risk factors for developing diabetes, which include: being aged 50 years and over, having a family history of diabetes, being obese and being physically inactive. While family history and age are not modifiable, obesity and physical activity are. If individuals are aware of their individual risk of diabetes and the potential implications, they may be more likely to modify their behaviour in an effort to eliminate the modifiable risk factors. While it is recognised that having diabetes increases health system use, it is also important to investigate whether being at higher risk of developing diabetes itself results in higher service use.

2.3.9.2 Investigation and findings

Following the Stage 1 clinic, a telephone follow up questionnaire was conducted during which people who did not already have diagnosed diabetes were asked if they considered themselves to be at high risk of developing diabetes at some stage later in life.[66] NWAHS data were also analysed to compare the Medicare Benefits Schedule (MBS) use of people without diabetes, depending on the number of diabetes risk factors they had.[67] Some of the findings of the study included:

- Of the people who did not have diagnosed diabetes, 73.6% did not think they were at high risk of developing diabetes, 17.6% thought they were at high risk and 8.8% said they did not know.
- More females (21.2%) thought they were at high risk than males (13.9%).
- Of those people with three or all four of the abovementioned diabetes risk factors, 74.1% did not think they were at high risk of developing diabetes.
- As the number of risk factors increased from 0 to 3 or more, the number of MBS services used also increased.
- Of the people with 3 or more diabetes risk factors, 97% either had a BMI of 30 or more, or undertook insufficient physical activity.

2.3.9.3 Implications

The fact that almost three quarters of people with three to four diabetes risk factors did not consider themselves at high risk of developing diabetes suggests that general awareness of diabetes risks is low. This suggests that in order to reduce the prevalence of diabetes in the population, it is necessary to raise public awareness of the risk factors for and the consequences of diabetes.

Efforts to reduce the prevalence of diabetes risk factors in the population also makes immediate economic sense when considering that people without diabetes use increasingly more health system resources as their number of risk factors increase. The high prevalence of obesity and insufficient physical activity among such people makes them the most obvious risk factors to target in order to achieve maximum health, wellbeing and economic gains.

Unless public perception of the risks is raised, it is unlikely that a population wide reduction in modifiable diabetes risk factors and a subsequent reduction in disease and associated healthcare costs will be realised.

2.4 Arthritis and musculoskeletal pain and stiffness

Related sections: *3.4* *Undiagnosed* asthma
3.5 *Physical activity*

2.4.1 Arthritis

2.4.1.1 Why is it important?

The term arthritis is used to classify a group of over 100 conditions that cause inflammation of the joints, resulting in pain, stiffness, disability and deformity. Arthritis and musculoskeletal conditions cause an estimated 4% of the disease burden in Australia, with direct annual costs estimated at $4.7 billion.[68,69]

As a result of the substantial economic and social burden posed by arthritis and musculoskeletal conditions, they were declared a National Health Priority Area in 2002, with the primary focus on the three most prevalent conditions, osteoarthritis, rheumatoid arthritis and osteoporosis.[68]

2.4.1.2 Investigation and findings

The NWAHS results indicated that 21.4% (one in five) of study participants had been told by their doctor that they had arthritis.[7] Of the different types of arthritis, 7.5% had osteoarthritis, 2.9% had rheumatoid arthritis, 0.5% had another type of arthritis and 10.8% did not know what type of arthritis they had.

The prevalence of arthritis was higher in those who were female, were aged 35 years or over, lived alone, with other adults or in a step/sole parenting arrangement, were separated, divorced or widowed, had a work status of home duties or retired or were a student. Those with a higher than secondary level of education, an income above $20,000 or who were never married were less likely to have arthritis.[70] Arthritis was more likely among people who were ex-smokers, overweight or obese, or had a high waist hip ratio, and less likely in current smokers and people who exercised. Those with arthritis scored worse than those without arthritis on all quality of life dimensions.

2.4.1.3 Implications

The effect of arthritis is widespread, due to the impact of this disabling condition on the high number of people who are affected together with their families in terms of decreased physical impairment in their daily lives, and quality of life. The cost for the community through lost productivity is also significant.

2.4.2 Musculoskeletal pain and stiffness

2.4.2.1 Why is it important?

Musculo-skeletal pain and stiffness affects many people in Australia, and is a major public health burden because of its contribution to pain, illness and disability. Back, neck, shoulder hip, knee and foot pain and/or stiffness can limit people's ability to carry out simple daily activities and as the condition worsens, often results in assistance being required by family members and community care.

Foot pain is present in approximately one third of people aged over 65 years and has been associated with decreased capacity to perform daily activities, problems with balance and increased risk of falls.[71,72,73,74] However little is known about the prevalence of foot pain in other age groups or specific socio-demographic groups in the Australian population.

2.4.2.2 Investigation and findings

With regards to musculoskeletal pain and stiffness, the NWAHS results indicated that:[7,75,76,77,78,79,80,81,82]

- 30.5% of participants had back pain.
- 23.2% of participants had back stiffness.

- 17.4% of participants had foot pain.
- In people age 45 years and over, more than 20% had foot pain and in people aged 44 years or less, at least 10% reported foot pain.
- Of those with foot pain, 62.5% had pain in both feet and 37.5% had pain in one foot only.
- Only 17.7% of those who reported foot pain had visited a podiatrist in the past year.
- Participants who used podiatry services were more likely to be female, aged over 45 years, or obese.
- Foot pain was associated with other joint pain, including knee, hip and back pain.
- 9.2% of participants had hip pain.
- 7.7% of participants had hip stiffness.
- 16% of participants had knee pain.
- Over 35% of those with knee pain had been told by a doctor that they had arthritis in their knee.[83]
- 20.9% of participants had shoulder pain.
- 12.4% of participants had shoulder stiffness.
- 13.7% of participants had hand pain, aching or stiffness.
- Over 35% of those with hand pain had been told by a doctor that they had arthritis in their hand.[84]

Univariate analysis of the data showed that musculoskeletal pain, aching and/or stiffness were more common in females and people aged 50 years or more, and less likely in people with a higher education or on higher incomes (Table 2.2).

Table 2.2: **Demographic variables associated with the prevalence of musculoskeletal pain, aching and/or stiffness.**

Location of pain, aching and/or stiffness	More likely in:	Less likely in:
Back	Aged 45+ or work status: part time, casual, unemployed, home duties, retired, student.	Education: bachelor degree or higher, annual gross household income $20,001+ PA, or never married.
Foot/Feet	Female, obese, high waist hip ratio, or aged 50+	
Hip	Female, aged 50+, or work status: home duties, retired, student.	Education: bachelor degree or higher.
Knee	Aged 50-59, or separated or divorced.	Education: bachelor degree or higher, annual gross household income $60,001+ PA, or never married.
Shoulder	Female, aged 50+, or work status: home duties or retired.	Education: bachelor degree or higher, annual gross household income $20,001+ PA, or never married.
Hand	Female, aged 50+, living alone or with a partner and no children, widowed, or work status: home duties, retired.	Higher than secondary education, annual gross household income $20,001+ PA, or never married.

Back, foot, shoulder and hip pain were most common in people who were overweight, obese, or had high central adiposity (Table 2.3).

Table 2.3: **Risk factors and chronic conditions associated with the prevalence of musculoskeletal pain, aching and/or stiffness.**

Location of pain, aching and/or stiffness	More likely in:	Less likely in:
Back	Smokers and ex-smokers, or overweight, obese, high waist to hip ratio and high waist circumference.	Physically active.
Foot/Feet	Overweight, obese and high waist to hip ratio, diabetes or arthritis.	
Hip	Obese, high waist to hip ratio or waist circumference, or arthritis.	Physically active.
Knee	Obese	
Shoulder	Smokers or obese.	Physically active.

People with musculoskeletal conditions had reduced health related quality of life scores in all dimensions, regardless of the location of the pain, aching or stiffness (Table 2.4).

Table 2.4: Health related quality of life outcomes for people with musculoskeletal pain, aching and/or stiffness.

Location of pain, aching and/or stiffness	Scored lower in:	Scored higher in:
Back	All dimensions	Nil
Foot/Feet	All dimensions	Nil
Hip	All dimensions	Nil
Knee	All dimensions	Nil
Shoulder	All dimensions	Nil
Hand	All dimensions	Nil

Other findings included:

- Those with shoulder pain were more likely to have depressive symptoms than those without.[85]
- In those with shoulder pain, females had greater pain and worse physical functioning than males.
- Those with shoulder pain had restricted range of movement compared to those without.
- Those with hand pain and/or stiffness had reduced grip strength compared to those without.

2.4.2.3 Implications

Musculoskeletal conditions were more prevalent in those classified as obese. This was seen in both weight bearing joints (hip, foot and knee) and non weight bearing joints (shoulders and hands). Older persons were also found to have higher prevalence of musculoskeletal conditions.

However, smoking, a risk factor that is less prevalent in those who are obese, was associated with back and shoulder pain, aching and or stiffness. As such, smoking may mediate musculoskeletal pain, aching and stiffness through an alternate mechanism to obesity. The finding that those who were physically active had reduced prevalence of back, shoulder and hip pain requires further investigation, and suggests that physical activity has the potential to deliver benefits beyond improved fitness, weight-loss and energy balance.

Perhaps of greatest concern was the observation that low income and education are associated with higher prevalence of musculoskeletal conditions. This highlights an issue of equity which requires investigation and addressing as a high priority.

Foot and knee pain, which both affect over 15% of the population and which are most prevalent in those who are female, obese and/or aged 50 years and over, are a particular concern with relation to physical activity. However, even in participants aged less than 45 years, at least 10% reported foot pain. Such pain is likely to reduce mobility and the capacity to exercise, suggesting that the health of these individuals is unlikely to improve without the design and implementation of specifically targeted interventions. As the population ages and the prevalence of obesity increases, there is likely to be an increasing prevalence of foot pain and associated reductions in health-related quality of life. Further research is necessary to determine the best practice models for managing foot pain and to determine whether existing foot care services are sufficient to meet current and future demands. The large proportion of people who reported foot pain but had not accessed podiatry services suggested that there may be a need to promote podiatry services more widely , particularly to men and younger people.

Overall, it is evident that efforts to reduce obesity and social health inequity and to increase physical activity at a population level would reduce the incidence of musculoskeletal conditions, in turn improving the quality of life for many.

2.5 Osteoporosis

Related sections: *3.5* *Physical activity*

2.5.1 Prevalence

2.5.1.1 Why is it important?

Osteoporosis is a musculoskeletal condition which results in thinning, weakening and reduced density of the bones, increasing the possibility of bone fractures.[68] The most common sites of fracture are the hips, wrists and spine; however any bone can be affected.[86] Osteoporosis is a National Health Priority Area (refer section 2.4).

The risk of developing osteoporosis can be reduced through adequate calcium and vitamin D intake and regular physical activity, and the risk of fractures can be minimised in those with osteoporosis through lifestyle changes, medication and falls prevention measures.[87,88] As such, it is important to identify those at risk and those with osteoporosis, in order to implement prevention and management strategies, and ultimately reduce the burden of osteoporosis in the community.

2.5.1.2 Investigation and findings

Of the entire NWAHS cohort, 3.8% (one in 28) self-reported that they had osteoporosis.[7,89,90,91,92] DEXA scans of participants aged 50 years and over revealed that:

- 3.6% of those scanned had osteoporosis.
- 15% of those scanned had osteopenia (a possible precursor to osteoporosis).
- Of those who reported that they did not have osteoporosis, 2.9% had osteoporosis and 12.6% had osteopenia.
- Of those found to have osteoporosis according to the DEXA scan, only 23% had stated that they had been told by a doctor that they had the condition.
- Of those aged 50 years and over who had been told by their doctor they had osteoporosis, only 9% had evidence of osteoporosis based on the DEXA scan results.

The prevalence of self-reported osteoporosis was higher in those who were female, were aged 50 years or over, widowed, or had a work status of part time, casual, home duties or retired. Those with a higher than secondary level of education, annual gross household income above $40,000 or who were never married were less likely to have osteoporosis. Osteoporosis was more likely among people who had cardiovascular disease or arthritis. Those with osteoporosis scored worse than those without osteoporosis in the Physical Functioning, Role Physical, Bodily Pain and General Health quality of life dimensions. Other findings included:

- Of women aged 40 years or more, osteoporosis was higher among those who had experienced menopause.
- Among participants who had fallen in the last year, those with osteoporosis were more likely to have had a fracture.
- The most common site of fracture among those with osteoporosis was the wrist.
- Among respondents who had a fracture as a result of a fall from standing height or less in the last five years, 16.8% had been told by a doctor that they had osteoporosis, and 12% were on benzodiazepines, medications that are known to increase the risk of falls.[93]
- Of those that had been told by a doctor that they had osteoporosis, 43.9% used bisphosphonates, osteoporosis medications that inhibit the resorption of bone.
- However, only 12.1% of those with osteoporosis and taking bisphosphonates also took calcium and vitamin D.

2.5.1.3 Implications

The majority of participants with low bone density had not been previously identified by their doctor. This has implications for the targeting of programs and information to both physicians and those at risk of or with osteoporosis.

The over-representation of osteoporosis among those with lower income and education levels has implications for access to DEXA scans and medications.

Medication is an important part of osteoporosis treatment and fracture prevention. The NWAHS results indicated that in many cases appropriate medications were not being taken, and in some case inappropriate medications were being taken.

Greater awareness by general practitioners on these issues would enable improved detection and treatment of those with osteoporosis.

2.6 Kidney disease

Related sections: *2.3.3 Undiagnosed asthma*

2.6.1 Prevalence

2.6.1.1 Why is it important?

A number of the chronic conditions and risk factors investigated by the NWAHS are known or suspected to increase the risk of kidney disease, including diabetes, high blood pressure, obesity, high alcohol consumption and smoking. The ultimate endpoint of kidney disease is kidney failure with dialysis or transplantation being the only current treatment options.[94]

2.6.1.2 Investigation and findings

The NWAHS results indicated that 11.5% (one in nine) of study participants had chronic kidney disease based on estimated glomerular filtration rate (eGFR), and that 5.5% (one in eighteen) had microalbuminuria or macroalbuminuria (presence of albumin protein in urine, indicating kidney damage).[7]

The prevalence of kidney disease based on eGFR was higher in those who were female, were aged 45 years or over, had diabetes, had high blood pressure or were overweight but not obese.[95]

The prevalence of microalbuminuria was higher in those who were aged 45 years or over, had diabetes, had high blood pressure or were obese.

Those with microalbuminuria scored worse than those without microalbuminuria on the quality of life dimensions of Physical Functioning, Role-Physical, Bodily Pain, General Health, Vitality and Social Functioning.

2.6.1.3 Implications

If kidney disease diagnosed is early, the progression to kidney failure can be delayed or prevented through medication and lifestyle changes.[96] Therefore, it is important to identify and screen those at risk in order to enable interventions that will reduce the burden of kidney disease in the community, and deliver better health outcomes for the individuals involved.

2.7 Cardiovascular disease

Related sections: *3.4.3 Undiagnosed asthma*

2.7.1 Prevalence

Related sections: *2.3.3 Pre-diabetes (impaired fasting glucose) and the metabolic syndrome*

2.7.1.1 Why is it important?

Cardiovascular disease (CVD) is recognised as a State and National Health Priority Area because of the significant burden that it places on the community in terms of health, social, economic and emotional costs.[97] Coronary heart disease and stroke are the leading causes of death in Australia[98] but these conditions are potentially preventable. A National Strategy for Heart, Stroke and Vascular Health in Australia has been established to improve the cardiovascular health of Australians.

2.7.1.2 Investigation and findings

The NWAHS results indicated that 6.2% (one in 16) of study participants had cardiovascular disease (self-reported doctor diagnosis of heart attack, stroke (including transient ischaemic attack [TIA]) and/or angina).[5,7]

The annual incidence of developing CVD was 5.6 incident cases per 1000 in the adult population, meaning that approximately 6,200 South Australian adults develop CVD each year.

The prevalence of CVD was higher among people who were 50 years or over, born in the UK or Ireland, widowed or with a work status of home duties or retired, and lower among people who had a bachelor degree or higher, had an annual gross household income above $20,000 per year or had never been married

The prevalence of CVD was higher among people who were overweight or obese, ex-smokers, or had a family history of CVD or stroke and lower among those who were low to high risk alcohol drinkers or had high cholesterol. The prevalence of CVD was higher among people with diabetes, COPD or asthma.

Those with CVD scored worse than those without CVD in all of the health-related quality of life subscales except Mental Health.

People with CVD were more likely to have used general practitioner, day surgery, hospital accident and emergency department, hospital clinic, eye specialist/ophthalmologist, dietician or nurse educator health services and less likely to have used chiropractor health services than people without CVD in the last 12 months in South Australia.

2.7.1.3 Implications

Ongoing efforts at the individual, neighbourhood and population level to prevent and delay the development of CVD will continue help to reduce the health, social and economic burden that this condition creates in the community.

2.8 Chronic conditions overall

2.8.1 The burden of chronic conditions on health-related quality of life

Related sections: *2.3.4 Quality of life along the diabetes continuum*
3.7.1 The burden of risk factors on health-related quality of life

2.8.1.1 Why is it important?

People with chronic conditions often experience impaired health-related quality of life because of the effect of the condition on their overall health status, and the significant lifestyle adjustments they are required to make as part of the daily management of their condition.

2.8.1.2 Investigation and findings

NWAHS health-related quality of life data were analysed to compare quality of life scores of those with diagnosed and undiagnosed chronic disease with the rest of the population.[99,100,101] Some findings included:

- People with diabetes scored lower than people without diabetes in all quality of life dimensions with the largest reductions observed in Physical Functioning and General Health.
- People with diagnosed diabetes scored lower than people with undiagnosed diabetes on all quality of life dimensions, but people with undiagnosed diabetes also had impaired quality of life in terms of Physical Functioning when compared with the general population.
- People with asthma scored lower than people without asthma in all quality of life dimensions with the largest reductions observed in Physical Functioning and General Health.
- People with moderate to severe chronic obstructive pulmonary disease (COPD) scored lower than people without COPD in all quality of life dimensions with the largest reductions observed in Physical Functioning and General Health. However, no reduction in quality of life was noted for those with mild COPD.
- People with diagnosed COPD had significantly reduced quality of life in all dimensions when compared with those with undiagnosed COPD. There was some reduction in the General Health dimension in those with undiagnosed COPD compared to the general population.

2.8.1.3 Implications

In addition to clinical symptoms and physical implications, aspects of social, emotional and mental functioning should be considered in the assessment and management of people with chronic conditions. Although those with undiagnosed conditions show minimal reduction in quality of life, early detection is important to prevent progression to the more debilitating stages along the disease continuum.

2.8.2 Experiences and perceptions of people with a chronic condition

Related sections: *2.1.4 Asthma perceptions, outcomes and management*

2.8.2.1 Why is it important?

The experiences, perceptions and understandings of people diagnosed with a chronic condition can significantly influence their decision making with regards to the management of their condition, and as such are important determinants of their progression along the chronic disease continuum, as well as their immediate and long term quality of life. Increased understanding of these factors will enable the provision and delivery of health services and interventions to meet the needs of individuals, resulting in improved population health and wellbeing.

2.8.2.2 Investigation and findings

Ten NWAHS participants who had previously been diagnosed with asthma or diabetes took part in a qualitative study to explore the experiences, perceptions and understandings of what it is like to live with and manage a chronic condition.[102]

Participants indicated that upon diagnosis they were initially concerned as to how the diagnosis would affect them. Some were concerned that the condition would have an impact on their lifestyle by stopping them doing what they wanted to do. Others were shocked, scared, in denial or did not really understand what they had been diagnosed with.

In having to live with the condition, most participants felt that their condition was always in the back of their minds, resulting in a continual burden which removed pleasure from their lives. Participants described their condition as being a nuisance, restrictive, annoying or worrying. When dealing with others, the participants found that others with the same condition could appreciate what they were feeling, but that others without the same condition (including healthcare professionals) often did not identify with them or understand their issues. This was particularly the case with diabetes and less so among people with asthma.

Dissatisfaction in dealings with health professionals was expressed, with claims that some were hard to talk to and did not want to listen, that information was provided in a form that was not understandable, and that health professionals did not have the time to thoroughly address their individual circumstances or were judgemental with regards to behavioural risk factors. As such, management plans tend to be standardised, prescriptive and inflexible.

2.8.2.3 Implications

While the findings of this small scale study may not be representative of all participants diagnosed with a chronic condition, they highlight implications for the practice of health care professionals. The support and information provided to a patient upon diagnosis with a chronic condition can have a significant impact on their wellbeing, as well as their progression along the chronic disease continuum. Health professionals should be open in their communication methods and work with patients to ensure that their patients' understanding of their conditions and the associated risks results in appropriate behaviour that has the potential to deliver the best possible health and quality of life outcomes in each individual circumstance.

2.8.3 Health service costs associated with chronic conditions

Related sections: *3.7.2* *MBS and PBS use and costs associated with chronic disease risk factors*

2.8.3.1 Why is it important?

Chronic conditions such as asthma, COPD and diabetes are associated with significant health care costs. Medicare Benefit Schedule (MBS) and Pharmaceutical Benefits Scheme (PBS) resource use reflect a major part of the overall direct costs of these conditions. Little is known about the costs of chronic conditions before they are diagnosed.

2.8.3.2 Investigation and findings

MBS and PBS data for the five year period July 1997 to June 2002 were obtained for 2352 of the NWAHS participants.[103,104,105] Analysis of the data resulted in the following findings:

- People with diagnosed diabetes used more MBS resources than people who did not have diagnosed diabetes.

- MBS resource use among people with undiagnosed diabetes was higher than among those who did not have diabetes. Although this did not reach statistical significance, estimates suggest that diabetes has an effect on health service use even before the condition has been diagnosed.
- PBS costs for those with diagnosed diabetes were higher than those with undiagnosed diabetes which in turn was higher than for those without diabetes.
- Similar patterns were shown for people with no, diagnosed and undiagnosed asthma and COPD. However in the case of asthma when broken down by gender, the relationship only held for females and not for males.[106]
- Males, both with and without asthma, use less services resulting in a lower medical cost.
- Diabetes has a substantial impact on healthcare system use, regardless of demographic or socio-economic status.

2.8.3.3 Implications

These results indicated that as people move along the chronic disease continuum for asthma, diabetes and COPD, their health system use and the associated costs progressively increase. As such, coordinated strategic efforts to prevent, reduce, slow and reverse progress along the chronic disease continuum at a population level would be likely to deliver significant economic savings for governments and individuals alike. Early detection and effective management are important factors in reducing health service costs. The tendency for males to use less medical services has implications for the prevention and management of chronic diseases.

CHAPTER 3: Risk Factors

3.1 Alcohol consumption

3.1.1.1 Why is it important?

Both protective and harmful effects of alcohol consumption have been shown in public health studies. Alcohol has been associated as a risk factor for heart disease, stroke, cancer, cirrhosis of the liver, mental health, accidents, violence and crime.[107] It has also been cited as having a protective health effect for ischaemic heart disease (reduced blood supply to the heart muscle). For some time in Australia there has been a trend to identify a safe level of consumption,[108] but this implies that there is a threshold below which ethanol is harmless. In one of the largest studies of alcohol consumption ever undertaken, total mortality increased remorselessly with intake per day.[109] However, two units (standard drinks) of alcohol per day were associated with lower all cause mortality than the consumption of no alcohol. Above three units per day, progressively increasing levels of consumption were associated with higher all-cause mortality. More recently, it has been shown that the regular consumption of more than two drinks per day is associated with both hypertension (high blood pressure) and renal (kidney) disease, although the mechanism by which this occurs still needs to be explained.[110]

3.1.1.2 Investigation and findings

The NWAHS results indicated that 6.1% (one in sixteen) of study participants were intermediate to very high risk alcohol drinkers, representing approximately 69,100 adults in South Australia.[5,7]

The annual incidence of becoming an intermediate to very high risk drinker was 9.6 incident cases per 1000 in the adult population. This means that approximately 10,700 South Australian adults become intermediate to very high risk drinkers each year.

The prevalence of intermediate to very high alcohol risk was higher among those who lived in the northern region, had an annual gross household income between $20,000 and $60,000, were separated, divorced or never married, or reported work status as unemployed, and lower among females, those aged 30-39 years or 50 years and over, and those who had an education level of bachelor degree or higher, were born outside Australia, the United Kingdom or Ireland, or reported work status as home duties or retired.

Quality of life was similar for no or low risk drinkers and intermediate to very high risk drinkers, however those classified as intermediate to very high risk scored lower on the General Health dimension.

People classified as having an intermediate to very high alcohol risk were more likely to have used hospital accident and emergency department services and less likely to have hospital clinic services than those classified as low or no alcohol risk.

3.1.1.3 Implications

Young, male, single people were more likely to be intermediate to very high risk alcohol drinkers, providing support for alcohol campaigns that are targeted at this population. Unemployed people are also an important target group.

Intermediate to high risk drinkers were more likely to use hospital accident and emergency department services, highlighting the accidents, violence and injuries associated with excessive alcohol consumption, in addition to the chronic disease concerns. Efforts to promote and enforce responsible alcohol consumption would be expected to result in a reduction in the use of such services particularly among males aged 18 to 24. However, further investigation is necessary to determine the most effective enforcement and promotion methods.

3.2 Cholesterol

3.2.1.1 Why is it important?

It is well established that high blood cholesterol is a major reversible risk factor for coronary heart disease (CHD). There is a close linear relationship between cholesterol levels and long term mortality, which extends across the range of cholesterol levels.[111] For the majority of people, dietary saturated fat is the main factor that raises blood cholesterol levels. However, genetics plays a role and regardless of dietary intake, some people have high cholesterol levels due to a deficiency in high density lipoprotein (HDL) cholesterol, which is thought to mediate the uptake and return of peripheral cholesterol to the liver for bile acid secretion.[112]

Cholesterol-lowering drugs or statins are prescribed widely in Australia, because these agents which reduce low density lipoprotein (LDL) cholesterol reduce CHD mortality. An Australian study of the effects of pravastatin, a cholesterol lowering therapy, in people with a broad range of cholesterol levels demonstrated reduced mortality from CHD and overall mortality, as well as reduced incidence of cardiovascular outcomes (including heart attack and stroke). The relative risk reduction was at least 20% for people on therapy compared to those receiving a placebo.[113]

3.2.1.2 Investigation and findings

The NWAHS results indicated that 36.1% (over one in three) of study participants had high blood cholesterol, representing approximately 411,600 adults in South Australia.[5,7]

The annual incidence of developing high blood cholesterol was 45.4 incident cases per 1000 in the adult population. This means that approximately 34,400 South Australian adults develop high blood cholesterol each year.

The prevalence of high cholesterol was higher among people who were 30 years or over, born in the UK or Ireland, and those undertaking home duties or retired, and lower among those who were a student, were in part-time or casual employment, had an annual gross household income over $60,000 per annum, had a bachelor degree or higher, or had never been married.

High cholesterol was less likely among those who had asthma or cardiovascular disease (including heart attack, stroke, and angina).

There were no differences observed between people with normal cholesterol and people with high cholesterol in any of the quality of life dimensions.

There were no differences between those with and without high cholesterol in terms of health service use over the past 12 months.

3.2.1.3 Implications

A high level of LDL cholesterol (the “bad” cholesterol) is one of the major risk factors for developing heart disease. Screening people for a high cholesterol level and assisting those found to have it with information about the need to have a healthy diet, with pharmacotherapy if necessary, may help with the prevention of heart disease.

3.3 High blood pressure (hypertension)

3.3.1.1 Why is it important?

High blood pressure, or hypertension, has been described as a chronic disease rather than a risk factor. However, it is a risk factor for many other diseases (stroke, heart disease, and diabetes complications). Epidemiological studies have shown that high blood pressure is a major independent risk factor for common adult cardiovascular disease, renal diseases, cerebral vascular diseases, aortic aneurysm and peripheral vascular disease. It is also a major risk factor for complications in diabetes. It is also the most common condition for which treatment is available.[4]

3.3.1.2 Investigation and findings

The NWAHS results indicated that 26.8% (over one in four) of study participants had high blood pressure, representing approximately 310,700 adults in South Australia.[5,7]

The annual incidence of developing high blood pressure was 33.6 incident cases per 1000 in the adult population. This means that approximately 29,200 South Australian adults develop high blood pressure each year.

The prevalence of high blood pressure was higher among those who were male, in the older age groups (≥30 years), those who were widowed, born outside Australia, retired or undertaking home duties. The prevalence was lower among those who had never been married, had an annual gross household income greater than $20,000, or had achieved an educational level of bachelor degree or higher.

The prevalence of high blood pressure was higher among people with diabetes, cardiovascular disease (including heart attack, stroke, angina), or COPD.

People with high blood pressure scored lower on Physical Functioning and General Health quality of life dimensions than people without high blood pressure.

People who had high blood pressure were more likely than people who did not have high blood pressure to have used general practitioner, community health centre, day surgery, hospital clinic or outpatients, eye specialist/ophthalmologist, other specialist doctor, podiatrist, dietician, or nurse educator services in the last 12 months, and less likely to have used psychologist or psychiatrist, hospital accident & emergency, physiotherapist, chiropractor, alternative therapist services, or ‘other’ services.

3.3.1.3 Implications

The fact that over one quarter of adults had high blood pressure, using clinical measures rather than self-reported data, indicated that these people had high blood pressure that was either undiagnosed or not well controlled. As high blood pressure is a risk factor for developing cardiovascular disease and diabetes-related complications, the planning of programs should target information delivery to increase awareness of this fact.[18]

3.4 Obesity

Related sections:

2.3.9 Perceptions and costs of diabetes risk factors
2.4 Arthritis and musculoskeletal pain and stiffness
3.5 Physical activity

3.4.1 Obesity and overweight according to Body Mass Index (BMI)

3.4.1.1 Why is it important?

Obesity is now widely considered to be a pandemic, due to its increasing prevalence in developed and developing countries[114]. This issue is of concern to health professionals, as obesity is a recognised risk factor for a number of chronic conditions including diabetes, coronary heart disease, stroke, arthritis and some forms of cancer.[115,116]

There is also a disturbing increase of obesity in children, which may lead to more chronic disease in adults in the future.[117] Obesity is related to nutrition and physical activity. The human body obeys the laws of thermodynamics, and an excess of energy intake over expenditure (when there is an imbalance between diet and physical activity) leads to energy storage in the form of fat.[118,119]

Obesity is most commonly measured using BMI, calculated using the formula: *weight (kg) / height (m)^2.*

3.4.1.2 Investigation and findings

The NWAHS results indicated that 27% (over one in four) of study participants were obese (BMI ≥30), representing approximately 327,900 adults in South Australia. In addition, 36.3% (one in three) of study participants were classified as overweight.[5,7]

The annual incidence of obesity according to BMI was 18.6 incident cases per 1000 in the adult population. This means that approximately 16,100 South Australians develop obesity each year.

The prevalence of obesity was higher among females, those 30 years of age or over, people living in the northern region of Adelaide, and those who reported work status as home duties or retired, and lower among those who had an education level of bachelor degree or higher, were on an annual gross household income between $20,001 and $40,000 or greater than $60,000, or had never been married. A lower proportion of people classified as overweight or obese were current smokers compared to those with normal BMI. People classified as overweight and obese were more likely to have high blood pressure and high cholesterol compared to those classified as having a normal BMI. People classified as obese were more likely to do minimal physical activity compared to people who maintained normal weight.[120] The prevalence of obesity was higher among people with diabetes or cardiovascular disease (including heart attack, stroke, and angina). People who were overweight or obese scored lower on all quality of life dimensions except Social Functioning and Role Emotional.

Analysis of the NWAHS data revealed that people classified as obese according to BMI were more likely to experience foot pain (24.5%), compared to those not classified as obese (14.5%). In turn, those with foot pain were more likely to experience knee, hip and back pain than those without foot pain. Those with foot pain also scored lower on all quality of life dimensions compared to those without foot pain.[121,122] Shoulder and knee pain was also found to be more common in people who are classified as obese.[123,124]

People who were obese were more likely than people who were of acceptable weight to have used general practitioner, day surgery, hospital outpatient/specialist/allied health, eye specialist or ophthalmologist, other specialist doctor, or dietician services in the last 12 months, and less likely to have used alternative therapist services. When controlled for age and gender, people who were obese according to BMI cost the health system significantly more in terms of Medicare Benefit Schedule (MBS) rebates paid than people of underweight, normal or overweight BMI.[125]

3.4.1.3 Implications

Public health and clinical strategies to address the obesity epidemic must begin with weight maintenance for the adult population, weight loss for those who are overweight and obese, and a general increase in physical activity for all. Modest weight loss improves glucose tolerance and blood pressure in obese people, and gains in these factors will have a positive impact on chronic diseases.

Those people in the pre-obese (overweight) BMI category aged 40 years and over should be targeted for future health promotion interventions aimed at halting, slowing or reversing their progression along the obesity continuum and reducing their risk of co-morbidities.

People classified as overweight and obese comprise a significant proportion of the risk factor burden. The high prevalence of physical inactivity observed among those who are obese (53.8%) is a factor of major importance. This identifies the need for health promotion programs that jointly target obesity and increased physical activity. In addition, the high level of blood pressure and high total cholesterol in people who were overweight and obese presents an important health management issue. It will be necessary to appropriately target interventions if these health conditions are to be improved and health gains made. The clustering of other risk factors with overweight and obesity creates a syndrome of concurrent morbidity and highlights an important priority target group.[7]

Such efforts to prevent people from moving along the continuum from overweight to obesity and to promote reduction of weight in those classified as obese is likely to have a dramatic impact on overall health resource use. Considering the fact that finite health care resources are available, successful efforts to reduce and prevent obesity will reduce escalating demand in this area and make valuable resources available for other purposes.

People who are overweight or obese make up over 60% of the North West Adelaide's adult population. This has huge implications given that these people are at higher risk of developing chronic conditions such as cardiovascular disease and diabetes, use more health services and have a poorer quality of life than people who are normal weight. While males were more likely to be overweight, females were more likely to be obese, and obesity affects all ages, making targeting of improvement and prevention strategies difficult.

The association of foot, knee and shoulder pain with obesity, and in turn the association of knee, hip and back pain with foot pain suggests that many people who are obese experience a greater amount of musculoskeletal pain than those who are not obese. This has implications with regards to interventions that aim to reduce obesity, as pain may be a barrier to some types of physical activity in many obese people. As such, pain management and appropriate physical activity recommendations should be considered by health professionals when planning and implementing interventions to reduce obesity.

3.4.2 How valid are self-reported height and weight?

3.4.2.1 Why is it important?

Data collected by self-report telephone survey based surveillance systems are used commonly by health planners, promoters and policy makers to make decisions regarding the division of funds, targeting of interventions, evaluation of programs and prioritising of health-related issues, and to track the distribution and prevalence of non-registry based chronic diseases and associated risk factors. As such, it is crucial that the data be valid to enable the best conclusions and decisions to be made.

The majority of data relating to obesity (as determined from BMI) prevalence and incidence in Australia are obtained in this fashion, from self-reported height and weight. However many studies worldwide have concluded that people usually under-estimate their weight and over-estimate their height, meaning that the available population data relating to obesity may be under-stating the extent of the problem.

3.4.2.2 Investigation and findings

In order to determine if self-reported obesity data can be used with confidence or with knowledge of its limitations, self-reported and clinically measured height and weight data were compared from the NWAHS.[126] Analysis of the data resulted in the following findings:

- On average, adults tended to over-estimate their height by 1.4cm and under-estimate their weight by 1.7kg.
- Males and females had similar differences in over-estimating height, but women had a greater difference in under-estimating their weight.
- People age 65 years and older over-estimated their height by the greatest amount and under-estimated their weight by the smallest amount.
- The overall difference between self-reported and clinically measured weight and height increased as BMI category increased (18-24 year old obese people under-estimated their weight and over-estimated their height more than other age groups).
- Under-weight people over-stated rather than under-stated their weight.
- Using self-reported data, 19.1% of participants were obese compared to 26.3% from the clinical measurements (an under-estimate of 7.2% using self-reported data).

3.4.2.3 Implications

Based on these results, it can be concluded that the prevalence of obesity and overweight in Australia based on self-report is likely to be substantially under-estimated, and this should be taken into consideration when allocating resources to health services to combat obesity and treat obesity related conditions. However, so long as the survey question remains the same and social pressures do not result in changes to the extent of incorrect estimation in the population; self-report data will still be useful for indicating trends in the population prevalence of obesity. Regular investigations should be conducted to confirm whether increasingly 'socially desirable' responses result in changes to the degree of incorrect estimation in the population as a result of health promotion campaigns and public perceptions on obesity.

Further investigations should be made into this phenomenon to determine whether formulas can be devised that can be applied to self-report data to provide a true estimate of the prevalence of overweight and obesity. However, as people from different age groups and social demographics tend to over or under-estimate to varying degrees, this is likely to be a difficult task.

3.4.3 Obesity and overweight according to central adiposity

Related sections: *2.2 Diabetes*
2.7 Cardiovascular disease

3.4.3.1 Why is it important?

Central adiposity as measured by waist hip ratio (WHR) or waist circumference (WC) can be calculated from measurements of waist and hip circumference using a standard measuring tape. A WHR of greater than 1.0 for men or 0.85 for women is indicative of android obesity. A waist circumference of ≥100cm for males and ≥90 cm for females is the level at which weight reduction is advised.[127]

Whereas body mass index (BMI) is a summary of overall height and weight, or total adiposity, WHR and WC provide a measure of fat distribution.[128] An android or centralised pattern of fat distribution, where excess body fat is distributed in the abdominal region rather than on the hips and thighs, plays an important role in determining risk of cardiovascular disease and diabetes, particularly in men.[129]

3.4.3.2 Investigation and findings

The NWAHS results indicated that 16.4% (one in six) of study participants had a high waist hip ratio, representing 190,200 adults in South Australia. However, 58.1% (over one in two) of participants were classified as having a high waist circumference.[5,7]

The prevalence of high waist hip ratio was higher among females, those who were aged 30 years or over, born in the United Kingdom or Ireland, separated, divorced or widowed, or had a work status of part time or casual employment, undertaking home duties or retired, and lower among those who were never married, had completed post-secondary education, or had an annual gross household income over $20,000.

The prevalence of high waist hip ratio was higher among those with diabetes, asthma, cardiovascular disease (including heart attack, stroke, angina), or a mental illness (including anxiety, depression, stress related condition, and other mental illness). Further Investigation of the NWAHS data showed that the prevalence of diabetes was substantially higher among those with central adiposity. This association held for high waist circumference and high waist hip ratio and for diagnosed and undiagnosed diabetes, even when controlled for age.[130] People who had a high waist hip ratio scored lower on all quality of life dimensions.

People with a high waist hip ratio were more likely than people with a normal or low waist hip ratio to have used general practitioner, day surgery, hospital accident and emergency, hospital clinic, eye specialist or ophthalmologist, other specialist doctor, podiatrist, dietician or nurse educator services in the last 12 months.

3.4.3.3 Implications

People with a high waist hip ratio, although a smaller proportion or the population than those who were classified as obese according to their body mass index (BMI), were more severely impaired in terms of their quality of life. Waist hip ratio, as a measure of fat distribution or central obesity, may be a more important indication of risk for cardiovascular disease and diabetes than overall obesity.

Waist hip ratio also provided more specific targeting information (related to older age groups, lower education and lower incomes), and it is therefore important to continue to investigate this measure and its correlation with BMI.[18]

3.4.4 Severe obesity according to Body Mass Index (BMI)

3.4.4.1 Why is it important?

People with severe or morbid obesity (BMI ≥35) are more likely to develop high blood pressure, diabetes, cardiovascular disease, respiratory dysfunction, infertility, gout, gall bladder disease, a range of cancers and bladder incontinence. It is also a risk factor for premature death, particularly from heart attack.[131,116] The severely obese are also more likely to place increasing demands on the health system. Health expenditure incurred by those with severe obesity is twice that of normal weight adults.[132]

While it is widely reported that the prevalence of obesity has increased dramatically, severe obesity has been increasing at twice the rate of obesity overall.

From a quality of life perspective, severely obese people often have lowered self-esteem and may be less active because of difficulties with transport and public venue seating. They may experience difficulty finding and maintaining employment and may be socially ostracised, leading to poorer mental health.

Obesity is classified based on BMI to provide increasing categories of severity and risk of co-morbidities as listed in Table 3.1.

Table 3.1: The values used for classification of obesity according to BMI

Obesity classification	BMI	Risk of co-morbidities
Obese Class I	30 to 34.9	Moderate
Obese Class II	35.to 39.9	Severe
Obese Class III	≥40	Very severe

3.4.4.2 Investigation and findings

NWAHS results suggested that in 2000, approximately 10% (one in ten) of adults living in the western and northern regions of Adelaide were classified as severely obese (BMI of 35 or over). Based on these clinical measures and extrapolated to the overall state population, it was estimated that almost 118,000 South Australian adults were severely obese.[133,134]

Males were more likely to be pre-obese (overweight) than females. However, females were more likely to be severely obese than males. Other socio-demographic parameters associated with severe obesity were aged 35-54 years, having an annual gross household income between $20,000 and $60,000, being in the middle to lower quintiles of the area level disadvantage index (SEIFA), having never been married, or having a work status of part time/casual, unemployed or home duties.

3.4.4.3 Implications

Severe obesity results in long term costs, both to the individual involved and to the health system. The fact that severe obesity is increasing at a rate faster than obesity in general, and more in women in younger age groups (20-54 years) and lower socio-economic groups, suggests an unprecedented long term health burden is yet to be fully realised.

As such, interventions and policies should be targeted at these identified socio-demographic population groups in order to prevent, halt and ultimately reverse this disturbing trend at the extreme end of the obesity continuum, if serious long term social and economic costs are to be reduced and/or avoided.

3.4.5 Which is the best measure to classify obesity?

3.4.5.1 Why is it important?

BMI based on self-reported or clinically measured weight and height is most commonly used to define and categorise overweight and obesity in population studies, due to the ease of the measurement required. However, a centralised pattern of fat distribution has been demonstrated to be important to consider with regards to chronic disease incidence. As a result, waist circumference and waist hip ratio have also been used to indicate obesity. Studies have found that prevalence of different types of chronic disease (high blood pressure, cardiovascular disease, coronary heart disease and diabetes) is more strongly associated with different obesity measures, and that differences also occur between males and females.

3.4.5.2 Investigation and findings

Data from the NWAHS were analysed to determine if participants classified as normal or underweight according to BMI would be classified as obese using the other criteria.[135,136,137] Some of the findings of the investigation included:

- The prevalence of overweight based on BMI was 35.2%.
- The prevalence of obesity based on BMI was 28.5%.

- Overall, 16.7% were classified as having a high waist-hip ratio.
- Based on waist circumference, 36.7% would be advised to lose weight.
- Males were more likely to be overweight or obese according to BMI.
- Females were more likely to have a high WC or WHR.
- Of people with normal or underweight BMI, 5% had a high WHR, however this applied to 0.1% of males and 8.5% of females.
- Overall, 26.3% of participants aged 60 years or over with normal or underweight BMI had a high WHR.
- Of people with normal or underweight BMI, 1.1% had a high WC, however this applied to 0.6% of males and 1.5% of females.
- Of participants with a high WHR, 10.9% were normal or underweight according to BMI.

3.4.5.3 Implications

Although obesity is considered a risk factor for many chronic diseases, it is evident that BMI, WC and WHR describe different types of obesity with differing risk profiles depending on the specific disease and the gender of the individuals in question. As such, reliance entirely on BMI would mean that not everyone at risk would be recognised. Based on this study, it is evident that WC and WHR may be more sensitive in older females in particular. With this in mind, population studies and interventions should determine all three measures in order to ensure that all those who are overweight or obese are identified.

3.4.6 Socio-economic status and obesity prevalence

3.4.6.1 Why is it important?

There is an increasing interest in the links between local area disadvantage and the prevalence of chronic disease and associated risk factors. It is increasingly apparent that individuals who live in areas of socio-economic disadvantage have a higher risk of developing chronic disease, regardless of their individual socio-economic status. Investigating the links between area of residence and chronic disease risk factors has the potential to enable the delivery of targeted interventions and increase understanding of the links between the social and physical environment and population health outcomes.

3.4.6.2 Investigation and findings

NWAHS data were analysed to identify the prevalence of obesity according to waist to hip ratio, waist circumference and body mass index by area level disadvantage according to the Index for Relative Socio-economic Disadvantage (IRSD) as defined by the Australian Bureau of Statistics (ABS) Socio-economic Indexes for Areas (SEIFA).[138] Some of the findings of the investigation included:

- Those living in the lowest quintile of socio-economic disadvantage had the highest prevalence of obesity according to all three obesity measures.
- A gradient of reduced obesity prevalence was evident from the lowest to the middle quintiles of relative area socio-economic disadvantage.
- Obesity prevalence was not notably different between the middle and higher quintile areas of relative socio-economic disadvantage.
- The increased prevalence of obesity in the lower quintiles was even more evident when the highest resolution area socio-economic index spatial unit available was used in the analysis.

3.4.6.3 Implications

There is a need to further investigate the links between the social and physical environments and the prevalence of chronic disease and chronic disease risk factors, particularly in the areas classified as the lowest quintiles of relative socio-economic disadvantage. This will increase understanding of the factors

involved and the ways that environments can be modified to improve population health outcomes, particularly in the locations where such interventions will have the most benefit. The smallest available SEIFA spatial unit should be used when investigating such relationships; otherwise there is a risk that small areas of high disadvantage will not be identified.

3.4.7 Investigating obesity-asthma associations

Related sections: *2.1 Asthma*

3.4.7.1 Why is it important?

There is substantial evidence in the literature to suggest an association between obesity and asthma. However, it has also been suggested that respiratory symptoms in obese people may be misdiagnosed as asthma. It is plausible that central obesity may be more strongly associated with asthma than generalised obesity (as classified by BMI) through a mechanical modifying affect on airway smooth muscle function. It is also uncertain if the relationship between obesity and asthma varies between those with allergic (atopic) and non-allergic asthma phenotypes.

3.4.7.2 Investigation and findings

Data from the NWAHS were analysed to investigate the relationship between asthma prevalence and severity and obesity (particularly centralised obesity as measured by waist circumference and waist hip ratio).[139,140,141,142,143] The possible modifying role of asthma phenotype (atopy) in the relationship was also investigated. Some of the findings of the study included:

- Non-allergic asthma was associated with both centralised and generalised obesity among both men and women.
- There was an association between non-allergic asthma and a history of former smoking in men and women.
- Participants with non-allergic asthma were significantly older than those with allergic asthma.
- An association between allergic asthma and obesity was only observed in severely obese women.
- Central obesity was associated with increased asthma severity. However, the risks associated with obesity did not persist after adjustment for age, sex and smoking.

3.4.7.3 Implications

The associations of obesity with asthma shown in this study suggest that centralised obesity should be considered in addition to BMI when assessing asthma risk, particularly for non allergic asthma. In addition, the fact that former smoking was associated with non allergic asthma, suggested that quit smoking campaigns which include a component of obesity prevention may also reduce the future incidence of asthma and other obesity related morbidity and mortality in the population. Non-allergic asthma should be considered in older, centrally obese symptomatic individuals.

3.4.8 Gender differences in asthma associated with obesity

Related sections: 2.1 Asthma

3.4.8.1 Why is it important?

Suggestions have been made that there is an association between obesity and asthma control or morbidity. However the few studies conducted have had inconsistent results and various limitations. Several biochemical and mechanical mechanisms have been proposed for the suggested association. It is important to gain a greater understanding of this possible association, as research findings may indicate target groups for specific interventions and management plans.

3.4.8.2 Investigation and findings

A study was conducted to analyse the relationships between obesity and asthma morbidity (moderate to severe respiratory symptoms, emergency department visits, primary care provider visits, bronchodilator drug use, and health-related quality of life) in 563 NWAHS participants with asthma.[144] Some of the findings of the study included:

- Compared to with those of normal weight, men who were obese according to waist circumference or body mass index were more likely to have moderate to severe respiratory symptoms, bronchodilator use, reduced lung function and quality of life, and more frequent primary care visits.
- In women, only reduced quality of life and increased use of primary care services were associated with obesity; and only centrally overweight and obese women experienced increased morbidity.
- In men both central and generalised obesity was associated with increased morbidity; and central but not general adiposity was associated with persistent airways obstruction.

3.4.8.3 Implications

It is important to consider and further investigate the observed differences in the effects of generalised and central obesity on asthma morbidity between men and women.

3.4.9 Self-perception of body weight

3.4.9.1 Why is it important?

If people are unaware or under-aware that they have a weight problem, they are unlikely to make the behavioural changes necessary to achieve healthy weight in response to educational interventions. Therefore, it is important to identify the prevalence, demographics and causes of weight under-classification in the population, in order to determine the extent of the issue and formulate ways to address the specific population groups involved.

3.4.9.2 Investigation and findings

A follow up survey was conducted on 2382 NWAHS participants to determine their self-perceived weight status.[145] This was compared to their BMI classification according to height and weight measurements taken in the clinic. The data were analysed for those who were obese but underestimated their weight status, to determine if socio-economic status (household income), area level disadvantage index (SEIFA), and country of birth were significantly associated with underestimation of weight. Some of the findings of the study included:

- Of those that were obese according to BMI, 59.6% perceived that they were ‘a little overweight’ and 5.8% perceived they were of ‘normal weight’.
- Underestimation of weight status was higher for males than females.
- Over 10% of females overestimated their weight status.

- Those who were obese and perceived themselves to be a little overweight were more likely to be from the lowest quintile of SEIFA, have a low household income (<$20,000 p.a.) or be born in Eastern or Western Europe.

3.4.9.3 Implications

The fact that nearly two thirds of people classified as obese (and who were therefore at high risk of a chronic condition) under-perceived their weight status has implications for interventions that aim to change behaviour to reduce weight through education. As such, it is important to identify ways to increase weight category awareness within the population. This research has indicated that such action is most important in population groups who are locationally and socio-economically disadvantaged as well as those born in Eastern or Western Europe.

Further investigation is needed to gain an understanding of the processes that lead to people's lack of awareness that they have a weight problem.

3.4.10 Beliefs about fast-food consumption

3.4.10.1 Why is it important?

An individual's consumption of food that delivers excess energy (above expenditure) is a key factor in the development of overweight and obesity. As such, it is important to understand the attitudes and social factors involved in the consumption of energy dense foods. Psychological theory suggests that behavioural intentions are influenced by: a person's beliefs about the outcome of certain behaviours, their beliefs about social behavioural expectations and their motivation to comply with such expectations, as well as their beliefs about factors that may impede or allow the completion of the behaviour.

Having a greater understanding of the intentions underlying eating behaviours will enable health professionals to design and implement interventions that may have considerable success in combating the obesity epidemic.

3.4.10.2 Investigation and findings

A random sample of 66 NWAHS participants was interviewed over the telephone using questions that were designed to reveal the underlying beliefs relating to fast food consumption.[146] Some of the findings of the study included:

- People associated the term 'fast-food' with food that is high in fats, low in nutritional value and purchased from large retail chains (pizza, burgers, chips and fried chicken).
- The opinion that frequent fast-food consumption is bad for health was unanimous.
- Over 75% of participants reported eating fast-food at least once a fortnight.
- Younger participants (<38 years) ate fast-food more frequently than older participants.
- Positive beliefs regarding fast-food were most commonly related to convenience.
- Over two thirds of participants reported positive feelings while eating fast-food while 18% reported negative feelings.
- Approximately 5% of participants reported feeling self-conscious when purchasing fast-food, perceiving that people would consider them too fat to be eating it.
- 77% of participant reported that their partner, children or parents had the greatest influence on their fast-food choices.
- People reported that working long hours, eating alone or being unable to prepare meals increased their fast-food consumption.

3.4.10.3 Implications

The fact that most participants held a belief that fast-food consumption had negative health consequences, yet most also ate fast food regularly suggested that recent health promotion campaigns have raised awareness but have been unsuccessful in changing fast-food consumption behaviour.

High levels of convenience, enjoyment and family member influence were the most commonly cited determinants of fast-food consumption. Health professionals and politicians should take these factors into consideration, and use them advantageously when setting policy and designing and implementing future campaigns that target fast-food consumption.

3.5 Physical activity

Related sections:

2.2.4 COPD association with physical activity
2.3.9 Perceptions and costs of diabetes risk factors
2.4 Arthritis and musculoskeletal pain and stiffness
2.5 Osteoporosis
3.4 Obesity

3.5.1.1 Why is it important?

Physical inactivity is related to a number of chronic diseases, and it has been shown that people who exercise for less than 30 minutes per week have an increased all cause mortality ratio of 2.8 compared to those who exercise for 30 minutes or more per week. Increased mortality risk persisted after adjustment for age, sex, current smoking, functional impairment and co-morbidity score. The relationship between physical inactivity and general adverse health outcomes has been well established and a graded inverse relationship has been demonstrated between measures of physical inactivity and all cause mortality.[147] Inactivity is also a significant predictor of disability in midlife and older populations.

3.5.1.2 Investigation and findings

The NWAHS results indicated that 28.1% (one in four) of study participants were sedentary and undertook minimal physical activity.[5,7]

The annual incidence of decreasing physical activity levels from active to sedentary was 41.5 incident cases per 1000 in the adult population. This means that approximately 35,400 South Australian adults reduce their activity levels to sedentary each year.

Those classified as sedentary were more likely to be female, aged 30 years and over, people living in the northern suburbs, retired or undertaking home duties or born outside Australia. Sedentary individuals were less likely to have a post secondary qualification, have an annual gross household income of more than $40,000 per annum, have never been married or be classified as a student or ‘other’.

Mean scores for those classified as sedentary were lower on all quality of life dimensions than for those who were physically active.

People who were sedentary were less likely to have used physiotherapist or alternative therapist services in the last 12 months.

3.5.1.3 Implications

People who were not physically active were more likely to be older females with lower education levels. They were also more likely to be impaired in terms of their quality of life. Encouraging these people to increase their level of physical activity by making environmental, social and health system changes, rather than simply trying to change the behaviour of individuals is a priority.

3.6 Smoking

Related sections: *2.2.3 COPD and smoking*

3.6.1.1 Why is it important?

The association of smoking with elevated risk of mortality from all causes is well established and includes several cardiovascular diseases, cancer, chronic obstructive pulmonary disease, peripheral vascular disease and others. Adjusted hazard ratios for all causes of mortality show that the risk of death increases with number of cigarettes smoked.[148] The health benefits of cessation are clearly positive regardless of the age of smoking initiation, the age of cessation or the daily number of cigarettes smoked. It has also been shown that former smokers had a 24% reduction in cardiovascular disease mortality within two years of quitting.[149]

3.6.1.2 Investigation and findings

The NWAHS results indicated that 24.4% (one in four) of study participants were current smokers, representing approximately 274,700 adults in South Australia.[5,7]

The annual incidence of becoming a current smoker was 6.9 incident cases per 1000 in the adult population. This means that approximately 6,200 South Australian adults become current smokers each year.

The prevalence of current smoking was higher among those living in the northern suburbs, those with an annual gross household income between $20,001 and $60,000 per annum, those who were separated, divorced or never married, and those with part-time or casual employment, or who were unemployed, and lower among females, those 30 years of age and over, those who had an educational level of bachelor degree or higher, those born outside Australia, those who were widowed, and those who were undertaking home duties or were retired.

Current smoking was higher among people with a mental health condition (including anxiety, depression, stress related problem, and any other mental health problem), and lower among those with diabetes or cardiovascular disease (including heart attack, stroke, and angina).

Current smokers had lower quality of life scores than non smokers across all dimensions.

People who were current smokers were more likely than people who were not current smokers to have used psychologist/psychiatrist services in the last 12 months, and less likely to have visited a general practitioner, used district nurses or other community nurses, day surgery, eye specialist/ ophthalmologist, or other specialist doctor (not in a hospital).

3.6.1.3 Implications

Continuation of quit smoking campaigns is essential to reduce the prevalence of current smoking. That the prevalence was higher among young people, males, people living in the northern suburbs, those who were unemployed or casually or part-time employed, people with a mental illness, those with no education beyond secondary and those who were never married, separated or divorced, provides specific targeting information for such campaigns.

Smokers scored lower all dimensions of quality of life including mental health, and were also more likely to have seen a psychologist or psychiatrist in the last year. Current smokers were also more likely to have a mental health condition. This suggests that programs to improve the mental health of smokers may also be important in making quit attempts more successful.

3.7 Risk factors overall

Related sections: *2.3.9 Perceptions and costs of diabetes risk factors*

3.7.1 The burden of risk factors on health-related quality of life

Related sections: *2.8.1 The burden of chronic conditions on health-related quality of life*

3.7.1.1 Why is it important?

Health-related quality of life is a widely accepted, measurable indicator of health status for people with chronic disease. However, chronic disease risk factors such as smoking and obesity have been shown to detrimentally impact on health-related quality of life even before the onset of chronic disease. To date few studies have investigated if multiple risk factors have an additive detrimental effect on health-related quality of life.

3.7.1.2 Investigation and findings

NWAHS data were analysed to determine the prevalence and distribution of chronic disease risk factors and to determine the effects of specific risk factors (smoking, intermediate to high alcohol use, insufficient physical activity, high blood pressure and obesity), and the cumulative effects of multiple risk factors (if any) on health-related quality of life.[150,151152] Some of the findings of the analysis included:

- Current smoking and insufficient physical activity were associated with significant reductions in all quality of life dimensions.
- Obesity was associated with significant reductions in all quality of life dimensions with the exception of Mental Health.
- Having one risk factor was associated with reductions in general health and mental health-related dimensions.
- Having two risk factors (compared to one) had adverse effects on all quality of life dimensions.
- Having three or more risk factors (compared to two) was associated with reductions in Vitality and all physical health quality of life dimensions.
- There was a negative trend on all quality of life dimensions as risk factors increased from zero to three or more for those with and without chronic disease.
- The effect of risk factors on quality of life was greater in those with chronic disease.

3.7.1.3 Implications

The burden of multiple risk factors on quality of life in the community is substantial, and this is evident even in the absence of chronic disease. This indicates that efforts to minimise risk factors to prevent or slow the onset of chronic disease can also have a positive impact on health-related quality of life. In those with chronic disease, management of risk factors can produce significant benefits in addition to any effect on the chronic disease status or progression. Interventions need to consider multiple risk factors and the possible interactions between them. Depending on the individual, it may be necessary to tackle each risk factor in a logically sequential fashion, based on a priority assessment.

Health campaigns to modify risk factor behaviour should highlight the potential for improvement in quality of life, in addition to the reduced likelihood of developing chronic disease, as this may be a greater motivating factor for some individuals.

Further investigation is needed to determine the personal and environmental factors that lead to various multiple risk factor profiles, in order to enable improve intervention targeting and make more efficient use of limited resources.

3.7.2 MBS and PBS use and costs associated with chronic disease risk factors

Related sections: 2.8.3 Health service costs associated with chronic conditions

3.7.2.1 Why is it important?

Chronic conditions are associated with high medical system costs (refer section 2.8.3) and it has also been recognised that having some chronic disease risk factors results in increased medical system use even prior to the development of chronic disease (refer sections 2.3.9 & 3.4.1). As such, it is important to identify the distribution of costs associated with various chronic disease risk factors, in order to quantify the economic gains that are possible through well designed and implemented interventions.

3.7.2.2 Investigation and findings

Medical Benefits Schedule (MBS) and Pharmaceutical Benefits Scheme (PBS) data for the five year period July 1997 to the end of June 2002 were obtained for 2352 of the NWAHS participants.[153]

Analysis of the data resulted in the following findings:

- MBS and PBS costs were higher for those with high blood pressure, and people who performed insufficient physical activity than for those without the risk factors.
- MBS and PBS costs were higher for ex-smokers than non-smokers. However, costs for current smokers were lower than for non-smokers.
- PBS costs were higher for those with no alcohol risk, and lower for those with intermediate to high alcohol risk when compared to those with low alcohol risk.

3.7.2.3 Implications

It is evident that high blood pressure and insufficient physical activity have a significant impact on pharmaceutical and medical system costs. However, it was interesting to note that current-smokers and high risk drinkers have lower pharmaceutical and medical service costs than all other groups. It has been suggested that this could be due to reluctance on the part of these participants to attend general practitioners. This requires further investigation, because GPs are important in the delivery of modifiable risk factor interventions. If smokers and heavy drinkers deliberately avoid such interventions, new and innovative intervention methods need to be formulated and implemented with regards to these risk factors.

3.7.3 Distribution of risk factors across the life course

3.7.3.1 Why is it important?

The prevalence of chronic disease risk factors varies between people of different age groups and further variations occur between males and females. If the distribution of risk factors between different demographic subgroups within the population is known, this will enable cost-effective targeting of interventions to reduce chronic disease prevalence. This is particularly relevant for younger age groups where promotion of healthy behaviours has the potential for the greatest long term impact on the prevalence and incidence of associated chronic disease.

3.7.3.2 Investigation and findings

Data from the NWAHS were analysed to determine the distribution of a range of modifiable chronic disease risk factors (smoking, high alcohol risk, insufficient physical activity, overweight and obesity, high cholesterol and high blood pressure) among people of different genders in three main age groups: younger (18-39 years), middle aged (40-59 years) and the elderly (60 years and over).[154] Some of the findings of the analysis included:

- 60.7% of female smokers, 52.4% of females classified as high alcohol risk, and 41.9% of females who were insufficiently active were in the younger age group.

- 61% of male smokers, 57.2% of males classified as high alcohol risk, and 44.2% of males who were insufficiently active were in the younger age group.
- 39.7% of females with high cholesterol, 38.9% of females with high central adiposity, and 36.9% of females who were overweight or obese according to BMI were in the middle aged group.
- 50% of males with high central adiposity, 41.9% of males with high cholesterol, and 40.4% of males with high blood pressure were in the middle aged group.
- 58.9% of females with high blood pressure, 42.6% of females with high central adiposity, and 35.4% of females with high cholesterol were in the elderly age group.
- 38.7% of males with high blood pressure, 33.8% of males with high central adiposity, and 35.1% of males with high cholesterol were in the elderly age group.

3.7.3.3 Implications

Within each age group, the top three risk factors were similar for each gender. The focus for those aged under 40 should be smoking, alcohol intake and physical activity. The focus for those aged between 40 and 59 should be on the management of cholesterol, obesity, central adiposity and blood pressure. In the elderly, the problems that develop in the middle aged tend to persist and additional co-morbidities such as arthritis, cardiovascular disease and mental health problems become more prevalent. Using this information to target groups along the life course has the potential to deliver improved health and wellbeing outcomes in the entire population. We need to recognise that each life-stage has different challenges that may need innovative and realistic approaches to help people maximise their chances for healthy ageing.

Appendices

Appendix 1 - Publications

In press/Accepted for publication

1. Adams RJ, Howard N, Tucker G, Appleton S, Taylor AW, Chittleborough C, Gill T, Ruffin RE, Wilson DH. Effects of area deprivation on health risks and outcomes: a multilevel, cross-sectional, Australian population study. *Int Journal Public Health*. In press.
2. Adams RJ, Appleton SL, Wilson DH, Taylor A, Gill T, Chittleborough C, Ruffin RE. Cholesterol lowering and the Australian Pharmaceuticals Benefits Scheme: a population study. *Aust Health Rev:* Accepted for publication.
3. Chittleborough C, Burke M, Taylor A, Wilson D, Phillips P, Adams R, Ruffin R. Health service use among a representative sample of diagnosed and undiagnosed diabetes and respiratory conditions. *Aust Health Rev*: Accepted for publication.
4. Adams R, Tucker G, Price K, Hill C, Appleton S, Wilson D, Taylor A, Ruffin R and on behalf of the North West Adelaide Health Study Team. Self-reported adverse events in healthcare that cause harm: Results from The North-West Adelaide Health Study. *Med J Aust:* Accepted for publication.

2009

5. Grant JF, Hicks N Taylor AW, Chittleborough C, Phillips PJ & the North West Adelaide Health Study Team. Gender-specific epidemiology of diabetes: a representative cross-sectional study. *Int J Equity in Health* 2009, 8:6.
6. Cole A, Gill TK, Shanahan EM, Phillips P, Taylor AW, Hill CL. Is diabetes associated with shoulder pain or stiffness? Results from a population based study. *Journal of Rheumatology* 2009; 36:371-7.
7. Hill C, Gill TK, Appleton S, Cleland L, Taylor AW, Adams RJ. The use of fish oil in the community: results of a population-based study (Letter to the Editor). *Rheumatology* 2009; 48: 441-442.
8. Adams RJ, Appleton S, Hill CL, Wilson DH, Taylor AW, Chittleborough C, Gill T, Ruffin R. Independent association of HbA1c and incident cardiovascular disease in people without diabetes. *Obesity* 2009: 17: 559-563.
9. Appleton SL, Ruffin RE, Wilson DH, Taylor AW, Adams RJ. Cardiovascular disease risk associated with asthma and respiratory morbidity may be mediated by short-acting beta-2 agonists. *J Allergy Clin Immunol* 2009 Jan;123(1):124-130.e1.

2008

10. Grant JF, Taylor AW, Ruffin RE, Wilson DH, Phillips PJ, Adams RJT, Price K & the North West Adelaide Health Study Team. Cohort profile: The North West Adelaide Health Study. *Int J Epidemiol* 2008; 1–8.
11. Menz HB, Gill, TK, Taylor AW, Hill, CL. Predictors of podiatry utilisation in Australia: the North West Adelaide Health Study. *Journal of Foot and Ankle Research*: 1:8.
12. Appleton SL, Ruffin RE, Wilson DH, Taylor AW, Adams RJ. Asthma is associated with cardiovascular disease in a representative population sample. *Obesity Research & Clinical Practice* 2008; 2:91-99.
13. Appleton SL, Wilson DH, Tucker G, Ruffin RE, Taylor AW, Adams RJ, On behalf of the North West Adelaide Cohort Health Study Team. Letter to the Editor: Sex differences in asthma morbidity associated with obesity in a representative population sample. *J Allergy Clin Immunol* 2008; 121(5):1285-7.
14. Dunn KI, Mohr PB, Wilson CJ, Wittert GA. Beliefs about Fast Food in Australia: A Qualitative Analysis. *Appetite*. 2008; 51(2):331-4.
15. Hill CL, Gill TK, Menz HB, Taylor AW. Prevalence and correlates of foot pain in a population-based study: the North West Adelaide Health Study. *J Foot Ankle Res* 2008; 1:2.
16. Howard NJ, Hugo GJ, Taylor AW, Wilson DW. Our perception of weight: socioeconomic and sociocultural explanations. *Obesity Research & Clinical Practice* 2008; 2:125-31.

17. Howard NJ, Taylor AW, Gill TK, Chittleborough CR. Severe obesity: Investigating the socio-demographics within the extremes of body mass index. *Obesity Research & Clinical Practice* 2008; 2:51-9.

2007

18. Price K. Debating the influence of self-reports by people living with chronic disease on healthy aging and longevity. *Ann N Y Acad Sci* 2007; 1114:144-53.
19. Price K, Cheek J. Avoiding death: The ultimate challenge in the provision of contemporary healthcare? *Health Sociol Rev* 2007; 16(5):397-404.

2006

20. Appleton SL, Adams RJ, Wilson DH, Taylor AW, Ruffin RE, on behalf of the North West Adelaide Health Study team. Central obesity is associated with non-atopic but not atopic asthma in a representative population sample. *J Allergy Clin Immunol* 2006; 118:1284-91.
21. Chittleborough C, Baldock, Taylor A, Phillips P. Health status assessed by the SF-36 along the diabetes continuum in an Australian population. *Quality of Life Research* 2006; 15(4):687-94.
22. Giles J, Cornelius S, Chittleborough C. General practice nurses diabetes impact. *Australian Diabetes Educator* 2006; 9(4):14-16.
23. Grant J, Chittleborough C, Taylor A, Dal Grande E, Wilson D, Phillips, Adams R, Cheek J, Price K, Gill T, Ruffin R (on behalf of the NWAH Study Team). The North West Adelaide Health Study: detailed methods and baseline segmentation of a cohort along a chronic disease continuum. *Epid Persp & Innovations* 2006; 3:4.
24. Hugo G, Franzon J. Child obesity in South Australia. Some initial findings. *Food, Culture and Society* 2006; 9(3):299-316.
25. Price K. Health promotion and some implications of consumer choice. *J Nurs Management* 2006; 14(6):494-501.
26. Ruffin RE, Wilson D, Appleton S. (on behalf of the North West Adelaide Health (Cohort) Study Team) When you can't breathe…nothing else matters. *Public Health Bulletin* 2006; 3 13-16.
27. Taylor A, Dal Grande E, Gill T, Chittleborough C, Wilson D, Adams R, Grant, Phillips P, Ruffin R. Do people with risky behaviours participate in biomedical cohort studies? *BMC Public Health* 2006; 6:11.
28. Taylor AW, Dal Grande E, Gill TK, Chittleborough CR, Wilson DH, Adams RJ, Grant JF, Phillips PJ, Appleton S, Ruffin RE. How valid are self reported height and weight? A comparison between CATI self-report and clinic measurements using a large representative cohort study. *Aust N Z J Public Health* 2006; 30(3):238-46.

2005

29. Adams R, Appleton S, Wilson D, Taylor A, Dal Grande E, Chittleborough C, Gill T, Ruffin R. Population comparison of two clinical approaches to the metabolic syndrome: Implications of the new International Diabetes Federation Consensus Definition. *Diabetes Care* 2005; 28(11):2777-9.
30. Appleton S, Adams R, Wilson D, Taylor A, Ruffin R. Spirometric criteria for asthma: adding further evidence to the debate. *J Allergy Clin Immunol* 2005; 116:976-82.
31. Ruffin RE, Wilson DH, Appleton SL, Adams RJ. An algorithmic approach to diagnosing asthma in older patients in general practice. *Med J Aust* 2005; 183(Suppl 1):S38-S40.
32. Wilson D, Adams R, Appleton S, Ruffin R. Difficulties identifying and targeting COPD and population-attributable risk of smoking – a population study. *Chest* 2005; 128:2035-42.
33. Wilson D, Appleton S, Adams R, Ruffin R. Undiagnosed asthma in older people: an underestimated problem. *Med J Aust* 2005; 183(Suppl 1):S20-S22.

2004

34. Adams R. Asthma older persons. Modern Medicine/Medicine Today 2004.
35. Appleton S, Adams R, Wilson D, Taylor A, Dal Grande E, Chittleborough C, Ruffin (& NWAH(Cohort) Study Team). The biomedically assessed cumulative burden of chronic disease risk factors on health-related quality of life in an urban population. *Health Promotion Journal of Australia* 2004; 15:55-62.

2003

36. Adams R, Wilson D, Appleton S, Taylor A, Dal Grande E, Chittleborough C, Ruffin R. Underdiagnosed asthma in South Australia. *Thorax* 2003; 58(10):846-50.
37. Cheek J. Negotiated social space: a relook at partnership in contemporary health care. *Primary Health Care Research & Development* 2003; 4:119-27.
38. Gill T, Chittleborough C, Taylor A, Ruffin R, Wilson D, Phillips P. Body mass index, waist hip ratio, and waist circumference: which measure to classify obesity? *Sozial- und Praventivmedizin* 2003; 48:191-200.

Appendix 2 – Published Reports

2007

1. Population Research and Outcome Studies. *North West Adelaide Health Study: Stage 2 Key Findings*. Department of Health, Adelaide, June 2007. ISBN 9780730898986.
2. Population Research and Outcome Studies. *North West Adelaide Health Study: Asthma*. Stage 2 Epidemiological Series Report 2007-01. April 2007.
3. Population Research and Outcome Studies. *North West Adelaide Health Study: Chronic Obstructive Pulmonary Disease (COPD)*. Stage 2 Epidemiological Series Report 2007-02. April 2007.
4. Population Research and Outcome Studies. *North West Adelaide Health Study: Cardiovascular Disease (CVD)*. Stage 2 Epidemiological Series Report 2007-03. April 2007.
5. Population Research and Outcome Studies. *North West Adelaide Health Study: Diabetes*. Stage 2 Epidemiological Series Report 2007-04. April 2007.
6. Population Research and Outcome Studies. *North West Adelaide Health Study: Current mental health condition*. Stage 2 Epidemiological Series Report 2007-05. April 2007.
7. Population Research and Outcome Studies. *North West Adelaide Health Study: Depression*. Stage 2 Epidemiological Series Report 2007-06. April 2007.
8. Population Research and Outcome Studies. *North West Adelaide Health Study: Mental health GHQ*. Stage 2 Epidemiological Series Report 2007-07. April 2007.
9. Population Research and Outcome Studies. *North West Adelaide Health Study: Renal health*. Stage 2 Epidemiological Series Report 2007-08. April 2007.
10. Population Research and Outcome Studies. *North West Adelaide Health Study: Arthritis*. Stage 2 Epidemiological Series Report 2007-09. April 2007.
11. Population Research and Outcome Studies. *North West Adelaide Health Study: Back pain*. Stage 2 Epidemiological Series Report 2007-10. April 2007.
12. Population Research and Outcome Studies. *North West Adelaide Health Study: Foot pain*. Stage 2 Epidemiological Series Report 2007-11. April 2007.
13. Population Research and Outcome Studies. *North West Adelaide Health Study: Hand pain*. Stage 2 Epidemiological Series Report 2007-12. April 2007.
14. Population Research and Outcome Studies. *North West Adelaide Health Study: Hip pain*. Stage 2 Epidemiological Series Report 2007-13. April 2007.
15. Population Research and Outcome Studies. *North West Adelaide Health Study: Knee pain*. Stage 2 Epidemiological Series Report 2007-14. April 2007.
16. Population Research and Outcome Studies. *North West Adelaide Health Study: Osteoporosis*. Stage 2 Epidemiological Series Report 2007-15. April 2007.
17. Population Research and Outcome Studies. *North West Adelaide Health Study: Shoulder pain*. Stage 2 Epidemiological Series Report 2007-16. April 2007.
18. Population Research and Outcome Studies. *North West Adelaide Health Study: Alcohol*. Stage 2 Epidemiological Series Report 2007-17. April 2007.
19. Population Research and Outcome Studies. *North West Adelaide Health Study: Blood pressure*. Stage 2 Epidemiological Series Report 2007-18. April 2007.
20. Population Research and Outcome Studies. *North West Adelaide Health Study: Body mass index*. Stage 2 Epidemiological Series Report 2007-19. April 2007.
21. Population Research and Outcome Studies. *North West Adelaide Health Study: Cholesterol*. Stage 2 Epidemiological Series Report 2007-20. April 2007.
22. Population Research and Outcome Studies. *North West Adelaide Health Study: Physical activity*. Stage 2 Epidemiological Series Report 2007-21. April 2007.

23. Population Research and Outcome Studies. *North West Adelaide Health Study: Smoking*. Stage 2 Epidemiological Series Report 2007-22. April 2007.
24. Population Research and Outcome Studies. *North West Adelaide Health Study: Waist circumference*. Stage 2 Epidemiological Series Report 2007-23. April 2007.
25. Population Research and Outcome Studies. *North West Adelaide Health Study: Waist hip ratio*. Stage 2 Epidemiological Series Report 2007-24. April 2007.
26. Population Research and Outcome Studies. *North West Adelaide Health Study: Health service use*. Stage 2 Epidemiological Series Report 2007-25. April 2007.
27. Population Research and Outcome Studies. *North West Adelaide Health Study: Medications*. Stage 2 Epidemiological Series Report 2007-26. April 2007.
28. Population Research and Outcome Studies. *North West Adelaide Health Study: Overall health status*. Stage 2 Epidemiological Series Report 2007-27. April 2007.
29. Population Research and Outcome Studies. *North West Adelaide Health Study: Quality of life*. Stage 2 Epidemiological Series Report 2007-28. April 2007.

2005

30. Grant J, Chittleborough C, Dal Grande E, Taylor A. Baseline biomedical findings, policy implications and research recommendations. SA Department of Health, Adelaide. March 2005. ISBN 0730893928.
31. Chittleborough C, Burke M, Taylor A. Medicare Benefits Schedule Health Insurance Commission data for chronic conditions and risk factors. SA Department of Health, Adelaide. March 2005. ISBN 0730894029.

2002

32. Chittleborough C, Cheek J, Grant J, Phillips P, Taylor A. Education and information issues among people with diabetes. Department of Human Services, Adelaide. June 2002. ISBN 0730891852.
33. Taylor A, Dal Grande E, Chittleborough C, Phillips P, Cheek J, Wilson D, Ruffin R. *The North West Adelaide Health Study – Key biomedical findings, policy implications and research recommendations*. SA Department of Human Services, Adelaide. May 2002. ISBN 0730891895.
34. Taylor A, Dal Grande E, Chittleborough C, Ruffin D, Wilson D, Phillips P. *The North West Adelaide Health Study – Summary of key biomedical findings, policy implications and research recommendations*. Department of Human Services, Adelaide. May 2002. ISBN 0730891909.
35. Wilson D, Appleton S, Taylor A, Dal Grande E, Chittleborough C, Ruffin R. The North West Adelaide Health Study – Risk factors and associated chronic diseases. Department of Human Services, Adelaide. May 2002. ISBN 0730891917.
36. Cheek J, Oster C. A qualitative investigation of the experiences, perceptions and understandings of people with a chronic condition. University of South Australia. May 2002. ISBN 0730891933.

Appendix 3 – Conference presentations

(Author presenting)

2009 - Submitted

Ruffin R, Appleton S, Brito-Mutunayagam R, Wilson D, Adams R. Excess lung function decline is associated with GOLD stage 0. *European Respiratory Society Annual Congress*, Vienna (Austria), 12-19 September 2009.

Tuckerman J, Grant JG, Taylor AW. North West Adelaide Health Study: summary of policy implications 2000-2008. *39th Public Health Association Australia,* Canberra, 28-30 September 2009.

Hill CL, Gill TK, Shanahan EM, Adams RJ, Taylor A. Effect of socio-economic status (SES) and musculoskeletal pain in Australia. *Australian Rheumatology Association*, Wellington (New Zealand), 3-6 May 2009.

Adams R, Appleton S, Brito-Mutunayagam R, Wilson D, Ruffin R. Smoking cessation in GOLD stage 0: an opportunity for intervention (oral presentation). *Thoracic Society of Australia and New Zealand*, Darwin, 4-9 April 2009.

Appleton SL, Hill C, Gill T, Wilson DH, Taylor AW, Adams RJ. Complementary and Alternative Medicine Use In Asthma (poster presentation). *Thoracic Society of Australia and New Zealand*, Darwin, 4-9 April 2009.

Taylor A, Baldock K, Phillips P. Diabetes incidence: seven-fold risk among those with metabolic syndrome (poster presentation). *3rd International Congress on Prediabetes and the Metabolic Syndrome,* Nice (France), 1-4 April 2009.

Phillips P, Taylor A, Baldock K. Development of metabolic syndrome affects health-related quality of life (poster presentation). *3rd International Congress on Prediabetes and the Metabolic Syndrome,* Nice (France), 1-4 April 2009.

2008

ORAL PRESENTATIONS

1. Baldock K, Phillips P, Chittleborough C, Taylor A. Increased medication use is associated with poorer health-related quality of life among people with diabetes independent of glycaemia. *Australasian Society for Psychological Research in Diabetes 10th Annual Scientific Conference*, Melbourne, 25 August 2008.
2. Grant J, Taylor A, Montgomerie A, McDermott R. Four studies and a collaboration: Intergenerational research in South Australia – the SAPHIRe Project. *Population Health Congress (Aust Epid Assoc, A'asian Fac Public Hlth Med, Aust Health Prom Assoc, Public Hlth Assoc Aust)*, Brisbane, 6-9 July 2008.
3. Cole A, Gill TK, Shanahan E, Philips P, Taylor AW, Hill CL. The association between shoulder pain and diabetes mellitus: a population based study. *European League Against Rheumatism (EULAR)* Paris, 11-14 June 2008.
4. Gill T, Taylor A, Hill C, Shanahan EM. The prevalence of musculoskeletal pain in an Australian population based cohort study. *Australian Rheumatology Association*, Adelaide, 17-21 May 2008.
5. Adams R. Chronic cough and mental health. *Thoracic Society of Australia and New Zealand*, Melbourne, 28 March-2 April, 2008.

POSTER PRESENTATIONS

6. Gill TK, Phillips P, Rowett D, Taylor AW and Laddipeerla NR. Medication use among those with osteoporosis in the community. *18th Annual Meeting Australian and New Zealand Bone and Mineral Society*, Melbourne, 28-30 August 2008.

7. Gill TK, Phillips P, Taylor AW, Laddipeerla NR. Prevalence of osteoporosis in a community sample. *18th Annual Meeting Australian and New Zealand Bone and Mineral Society*, Melbourne, 28-30 August 2008.
8. Baldock KL, Chittleborough CR, Gill TK, Phillips PJ, Taylor AW. Hypertension and dyslipidaemia: missing medications and missing targets. *Australian Diabetes Society Annual Scientific Meeting*, Melbourne, 27-29 August 2008.
9. Baldock KL, Chittleborough CR, Phillips PJ, Taylor AW. Incidence of diabetes in the North West Adelaide Health Study: socioeconomic and biomedical risk factors. *Australian Diabetes Society Annual Scientific Meeting*, Melbourne, 27-29 August 2008.
10. Gill T, Phillips P, Rowett D, Hill C, Taylor A. Medications and osteoporosis in the community – some missing and some inappropriate. *European League Against Rheumatism (EULAR,* Paris (France), 11-14 June 2008.
11. Hill C, Shanahan M, Gill T, Taylor A. Prevalence and associations of shoulder pain in a population-based study: The North West Adelaide Health Study. *European League Against Rheumatism (EULAR),* Paris (France), 11-14 June 2008.
12. Hill C, Gill T, Taylor A. The use of fish oil among participants in the North West Adelaide Health Study. *Australian Rheumatology Association*, Adelaide, 17-21 May 2008.

PUBLISHED ABSTRACTS

13. Hill C, Gill T, Taylor A. Knee pain prevalence and arthritis: Results from a population-based study cohort study. *European League Against Rheumatism (EULAR*), Paris (France), 11-14 June 2008.
14. Hill C, Gill T, Taylor A. Hand pain prevalence and arthritis: Results from a population-based study cohort study. *European League Against Rheumatism (EULAR,* Paris (France), 11-14 June 2008.

2007

ORAL PRESENTATIONS

15. Appleton S, Wilson D, Taylor A, Gill T, Ruffin R, Adams R. Relation of body composition to asthma in a population sample of older Australians. *12th Congress of the Asian Pacific Society of Respirology*, Gold Coast, 30 November-4 December2007.
16. Price K, Cheek J, Taylor A, Ruffin R. Is shortness of breath normal in the older person? *Geriaction National Conference: Caring for the Aged in all Contexts: Models, myths and magic*, Brisbane, 11–12 October 2007.
17. Appleton S, Wilson D, Taylor A, Ruffin R, Adams R. Relation of body composition to asthma in a population sample of older Australians. *European Respiratory Society Annual Congress*, Stockholm (Sweden), 15-19 September 2007. *Eur Respir J* 2007; 30: Suppl. 51, 43s.
18. Chittleborough C, Phillips P, Drakoulas M, Baldock K, Taylor A. Diabetes can ruin your day – Quality of life after diagnosis. *Australian Diabetes Society* Christchurch (New Zealand), 5-7 September 2007.
19. Price K, Cheek J, Wilson D, Adams R, Ruffin R. Challenging that time and place known as 'the consultation'. *19th IUHPE World Conference on Health Promotion and Health Education*, Vancouver (Canada), 10-15 June 2007.
20. Adams R, Appleton S, Wilson D, Taylor A, Gill T, Ruffin R. How COPD is defined on spirometry affects prevalence and disease burden in the community. *Thoracic Society of Australia and New Zealand*, Auckland (New Zealand), 25-28 March 2007.

POSTER PRESENTATIONS

21. Wilson D, Franzon J, Taylor A. Surveillance data identifies an obesity syndrome - what are the likely determinants? *5th International Conference on Behavioral Risk Factor Surveillance*, Rome (Italy), 24-26 October 2007.

22. Wilson D, Appleton S, Adams R, Ruffin R. Early detection of COPD: evidence from a population cohort study. *European Respiratory Society Annual Congress*, Stockholm (Sweden), 15-19 September 2007.
23. Phillips P, Baldock K, Chittleborough C, Taylor A. Renal function by stage of diabetes progression: impairment begins before diabetes develops. *Australian Diabetes Society* Christchurch, New Zealand, 5-7 September 2007.
24. Gill T, Taylor A, Phillips P. Osteoporosis: Underestimated and over represented: Prevalence of osteoporosis in the North West Adelaide (Cohort) Health Study. *The 19th IUHPE World Conference on Health Promotion and Health Education*, Vancouver (Canada), 10-15 June 2007.

2006

ORAL PRESENTATIONS

25. Potts N, Wilson D, Taylor A, Gill T, Schrader G, Ruffin R. The prevalence of depression in the North West Adelaide Health Study. *The Australasian Society for Psychiatric Research Annual Meeting*, Sydney, Australia, 6-8 December 2006.
26. Hill C, Gill T, Taylor A. Prevalence and associations of foot pain in a population-based study. *American College of Rheumatology*, Washington (United States of America), November 2006.
27. Price K. Debating the influence of denial in research and its impact on healthy ageing. *3rd International Conference on Healthy Ageing and Longevity*, Melbourne, 13-15 October 2006.
28. Grant J, Chittleborough C, Taylor A, Phillips P, Ruffin R. Plugging an important research gap: measured incidence of chronic disease from the North West Adelaide Health Study. *Australasian Epidemiological Association*, Melbourne, September, 2006.
29. Jury H, Avery J, Chittleborough C, Taylor A, Phillips P, Ruffin R. Overall health status in the north west of Adelaide. *Public Health Association of Australia*, Sydney, September 2006.
30. Chittleborough C, Taylor A, Wilson D, Adams R, Ruffin R. Gender differences in inequalities in asthma: the North West Adelaide Health Study. *European Respiratory Society*, Munich (Germany), September 2006.
31. Phillips P, Chittleborough C, Taylor A. Cumulative diabetes incidence: ten-fold risk among those with impaired fasting glucose. *Australian Diabetes Society*, Gold Coast, August 2006.
32. Price K. Ageing: the most significant chronic condition! *SA Gerontology*, Adelaide, June 2006.
33. Adams R. Appleton SL, Wilson DH, Taylor AW, Ruffin RE. Association of asthma, cholesterol and statins in a population sample. *American Thoracic Society*, San Diego (United States of America), May 2006.
34. Appleton S, Adams R, Wilson D, Taylor A, Ruffin R. Central obesity is associated with non-atopic but not atopic asthma: an epidemiological study. *Thoracic Society of Australia and New Zealand* Canberra, March 2006..

POSTER PRESENTATIONS

35. Chittleborough C, Phillips P, Taylor A. Socioeconomic inequalities among people with diabetes aged 65 years and over. *International Diabetes Federation* Capetown (Africa), December 2006.
36. Potts N, Wilson D, Taylor A, Gill T, Schrader G, Ruffin R. Depression and health risk factors in the North West Adelaide Health Study. *The Australasian Society for Psychiatric Research Annual Meeting*, Sydney, 6-8 December 2006.
37. Chittleborough C, Taylor A, Gill T, Phillips P, Adams R, Wilson D, Ruffin R. Socioeconomic disparities associated with metabolic syndrome differ by gender. *International Congress on Obesity*, Sydney, September 2006.
38. Howard N, Wilson D, Taylor A, Hugo G. Investigating spatial relationships and obesity: area and individual level disadvantage in the north west region of Adelaide, South Australia. *International Congress on Obesity*, Sydney, September 2006.

39. Taylor A, Wilson D, Adams R, Ruffin R. Examining asthma incidence in an Australian prospective cohort: the North West Adelaide Health Study. *European Respiratory Society*, Munich (Germancy), September 2006.
40. Appleton S, Adams R, Wilson D, Taylor A, Ruffin R. Asthma severity is not modified by central obesity. *European Respiratory Society*, Munich (Germancy), September 2006..
41. Price K. Ageing: the most significant chronic condition? *British Society of Gerontology*, Bangor (Wales), September 2006.
42. Baldock K, Chittleborough C, Phillips P, Taylor A. Reduction of A1c, blood pressure, and cholesterol decreases 10-year risk of coronary heart disease among those with diabetes. *Australian Diabetes Society,* Gold Coast, August 2006.
43. Montgomerie A, Chittleborough C, Taylor A, Phillips P, Adams R, Ruffin R, Wilson D. The relationship between metabolic syndrome and health related quality of life – results from the North West Adelaide Health Study. *Health Outcomes*, Canberra, August 06.

2005

ORAL PRESENTATIONS

44. Appleton S, Adams R, Wilson D, Ruffin R. The complexity of the association between obesity and respiratory disease. *Australasian Society for the Study of Obesity*, Adelaide, October 2005.
45. Baldock K, Jury H, Chittleborough C, Phillips P, Taylor A. The relationship of central obesity with diagnosed and undiagnosed diabetes – results from the North West Adelaide Health Study. *Australasian Society for the Study of Obesity*, Adelaide, October 2005.
46. Dal Grande E, Taylor A, Chittleborough C, Gill T, Grant J. The impact of undiagnosed chronic conditions (diabetes, asthma and COPD) on health-related quality of life: results from the North West Adelaide Health Study. *Australasian Epidemiological Association*, Newcastle, October ct 2005.
47. Grant J, Chittleborough C, Taylor A. The NWAH Study: quiet achievers in chronic disease epidemiology. *Public Health Assoc of Australia*, Perth, September 2005.
48. Chittleborough C, Taylor A, Wilson D, Adams R, Ruffin R. Population surveillance in North West Adelaide: lung function and chronic obstructive pulmonary disease (COPD) across the diabetes spectrum. *European Respiratory Society*, Copenhagen (Denmark), September 2005.
49. Gill T, Taylor A, Ruffin R. Risk factors and quality of life in the NWAH Cohort Study. *Health Outcomes*, Canberra, August 05.
50. Gill T, Taylor A, Ruffin R. Costs associated with chronic conditions in the NWAH (Cohort) Study. *Health Outcomes,* Canberra, August 05.
51. Ruffin R, Wilson D, Adams R, Appleton S. Asthma and obesity. *American Thoracic Society*, San Diego (United States of America), May 2005.

POSTER PRESENTATIONS

52. Appleton S, Adams R, Wilson D, Taylor A, Ruffin R. Central obesity is associated with non-allergic but not allergic asthma: an epidemiological study. *Australasian Society for the Study of Obesity,* Adelaide, October 2005.
53. Howard N, Grant J, Montgomerie A, Taylor A. Using a tape measure to examine chronic disease and risk factors: the North West Adelaide Health Study. *Australasian Society for the Study of Obesity,* Adelaide, October 2005.
54. Baldock K, Gill T, Chittleborough C, Taylor A. The relationship between waist to hip ratio and quality of life – results from the North West Adelaide Health Study. *Australasian Society for the Study of Obesity,* Adelaide, October 2005.
55. Montgomerie A, Grant J, Chittleborough C, Taylor A, Adams R. Results from the North West Adelaide Health Study – Which measure of central obesity is best? *Australasian Society for the Study of Obesity,* Adelaide, October 2005.

56. Baldock K, Chittleborough C, Phillips P, Taylor A. Coronary heart disease risk in South Australians with diabetes. *Australian Diabetes Society*, Perth, September, 2005.
57. Chittleborough C, Baldock K, Taylor A, Phillips P. Men are more likely than women to have prediabetes or the metabolic syndrome. *Australian Diabetes Society*, Perth, September, 2005.
58. Baldock K, Chittleborough C, Taylor A, Phillips P. Income and diabetes: prevalence is higher among the poor. *Australian Diabetes Society*, Perth, September, 2005.
59. Taylor A, Chittleborough C, Wilson D, Adams R, Ruffin R. Population surveillance in North West Adelaide: medical costs among males and females with diagnosed and undiagnosed asthma. *European Respiratory Society*, Copenhagen (Denmark), September 2005.
60. Gill T, Taylor A, Wilson D, Adams R, Ruffin R. Population surveillance in North West Adelaide: physical activity associated with chronic obstructive pulmonary disease (COPD). *European Respiratory Society*, Copenhagen (Denmark), September 2005.
61. Taylor A, Baldock K, Chittleborough C, Wilson D, Adams R, Ruffin R. Population surveillance in North West Adelaide: The impact of diagnosed and undiagnosed chronic obstructive pulmonary disease (COPD) on quality of life. *European Respiratory Society*, Copenhagen (Denmark), September 2005.
62. Wilson D, Appleton S, Adams R, Taylor A, Ruffin R. Population surveillance in North West Adelaide: undiagnosed asthma. *European Respiratory Society*, Copenhagen (Denmark), September.
63. Adams R, Appleton S, Wilson D, Taylor A, Ruffin R. Population surveillance in North West Adelaide: Misclassification of asthma is dependent on FEV1 reversibility criteria. *European Respiratory Society*, Copenhagen (Denmark), September 2005.
64. Adams R, Appleton S, Wilson D, Taylor A, Ruffin R. Population surveillance in North West Adelaide: the population attributable risk (PAR) of atopy for asthma varies with age. *European Respiratory Society*, Copenhagen (Denmark), September 2005.
65. Gill T, Taylor A, Ruffin R. Costs associated with risk factors for chronic conditions in the NWAH (Cohort) Study. *Health Outcomes*, Canberra, August 2005.
66. Wilson D. Research opportunities in the Dept of Medicine. TQEH Advertising Opportunities Day, Adelaide, July 2005.
67. Phillips P, Chittleborough C, Baldock K, Taylor A. Changing the diagnostic criteria for impaired fasting glycaemia: effects in a South Australian population. *1st International Congress on Prediabetes and the Metabolic Syndrome*, Berlin (Germany), April 2005.
68. Chittleborough C, Phillips P, Baldock K, Taylor A. Are the demographic and risk factor profiles different for males and females with impaired fasting glucose? *1st International Congress on Prediabetes and the Metabolic Syndrome*, Berlin (Germany), April 2005.
69. Taylor A, Phillips P, Chittleborough C, Baldock K. The effect of impaired fasting glycaemia on quality of life in a South Australian population. *1st International Congress on Prediabetes and the Metabolic Syndrome*, Berlin (Germany), April 2005.
70. Appleton S, Adams R, Wilson D, Ruffin R. Misclassification of asthma: a comparison of FEV1 reversibility criteria in the diagnosis of asthma. *Thoracic Society of Australia and New Zealand*, Perth, March 2005.

2004

ORAL PRESENTATIONS

71. Phillips L, Chittleborough C, Phillips P, Baldock K, Taylor A. Metabolic control in diabetes - the effect on health-related quality of life. *European Association for the Study of Diabetes*, Munich (Germany), September 2004.
72. Worthley D, Chittleborough C, Phillips P, Baldock K, Taylor A. Health-related quality of life in diabetes by stage of disease progression. *European Association for the Study of Diabetes*, Munich (Germany), September 2004.

73. Wilson D, Adams R, Taylor A, Ruffin R. Health promotion and population surveillance: an important partnership for improved health outcomes. *18th World Conference on Health Promotion & Health Education,* Melbourne, April, 2004.
74. Phillips P. NWAH Study information. *The Directions in Diabetes Medical Conference*, Adelaide, March 2004.

POSTER PRESENTATIONS

75. Grant J, Chittleborough C, Phillips P, Taylor A. A gendered look at the epidemiology of diabetes in SA. *Australasian Epidemiological Association*, Adelaide, October 2004.
76. Baldock K, Chittleborough C, Phillips P, Taylor A. Impaired fasting glucose: is it more than just high blood sugar? *Australasian Epidemiological Association*, Adelaide, October 2004.
77. Chittleborough C, Phillips P, Baldock K, Taylor A. Do people with diabetes have poorer health-related quality of life than those with asthma or COPD? *Australian Diabetes Society*, Sydney, August 2004.
78. Chittleborough C, Phillips P, Caudle L, Taylor A. Achieving diabetes management targets: the North West Adelaide Health Study population. *Australian Diabetes Society*, Sydney, August 2004.
79. Phillips P, Chittleborough C, Baldock K, Taylor A. Health-related quality of life in diabetes: the effect of metabolic control and stage of disease progression. *Australian Diabetes Society*, Sydney, August 2004.
80. Burke M, Chittleborough C, Phillips P, Taylor A, Cook G. Health service use and diabetes risk factor concentration. *18th World Conference on Health Promotion & Health Education,* Melbourne, April, 2004.
81. Chittleborough C, Burke, Taylor A, Dal Grande E, Grant J. Why should we reduce obesity in the population? Health resource use implications. *18th World Conference on Health Promotion & Health Education,* Melbourne, April, 2004.
82. Grant J, Chittleborough C, Dal Grande E, Taylor A. Severe obesity: who should be targeted? *18th World Conference on Health Promotion & Health Education,* Melbourne, April, 2004.

2003

ORAL PRESENTATIONS

83. Grant J, Chittleborough C, Dal Grande E, Taylor A, Wilson D, Phillips P, Ruffin R. Chronic disease and risk factor multiplicity: who should be targeted? *Public Health Association of Australia*, Brisbane, September/October 2003.
84. Chittleborough C, Taylor A, Phillips P, Wilson D, Ruffin R. Perception of diabetes risk in North West Adelaide: a population biomedical study. *Australasian Society for Behavioural Health & Medicine*, Brisbane, February 2003.

POSTER PRESENTATIONS

85. Appleton S, Wilson D, Adams R, Taylor A, Dal Grande E, Chittleborough C, Ruffin R. The burden of multiple biomedical and behavioural risk factors for chronic disease assessed in an urban population. *Global Surveillance Meeting*, Noosa, October 2003.
86. Chittleborough C, Burke M, Phillips P, Taylor A. Health service use among people with diabetes. *Australian Diabetes Society,* Melbourne, September 2003.
87. Grant J, Chittleborough C, Taylor A, Phillips P. Identifying people with diabetes-related complications from a population perspective. *Australian Diabetes Society,* Melbourne, September 2003.
88. Wilson D, Appleton S, Adams R, Ruffin R. Asthma and the burden of risk factors. *Thoracic Society of Australia & New Zealand,* Adelaide, April 2003.
89. Ruffin R, Wilson D, Adams R, Taylor A, Hiller J, Hugo G, Wilkinson D. A high prevalence of mild chronic obstructive pulmonary disease in a population sample. *Thoracic Society of Australia & New Zealand,* Adelaide, April 2003.

90. Chittleborough C, Dal Grande E, Taylor A, Grant J, Wilson D, Adams R, Ruffin R. Asthma prevalence and perception of severity in North West Adelaide: a population biomedical study. *Thoracic Society of Australia & New Zealand,* Adelaide, April 2003.

2002

ORAL PRESENTATIONS

91. Grant J, Gill T, Chittleborough C, Dal Grande E, Taylor A, Wilson D, Phillips P, Ruffin R. Who's skating on thin ice? North West Adelaide Health Study risk factor profile. *Public Health Association of Australia*, Adelaide, September, 2002.
92. Chittleborough C, Dal Grande E, Taylor A, Gill T, Grant J, Wilson D, Phillips P, Ruffin R. Impact of chronic conditions and risk factors on quality of life: the North West Adelaide Health Study. *Public Health Association of Australia*, Adelaide, September, 2002.
93. Dal Grande E, Ruffin R, Wilson D, Phillips P, Chittleborough C, Taylor A. Asthma and COPD in North West Adelaide: results from a biomedical study. *Public Health Association of Australia*, Adelaide, September, 2002.

POSTER PRESENTATIONS

94. Grant J, Chittleborough C, Taylor A, Cheek, Phillips P. What do people with diabetes want to know? Education and information needs of people with diabetes. *Australian Diabetes Society*, Adelaide, September 2002.
95. Chittleborough C, Phillips P, Grant J, Dal Grande E, Taylor A, Wilson D. A hidden menace: undiagnosed diabetes. *Australian Diabetes Society*, Adelaide, September 2002.

References

1 Commonwealth Department of Health and Aged Care and Australian Institute of Health and Welfare. *National Health Priority Areas Report: Diabetes Mellitus 1998.* AIHW Cat No PHE 10. HEALTH and AIHW, Canberra, 1999.

2 Commonwealth Department of Health and Aged Care. *National Health Priority Areas - Asthma.* Canberra, 1999. Available online: http://www.aihw.gov.au/nhpa/asthma/index.cfm

3 Mathers C, Vos T, Stevenson C. *The Burden of Disease and Injury in Australia.* Canberra: Australian Institute of Health and Welfare, 1999.

4 Wilson D, Appleton S, Taylor A, Dal Grande E, Chittleborough C, Ruffin R. The North West Adelaide Health Study – Risk factors and associated chronic diseases. Department of Human Services, Adelaide. May 2002. ISBN 0730891917. Available online: http://www.health.sa.gov.au/pros/portals/0/chronic-cond-risk-nwahs02.pdf [Accessed 23 June 2008].

5 Grant J, Chittleborough C, Dal Grande E, Taylor A. *Baseline biomedical findings, policy implications and research recommendations.* SA Department of Health, Adelaide. March 2005. ISBN 0730893928. Available online: http://www.health.sa.gov.au/pros/portals/0/FINAL%20Baseline%20Report%2010%20last%20updated%2021%20Mar%202006.pdf [Accessed 20 June 2008].

6 Grant J, Chittleborough C, Taylor A, Dal Grande E, Wilson D, Phillips, Adams R, Cheek J, Price K, Gill T, Ruffin R (on behalf of the NWAH Study Team). The North West Adelaide Health Study: detailed methods and baseline segmentation of a cohort along a chronic disease continuum. *Epidemiologic Perspective & Innovations* 2006; 3:4. Available online: http://www.epi-perspectives.com/content/3/1/4 [Accessed 25 June 2008].

7 Population Research and Outcome Studies. *North West Adelaide Health Study: Stage 2 Key Findings*. Department of Health, Adelaide, June 2007. ISBN 9780730898986. Available online: http://www.health.sa.gov.au/pros/portals/0/Stage%202%20Report%20for%20Release.pdf [Accessed 25 June 2008].

8 Ware JE, Snow KK, Kosinske M, Gandek B. *SF-36 Health Survey: Manual and Interpretation Guide*. Boston: The Health Institute, New England Medical Centre, 1993.

9 Population Research and Outcome Studies. *North West Adelaide Health Study: Quality of life*. Stage 2 Epidemiological Series Report 2007-28. April 2007. Available online: http://www.health.sa.gov.au/pros/portals/0/28%20Quality%20of%20Life%20final.pdf [Accessed 10 June 2008].

10 Australian Institute of Health and Welfare. *Australia's Health 1998: the sixth biennial health report of the Australian Institute of Health and Welfare.* Canberra. AIHW. 1998.

11 National Asthma Campaign. *National Asthma Strategy Goals and Targets.* Canberra, 1994.

12 Taylor A, Wilson D, Adams R, Ruffin R. Examining asthma incidence in an Australian prospective cohort: the North West Adelaide Health Study. *European Respiratory Society,* Munich, September 2006.

13 Chittleborough C, Taylor A, Wilson D, Adams R, Ruffin R. Gender differences in inequalities in asthma: the North West Adelaide Health Study. *European Respiratory Society,* Munich, September 2006.

14 National Asthma Campaign. *National Asthma Strategy: Strategies and Implementation.* Canberra, 1996.

15 Commonwealth Department of Health and Aged Care. *National Asthma Action Plan, Draft.* Canberra, 1999.

16 Wilson D, Appleton S, Adams R, Taylor A, Ruffin R. Population surveillance in North West Adelaide: undiagnosed asthma. *European Respiratory Society,* Copenhagen, September 2005.

17 Taylor A, Chittleborough C, Wilson D, Adams R, Phillips P, Ruffin R and The North West Adelaide Health Study Team. Population surveillance in North West Adelaide: Quality of Life in diagnosed and undiagnosed asthma. *European Respiratory Society,* Copenhagen, September 2005.

18 Taylor A, Dal Grande E, Chittleborough C, Phillips P, Cheek J, Wilson D, Ruffin R. The North West Adelaide Health Study – *Key biomedical findings, policy implications and research recommendations.* SA Department of Human Services, Adelaide. May 2002. ISBN 0730891895. Available online: http://www.health.sa.gov.au/pros/portals/0/sa-health-nwahs02.pdf [Accessed 24 June 2008].

19 Adams R, Wilson D, Appleton S, Taylor A, Dal Grande E, Chittleborough C, Ruffin R. Underdiagnosed asthma in South Australia. *Thorax* 2003; 58(10):846-50.

20 Wilson D, Appleton S, Adams R, Ruffin R. Undiagnosed asthma in older people: an underestimated problem. *Medical Journal of Australia* 2005; 183(Suppl 1):S20-S22

21 Chittleborough C, Dal Grande E, Taylor A, Grant J, Wilson D, Adams R, Ruffin R. Asthma prevalence and perception of severity in North West Adelaide: a population biomedical study. *Thoracic Society of Australia & New Zealand,* Adelaide, April 2003.

22 Australian Bureau of Statistics. *Causes of death, Australia*. Canberra. ABS. 1997. (Catalogue No. 3303.0).

23 Ryu J, Scanlon PD. Obstructive lung diseases: COPD, asthma and many imitators. *Mayo Clinic Proceedings* 2001; 414:782-87.

24 Ruffin R, Wilson D, Chittleborough C, Southcott A, Smith B, Christopher D. Multiple respiratory symptoms predict quality-of-life in chronic lung disease: A population based study of Australian adults. *Quality-of-life Research* 2000; 9:1031-39.

25 Ruffin RE, Wilson D, Appleton S. (on behalf of the North West Adelaide Health (Cohort) Study Team) When you can't breathe…nothing else matters. *Public Health Bulletin* 2006; 3:13-16.

26 Wilson D, Adams R, Appleton S, Ruffin R. Difficulties identifying and targeting COPD and population-attributable risk of smoking – a population study. *Chest* 2005; 128:2035-42.

27 Gill T, Taylor A, Wilson D, Adams R, Ruffin R. Population surveillance in North West Adelaide: physical activity associated with chronic obstructive pulmonary disease (COPD). *European Respiratory Society,* Copenhagen, September 2005.

28 Australian Health Ministers' Conference. National Diabetes Strategy 2000-2004. Commonwealth Department of Health and Aged Care, Canberra, 1999.

29 South Australian Department of Human Services in partnership with the Diabetes Health Priority Area Advisory Group. The Strategic Plan for Diabetes in South Australia. Adelaide, South Australia. 1999.

30 Baldock K, Chittleborough C, Taylor A, Phillips P. Income and diabetes: prevalence is higher among the poor. *Australian Diabetes Society,* Perth, September 2005.

31 Chittleborough C, Phillips P, Taylor A. Socioeconomic inequalities among people with diabetes aged 65 years and over. *International Diabetes Federation* Capetown, December 2006.

32 Grant J, Chittleborough C, Phillips P, Taylor A. A gendered look at the epidemiology of diabetes in SA. *Australasian Epidemiological Association,* Adelaide, October 2004.

33 Chittleborough C, Phillips P, Baldock K, Taylor A. Do people with diabetes have poorer health-related quality of life than those with asthma or COPD? *Australian Diabetes Society* Sydney, August 2004.

34 Chittleborough C, Taylor A, Wilson D, Adams R, Ruffin R. Population surveillance in North West Adelaide: lung function and chronic obstructive pulmonary disease (COPD) across the diabetes spectrum. *European Respiratory Society,* Copenhagen, September 2005.

35 Chittleborough C, Phillips P, Grant J, Dal Grande E, Taylor A, Wilson D. A hidden menace: undiagnosed diabetes. *Australian Diabetes Society,* Adelaide, September 2002.

36 Dunstan D, Zimmet P, Welborn T, Sicree R, Armstrong, Atkins R, Cameron A, Shaw J, Chadban S. *Diabesity and Associated Disorders in Australia – 2000: The Accelerating Epidemic.* The Australian Diabetes, Obesity and Lifestyle Study (AusDiab) Report. International Diabetes Institute, Melbourne, 2001.

37 Baldock K, Chittleborough C, Phillips P, Taylor A. Impaired fasting glucose: is it more than just high blood sugar? *Australasian Epidemiological Association,* Adelaide, October 2004.

38 Chittleborough C, Baldock K, Taylor A, Phillips P. Men are more likely than women to have prediabetes or the metabolic syndrome. *Australian Diabetes Society,* Perth, September 2005.

39 Adams R, Appleton S, Wilson D, Taylor A, Dal Grande E, Chittleborough C, Gill T, Ruffin R. Population comparison of two clinical approaches to the metabolic syndrome: Implications of the new International Diabetes Federation Consensus Definition. *Diabetes Care* 2005; 28(11):2777-9.

40 Phillips P, Chittleborough C, Baldock K, Taylor A. Changing the diagnostic criteria for impaired fasting glycaemia: effects in a South Australian population. *1st International Congress on Prediabetes and the Metabolic Syndrome,* Berlin, April 2005.

41 Chittleborough C, Phillips P, Baldock K, Taylor A. Are the demographic and risk factor profiles different for males and females with impaired fasting glucose? *1st International Congress on Prediabetes and the Metabolic Syndrome,* Berlin, April 2005.

42 Taylor A, Phillips P, Chittleborough C, Baldock K. The effect of impaired fasting glycaemia on quality of life in a South Australian population. *1st International Congress on Prediabetes and the Metabolic Syndrome,* Berlin, April 2005.

43 Montgomerie A, Chittleborough C, Taylor A, Phillips P, Adams R, Ruffin R, Wilson D. The relationship between metabolic syndrome and health related quality of life – Results from the North West Adelaide Health Study. *Health Outcomes,* Canberra, August 2006.

44 Phillips PJ, Baldock K, Chittleborough CR, Taylor AW. Development of metabolic syndrome is associated with impaired quality of life: longitudinal data from the North West Adelaide Health Study. *European Congress of Endocrinology*, Berlin, 3-7 May 2008.

45 Phillips P, Chittleborough C, Taylor A, Baldock K. Cumulative diabetes incidence: ten-fold risk among those with impaired fasting glucose. *Australian Diabetes Society,* Gold Coast, August 2006.

46 Phillips P, Baldock K, Chittleborough C, Taylor A. Renal function by stage of diabetes progression: impairment begins before diabetes develops. *Australian Diabetes Society,* Christchurch, New Zealand, 5-7 September 2007.

47 Chittleborough C, Taylor A, Gill T, Phillips P, Adams R, Wilson D, Ruffin R. Socioeconomic disparities associated with metabolic syndrome differ by gender. *International Congress on Obesity,* Sydney, September 2006.

48 Chittleborough C, Baldock, Taylor A, Phillips P. Health status assessed by the SF-36 along the diabetes continuum in an Australian population. *Quality of Life Research* 2006; 15(4):687-94.

49 Phillips P, Chittleborough C, Baldock K, Taylor A. Health-related quality of life in diabetes: the effect of metabolic control and stage of disease progression. *Australian Diabetes Society* Sydney, August 2004.

50 Worthley D, Chittleborough C, Phillips P, Baldock K, Taylor A. Health-related quality of life in diabetes by stage of disease progression. *European Association for the Study of Diabetes,* Munich, September 2004.

51 Phillips L, Chittleborough C, Phillips P, Baldock K, Taylor A. Metabolic control in diabetes - the effect on health-related quality of life. *European Association for the Study of Diabetes,* Munich, September 2004.

52 Chittleborough C, Phillips P, Drakoulas M, Baldock K, Taylor A. Diabetes can ruin your day – Quality of life after diagnosis. *Australian Diabetes Society,* Christchurch, New Zealand, 5-7 September 2007.

53 South Australian Divisions of General Practice and the South Australian Department of Health. *Managing type 2 diabetes in South Australia – screening, diagnosis and management in general practice*. Adelaide, 2002.

54 Chittleborough C, Phillips P, Caudle L, Taylor A. Achieving diabetes management targets: the North West Adelaide Health Study population. *Australian Diabetes Society,* Sydney, August 2004.

55 Grant J, Chittleborough C, Taylor A, Phillips P. Identifying people with diabetes-related complications from a population perspective. *Australian Diabetes Society,* Melbourne, September 2003.

56 Bloomgarden ZT. American Diabetes Association Annual Meeting, 1998: cardiac disease and related topics. *Diabetes Care* 1998; 21(10):1764-73.

57 Stevens RJ, Kothari V, Adler AI, Stratton IM. The UKPDS risk engine: a model for the risk of coronary heart disease in Type II diabetes (UKPDS 56). *Clin Sci* (Lond). 2001; 101(6):671-9.

58 Baldock K, Chittleborough C, Phillips P, Taylor A. Coronary heart disease risk in South Australians with diabetes. *Australian Diabetes Society,* Perth, September 2005.

59 Baldock K, Chittleborough C, Phillips P, Taylor A. Reduction of A1c, blood pressure, and cholesterol decreases 10-year risk of coronary heart disease among those with diabetes. *Australian Diabetes Society,* Gold Coast, August 2006.

60 Baldock K, Chittleborough C, Phillips P, Taylor A. *The North West Adelaide Health Study – Modelling reduction of coronary heart disease risk among people with diabetes.* Department of Health, Adelaide. August 2007. ISBN 9780730897224. Available online: http://www.health.sa.gov.au/pros/portals/0/Modelling%20Reduction%20of%20CHD%20Risk%20-%20August%202007 [Accessed 30 July 2008].

61 Phillips P, Wilson D, Beilby J, Taylor A, Rosenfeld E, Hill W, Parsons J. Diabetes complications and risk factors in an Australian population. How well are they managed? *International Journal of Epidemiology* 1998; 27:853-859.

62 Mazzuca SA. Does patient education in chronic disease have therapeutic value? *Journal of Chronic Disease* 1982; 35:521-29.

63 Diabetes Australia and The Royal Australian College of General Practitioners. *Diabetes Management in General Practice*. National Capital Printing. Canberra, 1998.

64 Grant J, Chittleborough C, Taylor A, Cheek, Phillips P. What do people with diabetes want to know? Education and information needs of people with diabetes. *Australian Diabetes Society,* Adelaide, September 2002.

65 Chittleborough C, Cheek J, Grant J, Phillips P, Taylor A. *Education and information issues among people with diabetes*. Department of Human Services, Adelaide. June 2002. ISBN 0730891852 Available online: http://www.health.sa.gov.au/pros/portals/0/diabetes-edu-info02.pdf [Accessed 23 June 2008].

66 Chittleborough C, Taylor A, Phillips P, Wilson D, Ruffin R. Perception of diabetes risk in North West Adelaide: a population biomedical study. *Australasian Society for Behavioural Health & Medicine*, Brisbane, February 2003.

67 Burke M, Chittleborough C, Phillips P, Taylor A, Cook G. Health service use and diabetes risk factor concentration. *18th World Conference on Health Promotion & Health Education,* Melbourne, April 2004.

68 AIHW, Australian Institute of Health and Welfare, *Arthritis and Musculoskeletal Conditions*, Feb 2005, Available online: http://www.aihw.gov.au/nhpa/arthritis/index.cfm [Accessed 13 August 2008].

69 Arthritis Australia, *What is Arthritis?*, January 2008. Available online: http://arthritisaustralia.com.au/What%20Is%20Arthritis [Accessed 13 August 2008].

70 Population Research and Outcome Studies. *North West Adelaide Health Study: Arthritis*. Stage 2 Epidemiological Series Report 2007-09. April 2007. Available online: http://www.health.sa.gov.au/pros/portals/0/9%20Arthritis%20final.pdf [Accessed 8 August 2008]

71 Menz HB, Tiedemann A, Kwan MMS, Plumb K, Lord SR: Foot pain in community-dwelling older people: an evaluation of the Manchester foot pain and disability index. *Rheumatology* 2006; 45:863-867.

72 Bowling A, Grundy E: Activities of daily living: changes in functional ability in three samples of elderly and very elderly people. *Age and Ageing* 1997; 26:107-114.

73 Menz HB, Morris ME, Lord SR: Foot and ankle characteristics associated with impaired balance and functional ability in older people. *Journal of Gerontology* 2005; 60A(12):1546-1552.

74 Menz HB, Morris ME, Lord SR: Foot and ankle risk factors for falls in older people: a prospective study. *Journal of Gerontology* 2006; 61A(8):M866-870.

75 Population Research and Outcome Studies. *North West Adelaide Health Study: Back pain*. Stage 2 Epidemiological Series Report 2007-10. April 2007. Available online: http://www.health.sa.gov.au/pros/portals/0/10%20Back%20pain%20final.pdf [Accessed 12 August 2008].

76 Population Research and Outcome Studies. *North West Adelaide Health Study: Foot pain*. Stage 2 Epidemiological Series Report 2007-11. April 2007. Available online: http://www.health.sa.gov.au/pros/portals/0/11%20Foot%20pain%20final.pdf [Accessed 12 August 2008].

77 Population Research and Outcome Studies. *North West Adelaide Health Study: Hand pain*. Stage 2 Epidemiological Series Report 2007-12. April 2007. Available online: http://www.health.sa.gov.au/pros/portals/0/12%20Hand%20pain%20final.pdf [Accessed 12 August 2008].

78 Population Research and Outcome Studies. *North West Adelaide Health Study: Hip pain*. Stage 2 Epidemiological Series Report 2007-13. April 2007. Available online: http://www.health.sa.gov.au/pros/portals/0/13%20Hip%20pain%20final.pdf [Accessed 12 August 2008].

79 Population Research and Outcome Studies. *North West Adelaide Health Study: Knee pain*. Stage 2 Epidemiological Series Report 2007-14. April 2007. Available online: http://www.health.sa.gov.au/pros/portals/0/14%20Knee%20pain%20final.pdf [Accessed 12 August 2008].

80 Population Research and Outcome Studies. *North West Adelaide Health Study: Shoulder pain*. Stage 2 Epidemiological Series Report 2007-16. April 2007. Available online: http://www.health.sa.gov.au/pros/portals/0/16%20Shoulder%20pain%20final.pdf [Accessed 12 August 2008].

81 Hill C, Gill T, Menz H, Taylor A. Prevalence and correlates of foot pain in a population-based study: the North West Adelaide Health Study. *Journal of Foot and Ankle Research* 2008; 1:2.

82 Menz H, Gill T, Taylor A, Hill C. Predictors of podiatry utilisation in Australia: the North West Adelaide Health Study. *Journal of Foot and Ankle Research* 2008; 1:8.

83 Hill C, Gill T, Taylor A. Knee pain prevalence and arthritis: Results from a population-based study cohort study. *European League Against Rheumatism (EULAR),* Paris, 11-14 June 2008.

84 Hill C, Gill T, Taylor A. Hand pain prevalence and arthritis: Results from a population-based study cohort study. *European League Against Rheumatism (EULAR),* Paris, 11-14 June 2008.

85 Hill C, Shanahan M, Gill T, Taylor A. Prevalence And Associations Of Shoulder Pain In A Population-Based Study: The North West Adelaide Health Study. *European League Against Rheumatism (EULAR),* Paris, 11-14 June 2008.

86 Osteoporosis Australia, *What is Osteoporosis?*, 2007. Available online: http://www.osteoporosis.org.au/osteo_osteoporosis.php [Accessed 13 August 2008].

87 Osteoporosis Australia, *Managing Osteoporosis*, 2007. Available online: http://www.osteoporosis.org.au/osteo_management.php [Accessed 13 August 2008].

88 Osteoporosis Australia, *Preventing Osteoporosis*, 2007, [Online] Available: http://www.osteoporosis.org.au/osteo_prevention.php [Accessed 13 August 2008].

89 Population Research and Outcome Studies. *North West Adelaide Health Study: Osteoporosis*. Stage 2 Epidemiological Series Report 2007-15. April 2007. Available online: http://www.health.sa.gov.au/pros/portals/0/15%20Osteoporosis%20final.pdf [Accessed 12 August 2008].

90 Gill T, Taylor A, Phillips P. Osteoporosis: Underestimated and over represented: Prevalence of osteoporosis in the North West Adelaide (Cohort) Study. *The 19th IUHPE World Conference on Health Promotion and Health Education,* Vancouver, Canada, 10-15 June 2007.

91 Gill T, Phillips P, Rowett D, Taylor A, Laddipeerla, P. Medication use among those with osteoporosis in the community. *Australian and New Zealand Bone and Mineral Society (ANZBMS) 18th Annual meeting*, Melbourne, 28-30 August 2008.

92 Gill T, Phillips P, Taylor A, Laddipeerla, P. Prevalence of osteoporosis in a community sample. *Australian and New Zealand Bone and Mineral Society (ANZBMS) 18th Annual meeting,* Melbourne, 28-30 August 2008.

93 Gill T, Phillips P, Rowett D, Hill C, Taylor A. Medications and osteoporosis in the community – some missing and some inappropriate. *European League Against Rheumatism (EULAR),* Paris, 11-14 June 2008.

94 Kidney Health Australia. *Kidney Disease*. Aug 2008. Available online: http://www.kidney.org.au/KidneyDisease/tabid/578/Default.aspx [Accessed 13 August 2008].

95 Population Research and Outcome Studies. *North West Adelaide Health Study: Renal health*. Stage 2 Epidemiological Series Report 2007-08. April 2007. Available online: http://www.health.sa.gov.au/pros/portals/0/8%20Renal%20disease%20final.pdf [Accessed 8 August 2008].

96 Kidney Health Australia. *Chronic Kidney Disease*. May 2006. Available online: http://www.kidney.org.au/LinkClick.aspx?fileticket=xgVWF4OsLok%3d&tabid=609&mid=881 [Accessed 13 August 2008].

97 Commonwealth Department of Health and Aged Care and Australian Institute of Health and Welfare. *National Health Priority Areas Report: Cardiovascular Health 1998.* AIHW Cat. No. PHE 9. HEALTH and AIHW, Canberra, 1999.

98 Australian Institute of Health and Welfare. *Heart, stroke and vascular diseases – Australian facts 2004.* AIHW Cat No. CVD 27. Canberra, 2004.

99 Chittleborough C, Dal Grande E, Taylor A, Gill T, Grant J, Wilson D, Phillips P, Ruffin R. Impact of chronic conditions and risk factors on quality of life: the North West Adelaide Health Study. *Public Health Association of Australia*, Adelaide, September 2002.

100 Taylor A, Baldock K, Chittleborough C, Wilson D, Adams R, Ruffin R. Population surveillance in North West Adelaide: The impact of diagnosed and undiagnosed chronic obstructive pulmonary disease (COPD) on quality of life. *European Respiratory Society*, Copenhagen, September 2005.

101 Dal Grande E, Taylor A, Chittleborough C, Gill T, Grant J. The impact of undiagnosed chronic conditions (diabetes, asthma and COPD) on health-related quality of life: results from the North West Adelaide Health Study. *Australasian Epidemiological Association*, Newcastle, October 2005.

102 Cheek J, Oster C. A qualitative investigation of the experiences, perceptions and understandings of people with a chronic condition. University of South Australia. May 2002. ISBN 0730891933 [Online] Available: http://www.health.sa.gov.au/pros/portals/0/chronic-cond-nwahs02.pdf [Accessed 24 June 2008].

103 Chittleborough C, Burke M, Taylor A. Medicare Benefits Schedule Health Insurance Commission data for chronic conditions and risk factors. SA Department of Health, Adelaide. March 2005. ISBN 0730894029. Available online: http://www.health.sa.gov.au/pros/portals/0/NW%20HIC%20Data%20for%20Chronic%20Conditions%20March%202005.pdf [Accessed 24 June 2008].

104 Chittleborough C, Burke M, Phillips P, Taylor A. Health service use among people with diabetes. *Australian Diabetes Society,* Melbourne, Sept 2003.

105 Gill T, Taylor A, Ruffin R. Costs associated with chronic conditions in the NWAH (Cohort) Study. *Health Outcomes,* Canberra, August 2005.

106 Taylor A, Chittleborough C, Wilson D, Adams R, Ruffin R. Population surveillance in North West Adelaide: medical costs among males and females with diagnosed and undiagnosed asthma. *European Respiratory Society,* Copenhagen, September 2005.

107 Murray RP, Connett JE, Tyas SL, Bond R, Ekuma O, Silversides C, Barnes GE. Alcohol volume, drinking pattern, and cardiac disease morbidity and mortality. Is there a U shaped function? *American Journal of Epidemiology* 2002; 155:242-48.

108 National Heart Foundation of Australia. *Risk Factor Prevalence Study. Survey Number 3 1989.* Canberra: Australian Institute of Health, 1990.

109 Doll R, Peto R, Hall E, Wheatley K, Gray R. Mortality in relation to consumption of alcohol: 13 years' observations on male British doctors. *British Medical Journal* 1994; 309:911-918.

110 Parekh RS, Klag MJ. Alcohol: role in the development of hypertension and end-stage renal disease. *Current Opinion in Nephrology & Hypertension* 2001; 10:385-90.

111 Stamler J, Wentworth D, Neaton JD, for the MRFIT Research Group. Is the relationship between serum cholesterol and risk of premature death from coronary heart disease continuous and graded? Findings in 356,222 primary screenees of the Multiple Risk Factor Intervention Trial (MRFIT) *Journal of the American Medical Association* 1986; 256:2823-8.

112 Genest J Jr. Genetics and prevention: A new look at high-density lipoprotein cholesterol. *Cardiology in Review* 2002; 10:61-71.

113 Long-Term Intervention with Pravastatin in Ischaemic Disease (LIPID) Study Group. Prevention of cardiovascular events and death with pravastatin in patients with coronary heart disease and a broad range of cholesterol levels. *New England Journal of Medicine* 1998; 339:1349-57.

114 Swinburn B, Egger G & Raza F. Dissecting obesogenic frameworks: the development and application of a framework for identifying and prioritizing environmental interventions for obesity. *Preventive Medicine* 1999; 29:563-70.

115 Population Health Division, Australian Department of Health and Ageing. About overweight and obesity. Available online: http://www.health.gov.au/pubhlth/stratgeg/hlthwt/obesity.htm [cited July 2003].

116 Population Research and Outcome Studies. *North West Adelaide Health Study: How many South Australians are severely obese?* 2003. Available online: http://www.health.sa.gov.au/pros/portals/0/BR%202003-03%20Severe%20BMI%20NWAHS.pdf [Accessed 19 June 2008].

117 Must A, Spadano J, Coakley EH, Field AE, Colditz G, Dietz WH. The disease burden associated with overweight and obesity in the United States. *Journal of the American Medical Association* 1999; 282:1523-29.

118 Koplan JP, Dietz WH. Caloric imbalance and public health policy. *Journal of the American Medical Association* 1999; 282:1579-81.

119 Hugo G, Franzon J. Child obesity in South Australia. Some initial findings. *Food, Culture and Society* 2006; 9(3):299-316.

120 Population Research and Outcome Studies. *North West Adelaide Health Study: Relationship between overweight and obesity and other health risk factors* Report 2003-03. Available online: http://www.health.sa.gov.au/pros/portals/0/br-obesity-risks04-2.pdf [Accessed 19 June 2008].

121 Hill C, Gill T, Taylor A. Prevalence and associations of foot pain in a population-based study. *American College of Rheumatology,* Washington, November 2006.

122 Gill T, Taylor A, Hill C, Shanahan EM. The prevalence of musculoskeletal pain in an Australian population based cohort study. *Australian Rheumatology Association,* Adelaide, 17-21 May 2008.

123 Hill C, Gill T, Taylor A. Knee pain prevalence and arthritis: Results from a population-based study cohort study. *European League Against Rheumatism (EULAR),* Paris, 11-14 June 2008.

124 Hill C, Shanahan M, Gill T, Taylor A. Prevalence And Associations Of Shoulder Pain In A Population-Based Study: The North West Adelaide Health Study. *European League Against Rheumatism (EULAR),* Paris, 11-14 June 2008.

125 Chittleborough C, Burke, Taylor A, Dal Grande E, Grant J. Why should we reduce obesity in the population? Health resource use implications. *18th World Conference on Health Promotion & Health Education,* Melbourne, Apr 2004.

126 Taylor AW, Dal Grande E, Gill TK, Chittleborough CR, Wilson DH, Adams RJ, Grant JF, Phillips PJ, Appleton S, Ruffin RE. How valid are self reported height and weight? A comparison between CATI self-report and clinic measurements using a large representative cohort study. *Australian and New Zealand Journal of Public Health* 2006; 30(3):238-46.

127 Population Research and Outcome Studies. *North West Adelaide Health Study: Waist circumference*. Stage 2 Epidemiological Series Report 2007-23. April 2007. Available online: http://www.health.sa.gov.au/pros/portals/0/23%20Waist%20circumference%20final.pdf [Accessed 12 June 2008].

128 Population Research and Outcome Studies. *North West Adelaide Health Study: Waist hip ratio*. Stage 2 Epidemiological Series Report 2007-24. April 2007. Available online: http://www.health.sa.gov.au/pros/portals/0/24%20Waist%20Hip%20Ratio%20final.pdf [Accessed 12 June 2008].

129 Australian Centre for Diabetes Strategies. *National Evidence Based Guidelines for the Management of Type 2 Diabetes Mellitus*. *Revised Draft.* Prepared by the Australian Centre for Diabetes Strategies, Prince of Wales Hospital, Sydney, for the Diabetes Australia Guideline Development Consortium. 2000.

130 Baldock K, Jury H, Chittleborough C, Phillips P, Taylor A. The relationship of central obesity with diagnosed and undiagnosed diabetes – results from the North West Adelaide Health Study. *Australasian Society for the Study of Obesity,* Adelaide, October 2005.

131 Curry TK, Carter PL, Porter CA. Resectional gastric bypass is a new alternative in morbid obesity. *American Journal of Surgery* 1998; 175(5):367-70.

132 Howard NJ, Taylor AW, Gill TK, Chittleborough CR. Severe obesity: Investigating the socio-demographics within the extremes of body mass index. *Obesity Research & Clinical Practice* 2008; 2:51-9.

133 Bariatric Surgery Program, University Hospitals of Cleveland. Frequently asked questions about morbid obesity [online] 2002 [cited July 2003]. Available online: http://www.uhcbariatrics.com/page04.asp

134 Grant J, Chittleborough C, Dal Grande E, Taylor A. Severe obesity: who should be targeted? *18th World Conference on Health Promotion & Health Education* Melbourne, April 2004.

135 Gill T, Chittleborough C, Taylor A, Ruffin R, Wilson D, Phillips P. Body mass index, waist hip ratio, and waist circumference: which measure to classify obesity? *Sozial- und Praventivmedizin* 2003; 48:191-200.

136 Montgomerie A, Grant J, Chittleborough C, Taylor A, Adams R. Results from the North West Adelaide Health Study – Which measure of central obesity is best? *Australasian Society for the Study of Obesity,* Adelaide, October 2005.

137 Howard N, Grant J, Montgomerie A, Taylor A. Using a tape measure to examine chronic disease and risk factors: the North West Adelaide Health Study. *Australasian Society for the Study of Obesity,* Adelaide, October 2005.

138 Howard N, Wilson D, Taylor A, Hugo G. Investigating spatial relationships and obesity: area and individual level disadvantage in the north west region of Adelaide, South Australia. *International Congress on Obesity,* Sydney, September 2006.

139 Appleton SL, Adams RJ, Wilson DH, Taylor AW, Ruffin RE, on behalf of the North West Adelaide Health Study team. Central obesity is associated with non-atopic but not atopic asthma in a representative population sample. *Journal of Allergy and Clinical Immunology* 2006; 118:1284-91.

140 Appleton S, Adams R, Wilson D, Taylor A, Ruffin R. Central obesity is associated with non-allergic but not allergic asthma: an epidemiological study. *Australasian Society for the Study of Obesity* Adelaide, October 2005.

141 Appleton S, Adams R, Wilson D, Ruffin R. The complexity of the association between obesity and respiratory disease. *Australasian Society for the Study of Obesity*, Adelaide, October 2005.

142 Appleton S, Adams R, Wilson D, Taylor A, Ruffin R. Central obesity is associated with non-atopic but not atopic asthma: an epidemiological study. *Thoracic Society of Australia and New Zealand* Canberra, Mar 2006. *Respirology* 2006; 11 (Suppl 2):A15.

143 Appleton S, Adams R, Wilson D, Taylor A, Ruffin R. Asthma severity is not modified by central obesity. *European Respiratory Society,* Munich, September 2006.

144 Appleton SL, Wilson DH, Tucker G, Ruffin RE, Taylor AW, Adams RJ, On behalf of the North West Adelaide (Cohort) Health Study Team. Letter to the Editor: Sex differences in asthma morbidity associated with obesity in a representative population sample*. Journal of Allergy and Clinical Immunology* 2008; 121(5):1285-7.

145 Howard NJ, Hugo GJ, Taylor AW, Wilson DW. Our perception of weight: socioeconomic and sociocultural explanations. *Obesity Research & Clinical Practice* 2008; 2(2):125-131.

146 Dunn KI, Mohr PB, Wilson CJ, Wittert GA. Beliefs about Fast Food in Australia: A Qualitative Analysis. *Appetite*. 2008; 51(2):331-4.

147 Martinson BC, O'Connor PJ, Pronk NP. Physical inactivity and short term all cause mortality in adults with chronic disease. *Archives of Internal Medicine* 2001; 161:1173-80.

148 Jacobs DR, Adachi H, Mulder I, Kromhout D, Menotti A, Nissinen A, Blackburn H. Cigarette smoking and mortality risk: twenty five year follow up of the seven countries study. *Archives of Internal Medicine* 1999; 159:733-40.

149 Kawachi I, Colditz GA, Stamfer MJ. Smoking cessation and time course of decreased risks of coronary heart disease in middle-aged women. *Archives of Internal Medicine* 1994; 154:169-75.

150 Appleton S, Adams R, Wilson D, Taylor A, Dal Grande E, Chittleborough C, Ruffin (& NWAH (Cohort) Study Team). The biomedically assessed cumulative burden of chronic disease risk factors on health-related quality of life in an urban population. *Health Promotion Journal of Australia* 2004; 15:55-62.

151 Gill T, Taylor A, Ruffin R. Risk factors and quality of life in the NWAH (Cohort) Study. *Health Outcomes,* Canberra, August 2005.

152 Baldock K, Gill T, Chittleborough C, Taylor A. The relationship between waist to hip ratio and quality of life – results from the North West Adelaide Health Study. *Australasian Society for the Study of Obesity,* Adelaide, October 2005.

153 Gill T, Taylor A, Ruffin R. Costs associated with risk factors for chronic conditions in the NWAH (Cohort) Study. *Health Outcomes,* Canberra, August 2005.

154 Grant J, Chittleborough C, Dal Grande E, Taylor A, Wilson D, Phillips P, Ruffin R. Chronic disease and risk factor multiplicity: who should be targeted? *Public Health Association of Australia,* Brisbane, September/October 2003.