PANO RG
Physical Activity Nutrition Obesity Research Group

OBESITY AND CHRONIC DISEASE PREVENTION AMONG OLDER ADULTS (55-74 years):
An evidence overview and framework
to inform policy and practice

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GLOSSARY

Abdominal obesity Defined as a waist-to-hip ratio of ≥0.90 cm for males or ≥0.85 cm for females

Aerobic activity Exercises in which the body's large muscles move in a rhythmic manner for sustained periods

Anthropometric Pertaining to measurements of the human body

Balance activity A combination of activities designed to increase lower body strength and reduce the likelihood of falling

Cardiac rehabilitation Measures used to help people with heart disease return to an active and satisfying life and to prevent recurrence of cardiac events

Chronic diseases A term representing a range of diseases characterised by complex causality, multiple risk factors, long latency periods, a prolonged course of illness, and functional impairment or disability. These diseases often require lifestyle management by the individual, e.g. heart disease, diabetes, osteoarthritis, mental illness, and cancer

Digestive disorders Diseases affecting any part of the digestive tract, including the oral cavity, oesophagus, stomach, gall bladder, intestines, as well as the peritoneum, and liver

Ecological model A health behaviour model that considers both individual and social environmental factors

Endocrine related disorders Includes disorders of thyroid gland, diabetes mellitus, disorders of glucose regulation, pancreatic secretion, other endocrine glands, malnutrition and other nutritional deficiencies, obesity and metabolic disorders

Epidemiological Pertaining to the study of the causes, distribution, and control of disease in populations

Effectiveness The ability [of an intervention] to produce the desired beneficial effect under real world conditions

Efficacy The ability [of an intervention] to produce the desired beneficial effect in expert hands and under ideal circumstances

Flexibility activity Activities designed to preserve or extend range of motion (ROM) around a joint

Food insecurity Inability to acquire appropriate and nutritious food on a regular and reliable basis

Functional capacity Refers to the physical ability of a person to perform a work-related series of tasks

Gap areas Those areas which determinants research indicates are likely to be useful areas in which to intervene but for which there is currently no evidence of effectiveness/few interventions

Healthy/Normal weight	Body Mass Index of between 20.0kg/m^2 and less than 25.0kg/m^2
Intermediate risk factor	Risk factors that lead to the incidence of chronic diseases, such as raised blood pressure, increased blood glucose, elevated blood lipids (hyperlipidemia or dyslipidemia), overweight and obesity; may also be considered as the behavioural risk factors that lead to these other risk factors, such as nutrition, physical activity and sedentary behaviour
Malnutrition	Essentially means poor nutrition, and can refer to under- (not enough) nutrition, over- (too much) nutrition, inappropriate types of food. It can occur from food intake, malabsorption of nutrients or the inability to use nutrients properly to maintain health
Menopause	Refers to the last menstrual period experienced by a woman and spans pre-menopause, peri-menopause (when menstruation becomes irregular) and post-menopause (when no menstrual period has been experienced in the prior 12 months)
Migrant	A person who was born overseas and has obtained permanent Australian resident status prior to or after their arrival
Multimorbidity	The simultaneous occurrence of two or more chronic conditions
Multiple Intervention	Intervention where a fixed set of components is delivered to participants
Musculoskeletal diseases	Conditions of the bones, muscles and their attachments such as joints
Neuropsychiatric disorders	Cerebral dysfunction from any physical cause manifested by changes in mood, behaviour, perception, memory, cognition, or judgment and/or psychophysiology
Obesity	Body mass Index greater than 30.0kg/m^2
Overweight	Body mass Index of between 25.0kg/m^2 and less than 30.0kg/m^2
Poly-pharmacy	Regular intake of multiple medications
Prescription	The order of a General Practitioner / Physician for the preparation and administration of a drug, device or other therapy for a patient
Promising interventions	Those for which evidence is accumulating or for which there is a strong rationale for action and/or parallel evidence
Psychosocial	Involving aspects of both social and psychological behaviour
Resistance/Strength/ Weight-bearing activity	Exercises that cause muscles to work or hold against an applied force or weight
Respiratory system diseases	Includes respiratory infections, influenza, pneumonia, suppurative and necrotic conditions of lower respiratory tract, and conditions affecting the interstitium and pleura

Retirement	Point in the life course where an individual ceases work, usually occurs at age 65 when an individual is then eligible for the government Aged Pension
Sarcopenia	The age-associated loss of skeletal muscle mass and function leading to disability, hospitalisation, and death
Sarcopenic obesity	A condition where obesity occurs with some form of muscle impairment (either defined by low muscle mass or poor muscle strength)
Social capital	Resources available to individuals and communities for their social relationships
Social cohesion	Shared norms, values and feelings of belonging within a local area, or the quality of social relationships and the existence of trust, mutual obligations and respect in communities or in the wider society
Social marketing	Application of marketing techniques to achieve specific behavioural goals for a social good. In the context of this report this refers to co-ordinated public education campaigns to promote health behaviours associated with obesity prevention, such as increased physical activity levels and improved dietary intake
Waist-to-height ratio	Ratio of the waist circumference (measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest) to body height
Waist-to-hip ratio	Ratio of the waist circumference (measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest) to the hip circumference (measured at the widest portion of the buttocks)
Walkability	An assessment of the characteristics (such as walker friendliness, comfort, safety, convenience and connectedness) of a place that influence how inviting it is for people to walk, not because they have to but because they will feel like they are missing out if they do not

LIST OF ABBREVIATIONS

AAMP (study)	Active Adult Mentoring Program
ABS	Australian Bureau of Statistics
ACSM	American College of Sports Medicine
ACSQHC	Australian Commission on Safety and Quality in Healthcare
AET	Aerobic Exercise Training
AFL	Active for Life, physical activity intervention program initiative
AGHE	Australian Guide to Healthy Eating, the national food selection guide
AHA	American Heart Association
AIHW	Australian Institute of Health and Welfare
ALED (study)	Active Living Every Day
ANS	Active Nutrition Script, pilot nutrition and exercise intervention
AusDiab	Australian Diabetes, Obesity and Lifestyle Study
BEACH	Bettering the Evaluation and Care of Health
BEST (study)	Balance, Exercise and Strength training at Home program
BMES (study)	Blue Mountains Eye Study
BMI	Body Mass Index, unit measure is kg/m^2
BP	Blood Pressure
CALD	Culturally and Linguistically Diverse, refers to a population group
CAP	Care Assessment Platform, technology-assisted home-care platform for cardiac rehabilitation
CHAMPS	Community Healthy Activities Model Program for Seniors
CHAP (study)	Lifestyle Challenge Programme
CHD	Coronary Heart Disease
CI	Confidence Interval
CIRS	Cumulative Illness Rating Scale
CAN	Community Nutrition Assistant
COPD	Chronic Obstructive Pulmonary Disease
CR	Cardiac Rehabilitation
CURF	Confidentialised Unit Record Files

CVD	Cardiovascular Disease, this term represents a range of conditions including coronary heart disease, cerebrovascular disease (stroke), heart failure, rheumatic heart disease and hypertension (high blood pressure)
DADHC	Department of Aging, Disability and Home Care
DALYs	Disability Adjusted Life Years
DE	Dietary Education
DIISR	Department of Innovation, Industry, Science and Research
DPP	Diabetes Prevention Program
DST	Dietary Screening Tool
EC	Experience Corps program
ENP (study)	Elderly Nutrition Program
ERASS	Exercise Recreation and Sport Surveys
ES	Exercise Scientist
F&V	Fruit and Vegetables
GALM (study)	Groningen Active Living Model
GHS	Get Healthy Information and Coaching Service, New South Wales telephone coaching program
GP	General Practitioner
HABITAT (study)	How Areas in Brisbane Influence healTh And acTivity study
HGW	House and garden work
HDL-C	High Density Lipoprotein Cholesterol, known as 'good' cholesterol
HIPS (study)	Health Improvement and Prevention Study
HOIST	Health Outcomes Information Statistical Toolkit, managed by the Centre for Epidemiology and Evidence, NSW Ministry of Health
HR	Hazard Ratio
HRQoL	Health-Related Quality of Life
LDL-C	Low Density Lipoprotein Cholesterol, known as 'bad' cholesterol
LIPA	Light Intensity Physical Activity
LTPA	Leisure Time Physical Activity
LTSB	Leisure-time sedentary behaviour
MACA	Ministerial Advisory Committee on Ageing

MET	Metabolic Equivalent of Task, multiples of an individual's resting oxygen intake
MI	Myocardial Infarction
MNA	Mini Nutrition Assessment tool
MST	Malnutrition Screening Tool
MVPA	Moderate-to-vigorous Physical Activity, considered as activities with a MET value >3.0mL/min/kg
NAASO	North American Association for the Study of Obesity
NEWS	Neighbourhood Environment Walkability Scale
NHPA	National Health Priority Area
NHPAC	National Health Priority Action Council
NHS	National Health Survey
NOM-tv	Netherlands on the Move, television program
NSPAC	National Seniors Productive Ageing Centre
NSW	New South Wales
PA	Physical Activity
PAART CVD	Pharmacist Assessment of Adherence, Risk and Treatment in Cardiovascular Disease
PAL (study)	Physical Activity for Life
PANACHE (study)	Physical Activity, Nutrition and Cardiac Health Study
PANS (study)	Physical Activity and Nutrition for Seniors pilot program
PASE	Physical Activity for the Elderly, measurement tool for physical activity
PG-SGA	Patient Guided- Subjective Global Assessment tool
PHI	Preventative Health Initiative
PLACE (study)	Physical Activity in Localities and Community Environments (Study)
PPEI	Health Promotion, Prevention and Early Intervention
PN	Practice Nurse
QLD	Queensland
QOL	Quality of Life
RCT	Randomised Controlled Trial
RET	Resistance Exercise Training

RPHS	Rural Primary Health Services program
RR	Relative Risk
RT	Resistance Training
SASI (study)	Stay Active Stay Independent program
SAYGO (study)	Steady as You Go
SDAC	Survey of Disability, Aging and Carers
SDPP	Sydney Diabetes Prevention Program
SD	Standard Deviation
SEIFA	Socio-Economic Indexes for Areas
SENIOR	Study of Exercise and Nutrition in Older Rhode Islanders
SES	Socioeconomic Status
SGPALS	Saltin-Grimby Physical Activity Level Scale questionnaire
SHAPE (study)	Senior Health and Physical Exercise project
SMS	Short Message Service
SOYF (study)	Stay on Your Feet program
SSWAHS	Sydney South West Area Health Service, now separated into the Sydney Local Health District and the South Western Sydney Local Health District
TPA	Total Physical Activity
TV	Television
VLTU	Very Long-Term Unemployed
WC	Waist Circumference
WHO	World Health Organization
WWW (study)	The Women Weigh-In for Wellness

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EXECUTIVE SUMMARY

Introduction

The Australian population is ageing, and people aged 65 years and over will comprise 23-25% of the population by 2056. Policies and services will increasingly be required to adapt and respond to the characteristics and needs of older people. In particular, the high prevalence of chronic health problems, reduced mobility and functional capacity, limited financial resources, higher prevalence of social isolation and changed social roles and responsibilities that characterise older age groups require significant changes in services and infrastructure, neighbourhood environments and community groups, as well as in individuals. Healthy ageing is a policy priority.

This document presents information on the patterns of health problems amongst older age groups, and identifies the most promising opportunities for preventive action to reduce risks of obesity-related chronic disease among those older adults living in the community. The age group 55-74 years has been chosen, as this age range offers significant opportunities for prevention efforts. Literature published prior to November 2012 is included.

Burden of chronic disease

Chronic disease and associated risk factors comprise the major problems associated with older age, accounting for the majority of premature deaths, morbidity, health burden and health costs. In Australia in 2003, adults aged 65-74 years comprised 6.8% of the population and experienced 16.3% of the total disease burden. Sharp increases in health costs are anticipated, due to projected higher rates of diabetes and other (especially musculoskeletal) diseases.

Ageing, weight status and lifestyle behaviours

Normal ageing is associated with increases in body fat and declines in lean muscle mass. These changes may occur earlier in women due to menopause. Overweight is associated with an increase in various morbidities, including diabetes and arthritis, stroke, joint replacement, and falls among adults aged 65-70+ years. Obesity at any age is associated with increased mortality and morbidity; in older adults aged ≥65 years obesity reduces functional capacity and mobility, and is associated with a lower quality of life. Sarcopenic obesity in particular contributes to mobility disability and functional impairment. Abdominal obesity is associated with chronic disease risk even in normal-weight older adults.

Preventing weight gain is a population-wide health policy goal, and for 55-74 year olds this is more important than weight loss in most cases. However, there are benefits in weight loss for the overweight and obese 55-65 year old population and obese people aged 65-75 years, if they have existing chronic disease or other chronic disease risk factors and/or if they are functionally-impaired.

Being physically active in older age has significant health and well-being benefits. A mix of aerobic, strength-based and flexibility activities are required for optimal health. Nearly three-quarters of adults >65 years do not take part in any sport or recreational activity, and participation in resistance exercise and balance and flexibility-enhancing activities is particularly low. The amount of time spent being sedentary has important metabolic consequences regardless of level of physical activity and in Australia the prevalence of sedentary behaviour, particularly TV watching, seems to be increasing among older adults.

Dietary patterns among older people are similar to other adults, with lower than recommended consumption of vegetables and fruit. However, there are additional nutritional risks in older people,

as ageing leads to reduced absorption or synthesis and accelerated loss of certain nutrients. Reduced income and social support may also influence older people's ability to attain adequate nutrition; with around 13% of community-dwelling Australians aged 50+ having some level of food insecurity.

Factors contributing to lifestyle behaviours and chronic disease risk

There is a wide range of underlying factors at the societal, community and individual levels which influence older people's physical activity, nutrition and weight. This document summarises research evidence on these underlying factors. Overall, interpersonal relations, social networks, and the physical environment have been reported to have important effects on healthy eating and participation in physical activity.

Prevention of chronic disease

There is an accumulating body of research evidence on interventions which directly address individual behaviour change. In particular, moderate intensity lifestyle and chronic disease prevention programs delivered in primary care are known to be effective in producing behaviour change among high risk individuals. These programs can be successfully implemented with individuals or in a group setting. Specific components include self-efficacy enhancement, goal setting and self-monitoring. Telephone and internet coaching and support are effective delivery modes, and can attain high reach including among those who are socially isolated. The development of healthy lifestyle services would provide appropriate infrastructure for chronic disease prevention programs.

A wide variety of programs are effective in promoting physical activity. Walking, aerobics and strength training programs have established health benefits and can be effectively implemented with older people, while other activities including water-based exercises, yoga, tai chi and dancing are also effective in improving older adults' physical function and well-being. Peer-led components to programs provide important social and emotional support.

Fewer community interventions aimed at improving diet among older adults have been trialled. Research indicates that nutrition education for older adults should include nutrition messages that are limited in number, simple, targeted, practical and reinforced. Programs should include group sessions, incentives, regular contact with health and allied professionals, scheduled follow-up meetings, and involve hands-on activities such as cooking, and peer-led support.

Social marketing interventions to increase walking and physical activity generally among older adults have been shown to be effective in the short-term. Community-wide walking campaigns targeting older adults have been successful. Risk communication strategies may be useful, particularly if targeted to different ages within the older age group. Social marketing targeting a reduction in TV watching may be particularly beneficial.

There is a range of physical and social environmental factors which influences older people's lifestyle behaviours. While there are clear links between the physical environment and participation in aerobic physical activity such as walking among older adults, the associations are complicated by social and psychosocial factors particular to this age group. Indirect evidence points to particular physical and aesthetic aspects, such as good lighting, even surfaces and separation from cars, as being important. Provision of adequate seating and opportunities for social interaction may provide additional benefits. The extent that participation in community gardens leads to increased consumption of fruit and vegetables is unknown, although there is a strong rationale for intervention in this area as there are numerous other positive health and well-being outcomes for older adults. There are no evaluations of interventions aimed at increasing availability and accessibility to healthier foods. Mobile delivery of fruit and vegetables is relevant for those who are socioeconomically disadvantaged or have a physical limitation that prevents them shopping for food.

There are many significant gaps in the evidence on interventions among older people. There is almost no research on ways to reduce sedentary time, particularly TV time; nor on optimal ways to increase social engagement and participation in order to increase program reach and achieve population level health impacts. Extensive marketing and promotion of community-wide opportunities and individual-level programs aimed at improving healthy lifestyles among older adults are likely to be required. There appears to be scope to extend existing falls prevention initiatives to promote increased physical activity overall. Interventions to reduce snacking of energy-dense, nutrient-poor foods, the provision of healthy food in local clubs, as well as health interventions targeting the workforce as they approach retirement (such as planned health assessments, flexible working opportunities), also warrant further investigation.

Further, despite an array of established social welfare policies and community services for older people in NSW and Australia, there has been little formal investigation of their health and social impacts, how these vary by population sub-group, and what the cost-effective ways are for scaled-up delivery as population ageing accelerates. Consideration should be given to the particular psychosocial aspects of ageing and different cultural perspectives to healthy ageing, particularly as nearly a quarter of this age group in NSW are from culturally- and linguistically-diverse backgrounds.

Summary

There is sufficient evidence to guide health and community interventions to reduce the risk of obesity and chronic disease in older people. Table 1 provides a summary of the most promising intervention approaches across various domains. This analysis also indicates priorities for research and development, in order to guide long-term planning.

Scaled-up interventions to address chronic disease risk could achieve immediate and short-term benefits in health. The projected health and economic burden associated with population ageing will require increased investment in preventive health services, social policy, urban infrastructure and community services, in order to ensure optimal quality of life, economic productivity and social cohesion.

Table 1 Recommended approaches for action for the prevention and management of obesity and chronic disease risk in community-dwelling older adults living in NSW (PA – physical activity)

This summary of recommended approaches for action for the prevention and management of obesity and related chronic disease in community-dwelling older adults living in NSW is based on a comprehensive review of the current policy and practice context, the determinants, and the research evidence of intervention effectiveness. These recommendations are a mix of approaches – some for which there is already a sufficient amount of evidence of effectiveness, as well as those that are promising either because there is a strong rationale to proceed with a particular approach (from determinants and epidemiological evidence) or for areas where there is emerging evidence of effectiveness. Although some approaches are recognised as effective, interventions will require consideration of the specifics of different target populations; which means they may require additional planning to ensure maximum reach, participation and adherence to programs, to maximise outcomes.

Domain	Recommended/Promising approaches
Health sector	Provide and promote routine health checks for people aged over 55 years
	Include assessment of weight and lifestyle behaviours as part of regular GP visits; implement telephone, internet-based, and face-to-face, moderate-intensity lifestyle/chronic disease prevention programs (individual and group based) via the primary health care setting; provide brief lifestyle advice by primary health care providers (i.e. GPs, practice nurses, dieticians) to at risk older people
	Implement more specialised, high intensity lifestyle programs for people at higher risk or with existing obesity-related chronic diseases
	Provide an integrated approach for chronic disease prevention and management – consider setting up '*lifestyle [mega] clinics*'
	Develop clinical pathways and protocols for weight management services for older people; including specialised referral patterns/links
	Encourage GPs to utilise current MBS items to refer older people to appropriate physical activity[1] and dietetic services
	Continue promotion and implementation of the NSW *Get Healthy Information and Coaching Service;* consider including a specific module for older adults
	Use community pharmacists to provide lifestyle and chronic disease prevention programs in rural and regional areas
	Consider ways in which existing health financing systems could facilitate people with established risks to use self-management approaches to improve their health
	Include adult waist circumference as an indicator in the NSW Population Health Survey (with different cut-off points for older adults)

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[1] A mix of aerobic, strength-based and flexibility exercises is important for optimal health outcomes of older people

Domain	Recommended/Promising approaches
Community programs	Workforce development for community-based staff to provide consistent information and advice for PA/nutrition
	Provide, publicise and support the implementation of community-based PA programs[1] for older people; include a peer support component wherever feasible
	Adapt exercise sessions designed for falls prevention to reach a wider target group; include a broader range of activities[2] while retaining falls prevention benefits
	Train accredited fitness leaders to conduct appropriate PA programs for older people[1]
	Implement and advertise low-cost active living programs such as gardening, therapeutic dance programs, exercise programs, and walking programs, for older adults of various ages and abilities
	Develop, implement and advertise communal kitchens, food co-ops, community gardens and community cooking groups
	Develop and implement programs promoting healthy menu options in clubs and other food services popular with older people
	Develop and implement healthy catering guidelines amongst agencies and services working with older people
	Continue to promote volunteerism among older people
	Promote peer advocacy, peer education, peer support, self-help groups and mutual aid approaches as a central part of an effective program
Information and Communication	Promote the health benefits of physical activity[1] and reduced sedentary behaviour (and health risks of low PA/sitting) to older people specifically
	Develop and conduct a series of social marketing campaigns segmented for different target groups across the older population: 45 to 55 years, 55-64 years, 65+ years
	Recognise the diversity of older people's experiences of health and ageing, when providing health information
	Deliver information and education for the families of older adults, health professionals, other service providers and community members more generally, about the needs of older adults, risk factors they experience, and programs available
	Disseminate information about nutrition and PA guidelines, and healthy weight/waist circumference measurements, for older people
	Use volunteer and community networks to communicate health information to older people

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Domain	Recommended/Promising approaches
Urban development, housing and transport services	Strengthen implementation of existing planning guidelines for residential areas to ensure good access to services and facilities
	Design parks and community recreational facilities appropriate for older adults' participation
	Design housing for optimal functioning of older people
	Increase availability and accessibility of public and community transport services, ensuring collaboration between industry, communities and local government
Research and Evaluation	Develop a strategic body of research on a range of community initiatives targeting older adults
	Evaluate effectiveness, reach, and implementation barriers of community programs
	Investigate ways to increase participation and sustain community interventions
	Evaluate programs promoting healthy menu options in food services/outlets popular among older adults
	Investigate ways to broaden falls prevention programs to increase total level of PA
	Investigate sedentary behaviour patterns of older adults and identify social marketing strategies to promote PA and reduce sitting/TV watching among older people
	Investigate snacking in older adults and ways of reducing snacking and increasing vegetables consumption
	Evaluate existing planning guidelines for residential areas (e.g. healthy urban checklist items specifically relevant to older persons)
	Evaluate feasibility and implications of implementing a health check around retirement age
	Investigate an integrated approach to the prevention and management of obesity and chronic disease in primary care
	Provide segmented analysis of health-related topics (weight status/waist circumference, nutrition, physical activity, sedentary behaviours) by age and gender in ongoing population health monitoring, and in the evaluation of programs and interventions
	Make use of existing databases, such as the *45 & Up Study*, to explore older persons health-related behaviours and contributing factors to obesity and chronic disease in this age group

1   INTRODUCTION

1.1   PURPOSE OF THIS REPORT

Older adults constitute the fastest growing population segment in Australia and NSW, and are the largest contributors to the increasing health and economic burden associated with chronic disease. The promotion of healthy weight and the prevention of obesity in older adults has the potential to significantly reduce the risk and burden of chronic disease overall. Behavioural changes, particularly increasing physical activity, reducing sitting time and improving nutritional intake, directly reduce the risk of chronic diseases and impact on weight.

As well as increased incidence of chronic disease, ageing is associated with increased incidence of sensory impairments, changes in cognitive processing time, alterations in balance and stamina, increases in falls and related injuries, and in disability. There is an increased likelihood of multiple health problems, and overall higher use of health care. Obesity in older adults increases the morbidity and mortality from chronic diseases such as stroke, heart disease, diabetes, osteoarthritis, certain types of cancer, and dementia. Additionally, any weight gain among this age group, regardless of initial weight status, also increases risks for these diseases. These diseases form a substantial component of the health burden in Australia.

In many documents, in Australia and internationally, older adults are considered to be those aged 65 years or more among the general population, and those aged 55+ years among the Aboriginal and Torres Strait Islander population. However, for the purposes of this review, older persons are considered to be those aged 55-74 years. This choice of age range is deliberate – weight loss in the late older age or elderly (those aged 75 years and older) is not beneficial, whereas prevention of weight gain as people transition towards older age is highly beneficial. Additionally, adults aged 75 years and over have more functional limitations and are more likely to live in institutions. Data presented in this report are limited to community-dwelling adults.

This evidence overview is not a systematic review, but nevertheless provides a comprehensive overview of the research evidence on the rationale, determinants and promising intervention approaches to reduce the prevalence of obesity and chronic disease risk among older adults. Evidence is derived primarily from Australian studies but also includes evidence from international studies that are relevant to the Australian context.

This report:
- Provides a synthesis of evidence about opportunities for promoting the health of older people through reducing overweight, obesity and the risk of related chronic diseases
- Examines the available epidemiological evidence on the weight status and obesity-related chronic disease risk profile of older adults in NSW, thereby presenting a rationale for addressing overweight and obesity and related chronic disease risk
- Considers the behaviours contributing to weight status in this age group and the wide range of factors contributing to these associated lifestyle behaviours
- Presents a structured planning framework to identify potential points for intervention based on analysis of contributing factors
- Examines the evidence around the effectiveness of potential interventions, considering the strengths, limitations and gaps within the evidence base
- Proposes a portfolio of evidence-based and promising intervention approaches for the reduction of obesity and related chronic disease risk.

1.2   CONTEXT OF THIS REPORT

This review is designed to be read and interpreted in the context of the substantial number of national and state-based policies addressing healthy ageing in Australia, including:

- *National Health Priority Areas (NHPAs)* (1994): defined in response to the global strategy of the World Health Organization (WHO) '*Health for all by the year 2000'*. Diabetes was added in 1996, asthma in 1999, arthritis and musculoskeletal conditions in 2002, and obesity in 2008 – to the original cardiovascular health, cancer control, injury prevention/control, and mental health (AIHW a).
- *National Strategy for an Ageing Australia (2001)*: included a framework to stimulate action by government, business, communities and individuals to respond to population ageing (Andrews 2001).
- *National Chronic Disease Strategy (2002-3)* provided national policy directions for improving chronic disease prevention and care across the nation. It focussed on directions to be taken by the health system and encouraged a collaboration with other sectors and services at all levels (NHPAC 2006).
- *Promoting Healthy Ageing in Australia (2003)* focused on the promotion of health and wellbeing, the prevention of ill-health and the contribution of the social and the built environment to healthy and productive ageing. It outlined a research agenda into housing design, assistive technologies, falls prevention, and health and well-being for older Australians (Prime Minister's Science, Engineering and Innovation Council 2003).
- *National Action Agenda to Address Overweight and Obesity in Adults and Older Australians* (2006) set goals of: weight gain prevention at the population level, better management of early risk, and improved management of weight. There was specific focus on older adults and people with established risk of weight-related chronic conditions (Commonwealth of Australia 2006).
- *National Preventative Health Taskforce* (2008) set goals targeting obesity, smoking and alcohol, and identified efforts to address healthy ageing in four key areas: improved integration in the economy and community, better lifestyles, adapting health systems to the needs of the elderly, and addressing the underlying social and environmental factors affecting healthy ageing (Commonwealth of Australia 2009).
- *Towards 2030: Planning for our changing population,* included a Positive Ageing Statement and vision statement: "*Older people will have independent, active, engaged and healthy lives with access to quality care and support when they need it"* (NSW Government 2008).
- *Preventing Falls and Harm From Falls in Older People: Best Practice Guidelines for Australian Community Care* were introduced in 2009 ((ACSQHC) 2009).
- *Prevention of Falls and Harm from Falls among Older People: 2011- 2015 Policy:* describes the actions that NSW Health will undertake between 2011 to 2015 to support prevention of falls and fall-related harm among older people at high risk of falling or who have already experienced a fall (NSW Department of Health 2011). Actions are in three key domains: health promotion, NSW Health clinical services and NSW Health residential aged care services.
- *Healthy Ageing Roundtable* discussion was convened by the NSW Ministerial Advisory Committee on Ageing in 2011. It provided an opportunity to investigate areas of policy and action by the NSW Government to communicate and promote health and wellbeing to older people, and to improve health literacy (NSW Ministerial Advisory Committee on Ageing 2011).
- The *NSW Health Policy and Implementation Plan for Healthy Culturally Diverse Communities 2012-2016* recognises a person's language, religion and ethnic background as fundamental considerations when providing effective health care (NSW Ministry of Health 2012).
- The *NSW Ageing Strategy* (July 2012) aims to help seniors live healthy, active and socially connected lives. The strategy uses a whole-of-government and whole-of-community approach and is based on social policy principles that support individual choice and responsibility; focuses on prevention and early intervention; and supports local decision making and community partnerships (Services 2012).

2   HEALTH STATUS OF OLDER PEOPLE

2.1   POPULATION PROFILE

2.1.1   Australia

The number and proportion of Australians aged 65 years and over have risen significantly in recent decades (Figure 1). In 2009, more than 2.9 million Australians (13.3% of the population) were aged 65 years or over, compared with just under 1.1 million (8.3% of the population) in 1971 (AIHW 2010a).
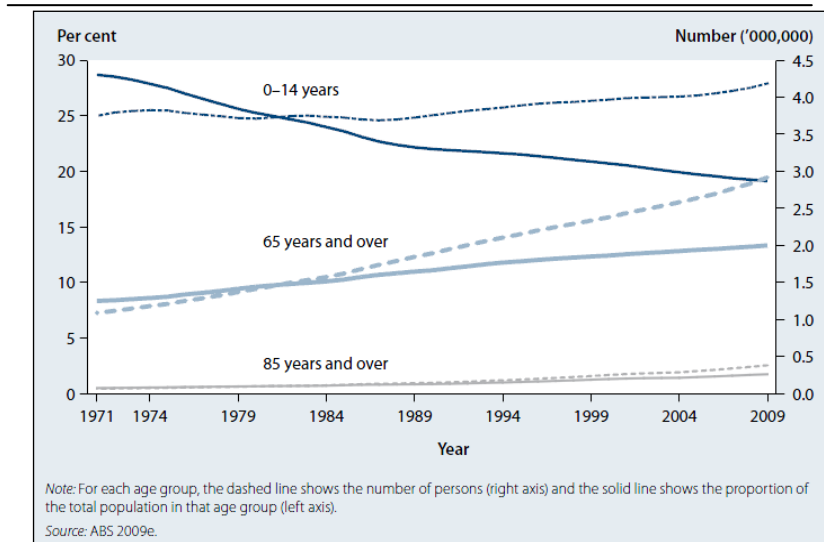
Source: (AIHW 2010a)

Figure 1 Number and proportion of population in selected age groups, Australia, 1971 - 2009

Ageing is the most dramatic change expected to occur in Australia's population over the next 50 years. The number of Australians aged 65 years and over is expected to increase to between 5.1 – 5.3 million in 2026 (between 18-20% of the population), and to between 7.8 – 10.4 million in 2056 (between 23-25% of the population). By 2101 this age group is projected to reach between 9.3 – 17.1 million (between 25-28% of the population) (ABS 2008a) (Figure 2). The sustained low levels of fertility following the post-World War II baby boom, combined with increasing life expectancy at birth, and the immigration of working age people, are the main contributors to the ageing of Australia's population.

2.1.2   New South Wales

The pattern in NSW is similar to that observed nationally, with 13.1% of the NSW population aged 65 years or over in 2010 (Centre for Epidemiology and Research 2011). By 2016, the older population (adults aged 65 years and over) is expected to outnumber the younger population (people aged 0–14 years) for the first time in the history of NSW (ABS and DADHC 2004).

In NSW, the proportion of adults aged 65 years and over is projected to increase to 22% (nearly 2 million people) in 2031 and 26.3% by 2051 (Government 2008) (Figure 3).
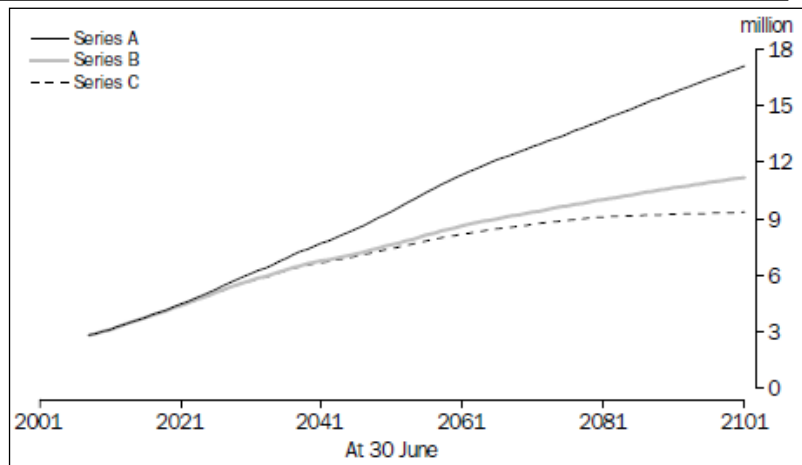
Notes: Series B largely reflects current trends in fertility, life expectancy at birth, net overseas migration and net interstate migration, whereas Series A and Series C are based on high and low assumptions for each of these variables respectively.

Source: (ABS 2008a)

Figure 2 Projected population aged 65 years and over, Australia, 2001 - 2101
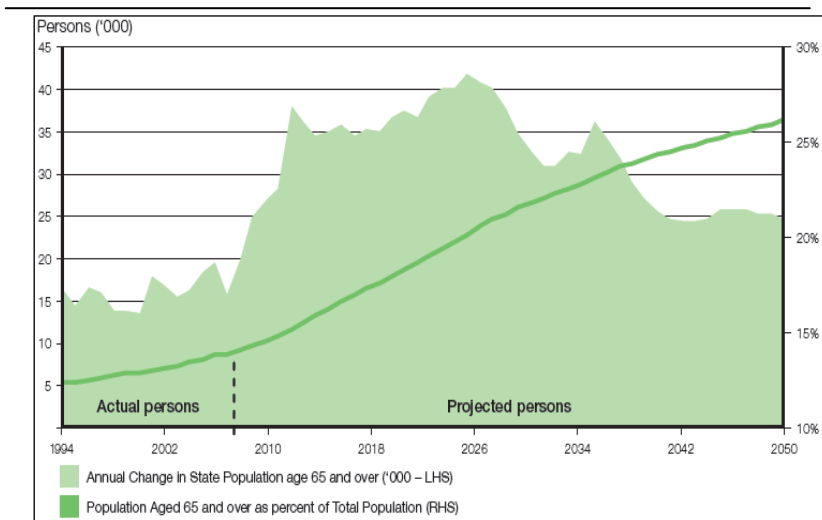
Source: NSW Long Term Fiscal Pressures Report Budget Paper No. 6, 2006-2007 Budget Papers, NSW Government, Sydney, pp. 2-7 (adapted), from (NSW Government 2008)

Figure 3 Projected annual increases in NSW population aged 65 and over

2.1.3   Population sub-groups

Aboriginal and Torres Strait Islanders

Older indigenous people are at higher risk of developing chronic diseases prematurely and their life expectancy is much lower (around 17 years less) compared to the general population (NSW Government 2008). Significantly lower life expectancies, accompanied by higher fertility rates, explain the age structure in this population. Figure 4 shows the age profile of the Aboriginal population in NSW. In general, this group is significantly younger than the non-Aboriginal population. Forty per cent of the Aboriginal population were younger than 15 years and only 3% were aged 65 years and older in 2007 (NSW Government 2008).

The Indigenous population in NSW is estimated to have increased from 101,500 people in 1991 to 152,700 people in 2006, and is projected to increase to between 208,300 and 210,600 people by 2021. This equates to an average growth rate of 2.1% to 2.2% per year between 2006 and 2021 (Figure 5). Similarly, the number of older Indigenous people (55 years and over) in Australia is projected to more than double over the period, from 40,000 in 2006 to between 82,000 and 86,600 in 2021 (ABS 2009).
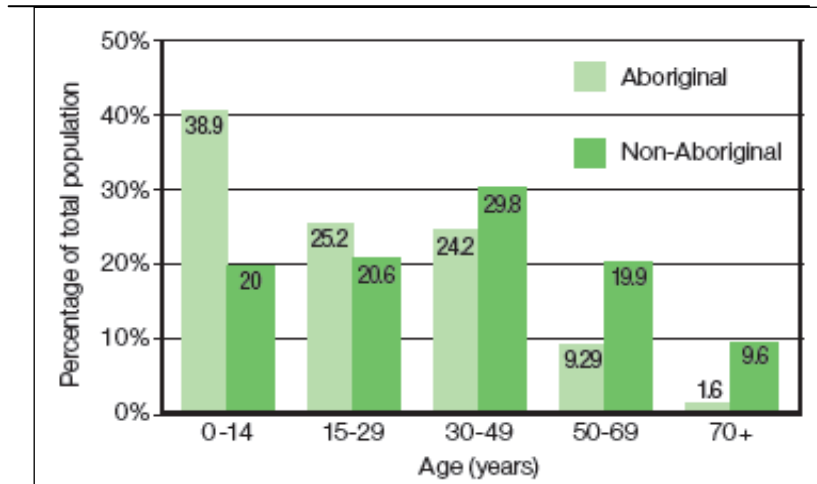
Source: NSW Health 2007, from (NSW Government 2008)

Figure 4 Age distribution of the Aboriginal versus non-Aboriginal population in NSW, 2007
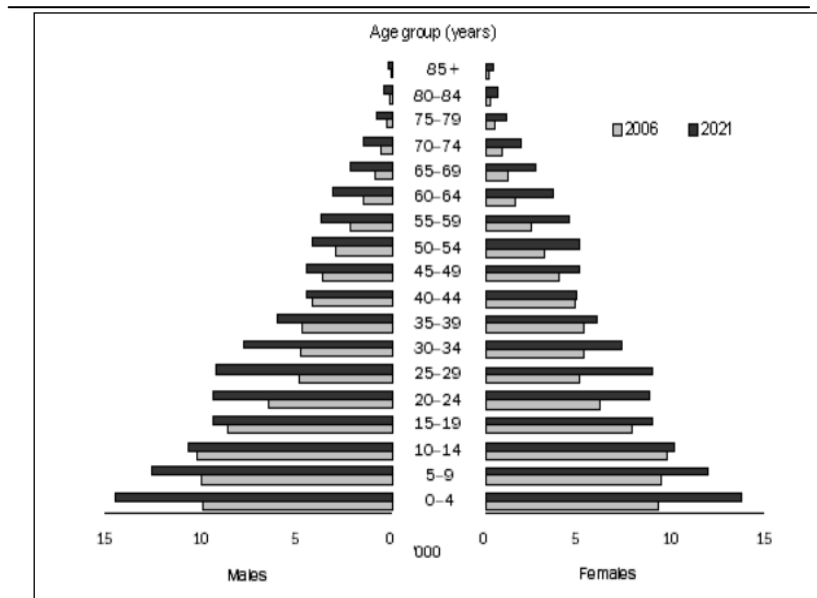
Source: Australian Bureau of Statistics 2009

Figure 5 Estimated and projected Indigenous population, NSW, 30 June 2009

Culturally- and linguistically-diverse older adults

The numbers of older adults from culturally- and linguistically-diverse (CALD) backgrounds are projected to increase substantially over the 30 years from 1996 to 2026 (Gibson, Braun et al. 2001). In 1996, 17.7% of the total older NSW population (65 years and over) were from CALD backgrounds. This was very similar to the Australian national average (17.8%). Those older adults who were born in Southern Europe (4.9% of the NSW population) and Eastern Europe (3.7% of the NSW population) made up a substantial proportion of the population from CALD backgrounds living in NSW.

Between 1996 and 2011 the number of older adults from CALD backgrounds living in NSW was estimated to have increased to 24.2% of the total older population in NSW, slightly above the Australian national average (22.5%). By 2026, this population is projected to increase to 26.0% of the total older population in NSW, a level well above that projected for the Australian population nationally (21.2%) (Gibson, Braun et al. 2001).

SUMMARY STATEMENT - Population levels of older adults in NSW

Similar to that observed nationally, 13.1% of the NSW population was aged 65 years or over in 2010. By 2016, the older population (aged 65 years and over) is expected to outnumber the younger population (people aged 0–14 years) for the first time in the history of NSW.
In NSW, the proportion of adults aged 65 years and over is projected to increase to 22% (nearly 2 million people) in 2031 and to 26.3% in 2051.

By 2026, the population of older adults from culturally and linguistically diverse backgrounds is projected to increase to 26.0% of the total older New South Wales population. The number of older Indigenous Australians will double by 2026.

2.2   CHRONIC DISEASE IN OLDER ADULTS

Current data show that older Australians have a longer life expectancy and are generally healthier than previous generations, across a range of health outcomes (AIHW 2010). Nevertheless, the combination of an ageing population and an unhealthy lifestyle is contributing to an increasing burden of disease and disability (Centre for Epidemiology and Research 2011).

The leading causes of ill-health and disability in the Australian population are chronic non-communicable diseases, most of which are considered preventable, largely through healthy lifestyle behaviours.

2.2.1   Prevalence

The prevalence of chronic disease and related risks increases with age. It is estimated that Australian adults aged 60 years and over have, on average, more than two chronic disease risk factors (National Public Health Partnership 2001). Table 2 shows that 32% of people aged 65 years and over reported suffering from at least one chronic health condition. The proportion of people reporting more than one chronic health condition increased with age, with 50% of adults aged 65 years and over reporting having two or more chronic conditions in the 2004-05 National Health Survey (NHS) (AIHW 2012b).

Recent data indicate that the most commonly reported long-term health conditions affecting people aged 65 and over were long-sightedness (53% of males and 57% of females), deafness for older males (43%) and hypertensive disease (high blood pressure or related conditions) for older females (38%) (ABS 2008b). Arthritis or other musculoskeletal problems were also common in this age group (AIHW 2010a) (Figure 6).

Table 2 Proportion of Australians reporting chronic health conditions, by age group, 2004-05 (%)

Number of chronic conditions	0-14 years	15-24 years	25-44 years	45-64 years	65+ years
None	86.9	80.8	74.0	47.0	18.4
One	12.3	17.0	21.0	32.0	32.0
Two	0.8	1.9	3.8	14.1	26.7
Three	-	0.3	1.1	5.1	15.3
Four	-	-	0.2	1.4	5.0
Five or more	-	-	-	0.5	2.6

Source: (AIHW 2012)
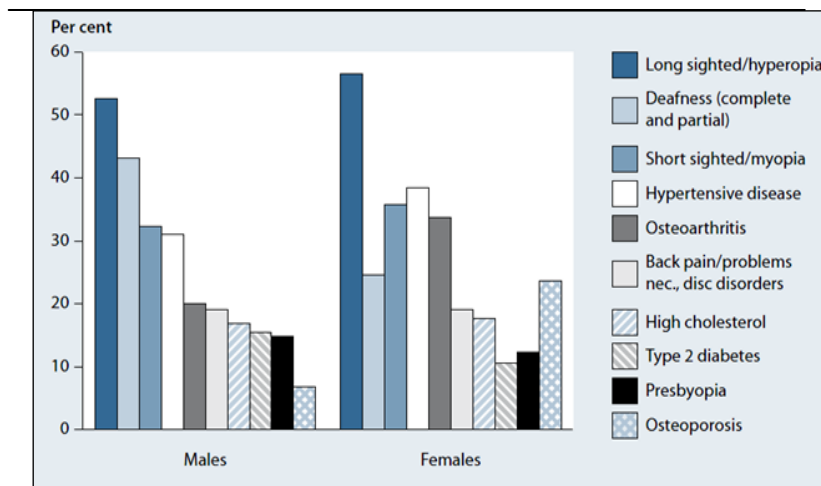
Source: AIHW analysis of the 2007-8 NHS, taken from (AIHW 2010a)

Figure 6 Most commonly reported long-term health conditions among community-dwelling adults aged 65 years and over, Australia, 2007–08

Multimorbidity

The simultaneous occurrence of two or more chronic conditions, known as multimorbidity, is significantly associated with higher mortality, increased disability, a decline of functional status and a lower quality of life. It also leads to a greater extent of health care utilisation (costs, length of hospital stay, and number of physician visits) (Gijsen, Hoeymans et al. 2001). Researchers have also found that the onset of multimorbidity occurs 10-15 years earlier in people living in the most deprived areas, compared with the most affluent; and low socioeconomic status is particularly associated with multimorbidity that includes mental health disorders. The presence of a mental health disorder increases as the number of physical morbidities increases, and is much more prevalent in more deprived than less deprived people (Barnett, Mercer et al. 2012).

Estimates of the prevalence and patterns of multimorbidity in Australia were studied by Britt and colleagues (2008) by conducting secondary analyses of data from a study of prevalence of selected conditions (a substudy of the BEACH [*Bettering the Evaluation And Care of Health*] program). The prevalence of multimorbidity was estimated as 37.1% of surveyed patients, 29.0% of people who attended a GP in 2005, and 25.5% of the Australian population. Prevalence and complexity (number of domains present) increased with age. For instance, 74.6% of surveyed patients aged 65-74 years had multimorbidity, 46% had morbidity in three or more domains, and 22.6% in four or more (See Table 2). Prevalence of multimorbidity did not differ between the sexes. The most common morbidity

combinations were arthritis/chronic back pain plus vascular disease (15.0% of sample), a psychological problem + vascular disease (10.6%) and arthritis/chronic back pain + a psychological problem (10.6%).

Knowledge of the common combinations of multimorbidity may help in planning the health services needed in the future by an ageing population. Flexible care management support systems, appropriate guidelines and care-coordination programs are required across a broader age range; and issues such as health literacy and polypharmacy are also important considerations.

Table 3 Prevalence of level of multimorbidity in Australia

Prevalence of levels of mulitmorbidity, by patient characteristics

Patient characteristic	No. in sample*	Prevalence of CIRS morbidity domains among the sample†			
		1 or more	2 or more	3 or more	4 or more
Sex‡					
Male	3581	60.3%	36.4%	20.1%	10.1%
Female	5522	60.5%	37.5%	21.1%	10.1%
Age (years)‡					
< 25	2047	20.2%	2.6%	0.6%	0.2%
25–44	2281	43.9%	14.7%	3.9%	1.1%
45–64	2450	76.9%	46.5%	22.7%	9.1%
65–74	990	92.3%	74.6%	46.0%	22.6%
75 +	1343	96.2%	83.2%	58.2%	33.4%

CIRS = Cumulative Illness Rating Scale. * Denominator for prevalence.
† Estimated prevalence among patients in general practice waiting room.
‡ Data were missing for sex of 53 patients and age of 45.

Source: (Britt, Harrison et al. 2008)

Disability

Increasing age is associated with risk of disability and loss of independence. According to the 2007 - 08 NHS, around 6% of Australians aged 55 - 64 years reported a profound or severe limitation that restricted them in their core activities such as self-care, mobility or communication. Additionally, 22% of 55-64 year olds reported mild or moderate core activity limitation (AIHW 2010a). Based on data from *The 2003 Survey of Disability, Ageing and Carers (SDAC),* it is estimated that over half of all people aged 65 years and over in that year experienced some type of disability that restricted everyday activities. 'Physical or multiple and diverse disability' was the most common type of main disabling condition at older ages, affecting 45% of older people (AIHW 2007a).

Dementia

Among people aged 65 years and over, dementia is the health condition most likely to be associated with a severe or profound core activity limitation. Other common conditions among older people with a profound or severe disability include Parkinson's disease, hearing disorders, hypertension, heart diseases and stroke (AIHW 2007b). Depression can also be a disabling condition, particularly for those in residential aged care (Andrews 2001).

The number of people aged 45 years and over living in Australia with dementia is expected to triple, to 650 000, by 2051. Lifestyle factors such as smoking, level of physical activity and body mass index influence the prevalence of dementia. Modelling studies have shown that a 5% increase in the prevalence of obesity every 5 years would lead to a 9% increase in the number of people with dementia in Australia by 2051. Similarly, if the level of inactivity increases by 2.5% every 5 years, it is projected that

there would be 7% more people with dementia compared to the 'ageing-only' scenario (Nepal et al. 2010).

Mortality

In 2007, 'cancer and other tumours' was the most common cause of death among Australians aged 45–64 years, followed by cardiovascular disease (coronary heart disease and stroke). For both sexes, cancer and other tumours and cardiovascular disease were the two most common causes among those aged 65–84 years, but cardiovascular disease dominated the 85 and over age group (AIHW 2010a).

In 2007, the leading causes of all deaths in NSW (after averaging results from the last two years) were cardiovascular diseases followed by malignant neoplasms (or cancers), each contributing around one third of all deaths. 'Dementia and Alzheimer's disease' was the third most common cause of death for older females (8.5%) and the sixth for older males (4.5%). Chronic obstructive pulmonary disease, which includes emphysema, was also a significant cause of death for older males and females in 2007, as was diabetes (ABS 2008b).

2.2.2   Burden of disease

Current burden of disease

'Disease burden' is the impact of a health problem as measured by premature death, prolonged illness or disability, or a combination. Calculated in DALYs (disability adjusted life years), it allows comparison of the effects of different diseases and injuries on an equal basis, and between different population groups. The more DALYs, the greater the burden, whether applied to an individual or a population.

In Australia in 2003, adults aged 65-74 years comprised 6.8% of the population and experienced 16.3% of the total disease burden, with cancer and cardiovascular disease accounting for over half of the total burden of disease and injury in this age group (Begg et al. 2007) (Figure 7).
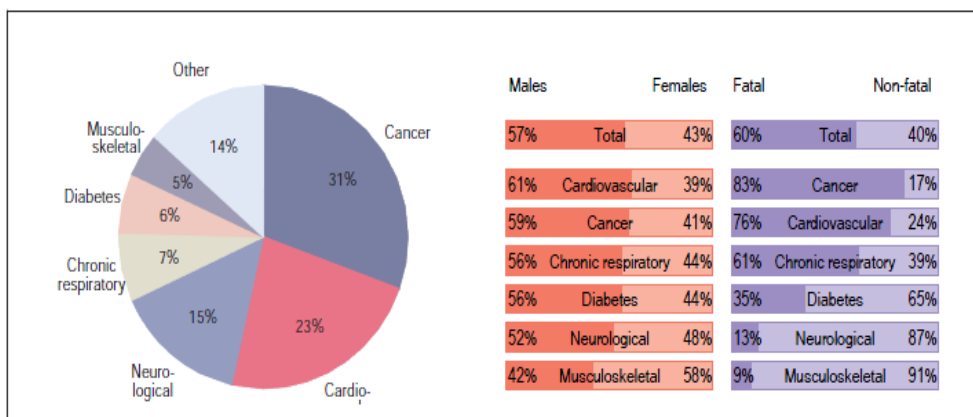
Source: Begg et al. 2007

Figure 7 Burden of disease (DALYs) by broad cause group, adults aged 65–74 years, Australia, 2003

The total burden of disease increases with age, until around age 75 years (Begg, Vos et al. 2007). The major chronic diseases rank in the top ten leading causes of disease burden. In 2003, the seven National Health Priority Areas (NHPAs), together with dementia, accounted for 72.8% of the total burden of disease and injury (National Public Health Partnership 2001) (Figure 8).
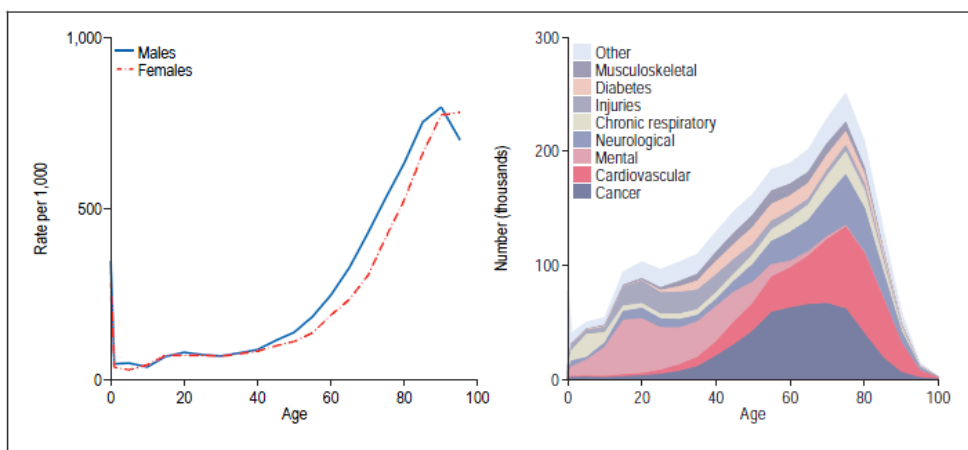
Source: Begg et al. 2007

Figure 8 Burden of disease (DALYs) by age and broad cause group, Australia, 2003

Projected burden of disease

Projections indicate that the burden of disease is likely to increase due to a larger proportion of the population alive at older ages. A major consequence of population ageing will be the steady growth in burden from neurological and sense disorders, from 12% in 2003 to around 16% in 2023. A steady decline in cardiovascular disease burden is predicted over the next two decades (decline to about 13% of total burden, particularly in the elderly), but a strong increase in burden due to diabetes is forecast, primarily as a consequence of the high prevalence of obesity. If current trends in obesity continue, diabetes will account for around 9% of total burden in 2023, compared to around 5% in 2003. Cancer is predicted to retain at around 19% of total burden in the next two decades and will remain the largest contributor to total burden in 2023 (Begg et al. 2007) (Figure 9).
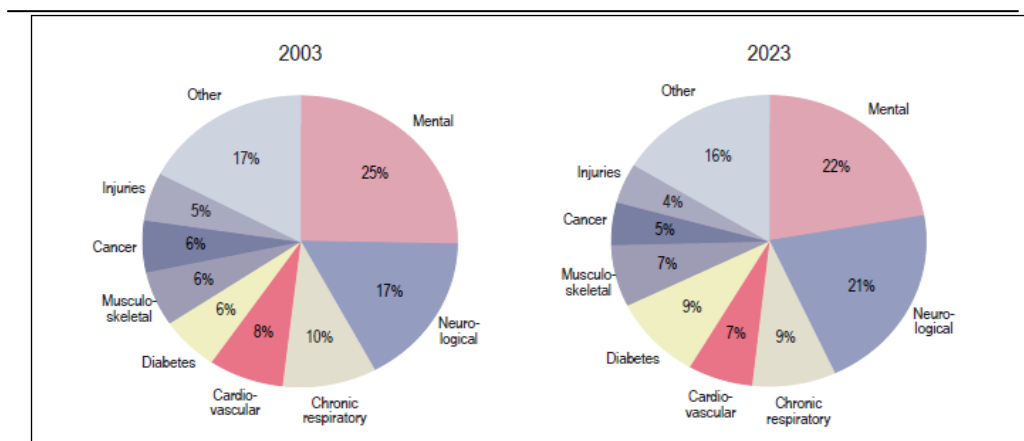
Source: modified from Begg et al. 2007

Figure 9 Proportion of total burden (DALYs) due to selected broad cause groups, Australia, 2003 - 2023

Figure 10 illustrates the findings described above by presenting trend projection of DALYs for the top five chronic health conditions.
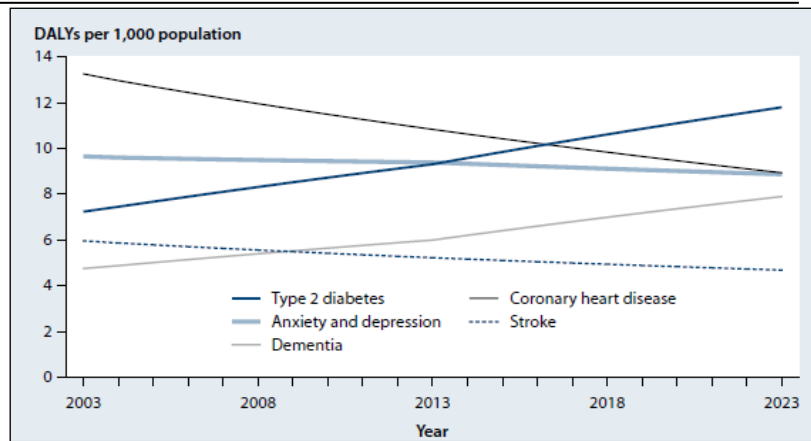
Source: AIHW Burden of Disease database, taken from AIHW (2010a)

Figure 10 Trends in leading causes of disease burden, Australia, 2003 – 2023

SUMMARY STATEMENT – Chronic disease among older Australians

The leading causes of ill-health and disability in the Australian population are chronic non-communicable diseases, most of which are considered preventable, largely through healthy lifestyle behaviours and maintenance of a healthy weight.

The proportion of people reporting more than one chronic health condition increases with age, with 50% of adults aged 65 years and over reporting having two or more chronic conditions in 2004-05.

In Australia in 2003, adults aged 65-74 years comprised 6.8% of the population and experienced 16.3% of the total disease burden, with cancer and cardiovascular disease accounting for over half of the total burden of disease and injury in this age group.

A strong increase in burden due to diabetes is forecast, primarily as a consequence of the high prevalence of obesity. If current trends in obesity continue, diabetes will account for around 9% of total burden in 2023, compared to around 5% in 2003.

The number of people aged 45 years and over living in Australia with dementia is expected to triple, to 650 000, by 2051, and will be affected by levels of obesity and inactivity.

2.2.3   Health system expenditure

In the US, Yang and Hall (2008) have demonstrated that among the elderly, men who were overweight or obese at age 65 had higher in-patient, outpatient, and prescription expenditures over their lifetime than men who were normal weight. Average total health-care expenditures were 6% higher for overweight, and 12.5% higher for obese men, when compared to normal weight men. Similarly, women who were overweight or obese at age 65 had higher in-patient, outpatient, prescription and nursing home expenditures over their lifetime than women who were normal weight. Average total health-care expenditures were 10.7% and 16.8% higher for overweight and obese women respectively, when compared to normal weight women (Wilkins et al 2011).

Wilkins et al (2011) examined the effects of changes in BMI between 2000-2005 among those aged 65 years and older in the US population. Overall, 35% stayed normal, 34% stayed overweight, 18% stayed

obese, 4% gained weight from normal-overweight, 3% gained weight from overweight-obese, 5% lost weight from overweight-normal, and 3% lost weight from obese-overweight BMI. Adjusted models revealed that those who 'stayed obese' had increased total and multiple expenditure types that were significantly higher than 'stayed normal', including total (11%), outpatient (25%), prescription (9%), and medical provider (4%) expenditures. Compared to 'stayed normal', total expenditures were 26% higher for both 'obese-overweight' and 'overweight-obese'.

Current expenditure, Australia

Overall health care costs are higher for the older age groups due to higher levels of chronic diseases. In 2004-05, over $15.0 billion in health expenditure was for those aged 55 to 74 years (Table 4).

Table 4 Allocated health expenditure by age and sex, Australia, 2004–05 ($ millions)

| | Age (years) | | | | | | | | | | |
	0–4	5–14	15–24	25–34	35–44	45–54	55–64	65–74	75–84	85+	Total
Male	1,265	1,175	1,851	1,976	2,300	2,895	3,801	4,029	3,732	1,085	24,109
Female	994	1,048	2,690	3,477	3,149	3,401	3,715	3,899	4,298	1,880	28,551
Female (excl. Maternal)	994	1,048	2,345	2,495	2,809	3,397	3,714	3,899	4,298	1,880	26,880
All persons	2,259	2,223	4,541	5,453	5,448	6,296	7,516	7,929	8,030	2,965	52,660

Source: Disease expenditure database, taken from (AIHW 2010b)

When allocated health expenditure is analysed on a per person basis, the effect of variation in age group size is removed and a different picture emerges (Figure 11). For example, expenditure for adults aged 65–74 years was only 5% more than for adults aged 55–64 years ($7.9 billion and $7.5 billion respectively). However, on a per person basis, adults aged 65–74 years were responsible for 66% more of the expenditure ($5,714) compared to the younger age group ($3,443).

Together, the NHPAs accounted for $22.8 billion, or 43%, of total allocated health expenditure. Figure 12 shows that 26% of total allocated expenditure on NHPAs was spent on cardiovascular diseases. Around 17% of expenditure was spent on musculoskeletal conditions and cancer, and 4% spent on diabetes. Most of these expenses occurred at the hospital and medical service levels (AIHW 2010b).

Projected expenditure, Australia

Total health and residential aged care expenditure is projected to increase by 189% in the period 2003 to 2033, from $85 billion to $246 billion (Goss 2008); and a large proportion of this is due to the ageing population. The major contributor is the projected change in volume of health services provided per case of disease ($81.3 billion), followed by population ageing ($37.8 billion) and overall population growth ($34.4 billion).

Figure 11 Allocated health expenditure by age and sex, Australia, 2004–05 ($ millions)

Figure 12 Health expenditure in National Health Priority Areas, Australia, 2004–05

Although favourable trends in disease rates lead to projected savings in expenditure for cardiovascular disease ($3.2 billion), cancers ($1.2 billion), and injuries ($1.7 billion), a sharp increase in costs is anticipated due to projected higher rates of diabetes ($1.8 billion) and other diseases. Table 5 shows that diabetes is projected to have the largest percentage increase in expenditure (436%) between 2003 and 2033, followed by dementia (364%), Parkinson's disease (334%), digestive disorders (238%) and sense disorders (236%). The massive projected growth in diabetes expenditure is due to multiple reasons, one major factor being the expected increases in obesity (Goss 2008).

Table 5 Projected health and residential aged care expenditure[a] by disease group, Australia, 2002–03 to 2032–33

	Expenditure (millions of 2006–07 dollars)[b]				Change 2002–03 to 2032–33
	2002–03[c]	2012–13	2022–23	2032–33	
Diabetes	1,607	2,831	5,007	8,610	436%
Type 2 diabetes	1,296	2,427	4,495	8,041	520%
Musculoskeletal	4,411	6,289	9,567	14,234	223%
Respiratory	7,188	9,679	14,483	21,947	205%
Cancer	3,487	5,128	7,807	10,112	190%
Cardiovascular	9,329	12,535	16,781	22,559	142%
Injuries	6,650	8,134	10,555	14,353	116%
Mental	5,147	6,670	8,998	12,109	135%
Total health & residential aged care expenditure ($m)	**85,063**	**115,471**	**167,729**	**246,056**	**189%**

Notes: a) Expenditure in this report refers to health care expenditure and expenditure on the high care portion of residential aged care expenditure. This is the definition of health expenditure that was used in the national health accounts up until 2004–05. Since then health expenditure has excluded residential aged care expenditure as that is now counted as part of welfare expenditure; b) Expenditure and GDP for all years is expressed in 2006–07 dollars to enable comparisons to be made across the period

Source: AIHW Disease expenditure projection model, adapted Goss, J. (2008)

SUMMARY STATEMENT – Health expenditure in Australia related to older adults

Overall health care costs are generally higher for the older age groups, due to higher levels of chronic diseases. In 2004-05, over $15.0 billion in health expenditure was for those aged 55 to 74 years.

Total health and residential aged care expenditure is projected to increase by 189% in the period 2003 to 2033, from $85 billion to $246 billion (an increase of $161 billion) and a large proportion of this is due to the ageing population.

Although favourable trends in disease rates lead to projected savings in expenditure for cardiovascular disease ($3.2 billion), cancers ($1.2 billion), and injuries ($1.7 billion), a sharp increase in costs is anticipated due to projected higher rates of diabetes ($1.8 billion), and increases for other diseases giving a projected expenditure increase due to worsening disease rates of $5.1 billion.

2.3 RISK FACTORS FOR CHRONIC DISEASE: RATIONALE AND PREVALENCE

2.3.1 Overview

Few behavioural risk factors, underpinned by socioeconomic determinants of health, are significant determinants of the main chronic diseases. These risk factors are considered to be modifiable and include poor nutrition, lack of physical activity, sedentary behaviours, smoking and alcohol consumption (Figure 13).
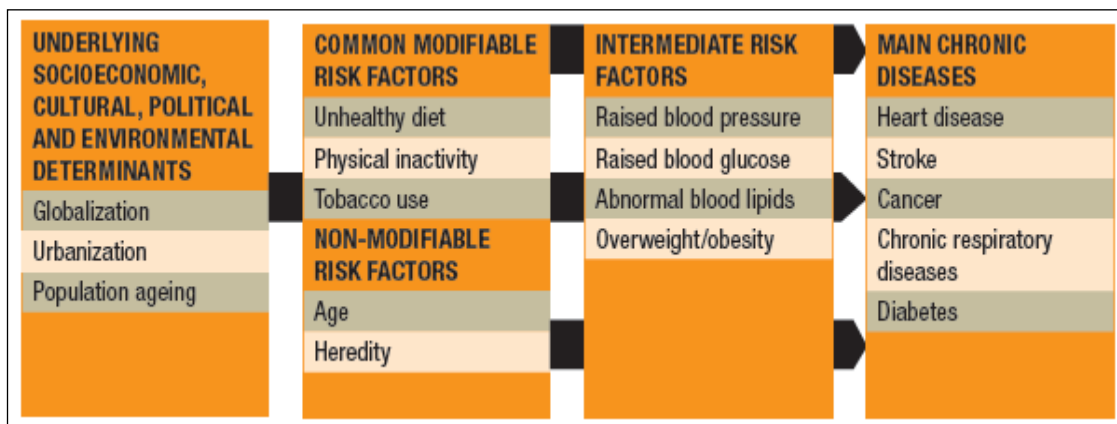
*So*urce: (WHO 2005)

Figure 13 Causes of chronic disease

Weight status is influenced by physical activity, sedentary behaviours and nutrition, and acts as an intermediate risk factor for various chronic diseases such as type 2 diabetes mellitus, atherosclerotic heart disease, stroke, osteoarthritis, sleep apnoea, cancers of the breast, prostate and colon, and all-cause mortality (Bellanger and Bray 2005) (Table 6). Other intermediate risk factors for chronic disease include hypertension, dyslipidemia, and impaired glucose intolerance and these too are underpinned by lifestyle behaviours.

The intermediate risk factors and key risk behaviours are the focus of chronic disease prevention. For late middle-aged and older adults, addressing lifestyle behaviours becomes important for minimising the loss of lean muscle mass, a key factor in the diminishing health of older adults, and improving physical function and quality of life.

Although weight loss *per se* may not be desirable for all overweight older adults, particularly those who are elderly (aged over 75 years) (cf. section 2.3.2), obesity and weight gain among normal weight and overweight 'young' older adults need to be addressed. Among those aged 55-70 years in particular, obesity is closely related to the development of chronic disease, and also aggravates existing chronic health conditions and associated medical complications.

Data from the 2007-08 NHS on selected risk factors for older Australians showed that three quarters of those aged 65-74 years were overweight and obese. Additionally, a large proportion of older adults did not meet physical activity recommendations (40%) or recommended daily intake of vegetables (71%) and fruit (35%) (Table 7).

Table 6 Relationships between selected chronic diseases and risk factors

Risk factor	Chronic disease							
	Arthritis	Asthma	COPD	Coronary heart disease [a]	Depression	Type 2 diabetes	Osteoporosis	Stroke
Behavioural								
Tobacco smoking	✓ [b]	✓	✓	✓			✓	✓
Physical inactivity	✓ [c]			✓	✓	✓	✓	✓
Alcohol misuse				✓	✓	✓	✓	✓
Poor nutrition				✓		✓	✓	✓
Biomedical								
Obesity	✓ [c]			✓	✓	✓		✓
High blood pressure				✓				✓
High blood cholesterol				✓				✓

COPD   Chronic obstructive pulmonary disease.
(a)   Also known as ischaemic heart disease.
(b)   Relates to rheumatoid arthritis.
(c)   Relates to osteoarthritis.

Source: Indicators for chronic diseases and their determinants 2008. Cat. no. PHE 75, from (AIHW 2010a)

Table 7 Prevalence of selected risk factors, adults aged 65 years and over, Australia, 2007-08 (per cent)
Source: AIHW analysis of the 2007–08 NHS CURF version 2, from (AIHW 2010a)

Selected risk factors	Age group (years)			Total 65 and over
	65–74	75–84	85 and over	
Males				
Inadequate daily fruit intake [a]	37.5	37.4	30.9	37.0
Inadequate daily vegetable intake [b]	73.1	68.4	81.8	72.0
Sedentary [c]	37.5	51.7	66.8	44.4
Overweight or obese [d][e]	78.9	76.7	58.9	77.0
Current smokers [f]	10.5	6.0	0.9	8.3
Risky or high-risk alcohol consumption [g]	11.5	5.6	3.5	8.9
Females				
Inadequate daily fruit intake [a]	32.5	32.5	35.4	32.8
Inadequate daily vegetable intake [b]	68.7	70.2	75.7	70.0
Sedentary [c]	41.4	57.3	67.8	50.0
Overweight or obese [d][e]	71.2	60.1	42.2	64.7
Current smokers [f]	9.1	5.7	1.5	7.0
Risky or high-risk alcohol consumption [g]	11.9	6.8	2.7	9.1
Persons				
Inadequate daily fruit intake [a]	34.9	34.8	33.9	34.8
Inadequate daily vegetable intake [b]	70.9	69.4	77.8	70.9
Sedentary [c]	39.5	54.7	67.5	47.4
Overweight or obese [d][e]	75.0	67.9	48.4	70.5
Current smokers [f]	9.8	5.8	1.3	7.6
Risky or high-risk alcohol consumption [g]	11.7	6.2	2.9	9.0

(a)   One or no serves per day. Dietary guidelines recommend at least two serves of fruit per day.
(b)   Three or fewer serves per day. Dietary guidelines recommend at least five serves of vegetable per day.
(c)   Physical activity for sport, recreation or exercise only; does not include those who exercised for transport or work.
(d)   Measured body mass index greater than or equal to 25.
(e)   Estimated as a proportion of those for whom height and weight were measured.
(f)   Daily, weekly or less than weekly current smoker.
(g)   In a 1-week period according to NHMRC Guidelines 2001.

2.3.2 Ageing, weight and health

Ageing process

Normal ageing is associated with a progressive increase in the ratio of fat mass to lean muscle mass (Prentice and Jebb 2001). As body weight tends to remain stable or slightly decrease after 60-70 years of age, these anthropometric changes cause an increase in body fat mass and a decline in lean muscle mass, although after 75 years of age both lean muscle mass and fat mass tend to decline (Villareal et al. 2005). The etiology of muscle loss is multifactorial, including inflammation, oxidative stress and hormonal changes, and is worsened by activity avoidance due to fear of pain (Vincent et al 2012). The age-associated loss of skeletal muscle mass and function is termed 'sarcopenia' (Fielding et al. 2011). Loss of muscle mass accounts for the decreases in basal metabolic rate, muscle strength, and activity levels, which in turn are the cause of decreased energy requirements associated with ageing (Li and Heber 2012). Sarcopenic obesity can have severe consequences and is associated with physical inactivity, slow gait, poor physical endurance, musculoskeletal degenerative diseases, mobility disability and functional impairment, which leads to a loss of independence and metabolic complications (Vincent et al. 2012).

Body Mass Index (BMI) and health

There is some evidence to suggest that being overweight as defined by a body mass index (BMI) of 25.0-29.9 kgm^{-2} is associated with a lower risk of mortality compared to being normal weight among older adults. A longitudinal study in Australia showed that the risk of mortality for Australian men and women aged 70-75 years is 13% lower among those who are overweight, compared to normal weight (BMI 18.5–24.9 kgm^{-2}). Kvamme et al. (2011) also found a reduced mortality risk among overweight compared to normal weight older adults. There are mixed results regarding mortality risk associated with obesity (BMI >30.0 kgm^{-2}); one study showed a similar mortality risk to normal weight (Flicker et al. 2010), while others have demonstrated an increased risk of mortality among older obese adults aged ≥65 years compared to those classified as normal weight (Kvamme et al. 2011; Donini et al. 2012).

Han et al (2011), however, indicated that the observation that the BMI value associated with the lowest relative mortality is slightly higher in older than in younger adults is often misinterpreted as obesity being not as harmful in the elderly. They cite evidence that the absolute mortality risk associated with increased BMI increases up to the age of 75 years. Beyond the age of 80 years, the association between BMI and mortality becomes weakened, primarily because the elderly with low body weight comprises a mix of those who have always been lean and physically active and those who have lost weight through chronic, covert or overt, ill health and cigarette smoking, and who are often physically inactive.

The relationship between weight status and bone health is contentious. Older adults who are overweight (not obese) may have a reduced risk of osteoporosis and hip fracture, due to increased bone mineral density and a cushioning effect of subcutaneous fat around the hip bone (Hannan et al. 2000; Barrera et al. 2004; Villareal et al. 2005). However, accumulating evidence suggests that obesity is detrimental overall to bone health (Cao 2011). Extreme obesity (a body mass index of more than 40 kg/m^2) is considered to be a risk factor for osteoporosis (Fini et al 2012).

Overweight and obesity up to around age 70 are serious risk factors for various morbidities, particularly for chronic disease. Increased body weight and adipose tissue accumulation amplify the risk of developing various age-related diseases, such as cardiovascular disease, type 2 diabetes mellitus, musculoskeletal disorders, respiratory diseases and certain types of cancer (Tzanetakou et al 2012). In free-living older adults (aged 65 years and older), overweight and obesity have been associated with a higher prevalence of diabetes and arthritis, and overweight has been associated with a higher prevalence of stroke in males (Hirani et al 2011). This study also showed that overweight males and obese females were more likely to have had a joint replacement, and overweight or obese women were more likely to have experienced a fall. An earlier study indicated that older women with a BMI of >27 kgm^{-2} at around 60 years, or >28 kgm^{-2} at around 76 years, may be at increased risk of decline in functional status and future disability (Launer et al. 1994). The risk for mobility disability and functional impairment, reduced

ability to perform activities of daily living, and lower quality of life, increases with severity of obesity in the older adult (Chapman et al 2011; Vincent et al 2012).

Intentional weight loss and health

Recommended weight loss

Shea et al (2010) indicate that, despite the reported benefits, weight loss is not always advised for older adults because some observational studies have associated weight loss with increased mortality. In their RCT, intentional dietary weight loss was not significantly associated with increased all-cause mortality over 12 years of follow-up in older overweight or obese adults (Shea et al. 2010). Weight loss in older adults is associated with a number of reduced morbidities. Weight loss interventions in obese older adults (60 years and older) have reduced the recurrence of hypertension or cardiovascular events (Witham et al. 2010). Bales and Buhr (2008) examined 16 randomised controlled trials of weight loss interventions in people aged over 60 years with a baseline BMI of ≥27 kg/m^2 who lost 3% or 2 kg in weight over 6–12 months. This review revealed that weight loss interventions led to significant benefits for those with osteoarthritis, coronary heart disease, and type 2 diabetes, while having slightly negative effects on bone mineral density and lean body mass.

The 2005 joint position statement from the American Society for Nutrition and The Obesity Society indicates that weight loss is only recommended in those persons aged 65 years and older if they are obese (≥ 30.0 kg/m2) and have functional impairments or medical complications that can benefit from weight loss, as this can reduce medical complications and improve physical function and quality of life (Villareal, Apovian et al. 2005). Similarly, others recommend modest weight loss of 5-10% in obese older adults as appropriate when functional problems such as osteoarthritis have resulted from the excess weight (Han et al 2011; Chapman et al 2011). The findings of the review by Han et al (2011) support the finding that the medical consequences of obesity are alleviated by modest, achievable weight loss (5-10 kg) with an evidence-based maintenance strategy. It is suggested that weight loss is associated with clinically important benefits in patients with diabetes, osteoarthritis and coronary artery disease (Witham and Avenell 2010). Whether or not to institute a weight loss intervention for obese older people needs to be carefully considered on an individual basis, with special attention to the weight history and the medical conditions of each individual (Bales and Buhr 2008).

Similarly, a review by Chau et al (2008) suggested individualised recommendations should be considered for elderly patients, with a focus on the underlying medical problems, functional status and living environments. In contrast with younger adults, the goal of weight management in older adults is the maintenance of weight with the achievement of a healthy, functional, and good quality of life; rather *than aggressive weight loss.*

Diet and exercise to achieve weight loss

A combination of exercise and modest calorie restriction is recommended to achieve weight loss among older overweight or obese adults. Weight-bearing aerobic and resistance exercise should be included to minimise loss of lean muscle, and potentially also bone mass, and use of calcium and vitamin D supplementation should be considered to assist with minimising bone loss (Villareal et al. 2005; Chapman et al 2011; Han et al 2011). The most recent evidence suggests that the combination of multimodal exercise (2-18 month programs including aerobic and strengthening exercise) and energy restriction (typically 750 kcal/day) among obese older adults appears to be very effective for counteracting sarcopenic obesity and improving mobility and function in the older adult (Vincent et al 2012). Such interventions can combat factors that invoke sarcopenia, including inflammation, oxidative stress and insulin resistance.

Stehr and von Lengerke (2012) conducted a systematic review to examine the role of exercise and physical activity for preventing weight gain in older people and found that exercise was associated with weight loss (1.1-6.0 kg) in all intervention studies (all of which studied an overweight sample) and with weight maintenance in most observational studies (all of which studied a general population or otherwise

overweight – but with unspecified age – adults). They concluded that exercise and physical activity can effectively prevent weight gain in older adults and postmenopausal women, either in terms of weight loss or maintenance. Exercise and physical activity can preserve lean body mass and thus are important for the balance between potentially positive and negative effects of weight reduction in later life (Stehr and von Lengerke 2012).

In studies involving overweight middle aged and older adults, moderate-intensity aerobic exercise training has been shown to be effective in reducing total body fat. Favourable changes in body composition, including increased fat-free mass and decreased total body fat mass have been reported in older adults who participate in moderate or high intensity resistance exercise training (Chodzko-Zajko, Proctor et al. 2009).

Underweight and health

Older adults who are underweight are at an increased risk of morbidity and mortality and may experience decreased functional independence and poor quality of life (Kretser et al. 2003; Truswell 2009; de Hollander et al. 2012). A higher mortality risk for older adults who are underweight might be explained by the association of low BMI with malnutrition and sarcopenia, which are also associated with higher mortality risks. Additionally, older adults with low BMI may be frailer and have low-grade inflammation (de Hollander et al. 2012).

Abdominal adiposity and health

Increases in body fatness associated with ageing are largely due to increases in intra-abdominal fat mass (Beaufrère & Morio, 2010). Increases in intra-abdominal fat may occur earlier in women during peri-menopause (ages 45-55 years), leading to a larger than healthy waist circumference (Sawchuk et al.; Dubnov et al. 2003).

Increasingly, the literature indicates that WC and waist-to-hip ratio may be better indicators than BMI for chronic disease risk among older adults (Price et al. 2006). Greater abdominal adiposity is closely associated with adverse metabolic profiles such as insulin resistance, dyslipidemia, and systematic inflammation, which play essential roles in the pathogenesis of CVD, diabetes mellitus and certain cancers (Berg and Scherer 2005). A recent meta-analysis including over 58,000 people aged 65–74 years showed that a large waist was consistently associated with all-cause and CVD mortality for people within the 'healthy' weight, overweight and obese BMI categories (de Hollander et al. 2012). The persistence of the association between high WC and adverse metabolic profiles (higher total cholesterol, low-density lipoprotein cholesterol and triglyceride levels, higher systolic and diastolic blood pressures, and higher fasting glucose levels) among normal-weight women has been shown in a number of studies (Zhang et al. 2008).

There is some suggestion that WC cut-points for the elderly should be defined at higher values. For instance, a 2-fold increased risk in CVD mortality was seen at WC levels of 123 cm for men and 105 cm for women (de Hollander et al. 2012). Heim et al (2011) also explored optimal cut-offs for high-risk waist circumference in older adults and proposed new potential WC cut-points of between 100 cm and 106 cm in men and 99 cm in women, based on several health outcomes (Heim et al. 2011).

2.3.3   Prevalence of overweight and obesity in older Australians

The NSW Population Health Survey collects self-reported data on weight and height. In 2011, a significantly higher proportion of males aged 55-64 years (69.7%) and 65-74 years (68.8%) were overweight or obese, compared with the overall adult male population (59.8%) (Figure 15). Similarly, among females, a significantly higher proportion of those aged 55-64 years (62%) and 65-74 years (60.7%), were overweight or obese, compared with the overall adult female population (45.4%) (Figure 14).

A slight increase of the proportion of overweight or obese adults aged 55-74 years, based on self-reported data (for which weight is commonly underreported), occurred between 1997 and 2011. Figure 15 shows that this increase came almost solely from an increase in levels of obesity rather than levels of overweight, which has remained relatively stable in both age groups between 1997 and 2011. Prevalence of obesity increased from 16.5% in 1997 to 27.8% in 2011 among 55-64 year olds in NSW, while overweight remained stable (38.3% and 38.7% respectively) (Figure 15a). Among 64-75 year olds, obesity increased from 16.1% in 1997 to 25.8% in 2011, with overweight increasing slightly from 35.4% to 39.7%

(Figure 15b). Higher levels of obesity in the younger of the two age groups in 2011 suggests that levels of obesity in the older age group will continue to increase as this cohort ages.
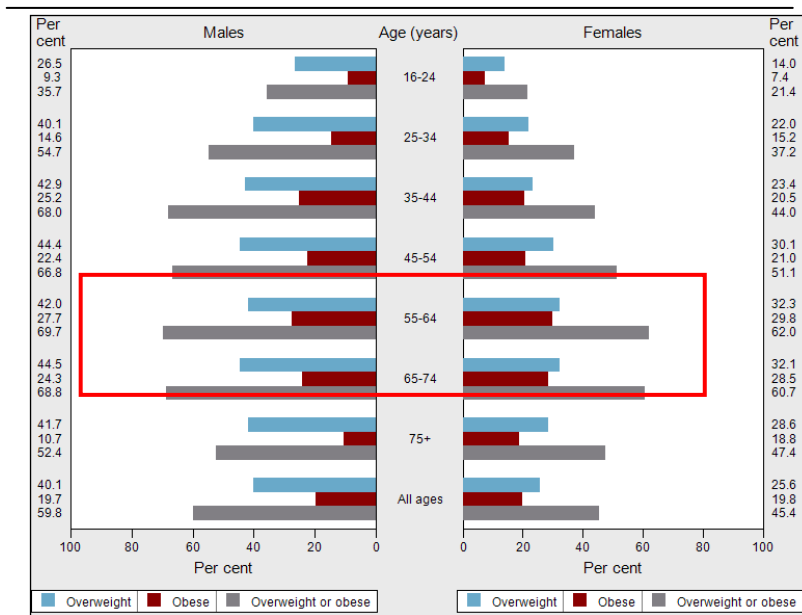
NOTE: Self-reported data collected through Computer Assisted Telephone Interviewing (Appel, Clark et al.)

Source: NSW Adult Population Health Survey (SAPHaRI). Centre for Epidemiology and Evidence, NSW Ministry of Health

**Figure 14 Proportion of overweight or obesity by age and sex,
adults aged 16 years and over, NSW, 2011**
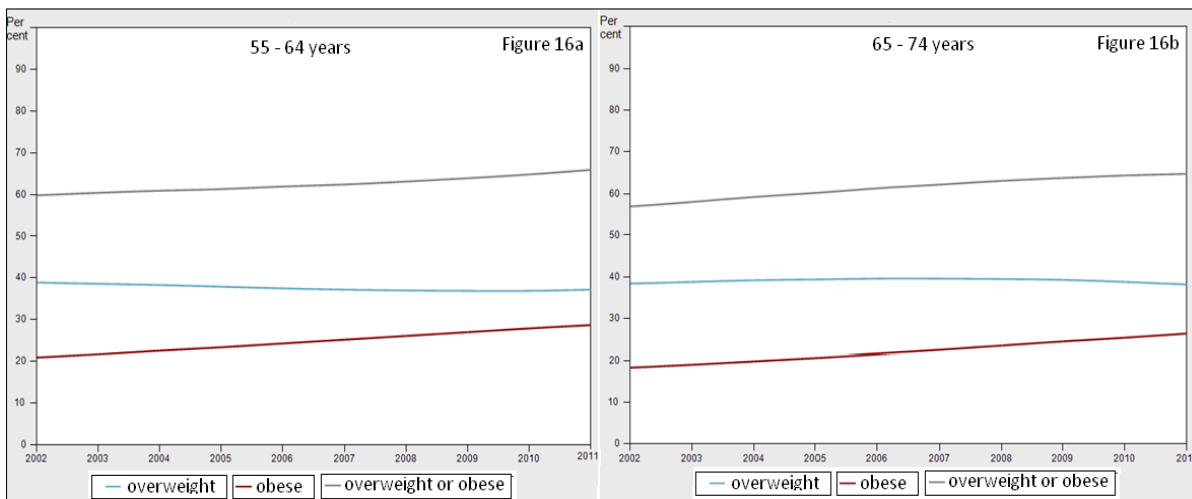
NOTE: Self-reported data collected through Computer Assisted Telephone Interviewing (Appel, Clark et al.).

Source: NSW Adult Population Health Survey (SAPHaRI). Centre for Epidemiology and Evidence, NSW Ministry of Health

**Figure 15 Trends in the proportion of overweight or obesity by age,
adults aged 55-74 years, NSW, 1997-2011**

National data from measured weights and heights in the 2007-8 NHS indicate that the prevalence of obesity is around 25-30% among Australians approaching retirement, with older males more likely to be overweight or obese than older females. In 2007-08 (ABS 2008c) (Table 8):

- Overweight: 39.9% males/34.6% females aged 55-64 years; 45.1% males/42% females aged 65-74 years
- Obese: 35% males/33.4% females aged 55-64 years; 33.9% males/29.4% females aged 65-74 years

Table 8 Body Mass Index (BMI, measured data) by age and sex, adults aged 18 years and over, Australia, 2007–08 (per cent)

Sex and BMI	18–24	25–34	35–44	45–54	55–64	65–74	75 and over	Total 18 and over
Males								
Underweight	3.6	2.3	0.8	0.5	0.1	0.4	1.0	1.2
Normal	56.6	35.8	28.5	22.8	25.0	20.7	24.7	31.1
Overweight	28.0	42.4	44.2	47.0	40.0	45.1	52.8	42.2
Obese	11.9	19.5	26.6	29.8	34.9	33.8	21.5	25.4
Total males	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Females								
Underweight	7.2	3.4	1.9	2.0	1.2	1.3	2.8	2.8
Normal	57.7	52.2	42.8	39.2	30.9	27.5	40.5	42.5
Overweight	20.7	26.5	32.5	32.5	34.7	41.9	32.5	31.1
Obese	14.4	18.0	22.8	26.4	33.2	29.3	24.2	23.7
Total females	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: AIHW analysis of the 2007–08 NHS, taken from (AIHW, 2010a)

There are no data available examining socioeconomic status and weight status among particular age groups in NSW. There is a relatively consistent inverse association between occupational status and weight gain for both men and women. When using education to assess SES, the evidence was unclear, particularly among men; similarly, when SES was assessed using income, findings were inconsistent (Ball and Crawford 2005).

A study examining patterns of overweight and obesity for different birth cohorts found that the prevalence of overweight in the Australian population rose with increasing age, and for cohorts born since 1960. It is postulated that the effects of the 'toxic environment' initiated in the late 1970s contributed to the epidemic of overweight in the 1980s, and that environmental changes of the past decade (1990–2000) have led to further increases in the proportions of overweight and obese people. Younger born cohorts appear to be more susceptible to becoming overweight more rapidly than older cohorts, especially for those born since 1960. Young generations have spent greater periods of their life or their entire life in the 'obesogenic environment' (Allman-Farinelli et al. 2008) (Figure 16).

Recent modelled progressions of the prevalence of obesity in Australia were obtained by using longitudinal data from the Australian Diabetes, Obesity, and Lifestyle (AusDiab) study. In this sample, 20% of those with normal weight or overweight progressed to a higher weight category over a five year period. Researchers suggest that if the current rates of weight gain are maintained, normal-weight adults will constitute less than one third of the population by 2025. When those people aged 25-29 years in 2000 reach 60-64 years, it is estimated that 22.1% will be normal weight and 42.4% will be obese (Walls et al. 2012).
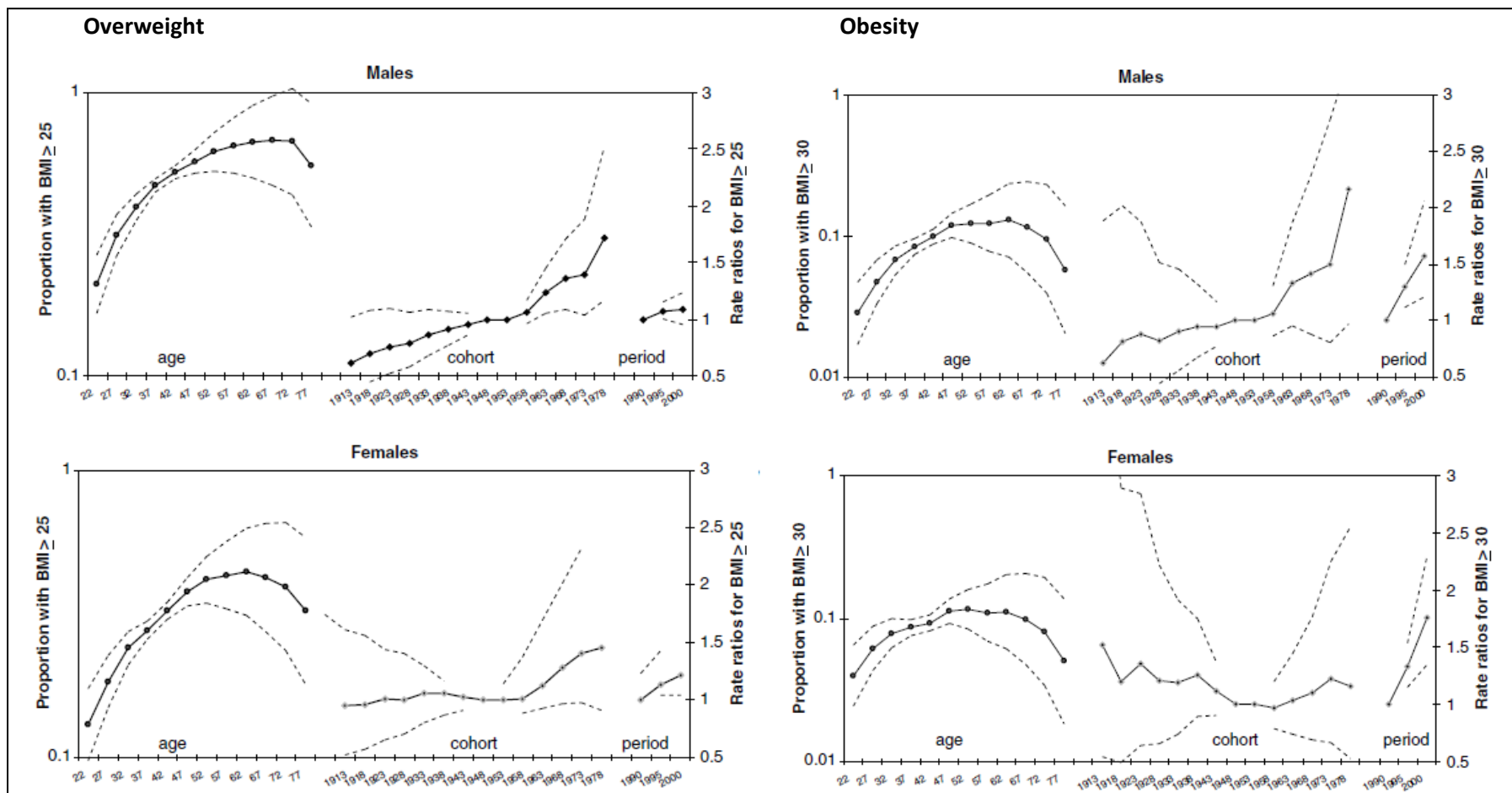
Source: (Allman-Farinell et al. 2008)

Figure 16 Estimates and 95% confidence intervals from the A-P-C model fitted to the Australian NHS data for prevalence of overweight and obese adults

Prevalence of abdominal obesity

Cut-offs currently used in Australia for adults to indicate risk of metabolic complications associated with excess abdominal adiposity are:

- Not at risk (male waist circumference less than 94 cm, female waist circumference less than 80 cm)
- Increased (male waist circumference ≥ 94 cm, female waist circumference ≥ 80 cm)
- Substantially increased (male waist circumference ≥ 102 cm, female waist circumference ≥ 88 cm).

In 2007-08, only 25.3% of adults aged 55-64 years and 19.4% of adults aged 65-74 years had a measured waist circumference that did not put them at increased risk of poor metabolic health (Table 9). A slightly higher proportion of older men than women had a waist circumference that put them at increased risk of poor health; however, a higher proportion of older women than men had a waist circumference that put them at substantially increased risk of poor health.

Table 9 also shows that the proportion of people at increased risk of poor health due to their waist circumference increases with age. Around 50% of all adults aged 55-74 years have a waist circumference that puts them at a substantially increased risk of poor health, compared to approximately one quarter of younger adults aged 25-34 years.

Table 9 Measured waist circumference by risk level, adults aged 18 years and over, Australia, 2007–08 (per cent)

Sex and risk level	18–24	25–34	35–44	45–54	55–64	65–74	75 and over	18 and over
Males								
Not at risk	79.6	59.7	42.8	37.1	28.4	22.1	25.1	46.4
Increased risk	11.1	19.4	27.5	28.4	28.7	31.9	29.9	24.0
Substantially increased risk	9.2	20.9	29.7	34.6	42.9	46.1	45.1	29.6
Females								
Not at risk	66.7	45.7	37.7	33.2	22.0	16.6	20.6	29.0
Increased risk	14.6	22.2	23.8	24.2	22.0	28.3	22.3	31.0
Substantially increased risk	18.7	32.1	38.5	42.6	55.9	55.1	57.2	40.0
Persons								
Not at risk	72.3	53.1	40.2	35.2	25.3	19.4	22.6	42.2
Increased risk	12.9	20.7	25.7	26.3	25.5	30.1	25.7	23.1
Substantially increased risk	13.9	26.2	34.1	38.5	49.2	50.6	51.6	34.8

Source: AIHW analysis of the 2007–08 NHS, from (AIHW 2010a)

> **SUMMARY STATEMENT - Prevalence of overweight and obesity and 'metabolic at-risk' waist circumference in older adults in NSW**
>
> In NSW a higher proportion of older adults aged 55-74 years than the overall adult population are overweight or obese. In 2011:
> - 68.4% of males aged 55-64 years and 68.1% aged 65-74 years were overweight or obese, compared to 60.1% of adult males overall
> - 60.3% of females aged 55-64 years and 58.4% aged 65-74 years were overweight or obese, compared to 48.0% of adult females overall
>
> Prevalence of overweight has remained relatively stable since 1997 (38.3% to 38.7% among 55-64 year olds and 35.4% to 39.7% among 65-74 year olds), however levels of obesity have risen substantially in both age groups from 1997 to 2011: from 16.5% to 27.8% among 55-64 year olds, and from 16.1% to 25.8% among 65-74 year olds.
>
> Recent modelled progressions of the prevalence of obesity in Australia indicate that when those people aged 25-29 years in 2000 reach 60-64 years, 22.1% will be normal weight and 42.4% will be obese.
>
> In 2007-08, only 25.3% of adults aged 55-64 years and 19.4% of adults aged 65-74 years had a measured waist circumference that did not put them at increased risk of poor metabolic health.

2.3.4 Nutrition

Nutrition guidelines for older people

Diet quality and quantity play important roles in preventing chronic disease, delaying onset of chronic diseases, and managing chronic diseases associated with ageing. *The Australian Guide to Healthy Eating,* published in 1998, outlines the recommended number of serves from each of the five core food groups required to maintain good health (Smith et al. 1998). A revised version of these guidelines is due to be released in late 2012.

- Foods particularly rich in protein such as meats, poultry, fish, eggs, nuts, milks, cheese, and yoghurts should feature as part of all meals across this life stage to help minimise declines in lean muscle mass that occur with older age (Truswell 2009; National Health and Medical Research Council 2011a). This is reflected in the increased recommended daily intake for protein between ages 51-70 and >70 years (from 64g/day to 81g/day for males, and from 46g/day to 57g/day for females) (Commonwealth Department of Health and Ageing Australia and Ministry of Health New Zealand 2006).
- Reduced fat milks, cheeses and yoghurts are recommended, except among those with poor appetite, who have lost weight, or are medically advised otherwise.
- It is also essential for older people to ensure they drink plenty of water every day, due to the decline in total body water, renal function and thirst perception that occur with age (Truswell 2009).

Under-nutrition

In general, older adults consume a varied diet; however, some older adults may be at an increased risk of consuming diets of limited variety, due to ageing-related physiological changes and other factors, such as food insecurity. Additionally, food-related activities such as the ability to obtain and prepare nutritious food and eat independently, the availability of dietary assistance if required, an

appropriate meal environment and food presentation are themselves greatly affected by health status and functional abilities in older people (Payette and Shatenstein 2005).

Under-nutrition, due to inadequate protein and energy intakes, can impair immune function and wound healing, and increase the risk of falls and subsequent osteoporotic fractures in older adults. Inadequate protein and energy intake is one factor that may exacerbate sarcopenia. Under-nourished older people are not only at risk of increased mortality, but are at increased risk of frequent and prolonged hospitalisation, falls, respiratory and cardiac complications, infections, pressure-ulcers, immune dysfunction and delayed ulcer healing (Visvanathan 2003; Roberts et al. 2005). Optimal nutrition enhances the metabolic effect of resistance training (Sundell 2011).

The causes of under-nutrition are multi-factorial including being housebound, social isolation, dementia, stroke, Parkinson's disease, gait and balance disorders, poly-pharmacy, chronic pain, depression, swallowing disorders, fractured hip, and recent hospitalisation. Inadequate food intake can also result from a loss of appetite, reduced energy requirements that occur with the age-related changes in body composition, poor dentition, dysphagia, and reduced olfactory and gustatory functions (Chen et al. 2001; Elmadfa and Meyer 2008).

Although caloric needs are lower in older people, the demands for most vitamins, minerals and trace elements are not or only slightly reduced. Only iron needs are lower for women after the menopause, but remain the same for men. Ageing is also commonly associated with impaired absorption of certain micronutrients (Elmadfa and Meyer 2008). Key micronutrients of concern in older adults are:

- **Vitamin B-12:** Mild vitamin B-12 deficiency is common among older adults, with a reported prevalence of between 10% and 38% (Hoey, Strain et al. 2009). Deficiencies result from reduced absorption, generally caused by atrophic gastritis, an age-related condition resulting in hypochlorhydria. Severe vitamin B12 deficiency often manifests as colalamin deficiency anaemia, neuropathy and myelopathy (Stover 2010), and is also associated with a number of common age-related problems such as cognitive decline, cardiovascular disease, and bone fractures (Hoey, Strain et al. 2009). Vitamin B12 is only found in animal products.
- **Folate:** Some older adults have elevated blood concentrations of the metabolite homocysteine, which indicates subclinical deficiency of folate or vitamin B-12. Higher homocysteine concentrations are associated with increased risk of vascular disease (Koehler, Pareo-Tubbeh et al. 1997). Foods rich in folate include leafy greens, legumes, fortified grain products such as pasta, cereal and bread, and sunflower seeds.
- **Zinc:** Deficiencies in zinc are most likely to result from inadequate intakes, and can reduce wound healing and immune functions. Foods rich in zinc include animal products such as milk, meats, poultry, and eggs, but also nuts and legumes; although the bioavailability of zinc from these foods may be lower.
- **Calcium:** Deficiencies in calcium result from reduced absorption that occurs with age, as well as an increase in urinary calcium excretion in postmenopausal women (Commonwealth Department of Health and Ageing Australia and Ministry of Health New Zealand 2006).
- **Vitamin D:** The estimated worldwide prevalence of vitamin D deficiency in older adults is 50% (Lauretani, Maggio et al. 2010). Cutaneous synthesis of vitamin D (occurs in areas of skin exposed to sunlight) is reduced in older people which can lead to deficiency, particularly among the institutionalised elderly who receive limited exposure to sunlight (Commonwealth Department of Health and Ageing Australia and Ministry of Health New Zealand 2006). Dietary sources of vitamin D include edible oil spreads (margarines) which are fortified with vitamin D in Australia, as well as fatty fish (e.g. salmon, sardines, mackerel) and eggs.

Under-nutrition is common among hospitalised and rehabilitating older adults. Among community-dwelling older adults under-nutrition is highest in those living alone (especially men), those with a lower level of education and those on lower incomes (Whitney et al. 2011). The prevalence of under-nutrition (or malnutrition) among community-dwelling older Australians (≥65 years) who are receiving or eligible to receive community care services, has been reported as 5-8%, with 15-40% at risk, depending on the method for measuring risk (Leggo et al. 2008; Visvanathan 2009; Rist et al. 2012). For those at risk of underweight, the promotion of consumption of healthy snacks has been reported as a recommended source of calories for those aged 65 years and over (Zizza et al. 2007).

Food insecurity

Food insecurity may contribute to under-nutrition, over-nutrition or malnutrition (inappropriate nutrition) in older adults. Food insecurity refers to the ability to acquire appropriate and nutritious food on a regular and reliable basis (Vozoris and Tarasuk 2003; Seligman et al. 2007; Innes et al. 2010). Australian researchers have found that obesity is more prevalent among those who report being food insecure (Burns 2004; Innes et al. 2010). Food insecurity has also been associated with inadequate fruit and vegetable consumption and more frequent consumption of takeaway foods and soft drinks (Innes et al. 2010). This is consistent with other studies which show that inadequate access to appropriate and nutritious foods may lead to a higher consumption of calorie-dense and nutrient-poor foods, as these are often inexpensive and readily available (Burns 2004; Drewnowski and Specter 2004; Seligman et al. 2007).

Individuals from food-insufficient households also have significantly higher odds of reporting poor/fair health, of having poor functional health, restricted activity and multiple chronic conditions, of suffering from major depression and distress, and of having poor social support (Vozoris and Tarasuk 2003). In particular, food insecurity in older people exacerbates diseases, increases disability, delays recovery from illness (Frongillo and Horan 2004), and results in early institutionalisation, decreased productivity, low social interaction and increased social inequality (Lee and Frongillo 2001).

Factors associated with food insecurity in older adults include poor health, multiple chronic health conditions, non-couple households or living alone, limited mobility, limited financial resources, and a lack of social support or living in rural areas which may reduce access to healthy foods (Burns 2004; Frongillo and Horan 2004; Quine and Morrell 2006). Physical and economic access to culturally appropriate foods may also affect the ability of older people from different cultural backgrounds to access nutritious food of their choice (Radermacher et al. 2010).

Prevalence of food insecurity

A single item question about food insecurity is included in Australian national monitoring surveys "*In the last 12 months, were there any times that you ran out of food and couldn't afford to buy more?*" Using this question in NSW in 2009, young adults aged 25-34 years were most likely to report having experienced food insecurity in the previous 12 months (6.4%), compared with 2.3% of older adults aged 55+ years (Centre for Epidemiology and Research 2011). Using the same single item question, 2.8% of Australians aged 55 years and over reported experiencing food insecurity, compared with 7.2% of those aged under 55 years (Temple 2006). This single item food security question only addresses the financial aspect of food insecurity; hence, it may under-represent the actual level of food insecurity. For example, when using the validated 12-item *Food Security Hunger Measurement tool* (Radimer, Olson et al. 1992), Australian researchers found 13% of community-dwelling persons aged 50+ years had some level of food insecurity (Foran et al. 2003).

Dietary intake in Australian older adults

Overall

Flood et al (2010) assessed patterns of food and nutrient intake in a cohort of older Australians (49 years and over at baseline) in the 'Blue Mountains Eye Study' (BMES). In 1992-1994, 3654 people were examined; with 2334 being re-examined 5 years later and 1952 re-examined after 10 years. A 145-item food frequency questionnaire was used to assess food and nutrient intake on each occasion, and 1166 participants provided usable dietary data at all three examinations. Energy intake and sugar intake increased significantly among women over the 10-year period (P-value for trend <0.0001). Long-chain omega-3 fatty acid, fish intake and folate intake increased significantly and wholemeal/grain bread consumption decreased significantly in men and women. Many of the observed changes in diet over the 10-year period were consistent with current population dietary recommendations. However, some appear to have been due to poorer dietary choices (Flood et al. 2010).

Fruit

Fruit and vegetable consumption is strongly linked to the prevention of chronic disease and to better health (NHMRC 2003). Begg et al (2007) reported that inadequate fruit and vegetable consumption was estimated to be responsible for 2.1% of the total burden of disease in Australia in 2003, ranking seventh of 14 risk factors studied.

The 2011 NSW Population Health Survey found that 48.7% of males and 58.1% of females aged 65-74 years, and 44.6% and 57.9% of males and females aged 55-64 years, consumed the recommended two serves of fruit per day (Figure 17). In the *2007–08 NHS,* 37% of males and 33% of females aged 65 years did not meet recommendations for fruit intake (AIHW 2010a).
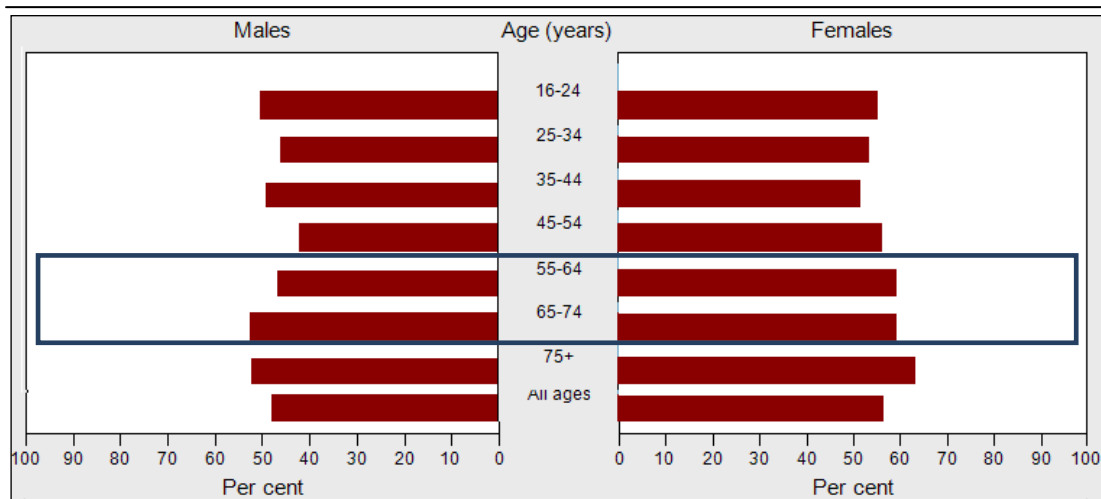
Figure 17 Proportion of adults consuming two or more serves of fruit a day by age, NSW, 2011

Between 1997 and 2009, there was a significant increase in the proportion of persons aged 55 to 74 years who ate the recommended two serves or more of fruit per day (53% to 62.5%). However, there has been a decline in consumption in recent years (Figure 18).
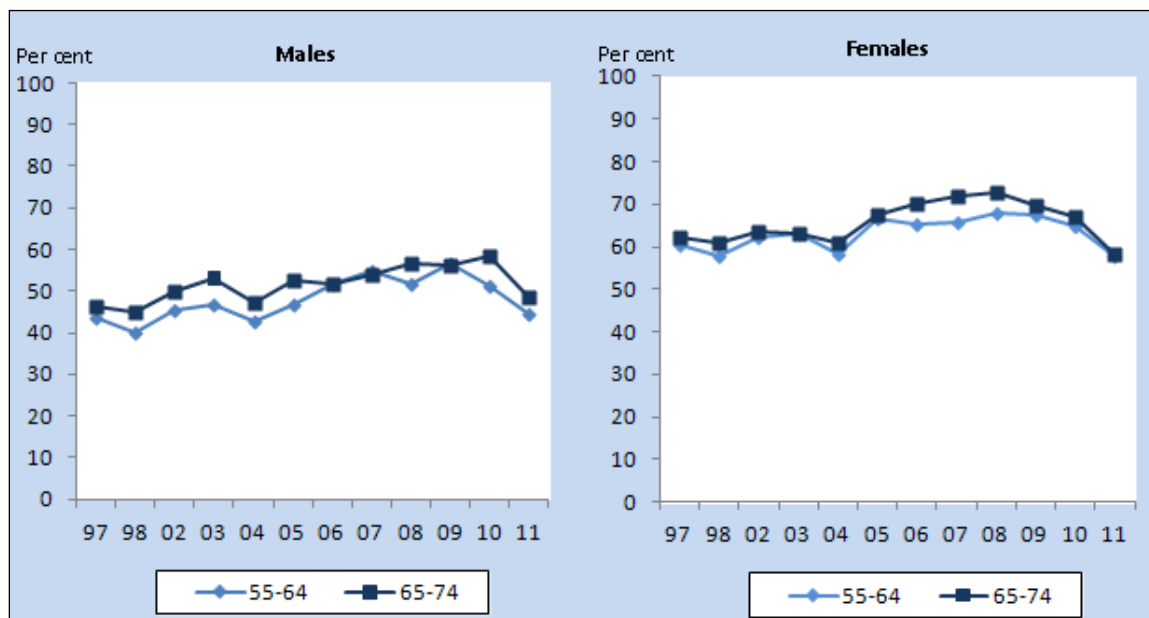
Figure 18 Trends in the prevalence of recommended fruit consumption by age, adults aged 55-74 years, NSW, 1997-2011

The increase in fruit consumption between 1997 and 2007 in adults aged 65 years and over was significant among those in the first or least disadvantaged quintile, and those in the third and fourth quintiles of disadvantage, but not among those in the most disadvantaged quintile (Figure 19) (Research 2008).
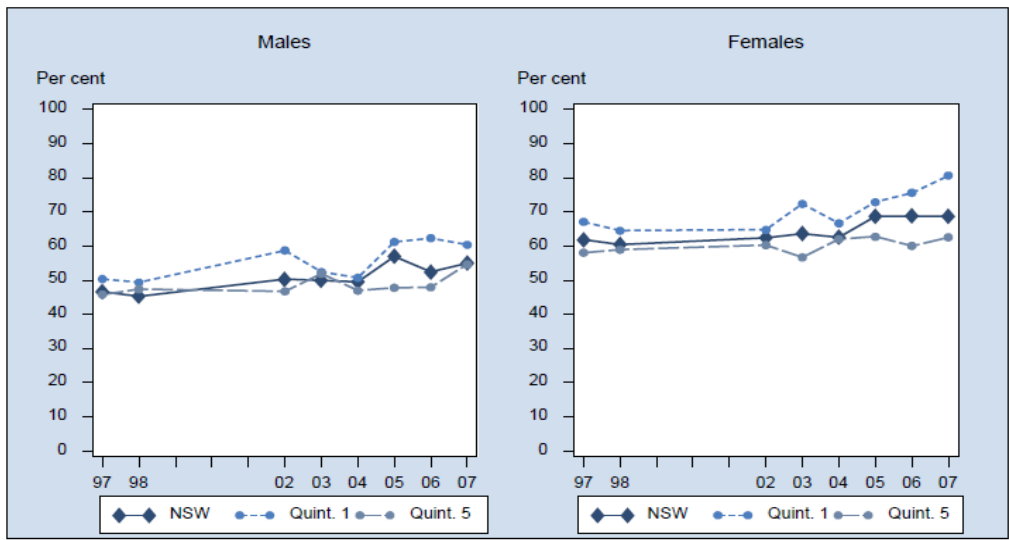
Source: NSW Adult Population Health Survey (SAPHaRI). Centre for Epidemiology and Evidence, NSW Ministry of Health

Figure 19 Trends in the prevalence of recommended fruit consumption by socioeconomic disadvantage, adults aged 65 years and over, NSW, 1997-2007

Vegetables

According to the *2011 NSW Population Health Survey*, only 7.5% and 9.5% of males and 17.8% and 15.3% of females aged 55-64 years and aged 65-74 years, respectively, consumed the recommended five or more serves of vegetables per day (Figure 20); although prevalence was higher than among younger age groups. National data from the *2007–08 NHS* indicate 12% of males and 13% of females aged 65 years or over meeting the recommended vegetables intake (AIHW 2010a).
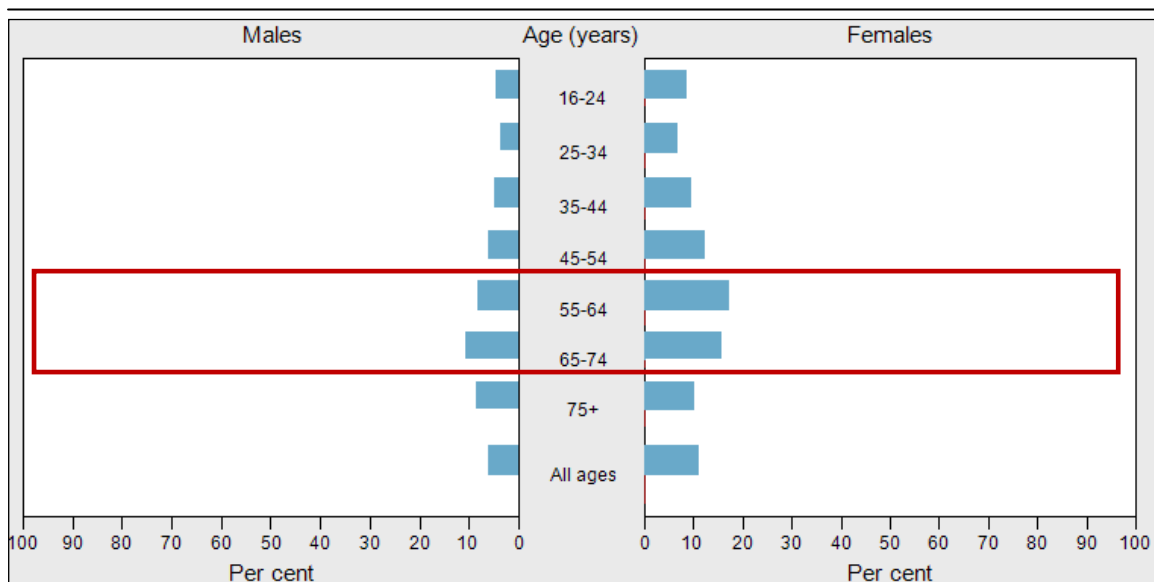
Source: NSW Adult Population Health Survey (SAPHaRI). Centre for Epidemiology and Evidence, NSW Ministry of Health

Figure 20 Proportion of adults consuming five or more serves of vegetables per day, by age, NSW, 2011

Between 1997 and 2011, there was a small increase in the proportion of persons aged 55 to 74 years who ate the recommended 5 serves or more of vegetables (11.0% to 12.5% in 2011). This increase was significant in females (12.5% to 16.5%), but among males consumption fluctuated from 7% to 11% (Figure 21).
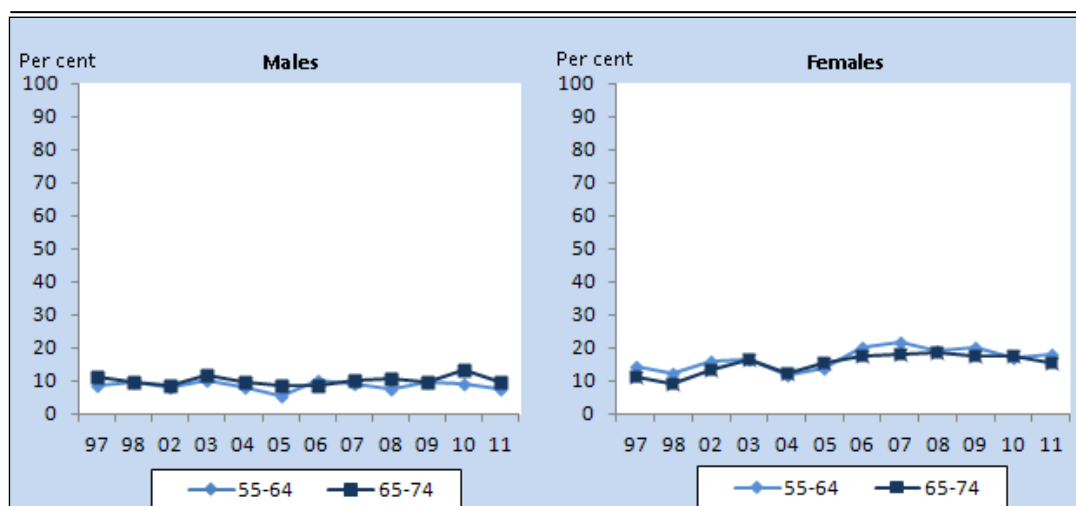
Figure 21 Trends in the prevalence of recommended vegetables consumption by age group, adults aged 55-74 years, NSW, 1997-2011

The increase in the proportion of older adults (aged 65 years and over) consuming five or more serves of vegetables per day was significant in the second quintile of disadvantage (6.9% to 14.1%) but not among the more disadvantaged groups, and also significantly increased between survey years among those in the urban health areas (9.0% to 12.4%) and rural health areas (11.4% to 14.8%) (Centre for Edpidemiology and Research 2008a).

Dairy products

Dairy products provide an important source of protein, energy and calcium for older adults. It is recommended that persons aged 60+ years require two to three serves of dairy products every day, where one serve is equivalent to 250mLs of milk, 200g of yoghurt, or 40g of cheese (Smith et al. 1998). Findings from the Blue Mountains Eye Study indicated a non-significant increase in total dairy products consumed by women, although there was a significant increase in yoghurt consumption in men and women from 1992-1994 (Flood, Burlutsky et al. 2010). There was a significant reduction in whole-milk intake, but no change in the consumption of reduced fat milk.

Data from the *NSW Population Health Survey* show that, between 1997 and 2007, there was no significant change in the proportion of persons aged 65 years and over who usually drank lower or reduced fat milk. However, there was a significant decrease among persons in the fifth or most disadvantaged quintile (Figure 22), and among those residing in urban health areas; this contrasts with a significant increase in consumption among those in rural health areas (Centre for Epidemiology and Research 2008a).
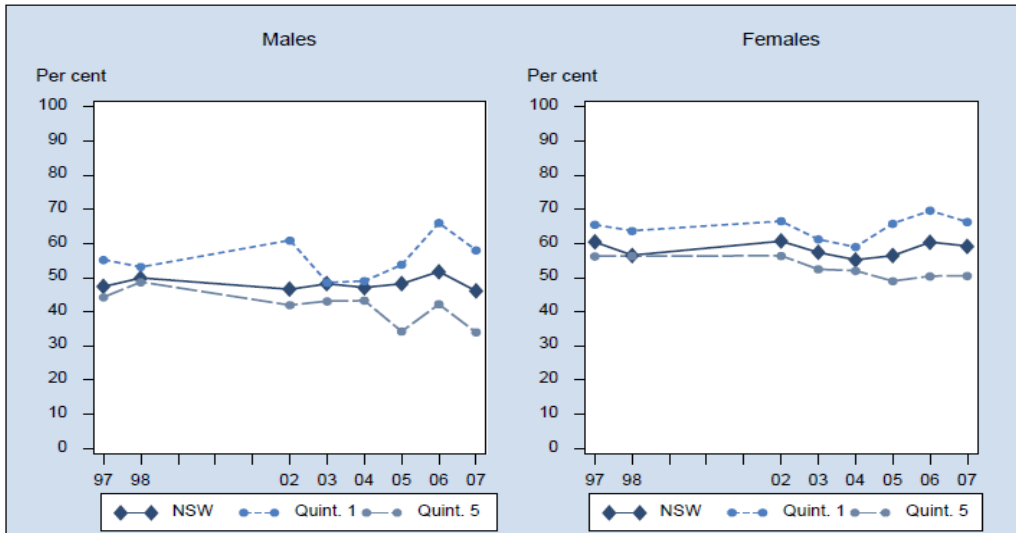
Source: NSW Adult Population Health Survey (SAPHaRI). Centre for Epidemiology and Evidence, NSW Ministry of Health

Figure 22 Trends in the usual use of lower fat milks by socioeconomic disadvantage, adults aged 65 years and over, NSW, 1997-2007

Bread and cereals consumption

Bread and cereal foods are an important source of energy, dietary fibre and B-group vitamins. It was considered in 1998 that men and women aged 60+ years required approximately 4-6 serves and 3-5 serves of bread and cereal foods daily (Smith A et al. 1998); however, the recommended amounts are likely to be lower in the revised dietary guidelines in Australia. Between 2002 and 2007 there was no significant change in the proportion of persons aged 65 years and over who ate breakfast cereal, breads, pasta, rice, or noodles once a day or more. However, there was a significant decrease among persons in the first or least disadvantaged quintile (99.5% to 96.9%) and third quintile (99.4% to 97.2%), and among persons in the rural health areas (99.0% to 97.7%) (Centre for Epidemiology and Research 2008a) (Figure 23).
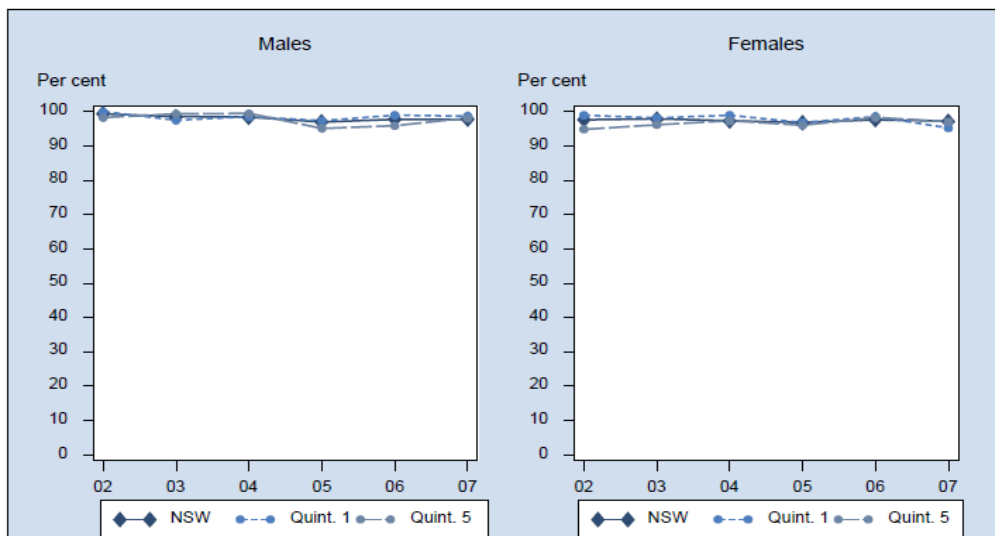
Source: NSW Adult Population Health Survey (SAPHaRI). Centre for Epidemiology and Evidence, NSW Ministry of Health

Figure 23 Trends in the proportion of people eating breads and cereals once a day or more by socioeconomic disadvantage, adults aged 65 years and over, NSW, 2002-2007

Processed meat products consumption

Processed meats (such as devon, chicken loaf or frankfurters) are often higher in sodium compared with fresh meats, and their consumption may increase the risk of colorectal cancer (Cancer Council Australia October 2007, updated July 2009). Therefore, it has been recommended to choose fresh meats rather than processed meats (Smith A et al. 1998). Figure 24 shows that between 1997 and 2007, there was no significant change in the proportion of persons aged 65 years and over who ate processed meat products less than three times a week (prevalence was already high) (Centre for Epidemiology and Research 2008a).
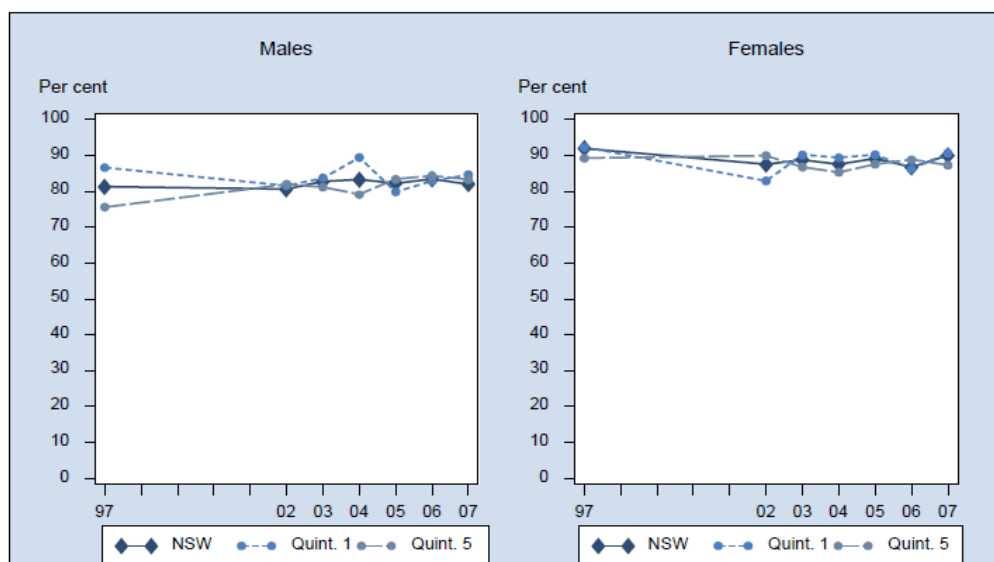
Source: NSW Adult Population Health Survey (SAPHaRI). Centre for Epidemiology and Evidence, NSW Ministry of Health

Figure 24 Trends in the proportion of people eating processed meat products less than 3 times a week by socioeconomic disadvantage, adults aged 65 years and over, NSW, 1997-2007

Potato crisps or salty snacks consumption

Non-core or 'extra' foods, such as potato crisps or salty snacks, should only be consumed sometimes in small amounts, or not at all, as they are not a good source of essential nutrients and often contain too much fat, salt or sugar (Smith A et al. 1998). Older adults (55+ years) are more likely to report never or rarely consuming potato crisps or salty snacks (71%), compared with those aged 18-54 years (36%) (Centre for Epidemiology and Research). Between 2005 and 2007, there was no significant change in the proportion of persons aged 65 years and over who ate potato crisps or salty snacks less than once a month (Centre for Epidemiology and Research 2008a). Figure 25 shows the proportion of older adults who eat potato chips or salty snacks less than once a month by level of socioeconomic disadvantage.

Fast food consumption

Fast food consumption is more frequent among younger adults than older adults. According to data from the *2007 NSW Adult Population Health Survey*, 12% of persons aged 55+ years reported consuming fast food once or more times per week compared with 48% of persons aged 35-54 years, and 74% of those aged 18-34 years (Centre for Epidemiology and Research). Data from the ABS show that age pensioner households spend a much higher proportion of their budget on tea, coffee, meat (including beef, lamb, pork) and eggs, but spend much less on soft drinks and fast food (ABS 2007).
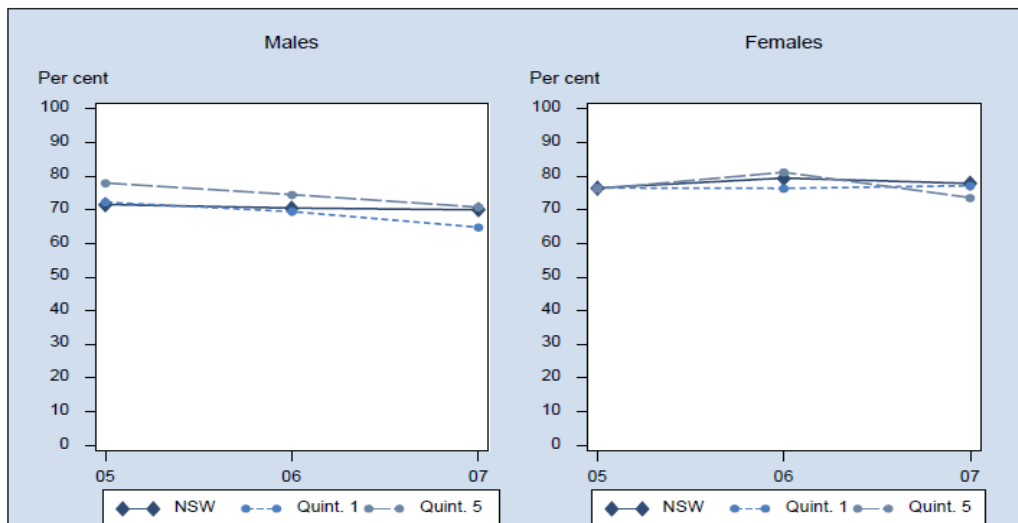
Figure 25 Proportion of people eating potato crisps or salty snacks less than once a month by socioeconomic disadvantage, adults aged 65 years and over, NSW, 2005-2007

SUMMARY STATEMENT - Dietary intake among older adults in NSW (NSW 2010)

Fruit intake: 48.6% and 35.0% of males and females aged 55-64 years and 41.6% of males and 33% of females aged 65-74 years consumed less than the recommended ≥2+ serves fruit/day.

Vegetables intake: 9.2% and 13.0% of males and 16.7% and 17.9% of females aged 55-64 years and aged 65-74 years, respectively, consumed the recommended ≥5 serves vegetables/day

Reduced fat milk: Approximately 50% of males and 60% of females drink low or reduced fat milk

Fast Food: In NSW 12% of persons aged 55+ years reported consuming fast food once or more times per week compared with 48% of persons aged 35-54 years, and 74% of those aged 18-34 years.

2.3.5 Physical activity

Benefits of physical activity among older adults

Physical activity is an important factor in maintaining good overall health and wellbeing across the life course, including in older age. The considerable role physical activity plays in the prevention and management of chronic disease is summarised in a table in Appendix A (Table A1; Chodzko-Zaiko et al 2009). A large cohort study in the US followed up 5973 healthy men (mean age= 65 years) from 1988 to 1998 and found those with lesser levels of physical activity were more likely to gain weight than men meeting the guidelines of approximately 60 min day of moderate-intensity physical activity (Shiroma et al. 2012).

Regular physical activity has a number of benefits beyond maintenance of a healthy metabolic profile and healthy weight status, and that are particularly important for older adults. It can slow the decline in functional capacity and cognition, improve mobility and independence, and benefit

areas of mental health such as social interaction and overall well-being (Macmillan et al. 2011). Moreover, higher levels of aerobic physical activity have been associated with increased longevity, reduced pain from arthritis, reduced risk of falls and fractures, reduced risk limitation and disability (Paterson and Warburton 2010; Bruce et al. 2002). Participation in 'self-selected exercise' activities, such as walking for exercise, aerobic dance, weight lifting, golfing, jogging or swimming, may delay the progression and onset of frailty (defined as slow gait or difficulty rising with arms folded) (Peterson et al. 2009).

A broad range of physical activity options can improve health outcomes for older people, both in the short and medium-term (Sims, Hill et al. 2006):

- Endurance and strength training activities can be used to prevent and treat congestive heart failure, depression, diabetes, osteoporosis and other conditions affecting older people
- Progressive resistance training can slow and even reverse age and disease-related loss of muscle mass and function
- Activities involving balance can improve stability and reduce risk of falls.

Sundell (2011) indicates that resistance training, in particular, has beneficial effects on the musculoskeletal system and a favourable effect on metabolic syndrome since, it decreases fat mass including abdominal fat. It also enhances insulin sensitivity, improves glucose tolerance and reduces blood pressure values; and can maintain or even increase bone mineral density. Indeed, Sundell (2011) considers that resistance training is probably the most effective measure to prevent and treat sarcopenia. Optimal nutrition enhances the anabolic effect of resistance training.

National Physical Activity Guidelines for older people

Australian physical activity guidelines for older people

The first Physical Activity Recommendations for Older Australians were developed in reference to the existing National Physical Activity Guidelines for Adults to reflect the heterogeneity of the older population (aged 65 years and over) in terms of physical capacity, activity patterns and cultural diversity (Elliot 2009). In Australia, it is recommended that older adults:

- Should do some form of physical activity – no matter what their age, weight, health problems or abilities
- Should accumulate at least 30 minutes of moderate intensity physical activity on most, preferably all, days
- Should be active every day in as many ways as possible, doing a range of physical activities that incorporate fitness, strength, balance and flexibility, and
- Those who have stopped physical activity, or who are starting a new physical activity, should start at a level that is easily manageable and gradually build up the recommended amount, type and frequency of activity.

National Physical Activity Guidelines – United States

The Position Stand of the American College of Sports Medicine and the American Heart Association (Nelson et al 2007; Chodzko-Zaiko et al 2009) is summarised in Table A2 (Appendix 1). In summary, physical activity in older adults (aged 65 years and older) should be the same as for all adults, i.e. a minimum of 30 minutes moderate intensity physical activity five days per week OR vigorous activity for 20 minutes three times per week; plus muscle-strengthening activity; however, the recommended intensity of aerobic activity needs to take into account the older adult's aerobic

fitness; activities that maintain or increase flexibility are recommended and balance exercises are recommended for older adults at risk of falls. In addition, older adults should have an activity plan for achieving recommended physical activity that integrates preventive and therapeutic recommendations:

- a combination of aerobic exercise training (AET) and resistance exercise training (RET) activities seems to be more effective than either form of training alone in counteracting the detrimental effects of a sedentary lifestyle on the health and functioning of the cardiovascular system and skeletal muscles
- although there are clear fitness, metabolic, and performance benefits associated with higher-intensity exercise training programs in healthy older adults, it is now evident that such programs do not need to be of high intensity to reduce the risks of developing chronic cardiovascular and metabolic disease
- exercise prescription for older adults should include aerobic exercise, muscle strengthening exercises, and flexibility exercises. In addition, individuals who are at risk for falling or mobility impairment should also perform specific exercises to improve balance in addition to the other components of health-related physical fitness.

SUMMARY STATEMENT - Physical activity, health and older adults

Being physically active in older age has significant cardiovascular and metabolic health benefits, and also helps to control weight and combat chronic disease.

A range of physical activity options can improve a broader range of health outcomes for older people, in the short and medium-term:
- Endurance and strength training activities can be used to prevent and treat congestive heart failure, depression, diabetes, osteoporosis, osteoarthritis, and other conditions affecting older people
- Progressive resistance training can slow and even reverse age and disease-related loss of muscle mass and function
- Activities involving balance can improve stability and reduce risk of falls
- Physical activity generally results in improved health-related quality of life and overall quality of life

Prevalence of physical activity in the older population

Research indicates that physical activity among older adults tends to decrease with age, and older women tend to be less physically active than older men (NARI2003; NARI 2010).

Results from the 1999 National Physical Activity Survey indicated that 51% of men and 37% of women aged between 60 and 75 years were classified as sufficiently active to attain the health benefits associated with physical activity (Armstrong, Bauman et al. 2000). Data from the *2011 NSW Population Health Survey* indicated that 54.2% of men and 44.2% of women aged 55-74 in NSW, undertook sufficient physical activity (Figure 26).
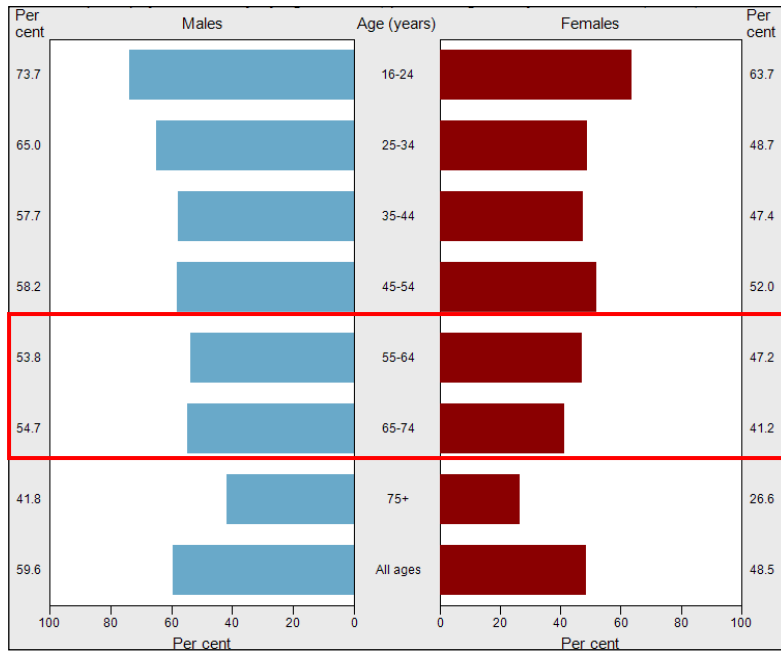
Figure 26 Proportion of adults undertaking sufficient physical activity by age, NSW, 2011

There was a significant increase in the proportion of persons in NSW aged 55 to 64 years (43.1% to 50.5%) and those aged 65 to 74 years (40.1% to 48%) who undertook adequate levels of physical activity – defined as 150 minutes of moderate activity a week over 5 separate occasions – in NSW between 1998 and 2011 (Figure 27). This significant increase was observed for males and females, in all quintiles of socioeconomic disadvantage, except the second and third, and in all geographical regions except remote/very remote (Centre for Epidemiology and Research 2008b).
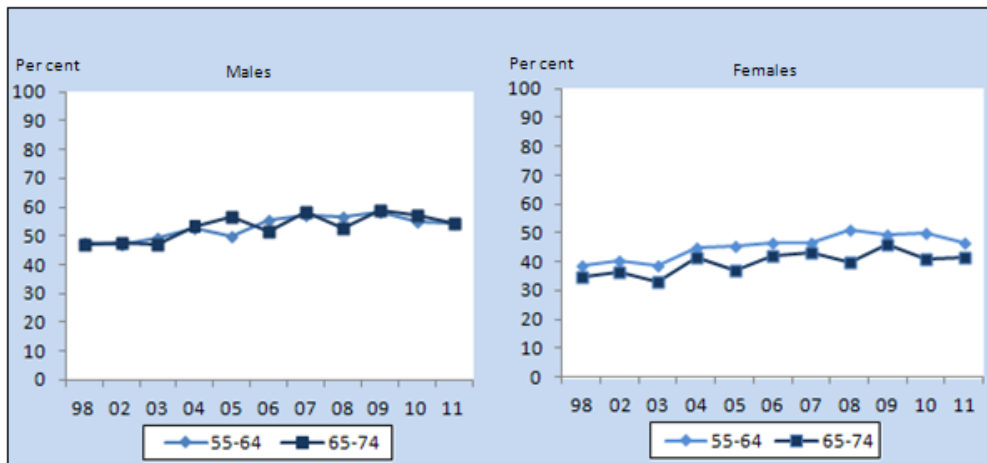
Figure 27 Trends in the proportion of people undertaking adequate physical activity by year and sex, adults aged 55-74 years, NSW, 1998-2011

NSW adults aged 45 years and over in the 5th quintile (most disadvantaged) were less likely to meet physical activity recommendations compared to those in the 1st quintile of disadvantage (Figure 28).
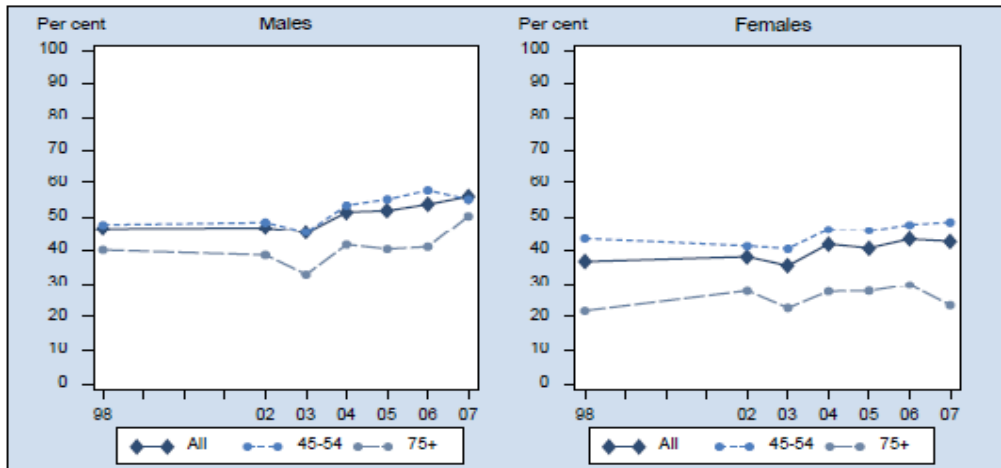
Figure 28 Trends in the proportion of people undertaking adequate physical activity by socioeconomic disadvantage, adults aged 45 years and over, NSW, 1998-2007

The Exercise Recreation and Sport Surveys (ERASS) are independent cross-sectional national surveys that monitor population participation in sports and recreational activities. Data from 2001-2009 indicated that among adults aged ≥65 years:

- 32%, did not take part in any sport or recreational activity over an entire year
- 41% engaged in one activity, 19.5% in two activities and 8% in three or more activities
- walking was reported by 45.6% and, of those people, 53% engaged exclusively in walking
- 52.9% participated in aerobic activities such as walking, running, golf, swimming, cycling, rowing, racket sports
- 14.5% participated in any muscle training workouts
- 4.4% participated in any of the balance and flexibility enhancing activities as Tai Chi, dance and yoga
- 2.6% of older adults reported a combination of aerobic, balance and strength activities
- the likelihood of being a multiple-activity participant decreased by age 70 and continued to decline for every age decade.

Gardening is the second most frequent type of reported physical activity after walking among older adults (Yusuf et al. 1996; Ashe et al. 2009). Several studies measured the intensity of energy expenditure of four self-paced household and garden tasks (sweeping, window cleaning, vacuuming and lawn mowing) in a sample of 55- to 65-year-old Australian men and women and found that these more vigorous home-based household/garden activities were performed at sufficient intensity (greater than the 3.0 MET) to contribute to the 150 min of moderate intensity exercise per week required to confer health benefits (Withers et al. 2006; Gunn et al. 2005). Therefore, older adults who perform moderate-intensity gardening tasks are more likely to meet physical activity recommendations than those who don't have the opportunity to engage in these activities.

A study examining the independent effects of age, birth cohort and period of study on Leisure Time Physical Activity (LTPA) found that participation in any LTPA decreased until middle age with some increase at retirement age, 60–70 years, before declining again. After 60–70 years of age the time spent and volume of PA was similar between males and females. Males showed two shifts: a decline from 20 to 40 years and then an increase from 60 years until 70 years. Females showed an increase in LTPA with age, becoming more prominent after 50 years and then declining from 70 years

(Allman-Farinelli et al. 2009). Among those who participated in LTPA, the energy expenditure decreased with age in males, but increased in females.

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SUMMARY STATEMENT - Physical activity participation among older adults in NSW

In 1999, 51% of men and 37% of women aged between 60 and 75 years in Australia were classified as sufficiently active to attain the health benefits associated with physical activity. Data from the *2011 NSW Population Health Survey* indicate that 54.2% of men and 44.2% of women aged 55-74 in NSW, undertook sufficient physical activity.

Data from *2001-2009 ERASS surveys* indicated that among adults aged ≥65 years:
- 32% do not adults did not take part in any sport or recreational activity over an entire year
- 41% engaged in 1 activity, 19.5% in 2 activities and 8.0% in 3 or more activities
- 14.5% engaged in muscle training; 4.4% engaged in balance and flexibility-enhancing activities; and 2.6 reported a combination of aerobic, balance and strength exercises.

Participation in any leisure-time physical activity (LTPA) decreases until middle age; there is some increase at retirement age (60–70 years) before declining again in the elderly.

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2.3.6 Sedentary behaviour

Overall sedentary behaviour

Sedentary behaviour (e.g. sitting, TV viewing, driving a car) refers to low energy expenditure behaviours (1.0 to 1.5 Metabolic Equivalent Tasks (METs), with 1 MET being energy expenditure at rest) and is distinct from physical inactivity, often conceptualised as a lack of moderate-to-vigorous physical activity (MVPA) (Pate et al. 2008).

Time spent being sedentary is linked to increased mortality and morbidity and this is independent of level of physical activity. In Australia, findings from the Health in Men Study and the Australian Longitudinal Study of Women's Health showed that for older adults aged 70-75 years being sedentary doubled the mortality risk for women across all levels of BMI (HR=2.08; 95% CI=1.79-2.41) and a 28% greater risk for men (HR=1.28; 95% CI=1.14-1.44) (Flicker et al. 2010). In addition, Van der Ploeg et al (2012) linked data from the *45 and Up Study* to mortality data from 2006-2010 in NSW, and showed that prolonged sitting was significantly associated with higher all-cause mortality risk independent of physical activity (van der Ploeg et al. 2012). Other studies have found associations between the amount of daily sitting time and mortality rates, in particular for cardiovascular disease (Patel et al. 2010; Katzmarzyk et al. 2009; Dunstan et al. 2010).

The amount of time spent in sedentary activities per day and the amount of time spent sitting also have important metabolic consequences that may influence specific biomarkers of obesity, cardiovascular and other chronic diseases, regardless of physical activity level (Gardiner et al. 2011; Bowman 2006; Matthews et al. 2012; Thorp et al. 2010). In addition to being associated with a greater risk of the metabolic syndrome, high sedentary behaviour is associated with larger waist circumference, high triglyceride and fasting glucose levels, and lower high-density lipoprotein cholesterol (HDL-C) levels (Thorp et al. 2010).

Less sedentary time also results in an overall improved quality of life among older adults. For example, a prospective cohort study of nearly 1100 community-dwelling older adults aged 62 years and over in Spain found that the number of sitting hours showed a gradual and inverse relation with the score on the scales of physical functioning, physical role, bodily pain, vitality, social functioning

and mental health. Quality of life can be effectively improved by the replacement of leisure-time sedentary behaviour (LTSB) by physical activity of light intensity such as walking, dancing, and gardening (Balboa-Castillo et al. 2011). Retirement might be a window of opportunity for interventions to prevent and reduce sedentary time. Because some older people have difficulty in adopting and maintaining MVPA, reducing sedentary behaviour and increasing light-intensity activity may be an effective and practical strategy to achieve health benefits in this age group (Inoue et al. 2012). Interventions not only need to emphasise a reduction on time spent viewing television or videos, or participating in similar sedentary activities, but also to discourage snacking or eating while watching television (Bowman 2006).

Therefore, high sedentary behaviour needs to be considered as a separate health risk from lack of physical activity; especially for older adults whose health or physical functioning limits their participation in moderate intensity physical activity (Gardiner et al. 2011).

Television viewing time

Television viewing time is a good marker of overall sedentary time, especially in women (Sugiyama et al. 2008). Prolonged television viewing has been specifically associated with mortality from cardiovascular disease and cancer (Matthews et al. 2012), and has been shown to elevate the risk of overweight/obesity among the elderly population, especially among those not working (Inoue et al. 2012). Additionally, high levels of television viewing time have been associated with greater risk of the metabolic syndrome, although in women only (Gardiner et al. 2011).

Findings from *The Australian Diabetes, Obesity and Lifestyle Study (AusDiab),* indicate that, regardless of leisure-time exercise levels and adiposity status, there is a progressive rise in mortality risk for each 1-hour increment in television viewing; 11% and 18% increased risk of all-cause and CVD mortality, respectively (Dunstan et al. 2010). Data from the *45 and Up Study* involving 91 266 men and women from NSW, Australia, in 2006-2007, showed that obesity increases with increasing screen time, independently of purposeful physical activity. Compared to individuals with <2h daily screen-time, the adjusted relative risks (RR) for obesity were 1.35 (95% CI 1.26, 1.44), 1.70 (95% CI 1.59, 1.82), 1.94 (95% CI 1.81, 2.08) and 1.92 (95% CI 1.80, 2.06) for 2–3, 4–5, 6–7 and 8 hours of screen time, respectively. This effect, although prevalent across all population groups examined, was higher among full-time workers and disabled individuals (Banks et al. 2010).

Potential mechanisms for the relationship between television viewing time and health outcomes include reduced energy expenditure, increased caloric intake, reduction in time spent in cognitively and physically challenging activities, and negative influence of TV content on health-related attitudes (Bowman 2006; Depp et al. 2010). The direction of causality is likely to be bi-directional. More TV viewing and sitting lead to poorer health; but, also, poorer health is associated with higher TV viewing and sitting. For example, data from the Continuing Survey of Food Intakes by Individuals 1994–1996 in the US showed that the profile of adults watching more than two hours of television per day included those aged 50 or older, retirees or unemployed, low household income, low level of education, being overweight, and suffering health conditions such as diabetes, hypertension, heart disease, or high blood cholesterol.

SUMMARY STATEMENT - Sedentary behaviour, health and older adults

The amount of time spent in sedentary activity per day has important metabolic consequences that may influence specific biomarkers of chronic disease, regardless of physical activity level

More TV viewing and sitting leads to poorer health; but also poorer health is associated with higher TV viewing and sitting

Prevalence of sedentary behaviours in older Australians

Findings from the *1999 National Physical Activity Survey* indicated that 18% of Australians aged 60 to 75 years were sedentary, i.e. reported no participation in physical activity (Armstrong et al. 2000).

Data from the *2004-2005 NHS* showed that the proportion of adults aged 75 years and above who were sedentary increased from 1995 to 2004-2005 (Table 10). Among 65-74 year olds, the prevalence of sedentary behaviour in 2004-2005 was 31.9% for men and 40.5% for women (ABS 2006).

Table 10 Prevalence of sedentary behaviour in older adults, Australia, 1995 - 2005

	Men (%)		Women (%)	
	65-74 years	75 and over	65-74 years	75 and over
2004-200**5**	31.9	51.5	40.5	58.6
2001	30.9	44.0	38.8	55.9
1995	35.6	44.9	43.7	54.0

Source: (ABS 2006)

The *2007-08 NHS* found that men aged 65 and over reported spending more time on audio/visual media per day (three hours and 31 minutes compared with two hours 53 minutes for older women), but reported spending less time per day on games, hobbies, arts and crafts than women (15 minutes compared to 26 minutes)(ABS 2008d). Similarly, the *Health in Men Study* and the *Australian Longitudinal Study of Women's Health* reported that among those older adults aged 70-75 years, women were less likely than men to report being sedentary (18.1% of women vs. 24.9% of men) (Flicker et al. 2010).

Self-reported data from the *New South Wales Falls Prevention Baseline Survey 2009* showed that 46.1% of males and 40% of females aged 65 years and over usually spent more than 4 hours per day sitting on a weekday, and 9.5% of older adults living in NSW reported that they usually spent 7 to 8 hours sitting on a weekday. These data also indicated a positive association between experiencing a fall in the last 12 months and prolonged sitting time. Nearly 12% of older adults who had fallen usually sat for more than 6 hours a day on weekdays, compared to 7.7% of older adults who had not fallen (Centre for Health Advancement and Centre for Epidemiology and Research 2010) (Figure 29).
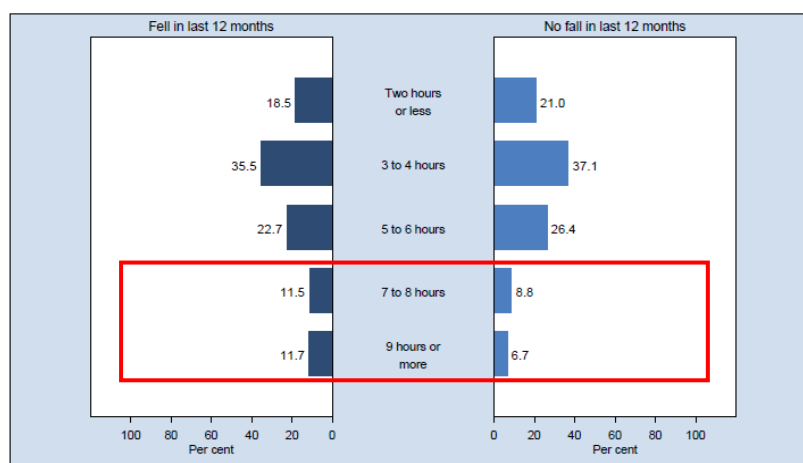
Source: (Centre for Research Advancement and Centre for Epidemiology and Research 2010).

Figure 29 Minutes usually spent sitting on a weekday, by history of falling, adults aged 65 years and over, NSW, 2009

A nationally representative study of American adults who completed a diary-based measure of activity reported that adults aged 65 years and over spent threefold more waking time watching TV than their younger counterparts. Some practical reasons why older adults may watch more TV than younger people are that older adults have more leisure time due to retirement, and that watching TV is an easy leisure activity, especially in the presence of barriers to participate in other leisure activities, including exercise. Although older adults watched more TV, they enjoyed it less. In contrast, non-TV leisure activities such as reading, socialising, hobbies and relaxing, were associated with greater happiness and lower ratings of perceived stress, which were not related to age (Depp et al. 2010).

Additionally, the *Physical Activity in Localities and Community Environments* (PLACE) study, reported an association of neighbourhood walkability with TV viewing in a large sample of Australian adults (mean age = 44 years) living in urban areas of Adelaide (Sugiyama et al. 2007). Walkability was a significant predictor of women's TV watching time, but not for men. Women living in medium- and high-walkable areas were found to spend significantly less time watching TV compared to those living in low-walkable areas. Gender differences indicate that for women, TV watching time appears to be associated with environmental and behavioural factors, while for men, TV time is independent of these factors.

SUMMARY STATEMENT - Prevalence of sedentary behaviour among older adults

Data from the *2004-2005 NHS* showed that the prevalence of sedentary behaviour in 2004-2005 was 31.9% for men and 40.5% for women aged 65-74 year olds

TV watching is common among older Australians

Overall, women were less likely than men to report being sedentary

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3 UNDERLYING FACTORS CONTRIBUTING TO POOR LIFESTYLE BEHAVIOURS, OBESITY AND CHRONIC DISEASE RISK IN OLDER ADULTS

A structured approach for intervention planning involves analysis of factors contributing to the health problem, and assessing the extent to which these factors are amenable to intervention. Figure 30 presents a conceptual framework describing the determinants and factors contributing to a higher risk of unhealthy lifestyle behaviours, which underpin the risk of unhealthy weight status, metabolic risk factors and chronic disease, in older adults. The framework proposes three types of underlying factors: individual-level, community-level and societal-level.
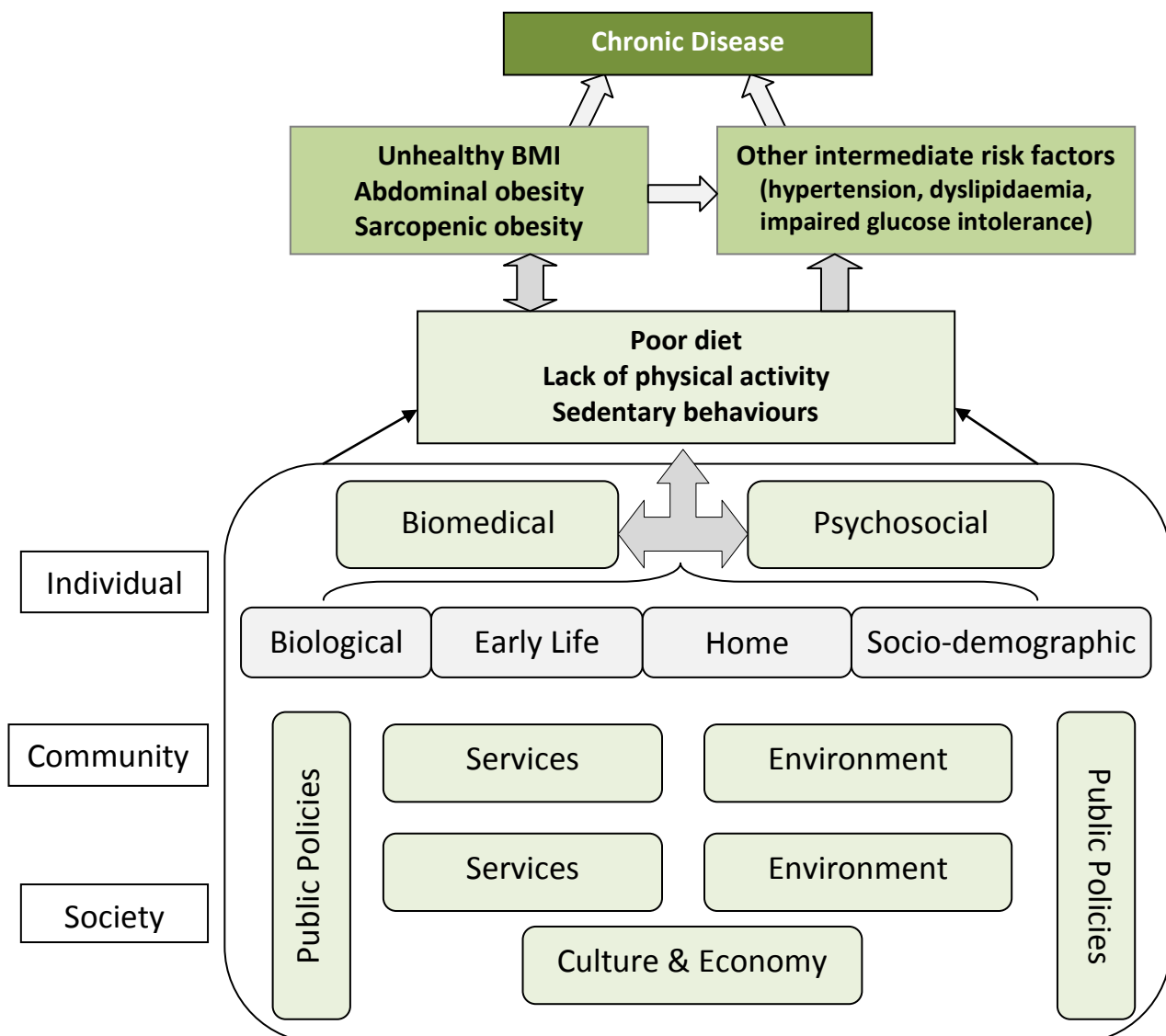
Figure 30 Framework of factors contributing to chronic disease risk in older adults aged 55-74 years

Many of the individual contributing factors are linked with, and may be exacerbated by, community and societal factors. Alternatively, and importantly, interventions at community and society levels can result in changes to policies, services and environments, and these can in turn influence, and in

some cases address, individual factors. The biological, early life, home and socio-demographic factors are largely non-modifiable once adults have reached older age. However, they broadly affect the biomedical and psychosocial factors that influence maintenance of a healthy lifestyle among older persons. The non-modifiable individual-level factors can, however, be influenced through supportive community and societal physical environments and services, themselves underpinned by healthy public policy.

Importantly, an unhealthy weight, abdominal obesity and sarcopenic obesity can be bidirectionally linked to an unhealthy diet, low physical activity and high sedentary behaviour, such that being obese or having abdominal obesity can affect access to a healthy diet and participation in physical activity (largely via impairment of functional capacity), as well as unhealthy lifestyle behaviours leading to an unhealthy weight, abdominal obesity or sarcopenic obesity; whereas the link between lifestyle behaviours and metabolic risk factors for chronic disease (hypertension, dyslipidemia and impaired glucose tolerance) is unidirectional.

The factors summarised by this conceptual framework are listed in Table 11, and are discussed in the remainder of this chapter.

3.1   INDIVIDUAL FACTORS

3.1.1 Biological

Genetic factors can contribute to diseases in multiple ways (Andrews 2001). Family history usually reflects the combined effects of genetic susceptibility, shared environmental exposures and common behaviours among relatives. Family history has been shown to be a risk factor for the majority of chronic diseases, including cardiovascular disease, diabetes, several cancers (breast, ovarian, colorectal, prostate, and lung), osteoporosis, asthma and mental illness (Emery et al. 2010). Family history of a common chronic disease is associated with a 2–5 fold relative risk of developing the condition, and increases with the number of affected relatives and early age of onset (Yoon et al. 2002). For example, parental history of type 2 diabetes is associated with a relative risk of 2.2 and a lifetime risk of 40% (Emery et al. 2010). Evidence suggests that family history is most useful for predicting disease when there are multiple family members affected, the relationship among relatives is close, and disease occurs at a young age (Yoon et al. 2002).

The prevalence of chronic disease also varies by ethnicity. Indigenous peoples, such as Aboriginal and Torres Strait Islander peoples in Australia, have much higher rates of chronic disease and mortality, and greater exposure to risk factors than other Australians. For instance, self-reported diabetes was almost four times as high as for other Australians (AIHW 2003). Genetic factors are considered to influence higher rates of diabetes in Aboriginal populations; as well, the rapid transition from a traditional to a 'western diet' is considered to make Indigenous peoples more susceptible to the effects of an obesogenic and diabetogenic environment (O'Dea et al 1988; O'Dea 1991; Blyton 2009).

Table 11 Factors contributing to increased risk of poor lifestyle behaviours, obesity and chronic disease risk in older people

INDIVIDUAL	
Biomedical	**Cognitive and Psychosocial**
• Ill-health • Mental health issues (i.e. depression, dementia) • Menopause • Loss of cognition • Disability • Functional limitations • Poor appetite and digestibility issues	• Low health awareness/literacy/knowledge of nutrition/PA/SB benefits/risks • Food/physical activity attitudes and beliefs • Low confidence and self-efficacy (e.g. food preparation, physical activities, fear of falls and injury/previous fall or injury) • Resistance to change; focus on routine; lack of motivation • Loss of sense of accomplishment and identity • Lack of family support/interaction • Lack of friends (social isolation)
Home living environment	**Socio-demographic**
• Living alone • Caring for a family member (parent, partner, grandchildren) • Limited/no access to private transport • Lack of housing security (renting) • Poor cooking and food preparation facilities • No garden • No dog ownership • Increased leisure time*	• Low education level • Low disposable income • Living in rural or remote areas • Sedentary occupation • Non-sedentary pre-retirement occupation • Change in employment status (recently retired/early retirement)
Biological	**Early life**
• Gender* • Genetics/family history of chronic disease/ ethnicity/race/Aboriginal status • Cultural background*	• Poor foetal development • Slow or retarded growth in infancy • Childhood nutrition and physical activity home environment • Abuse and neglect during childhood

COMMUNITY (neighbourhood/workplaces)	
Services	**Environment**
• Limited community networks • Costs of community activities • Lack of recreation and exercise services/ facilities • Limited access to local services/facilities • Low availability of public transport • Low accessibility to public transport	• Lack of supermarket(s) within walking distance • Low availability of affordable, healthy food outlets • Low neighbourhood walkability • Unsafe neighbourhood (real or perceived) • Low residential density (of older adults)

SOCIETY	
Services	**Culture and economy**
• Lack of health services to support lifestyle behaviour modification • Low availability of and accessibility to allied health professionals • Lack of health check at retirement	• Negative cultural perceptions and norms towards older persons • Lack of workplace flexibility • Limitation of social welfare and related systems • Limitation of health insurance systems
Environment	
• Lack of built infrastructure and services specifically designed for older people	

* Direction of association varies

Patterns of chronic disease and their consequences differ for women and men. For example, women are more likely than men to have arthritis, which leads to higher rates of disability. Women usually develop heart disease about ten years later than men, but women are more likely to experience depression or have multiple chronic conditions than men. Older men have higher rates of diabetes than women (Bierman et al. 2009).

3.1.2 Early life

Research has found that foundations for adult health track back to early childhood and before birth. Poor foetal development is a risk for health in later life. Slow or retarded physical growth in infancy is associated with reduced organ development and function, which increases the risk of illness later in life. Poor emotional support, abuse and neglect in the early years also lead to reduced cognitive and emotional functioning in adulthood (Wilkinson and Marmot 2003; Kuh and Ben-Shlomo 1997).

Additionally, there is evidence that experiences related to participation in activity during childhood and adolescence may influence adult health behaviours. For instance, a qualitative study by Buman et al (2010) among sedentary older adults in the US showed that beliefs and experiences formed at a young age were manifested over time to determine current behaviours and attitudes with regard to physical activity (Buman et al. 2010). Taylor et al (1999) reported that participation in team sport during childhood was positively associated with more adult exercise (Taylor et al. 1999).

Childhood also plays a highly significant role in food choice decisions. In a qualitative study, Falk et al (1996) found that childhood food experiences imprinted ideals (strongly held beliefs and attitudes about what should be) that remained very important for people even after they aged (Falk et al. 1996).

3.1.3 Socio-demographic

People's social and economic circumstances influence their lifestyles, health behaviours and attitudes as well as knowledge about health issues (Andrews 2001). Socioeconomic disadvantage is strongly associated with an increased burden of common chronic conditions and comorbidity. Individuals with low income and/or less education are more likely to have chronic illness and comorbidity than those who have higher income or more education (Bierman et al. 2009; Wilkinson and Marmot 2003).

In the Florey Adelaide Male Ageing Study (FAMAS), a representative cohort of Australian men aged 35-80 years, obesity was associated with most of the chronic diseases (Martin et al. 2008). The study showed that a number of sociodemographic factors interacted to determine disease status but that they also acted independently in increasing the risk of specific chronic disease; independent of age, sociodemographic factors that were associated with chronic disease included: low income status (diabetes), separation/divorce/widowed (asthma and diabetes), unemployment (Cancer Council Australia), high waist circumference (diabetes), elevated cholesterol (angina), and a family history of obesity (angina). The authors concluded that socio-demographic factors interact to determine disease status.

Potential mediators of the relationship of SES with health outcomes include poor knowledge about the benefits of a healthy diet and physical activity, fewer skills, or differing social norms, and environmental issues such as access to healthy foods (Ball and Crawford 2005). Homebound older adults with low education and limited income have been found to be more likely to be motivated by price when making food choices and usually report money problems as a barrier to food choice (Locher, Ritchie et al. 2009).

'Rurality' can affect health status of older people. It has been hypothesised that elderly persons residing in rural areas could be at greater nutritional risk than those in urban areas because of isolation and limited access to food outlets. However, it is also reported that rural elderly persons may receive more support from family members and the community than do those living in urban areas (Krondl et al. 2008).

Analysis of the 2009 *NSW Falls Prevention Baseline Survey* found that community-dwelling adults aged ≥65 years with the highest education levels and lowest level of disadvantage (SEIFA) were more likely to be physically active (Macniven et al. 2012). Data from the HABITAT multilevel longitudinal study of physical activity, among 40-65 year olds living in Brisbane, indicated that residents of advantaged neighbourhoods reported significantly higher levels of total activity, general walking, moderate and vigorous activity, and were more likely to exceed PA recommendations (Turrell et al. 2010). Participation in multiple physical activities has been found to be lower among those less educated, divorced or widowed and from the most disadvantaged (SES) groups (Merom et al. 2011).

A study conducted in the Western suburbs of Melbourne found that the location and reasons for walking differed by level of walking activity, gender and cultural group. For instance, those who reported walking more than 150 minutes/week were more likely to report health and fitness as a reason for walking than those who attained less than 150 min. Shopping was the second most common reason for walking, but those who were more likely to report shopping as a reason for walking usually did not meet the physical activity recommendations of 150 minutes a week. Those who did very little walking (<10 min at a time and <150 min per week) indicated fear of crime and concerns about safety as main issues. Whilst men reported walking more often in the park and on trails, women more frequently cited the shopping mall as a walking location (Bird et al. 2010).

Retirement is an important life-stage transition. Overall, people gain weight when they retire (Chung et al. 2009); however, the effect of retirement on weight is heterogeneous across different wealth and occupation subgroups. Chung et al (2009) found that weight gain occurred among people who were retiring from physically demanding occupations or retirees with low wealth status, and among those who were already overweight or obese; however, retirement was not likely to shift people of normal weight into the obese or overweight category (Chung et al. 2009). Conversely, Forman-Hoffman et al (2008) reported that only women in blue-collar professions and normal-weight women appeared to be susceptible to weight gain upon retirement (Forman-Hoffman et al. 2008).

Behavioural changes at retirement may relate to food intake, physical activity, and sedentary behaviours. Those who retire from physically active jobs become less active and those with former sedentary jobs often become more active (Goldman et al. 2008). *The Health and Retirement Study* in the US found that retirement decreased consumption of food away from home, and retirees allocated more time to food preparation (2.3 h/wk) than did working people. Among married couples, retirement of the wife rather than the husband was influential in reducing household members' spending on eating out (Chung et al. 2007). In a Dutch study, men leaving the workforce had changes in diet, such as decreased fruit consumption and fibre density of the diet, increased consumption of sugar-sweetened soft drinks, and increased amount consumed at breakfast (Nooyens et al. 2005). Retirees might compensate for feelings of isolation and depression due to the loss of social interaction, sense of accomplishment and personal identity, by emotional eating (Forman-Hoffman et al. 2008).

3.1.4 Biomedical

Ill-health

Health conditions and illnesses can affect lifestyle behaviours and therefore act as intermediate risk factors for chronic diseases. Self-rated poor health, 'feeling too old' or having ongoing 'injury/illness' can restrict everyday activities, including physical activity participation and adequate food consumption (Burton et al. 2011). Older people often cite poor health as a barrier to participation in physical activity (Moschny et al. 2011). Analysis of the *2009 New South Wales Falls Prevention Survey* found that the most common self-reported barrier for physical activity was ill health (50%), and this was the only barrier significantly associated with a reduced likelihood of meeting physical activity recommendations after adjusting for other factors (Macniven et al. 2012). While ill-health is an obstacle to physical activity in older adults who perceive themselves to be insufficiently active, improved health is an enabler of physical activity in this age group (Belza et al. 2004; Sawchuk et al. 2011).

A history of depression was also found to be a negative predictor of improvements in physical activity among older people in interventions (Porter et al. 2011). Similarly, dementia has been cited as a health condition most likely to be associated with a severe or profound core activity limitation (AIHW 2007b).

Menopause

Menopause is an important transition for women's health. It is associated with a rise in atherogenic risk factors (i.e. increase in blood pressure), a worsening of the blood lipid profile, a progressive gain in body weight, and an increased tendency for central obesity with excess intra-abdominal visceral fat deposition (Morss et al. 2004).

The international literature reports that a large proportion of postmenopausal women are overweight and obese (Flegal et al. 2010; Carels et al. 2004; Rose et al. 2004). In Australia, 55% of women aged 50–55 years were found to be either overweight or obese (Brown et al. 2008). Although it is not clear if menopausal transition itself promotes weight gain, it is known that the physiological withdrawal of endogenous oestrogen, together with physical inactivity, contribute to the increased risk of metabolic syndrome, diabetes, cardiovascular disease, and all-cause mortality (Genazzani and Gambacciani 2006; Haddock et al. 1998).

Research suggests that weight gain during and after menopause may contribute more to chronic disease risk than weight gain prior to menopause (Carels et al. 2004). Together, weight gain following menopause and lower cardiorespiratory fitness are associated with elevated low density lipoproteins, triglycerides and total cholesterol and lower high density lipoproteins (Barnett 2009). A study in North Queensland investigated cardiovascular-related physiological differences among postmenopausal women in relation to their physical activity levels and found that women who did not exercise had a significantly lower level of cardiorespiratory fitness and higher resting diastolic blood pressure, BMI and WHR (Barnett 2009).

3.1.5 Cognitive and psychosocial

Beliefs, attitudes and knowledge about specific health issues also influence people's health and their health related behaviours.

Perceived wellness

A study in South-East Queensland in older adults aged 65 years and over found that modifiable lifestyle factors identified as having a positive effect on perceived wellness were regular exercise,

most likely due to its contribution to physical functioning, and capability (Foottit and Anderson 2012).

Eating

Older adults' food choices are influenced by motivations and perceived barriers associated with both health and non-health related factors. A study conducted in homebound older adults found that sensory appeal, convenience, and price of foods were the most important factors in food selection. Older women make choices based on health and sensory appeal while older men make choices based on weight control and mood. Although health was not reported as being an especially important motivation for food selection, ill-health reported as being the greatest perceived barrier to consuming the foods or meals that participants wanted to eat (Locher et al. 2009). In Ireland, functional mobility and social support were the two main factors negatively associated with abnormal nutritional status (Romero-Ortuno et al. 2011).

Bouchard et al (2012) compared older (<60 years) versus younger adults with pre-diabetes who enrolled in a lifestyle modification program (≥60 years), in terms of expectations and readiness to modify eating habits and physical activity level (aged 27-78). They found that increasing age is associated with lower expectations and reduced readiness for change.

Physical activity

There are many factors influencing older adult participation in regular physical activity. Being younger, being male, being married, being more fit at baseline, being a non-smoker, having more education, having better overall health, having lower body mass, not having emotional distress, having fewer disabilities, and having fewer chronic diseases and pain, are associated with being active (Schutzer and Graves 2004; Burton et al. 1999). In an Australian study, men and women were found to think differently about exercise, with women having differential physical activity histories to men (Stewart et al 2011).

Many of the barriers to engaging in physical activity among older people are attitudinal (Lee et al 2008). Also, lack of knowledge and understanding of the relationship between moderate exercise activity and health is a significant barrier. Older adults who are not aware of health benefits derived from exercise and the role of physical activity in disease prevention are limited in their motivation and initial involvement in any exercise program. Moreover, older adults often report fear of falling as a barrier to engaging in physical activity. Older adults living in NSW who had a fear of falling were significantly less likely to meet the PA guidelines (42% vs. 50%) (Macniven et al. 2012).

Perceived adverse weather conditions have also been identified as a barrier for physical activity participation. For instance, a study by Klenk et al (2011) found strong associations between weather conditions and daily walking duration in community-dwelling older people. Global radiation, maximum temperature, precipitation, humidity and wind speed led to a reduction in PA (Klenk et al. 2011). Conversely, perceived feelings of enjoyment and satisfaction, along with self-regulatory skills, such as goal setting, monitoring of progress, and self-reinforcement or motivation, are predictors for sustaining exercise behaviour in older adults (Schutzer and Graves 2004).

Self-efficacy is commonly identified in the literature as an important determinant of exercise behaviour in various populations and in many types of behavioural learning. McAuley et al (2011) found that, among older adults with a mean age of 66 years, higher levels of executive function and use of self-regulatory strategies at the start of an exercise program enhance beliefs in exercise capabilities, which in turn leads to greater adherence.

Social support is strongly correlated with physical activity (Kouvonen et al. 2011; Oliveira et al. 2011). For older adults, social support and group cohesiveness have been recognised as long-term predictors of self-efficacy related to exercise adherence (Schutzer and Graves 2004). In a German study of adults aged 65-85 years, a synergistic effect was found between self-efficacy and social support in terms of levels of PA (Warner et al. 2011). People with low self-efficacy were less likely to be active in spite of having social support, and people with low support were less likely to be active even if they had high self-efficacy.

A sense of belonging to a social network makes people feel cared for, loved, esteemed and valued. In contrast, social isolation directly contributes to health problems and reduces the ability of people to access information and help (Seniors et al. 1997). Social isolation has been associated with higher rates of premature death; and those with limited social and emotional support are more likely to experience more depression, lower well-being, and higher levels of disability from chronic diseases (Wilkinson and Marmot 2003). Many studies have shown that older adults prefer group-based physical activity programs (Belza et al. 2004; Chiang et al. 2008; Brown et al. 2009) and the 'lack of company' has been established as a barrier to engage in physical activity (Moschny et al. 2011). Macniven et al (2012) found that those who cited 'people to exercise with' as a potential enabler were less likely to meet the physical activity guidelines, highlighting the importance of addressing social support in any health promotion program. Addressing social isolation is not easy, for it is directly linked to the undervaluing of seniors in society and a number of other issues, such as poverty, low literacy, language barriers, geographic isolation, inadequate housing, transportation problems, gender and culture (Mcleod 1997).

Home living environment

Older adults often experience changes in their living arrangements as they age, with increased likelihood of living alone or living in a residential aged care facility. Most people continue to live in their own home, making use of aged care assistance packages or support from families and friends as needed (ABS and DADHC 2004). Women are twice as likely as men to live alone (ABS and DADHC 2004). Living alone increases the chance of not eating regularly, unless opportunities to socialise and share meals are available. Living and eating alone may contribute to reduced food intake, particularly among older men. In addition, sadness and depression may exacerbate this situation, leading to social isolation, with its potential for changes in appetite and well-being (Sahyoun 2002; Krondl et al. 2008).

Although the literature has shown that older adults living alone are more likely to be sedentary (King 2001; Wilcox et al. 2002), an Australian study found that sole living older women reported higher physical activity participation, possibly due to their incidental activities, such as conducting domestic tasks without assistance from a partner or others, and undertaking active transport (Bird et al. 2009). A study in Melbourne (n=473 women, aged >40 years) indicated that fruit and vegetable consumption was significantly higher among women who lived with others compared to those living alone (Hunter et al. 2010).

Having a pet has been associated with lower systolic blood pressure and blood cholesterol levels, better survival rates after a heart attack, lower levels of mental stress, lower feelings of loneliness and depression, and higher self-esteem (Cutt et al. 2007). It has also been hypothesised that pet owners have a lower cardiovascular risk profile because owning a dog encourages more physical activity (Dobson 1998). In many studies dog owners reported more walking than non-dog owners (Thorpe et al. 2006; Brown and Rhodes 2006; Cutt et al. 2008). On average, walking with a dog made up a large component of dog walkers' total minutes of physical activity (37.5%) and total walking (74.3%) each week (Cutt et al. 2008). However, living in the same household with a dog may be of little benefit if the person is not the one who walks and interacts with the dog (Thorpe et al.

2006; Gillum and Obisesan 2010; Bauman et al. 2001). An Australian study found that 23% of dog owners did not walk with their dog.

Contrary findings from a survey of 2551 community-based Australians aged 60-64 revealed that pet ownership conferred no health benefits for this particular age group. Instead, caring for a pet was associated with negative health outcomes, including more symptoms of depression, poorer physical health and higher rates of use of pain relief medication (Parslow et al. 2005). Pets can pose a health hazard to some people through infection, allergy and injury. For example, a recent report indicated that animals in the household may increase the risk of falls among the elderly (CDC 2009).

Older people may also be providers of child care. In 2008, grandparents provided care on a usual basis for 19% of all children aged 0–12 years in NSW (ABS 2008e). Caring for grandchildren may have negative health impacts, such as time pressures, added emotional stress and increased amount of work. Caring for grandchildren reduces time for self-care, such as exercising and going to the doctor, and time for engaging in hobbies and socialising. However, health disadvantages among grandparent caregivers arise from grandparents' prior characteristics, not as a consequence of providing care (Hughes et al. 2007; Lo and Liu 2009). In addition, caring for a grandchild can be rewarding, and may lead to a more active lifestyle, healthier meals, or a reduction in smoking (Weber and Waldrop 2000).

3.2 COMMUNITY FACTORS

3.2.1 Physical and social environment

Older adults may be more influenced by their residential environment, as they tend to travel outside their own neighbourhoods less often than do younger adults and children, who travel for work and school. They also tend to have a longer duration of exposure to neighbourhood influences than younger individuals. Neighbourhood environment has a large impact on the elderly's health and functioning due to a combination of physical/mobility and mental decline associated with age, reduction in social networks and social support, and increased fragility (Yen et al. 2009; Rosso et al. 2011).

Elements of the built environment such as transportation systems (street network and transit systems, land use patterns (density, land-use mix) and urban design (safety, attractiveness, site design) can affect functional limitations and disability in both positive and negative directions. For instance, in NSW the *Step by Step* program (Merom et al. 2009) found that the presence of street lights at night, and greenery and interesting scenery (aesthetics) were positively associated with changes in walking among physically inactive adults aged 30–65 years. The authors suggest that people who are interested in changing their walking behaviour may be able to do so without any intervention if they have a supportive environment.

The social environment is also important and is likely to influence physical activity in older adults. A US study of 190 older adults (mean age: 74 years) found that characteristics of the built environment promoting PA and general activity engagement might be secondary in importance to attributes of the social environment that promote safety and social cohesion (King 2008). Older people are more likely to be more active if others are also physically active, by way of providing social support and an increased sense of safety (Strath et al. 2012). A study in the Netherlands (n= 945 older adults, aged >/=70 years) showed that social capital of individuals, neighbourhood services, neighbourhood social capital, and neighbourhood social cohesion predicted the wellbeing of older adults (Cramm et al. 2012). Single and poor older adults reported lower levels of wellbeing than did better off and married older adults. The wellbeing of older adults may also be enhanced through the improvement

of quality of neighbourhood services. A local study in Adelaide reported that the quality of social relationships in an area can affect health. For instance, in areas where residents feel a sense of cohesion, shared values, and a sense of safety, use of local facilities increased (Baum et al. 2009).

Eating

There is limited research on how the food environment influences dietary intake in older people. In the general population, studies have shown that access to shops, and to healthy food choices in particular, can increase the purchasing of healthier foods (Gebel et al. 2005). A recent review found that residents of areas with greater access to supermarkets or lower accessibility to takeaway outlets had a lower prevalence of overweight/obesity compared with those living in areas with limited supermarket access or a greater accessibility to takeaway outlets (Giskes et al. 2011). However, it seems likely that immediate food availability and consumption is not a simple relationship, and depends on access to transport and delivered food services, for example.

Physical activity

A systematic review of the relationship between the physical environment and physical activity in older adults found a scarcity of studies focusing on older adults (65+) (Van Cauwenberg et al. 2011). Only a few environmental characteristics were found to relate negatively to PA, but overall, inconsistent results were found and most of the reviewed articles reported non-significant relationships, which might be caused by methodological issues. However, overall, evidence indicates that a high density of intersections, street and traffic conditions, and proximity to select destinations and green space, are the most likely factors to impact on mobility in older persons (Rosso et al. 2011). For example, a study looking at the influence of physical activity resources and SES on walking among community-dwelling men showed that proximity to parks and proximity to trails, respectively, were associated with a 22% and 34% higher likelihood of maintaining or increasing walking time in high-SES neighbourhoods, but not in low-SES neighbourhoods (Michael et al. 2010). In the US, King et al (2011) indicated that older adults living in more walkable neighbourhoods had more transport activity, more moderate-to- vigorous physical activity and lower body mass index relative to those living in less walkable neighbourhoods. The most mobility-impaired adults living in more walkable neighbourhoods also reported transport activity levels that were similar to less mobility-impaired adults living in less walkable neighbourhoods (King et al. 2011). Another American study in adults over age 65 years found that increased neighbourhood walkability was related to more walking, less time spent travelling in a car, and lower odds of being overweight (Frank et al. 2010).

Living in a neighbourhood with a higher density of older adults has been associated with better mental health and a protective effect on the likelihood of reporting poor health. It has been proposed that a higher concentration of older adults in a neighbourhood may be a marker for better service provision targeted towards the elderly (Yen et al. 2009). Elderly individuals not living in close geographic proximity to a recreation centre or fitness facility, park, golf course, swimming pool, or foot path are found to be significantly less physically active. Moreover, environments with high crime decrease the likelihood of older people becoming more active (Schutzer and Graves 2004).

Carlson et al (2012) evaluated the ecological model predictions of cross-level interactions among psychosocial and environmental correlates of physical activity in 719 community-dwelling older adults in a US community. Walkability, social support, and self-efficacy were consistently related to physical activity; and total physical activity minutes per week were greater when both psychosocial and environmental factors were supportive of physical activity. For instance, individuals with more positive psychosocial attributes who lived in a supportive environment participated in 30-59 more minutes of physical activity per week compared to those living in unsupportive environments.

Access to a walking partner and a supportive environment may be particularly effective in facilitating older adults' physical activity (Carlson, et al. 2012).

3.2.2 Services

In this document, the term 'community services' refers to those services provided by governments, non-government agencies or community groups that are implemented at a local level to provide assistance, support and care for people living in the community. (Other, population-wide community services are discussed as 'Societal factors' in this document.) The types of services which particularly benefit older people and address factors related to chronic disease risk include:

- community activities such as physical activity, social or cultural events

- community networks, which may be focused on particular issues (e.g. local history) and can be supported by agencies through subsidies, access to venues such as libraries and community centres

- recreation and exercise facilities such as public swimming pools, outdoor exercise equipment, gyms, bowling facilities, public golf courses

- other community facilities such as community gardens, libraries, community centres, seating along footpaths, street and park lighting, bus shelters, barbecues in parks

- public transport services and community transport services

- food services, such as delivered meals on wheels, and community kitchens.

These types of services can improve the amenity of the community neighbourhood, enhance physical activity, promote social networks and social support within the community, and promote accessibility to meet people's physical, cultural and social needs. Local government plays a key role in provision of such community services, while many non-government agencies and charitable groups are also active in this area. As indicated above, it has been proposed that a higher concentration of older adults in a neighbourhood may be a marker for better service provision targeted towards the elderly (Yen et al. 2009).

3.3 SOCIETAL FACTORS

3.3.1 Environment

Evidence suggests that supportive environments improve quality of life in older adults (Rosso et al. 2011). As outlined above, there are many aspects of the physical and social environment which affect older people's quality of life. While older people may be most influenced by these factors at the neighbourhood and community level, the quality and amenity of local environments are in turn determined by national and state level policies, programs and funding allocations. For example, national, state and local governments have shared responsibilities in relation to road safety. Similarly, many community agencies and non-government organisations receive state government funding support. For example, while organised and delivered at the local level, delivered food services (e.g. Meals on Wheels) are funded by state governments. The home modification and maintenance service aims to improve the functionality of homes to assist people with disability or functional impairments to remain at home and live independently, and is delivered through local organisations and funded and managed at state government level; whilst other aged care services are funded and managed at the commonwealth government level. The priority given to services and facilities for older people and the overall design and appropriateness of services and facilities are often determined by societal policies.

3.3.2 Services

Health services

Frequency of contact with health professionals increases substantially as people age. Thus, access to a wide range of health services is important for older people. Advice from health professionals may actively influence older adults to adopt healthier behaviours (Schutzer and Graves 2004). However, the majority of GPs do not routinely provide lifestyle advice, due to time constraints, limited reimbursement for preventive counselling, lack of training and lack of perceived effectiveness as a behavioural counsellor (Schutzer and Graves 2004). For example, in Canada, older patients with CVD indicated that many consulted their GP for PA advice; but many reported that their physician rarely or never discussed their level of physical activity or helped them to increase their activity level (Rolfe et al. 2010).

In general, there is a lack of health services to support lifestyle behaviour modification. A multidisciplinary approach for service delivery to older adults, including not only allied health professionals such as occupational therapists, dieticians, exercise physiologists, aging services specialists, but also healthcare services and facilities administrators, is a critical part of reducing the risk of chronic diseases.

Other services

Free bus travel for older people has been associated with increased use of public transport. For instance, in England, all residents aged 60 years and older or with a disability became entitled to free off-peak travel on local buses since 2006. This policy aimed at providing greater freedom and independence to older people in their retirement. Older people who used public transport were less likely to be obese and also less likely to become obese than to those who did not (Webb et al. 2012).

3.3.3 Culture and economy

Societal attitudes

Positive community attitudes to older people and the ageing process can influence the level of involvement of older people in society, and promote social cohesion. Social cohesion, defined as "the quality of social relationships and the existence of trust, mutual obligations and respect in communities or in the wider society", helps to protect people and their health (Wilkinson and Marmot 2003). A study of a community with initially high levels of social cohesion showed low rates of coronary heart disease; however, when social cohesion decreased, heart disease rates increased (Wilkinson and Marmot 2003).

Current attitudes to older people are not always positive or supportive, and are affected by stereotypes (Andrews 2001). The media often portray older people in negative ways and frequently show them to be frail and defenceless. Younger people are often unaware of the actual contributions made by older people, and their knowledge and experience is not always seen as relevant. Negative social images of older people, combined with the growing displacement of older workers, the increasing poverty of seniors, and the social isolation experienced in later life by making seniors feel not needed, not valued and not able to contribute to the society to which they belong, contribute to overall negative attitudes (MacLeod 1997). These negative attitudes have the potential to act as barriers to older people's lifestyles, their capacity to participate in society, and in their quality of life and health (Andrews 2001). The various national and state healthy ageing policies (cf. section 1.2) seek, in part, to redress the negative attitudes to older people.

Chronic disease and workforce participation

Maintaining good health supports participation in the labour force. As people approach retirement age, their health is one of the factors that may influence decisions about their participation in the labour force. In fact, local studies have shown that a significant number of Australians aged 45 to 64 years leave the workforce due to ill health (Pit et al. 2010; Schofield et al. 2008). A recent study looking at the effects of chronic illness in workforce participation in Australia (n=4574 members of the National Seniors Australia, aged 50 years and over) found that people with chronic illness are almost three times as likely to retire because of ill health as people without a chronic illness. Moreover, each additional chronic illness diagnosed prior to age 50 reduced the extent of working life by one year, and for those experiencing a chronic disease before age 60, each additional disease leads to a 0.7 year's reduction in working life. Conditions significantly related to earlier retirement include diabetes, arthritis and depression (Yen et al. 2011).

Analysis of the 2004–2005 NHS showed that mature age workers (between 45-74 years) were slightly healthier than their non-working counterparts; with 8 out of 10 workers having a chronic health condition such as cardiovascular disease, diabetes or obesity, compared with 9 out of 10 of the non-working population. Cardiovascular disease and arthritis each affected around a quarter of all mature age workers compared with half of non-workers. Even with a major health condition, 56% of mature age workers still assessed their health as very good or excellent, compared with 31% of those who were not working (ABS 2008c).

Participation of older adults in the workforce

In 2009-2010, people aged 55 years and over made up 16% of the total labour force in Australia. The participation rate of Australians aged 55 and over in the workforce has increased from 25% to 34% over the past 30 years, especially in the past decade (ABS 2010). Increasing the employment participation of mature age people (aged 50 years and over) is a crucial way of lessening the economic challenges of an ageing population, and increasing the ability of people to fund their own retirement. Additionally, more mature age people in employment will increase the Government's revenue base, and will potentially lower the costs associated with ill health (NSPAC 2011).

Barriers to increased workforce participation among older people

A comprehensive review of the literature identified 14 barriers to mature age employment including: discrimination in employment on the basis of age, care-giving responsibilities, flexibility of employment arrangements, issues around private recruitment firm practices, job search assistance, leisure time trade-off, mental health barriers, mismatch of skills and experience with industry demands, physical illness, injury and disability, re-entry issues barriers of the VLTU (Very Long-Term Unemployed), re-training and up-skilling barriers, superannuation, tax-transfer system, and workplace barriers. Responses to these barriers need to involve many stakeholders, including government, employer organisations, employers, trade unions as well as mature age people (NSPAC 2011).

Older workers may look for workplace flexibility to meet personal obligations, such as the need to care for frail parents, disabled spouses, or young grandchildren, worsening health, declining physical energy, or a growing preference for more leisure after a lifetime of work (Johnson 2011). Providing older employees with flexible work options such as reducing their hours, moving to less demanding positions and working flexible schedules could encourage them to work longer and delay retirement (Johnson 2011). Keeping older adults active and engaged in a job can promote their physical and emotional health and overall well-being (Calvo 2006).

In addition to contributing to a stronger economy, phased retirement programs allow employers to benefit from older people's skills and knowledge. Retaining mature age workers in the workforce

assists in maintaining a level of expertise which would otherwise be lost (ABS 2008c). Studies have shown that people over 45 stay longer in their jobs, contribute to the long-term performance of a company, have low levels of absenteeism and are flexible in their working hours and conditions. Age diversity in an organisation is also widely regarded as a sound business strategy (Queensland Government, 2005).

SUMMARY STATEMENT - Contributing factors to the risk of overweight, obesity and related chronic disease in older people

There are a large number of factors affecting older persons' capacity to undertake physical activity, reduce sedentary behaviours, eat healthily and maintain a healthy weight and metabolic profile.

Identification of the modifiable contributing factors informs intervention points, and ways in which interventions may be tailored for different population segments.

Interventions to modify the environment can support health behaviours. Increased availability and accessibility to community services, and public policy interventions can also underpin health behaviours.

Individual factors that may impact on the success of interventions in this age group include self-efficacy, knowledge and beliefs, perceived health benefits, and health literacy. There are gender differences in how these individual factors affect health behaviours and outcomes.

4   APPROACHES TO REDUCING OBESITY AND CHRONIC DISEASE RISK AMONG OLDER ADULTS

4.1   INTRODUCTION

4.1.1 Overview

Improving older people's health is a national policy priority in Australia (WHO 2002). Healthy diets, regular and adequate physical activity, and reduced sedentary time, are important factors in promoting and maintaining metabolic, functional and psychosocial health for older Australians. This section focuses on the areas for action to promote healthy behaviours and reduce overweight, obesity and related chronic disease risk among late middle-aged and older adult Australians. It includes:

- the potential intervention approaches based on an analysis of determinants and contributing factors to poor lifestyle behaviours among this target population (as described in the previous section);

- research evidence on the effectiveness of interventions aimed directly at individual lifestyle behaviour change among those at high risk of chronic disease (those that are overweight or obese or have other metabolic risk factors) and those with existing chronic disease;

- research evidence on the effectiveness of community-level programs aimed at changing healthy lifestyle behaviours in the older population; and,

- research evidence on the effectiveness of society level interventions among older adults.

4.1.2 The nature of evidence

In reporting on available evidence regarding the effectiveness of interventions, we examined available reviews, including systematic reviews, and a range of intervention research studies, including controlled trials, quasi-experimental studies and simple evaluation studies, where they encompassed interventions for the age group of interest. Literature was searched up to October 2012.

In appraising this evidence we took account of the following:

- overall intervention effectiveness, and any information on effectiveness specifically for older adults

- the generalisability and applicability of the intervention and findings to the Australian population and context

- the feasibility and likely reach of the intervention at population level in the NSW context.

4.2   POTENTIAL INTERVENTION APPROACHES

Table 12 summarises potential intervention approaches identified through analysis of the determinants and contributing factors to poor lifestyle behaviours among older adults in Section 3.

Table 12 Examples of potential intervention approaches to encourage healthy lifestyle behaviours in older adults aged 55-74 years

	Contributing factors		Intervention domain	Potential intervention approaches
	Category	Example		
Individual Factors	Biomedical	Chronic disease risk factors	Health services	Preventative health services, through web, phone, and face to face individual/group
		Ageing-related health issues	Health services	Access to a variety of health professionals
		Disability	Urban design	Appropriate built environment; housing design
	Cognitive and psychosocial	Low confidence or motivation to participate in PA	Health services	Behavioural lifestyle programs with goal setting and support
			Community services	Peer-led advice and support programs
		Lack of lifestyle skills	Community services	Cooking skills training, Physical activity programs
		Low health literacy	Community services	Nutrition education services
		Lack of support family/friends	Community services	Social engagement / networks / group activities
		Low health awareness and knowledge of healthy lifestyle	Communications	Social marketing – risk awareness
	Home living conditions	Lack of housing security	Community services	Subsidised housing
				Food services
		Limited home facilities	Housing services	Appropriate housing design
			Community services	Access to community gardens
		Care responsibilities	Community services/society	Support networks for older adults who are carers
	Socio demographic	Rural and remote locations	Health services	Accessible preventive health services, through web, phone, and local groups, centres
			Urban design	Appropriate built environment and services
				Neighbourhood walkability
			Transport	Accessible transport services
		Retirement transition	Health services	Health checks
			Community services	Physical activity programs
			Society wide	Volunteer roles
			Communications	Social marketing on healthy lifestyle targeting retirees
				….continued next page

Community Factors	Lack of recreation and exercise facilities	Urban design and planning	Amenities for walking, recreation in local parks
		Community services	Gyms or exercise classes at community centres
	Low neighbourhood walkability	Urban design and planning	Improved walkability (e.g. aesthetics, lighting, walking trails, benches)
	Lack of availability of affordable healthy food	Food services	Healthy choices in food services in community venues
	Limited access to private/public transport	Urban design/ transport	Accessible community public transport, transport infrastructure
	Lack of programs tailored to CALD groups	Community services	Programs targeting specific cultural communities
Societal Factors	Lack of flexibility in workplaces for part-time work	Workplace	Workplace flexibility arrangements
	Limitation of health insurance systems	Health services	Planned health assessment for screening high risk patients
	Negative social perceptions and norms	Communications	Social marketing
	Lack of information on healthy choices when dining out	Public policy	Menu labelling

4.3   LIFESTYLE BEHAVIOUR CHANGE INTERVENTIONS TARGETING HIGH RISK GROUPS

Multiple studies indicate that brief counselling interventions, with motivational interviewing and delivered by GPs or practice nurses, can produce short-term changes in health behaviours in older adults at risk or for those with existing chronic disease (Smith 2004; Goldstein, Pinto et al. 1999; Kerse, Elley et al. 2005).

However, the majority of GPs do not routinely provide lifestyle advice, due to time constraints and competing priorities, limited reimbursement for preventive counselling, lack of training and lack of perceived effectiveness as a behavioural counsellor, and increased workload – not only for those delivering the intervention but also for administrative staff (Schutzer and Graves 2004).

4.3.1   Target group: Overweight and obese older adults

A small number of systematic reviews have examined the effectiveness of weight reduction interventions in older people (Bales and Buhr 2008; McTigue et al. 2006; Witham and Avenell 2010). Intensive, counselling-based interventions incorporating diet and exercise can lead to modest (3 to 4 kg) sustained weight loss in obese older people. A separate meta-analysis also showed that weight loss in lifestyle interventions was relatively modest, with an average of 2.8 kg at 12 months, and higher intensity interventions were associated with greater weight loss (Norris et al. 2005). A systematic review and meta-analysis by Armstrong et al (2011) showed that motivational interviewing appears to enhance weight loss in overweight and obese adults – although only one of the 12 included studies was among older people (older obese women with type 2 diabetes). Cognitive behavioural therapy strategies such as self-monitoring, goal setting, social support, and stimulus control are recommended, as well as a modest reduction in energy intake (500–750 kcal/d) and a multi-component exercise program that includes stretching, aerobic activity, and strength exercises for older adults (Villareal et al. 2005).

A randomised controlled trial of 641 overweight long-term (>5 years) survivors (aged 65-91 years) of colorectal, breast and prostate cancer, residing mostly in 21 US states, plus in Canada and the United Kingdom, compared a 12-month intervention promoting exercise, improved diet quality, and modest weight loss delivered via telephone counselling and tailored mailed materials versus a delayed-intervention control arm (Morey et al. 2009). Results showed that the intervention not only enhanced physical functioning, but overall health and quality of life (self-reported data).

The long-term effects (2 years) of a computer-delivered intervention versus a face-to-face weight loss intervention delivered in a general practice setting (Appel et al. 2011) were compared in 415 obese patients (mean age: 54.0 years) with at least one cardiovascular risk factor, recruited from six primary care practices. Weight-loss support provided remotely through the telephone, a study-specific website, and e-mail, was compared to in-person support during group and individual sessions. There was also a control group in which weight loss was self-directed. At 24 months, weight loss was of a similar magnitude for both interventions (–4.6 kg in the group receiving remote support only, and –5.1 kg in the group receiving in-person support) compared to –0.8 kg in the control group.

A Swedish study examined how members above the age of 65 years performed in an internet-based behavioural weight loss program, compared to younger members (van der Mark et al. 2009). Participants aged 65 years or older were more likely to remain active in the weight club for at least 6 months compared to younger age groups. They had the highest frequency of recordings of food intake

and current weight. Among women, those older than 65 years had on average the highest percentage of weight loss (5.6 kg, 6.8%), and men older than 65 years had the highest number of logins (161 in 6 months).

The Active Nutrition Script (ANS) was a brief pilot nutrition and exercise intervention for the prevention of weight gain in patients attending GPs located across greater Melbourne (Booth et al. 2006). The intervention included GP-provided nutrition messages and personalised exercise advice for a healthy lifestyle and/or the prevention of weight gain, administered as 10 scripts over 4 weeks to patients with a BMI between 23 and 30 kg/m^2. A total of 145 patients (mean age: 54+/-13.2 years, mean BMI: 31.7+/-6.3 kg m^2; 57% female) participated. However, GPs administered the script to obese patients for weight loss, rather than to prevent weight gain, among the target group.

Ongoing evaluation studies include a randomised-controlled trial being conducted in Nebraska, US, among rural women aged 45-69 years old with a BMI of 28 to 45 (Hageman et al. 2011). *The Women Weigh-In for Wellness (WWW)* study aims to compare the effectiveness of theory-based behaviour-change interventions using (1) website only, (2) website with peer-led support, or (3) website with professional email-counselling to facilitate initial weight loss (baseline to 6 months), guided continuing weight loss and maintenance (7-18 months) and self-directed weight maintenance (19-30 months). Assessments will be conducted at baseline, 3, 6, 12, 18, 24 and 30 months.

4.3.2   Target group: Older adults with or at risk of type 2 diabetes

There is strong evidence from multiple, large RCTs and systematic reviews that lifestyle intervention aimed at reducing obesity and increasing physical activity is equally as effective as pharmacological intervention for reducing the risk of type 2 diabetes (in males and females aged 35-70 years with impaired fasting glucose (Norris et al. 2005; Gillies et al. 2010; Dombrowski et al. 2010). In the US, *The Diabetes Prevention Program (DPP)* randomised participants, in which 20% were 60 years or older, to 1 of 3 treatment groups: (1) intensive lifestyle-modification program with the goals of at least a 7% weight loss and at least 150 minutes of physical activity per week, (2) standard lifestyle recommendations plus Metformin, or (3) standard lifestyle recommendations plus placebo. Findings for the older adults' subgroup (those 60 years and over) indicated that the development of diabetes was prevented or delayed by 71% in the intensive lifestyle intervention group and by 11% in the Metformin group, compared with the placebo group (Knowler et al. 2002).

Live Well, Be Well was a community-based translational lifestyle research program aimed at reducing diabetes risk in lower SES and ethnic minority adults (mean age 55-58 years; n=230) living in the US. Trained health department counsellors provided education and skills training to modify diet and physical activity through telephone-based counselling (12 calls), 2 in-person sessions and 5 optional group workshops. The lifestyle counselling intervention showed significant results in terms of weight loss and triglyceride levels when compared to the control group. Additionally, the intervention group consumed less fat, but more fruits and vegetables (Kanaya et al. 2012).

In an RCT in Iran, a total of 100 diabetic patients aged ≥60 years (mean age: 67.06 ± 3.56 years; n=97 at follow-up) participated in four 70-minute educational sessions conducted over one month (Sharifirad et al. 2011). Nutrition education involved the 'BASNEF' model: Beliefs, Attitudes, Subjective Norms and Enabling Factors. Two telephone follow-ups occurred in week 4 and 8 post-intervention. After 3 months there was an increased intake in the mean daily servings of fruits, vegetables and dairy and a decrease in HbA1c and fasting blood sugar (FBS) levels in the intervention group compared to the control group.

Instigated in 2000, *Kitchen Creations: A Cooking School for People with Diabetes and Their Families (KC),* is a program with cooking schools in New Mexico, US (Archuleta et al. 2012). 117 people with type 2 diabetes (mean age: 63 ± 11 years) from diverse ethnic and socioeconomic backgrounds took part in a series of 3-hour-long cooking classes that featured current nutrition recommendations, hands-on cooking, plus elements from the social cognitive theory (i.e. cognitive restructuring, self-efficacy, and social support) were available for diabetics and their families. Participants prepared and ate a meal together. Three-day food records showed that participants significantly decreased their intake of energy, fat, and percentage of calories from fat, saturated fat, cholesterol, sodium, and carbohydrate.

A US based dietician-led, 10-week nutrition education program targeting 92 adults with type 2 diabetes (mean age: 72.1 experimental group, mean age: 73.0 control group) resulted in increased knowledge, positive outcome expectations, an increase in self-efficacy of diabetes management, increased decision-making skills, and decreased barriers to diabetes management (Miller et al. 2002). A diabetes education and group support program led by a clinical nurse specialist, a dietician, and a community worker in a rural Texas-Mexico border community was successful in improving diabetes knowledge, fasting blood sugar levels, and glycosylated haemoglobin levels among Mexican Americans (Brown and Hanis 1995).

The community-based program in Melbourne*, Lift for Life®,* was a research-to-practice initiative designed to disseminate an evidence-based resistance training program (for adults with or at risk of developing type 2 diabetes) to existing health and fitness facilities (Minges et al. 2011). Eighty six participants (mean age: 66.4 ± 8.7) completed the baseline and week 8 assessments. There was a significant decrease in mean waist circumference and the timed agility test; and significant increases in lower body and upper body strength; with significant differences remaining after 16 weeks. Similarly, there has been an implementation study on a community-based diabetes prevention program in NSW. The *Sydney Diabetes Prevention Program* (SDPP) was conducted in 1,550 participants aged 50-65 years at high risk of future development of diabetes, recruited through General Practice and delivered in a community setting (Colagiuri et al. 2010). Initial evaluation indicates modest weight loss at 12 months (about 2 kg) and low referral rates from most participating GPs. In diabetes prevention programs, further research is ongoing to better understand enrolment at the GP and individual level (e.g. Laws et al. 2012). Targeted strategies are required to engage groups such as smokers and high risk ethnic groups.

The Logan Healthy Living Program was a 12-month telephone counselling intervention for physical activity and dietary change targeting middle-aged to older-aged primary care patients with chronic conditions (diabetes and hypertension) living in a disadvantaged community in Queensland (Goode et al. 2011). A total of 434 patients (mean age: age, 58.2 ±11.8 years) were randomised into the intervention (n= 228) or to usual care (n=206). The initiation phase (1-4 months) consisted of up to 10 weekly or fortnightly calls; the maintenance-enhancement phase (5-12 months) consisted of up to eight monthly calls. At 12 months, patients in both conditions increased moderate-to-vigorous physical activity, decreased calorie intake from total fat, saturated fat, and increased vegetable, fruit and fibre intake. Those completing a higher number of calls were more likely to be female, white, older than 60, retired, and earning a lower income (due to being retired).

The Pharmacy Diabetes Care Program, a pharmacy diabetes service model for patients with type 2 diabetes was successfully implemented in 28 community pharmacies in four states across Australia (Krass et al. 2007). A total of 289 subjects (n=149 intervention, n=140 control) completed the study (mean age: 62 years). The intervention comprised an ongoing cycle of assessment, management and

review, provided at regular intervals over 6 months in the pharmacy and offered patients services such as adherence support, medication review, goal setting, and diabetes self-management and lifestyle information focusing on increasing physical activity and weight loss. The intervention indicated improved health outcomes for patients, including better glycaemic control, better BP control, and improved QOL.

Botomino et al (2008) investigated the effects of pharmacy-based counselling on changes in lifestyle and body weight after screening adults for type 2 diabetes in Switzerland (n= 1,370, mean age 59.9 years). Pharmacists provided either standard counselling/care (SC) or intensive counselling (IC) to subjects at moderate risk and SC to persons at high risk for type 2 diabetes (HRC). Three months post-screening, all groups – particularly HRC – showed reduced body weight, and these changes were sustained at one year follow up.

4.3.3   Target group: Older adults requiring cardiac rehabilitation

Improving individual physical activity and dietary behaviours are considered essential components of cardiac rehabilitation (CR) care to prevent secondary cardiac events (Braverman 2011). A systematic review, conducted by Jolliffe et al (2001), focusing on the effectiveness of exercise-based interventions compared with usual care on the mortality, morbidity, health-related quality of life (HRQoL) and modifiable cardiac risk factors of patients with CHD found that exercise-based cardiac rehabilitation was effective in reducing cardiac deaths. Participants were all adults, mean age was 53.1 (exercise only) and 56.3 (comprehensive cardiac rehabilitation), mostly men. Total cardiac mortality was reduced by 31% and 26% in the exercise only and comprehensive cardiac rehabilitation intervention groups respectively when compared to usual care (Jolliffe et al. 2001). Similar findings have also been reported in two additional reviews comparing exercise-based rehabilitation with usual medical care (Taylor et al. 2004; Heran et al. 2011). In the latest update of the literature, Heran et al (2011) revealed that in addition to reducing total and cardiovascular mortality (in medium to longer-term studies), exercise-based cardiac rehabilitation reduces hospital admissions (in shorter term studies) but not total MI or revascularisation.

Chase (2011) conducted a systematic review of physical activity interventions conducted as part of CR. Behavioural interventions (self-monitoring, prompting, goal setting, and feedback) and combinations of interventions led to more consistent, positive findings compared to cognitive interventions (self-efficacy enhancement measures, barrier management, and problem solving) which produced inconsistent results.

In the last two decades studies have explored the effectiveness of home-based compared to hospital-based CR programs. Evidence indicates that they are not only effective in reducing risk factors and obtaining positive behavioural outcomes, but also they are cost-effective (Taylor et al. 2007). In NSW, the *Physical Activity, Nutrition and Cardiac Health (PANACHE)* lifestyle intervention has demonstrated positive effects on physical activity in patients with cardiac disease, and attracts patients who would not normally be reached. The intervention involves four telephone-delivered behavioural coaching and goal-setting sessions over eight weeks. The coaching sessions are on weight, nutrition and physical activity and are supported by written materials, a pedometer and two follow-up booster telephone calls. A current replication study is examining the efficacy and cost-effectiveness of this low cost, high reach intervention among people with CVD in rural and urban areas of Australia (Sangster et al. 2010).

The Australian e-Health Research Centre and Queensland Health developed *the Care Assessment Platform*, an innovative technology-assisted home-care CR program which uses mobile phones and the internet to provide all the elements of traditional CR for patients recovering from a myocardial

infarction – including education, mentoring, goal setting, personal feedback and weekly telephone counseling, over a 6-week period (Varnfield et al. 2011; Walters et al. 2010). Mobile phones have an inbuilt accelerometer and a Wellness Diary that allows entry of health parameters such as weight, fat %, exercise (other than steps), blood pressure, stress, tiredness, sleep, eating, smoking and alcohol use. The data are synchronised daily to a web portal and accessed by mentors who review and provide personalised feedback at face-to-face counseling sessions. Patients also receive motivational and educational multimedia materials and daily SMS messages. An RCT is currently being conducted to evaluate clinical outcomes, acceptability and adherence to the technology. Preliminary data show promise.

However, current cardiac rehabilitation programs need to develop strategies for increasing attendance adherence (Taylor et al. 2011), and tailoring and targeting programs for those with multiple co-morbidities (Miketic et al. 2011), culturally diverse populations, and Aboriginal and Torres Strait Islanders, in order to ensure equitable service delivery (Haghshenas and Davidson 2011).

4.3.4 Target group: Older adults with cardiovascular risk factors

A systematic review of randomised controlled trials evaluating whether lifestyle counselling interventions delivered in primary care settings by primary care providers to low-risk adult patients were effective in changing factors related to cardiovascular risk, showed that the benefits appear to be minimal. This review recommended that resources and time in primary care be spent on patients at higher risk of cardiovascular disease (CVD), such as those with existing heart disease or diabetes (Fleming and Godwin 2008).

A systematic review of 30 RCTs (11 765 patients, mean age range=52 – 77 years) examining the impact of pharmacist care on the management of CVD risk factors among outpatients identified a range of intervention approaches, including education and counselling about medications, lifestyle, or compliance, feedback to physician, and medication management (Santschi et al. 2011). Pharmacist interventions achieved greater reductions in systolic and diastolic BP, total cholesterol, and LDL-C, and in the risk of smoking compared with usual care groups. Given the difficulties in accessing primary care physicians, the integration of pharmacists in the care of outpatients should be considered as a valuable solution for improving the management of CVD risk factors.

The Pharmacist Assessment of Adherence, Risk and Treatment in Cardiovascular Disease (PAART CVD) was a single-cohort intervention study in Australia examining the feasibility of engaging community pharmacists to run disease state management programs for reducing risk of CVD (McNamara et al. 2012). Twelve Australian pharmacists from 10 community pharmacies (5 rural, 5 metropolitan) were provided with intensive training on assessment, prevention and management of CVD risk factors. Patients aged 50-74 years who were taking medication for cholesterol, high blood pressure (BP), or both, and who did not have a self-reported history of CVD or diabetes, were offered 5 sessions at monthly intervals in a private counselling area (n=67, 73% female, mean age: 60). Participants achieved an estimated absolute risk reduction of 1.7% over 5 years. Clinical improvements were accompanied by several improvements to individual risk factors and self-reported health behaviours, including medication adherence.

A quasi-experimental study in the U.S assessed the effects of diet education (DE) plus light resistance training (RT) on coronary heart disease risk factors in 96 overweight and obese community-dwelling older adults (mean age: 69.2 years)(Cottell et al. 2011). The intervention consisted of 30 minutes of DE

(once per week, led by dietician) and ~80 minutes of RT (two separate sessions per week) for eight weeks. Significant changes were seen in diet and in triacylglycerol, as well as in blood pressure, weight, waist circumference, hip circumference, percentage body fat, fat mass, and body mass index (all p<0.05).

The Lifestyle Challenge Programme (CHAP) was a two-arm cluster randomised controlled trial targeting residents aged ≥65 years living in 39 mid-sized communities in Ontario, Canada (Kaczorowski et al. 2011). The mean number of residents was 3606, and their mean age was 74.8 ± 0.53 years. CHAP was co-directed by a pharmacist and involved a physician specialising in nutrition, a behavioural psychologist, a dietician and an exercise physiologist. Residents were invited to attend volunteer-run cardiovascular risk assessment and education sessions held in community based pharmacies over a 10 week period; automated blood pressure readings and self-reported risk factor data were collected and shared with participants and their family physicians and pharmacists. Population level reductions in rates of hospital admission for cardiovascular disease were significant.

In NSW, *The Health Improvement and Prevention Study (HIPS)* is a stratified randomised controlled trial involving 30 general practices. It aims to evaluate the capacity of general practice to identify patients at high risk for developing vascular disease and to reduce their risk of vascular disease and diabetes through behavioural interventions delivered in general practice and by the local primary care organization (Fanaian et al. 2010). Patients aged 40-64 years enrol in the trial by attending a health check in which the GP and practice nurse (PN) provide brief lifestyle counselling based on the '5As model' (Ask, Assess, Advise, Assist, and Arrange). High risk patients are then referred to a diet education and physical activity program. The program consists of two individual visits with a dietician or exercise physiologist and four group sessions, after which patients are followed up by the GP or PN at 6 and 9 months. No results are available yet.

4.3.5 Target group: Older adults with other ill-health

A pilot study conducted in Canada examined the feasibility and benefits of an *Internet-based videoconferencing healthcare support program* for community-dwelling older adults with chronic disease (Marziali 2009). Eighteen participants were involved (mean age: 60.8 years, 83% women). The intervention aimed to support group member bonding and sharing of challenges and strategies for managing a chronic disease. Ten, weekly, professionally-facilitated sessions were followed by weekly group meetings in a self-help mode for an additional 3 months. Participants were interviewed after 6-months. Overall, the delivery of professional healthcare services to home-based older adults with chronic disease showed promising results. Participants responded positively to using technology, they also valued the information shared regarding self-care, and reported feeling less lonely and isolated.

An RCT in Australia evaluated the effect of an exercise-based model of hospital and in-home follow-up care for older people at risk of hospital readmission on emergency health service utilisation and QOL (Courtney et al. 2009). A total of 128 patients with an acute medical admission, aged ≥65, and with at least one risk factor for readmission (multiple comorbidities, impaired functionality, aged ≥75, recent multiple admissions, poor social support, history of depression) were invited to take part in an individualised program of exercise strategies and nurse-conducted home visit, and telephone follow-up commencing in the hospital and continuing for 24 weeks after discharge. The intervention group (n=64, mean age: 78 ±6.3 years) required significantly fewer emergency hospital readmissions (22% of intervention group, 47% of control group, P=.007) and emergency GP visits (25% of intervention group,

67% of control group, P<.001). The intervention group also reported significantly greater improvements in QOL than the control.

4.3.6   Target group: Pre and post-menopausal women

A 6-month weight loss intervention in Korea targeting early postmenopausal healthy women examined the relationship between self-efficacy and subsequent weight loss (Shin et al. 2011). Out of 138, 90 women (mean age=56.3) completed to 6 months. They received a balanced meal plan with reduced energy intake, and nutritional and behavioural sessions every 2 weeks during the first 3 months. At month 6, participants had lost 3.6 +/- 4.1 kg (mean +/- SD) or 4.4% and decreased in weight from 82.2 +/- 11.1 kg to 77.6 +/- 11.4 kg (P < .001). Overall, participants who had higher total self-efficacy and self-efficacy to resist eating when food was available were able to lose more weight.

In the US, 44 obese, sedentary, postmenopausal women (mean age: 54.7 years) were randomly assigned to receive either a lifestyle change or a lifestyle change + self-control skills intervention (Carels et al. 2004). Women in the lifestyle change intervention met weekly for 6 months (24 times) for 60–75-minute sessions, and women in the lifestyle change + self-control skills intervention met weekly for 90–120 minutes. Participants were weighed at the end of each session. The self-control skills training consisted of a combination of didactic instruction, individual activities, and weekly out-of-class assignments. Women significantly increased their physical activity and cardiorespiratory fitness and reduced their body weight, fat mass, body fat, BP, total cholesterol, triglycerides, and LDL cholesterol and improved their diet. The addition of self-control skills training *did not* significantly improve cardiovascular risk reduction. Although women maintained their previous increases in physical activity at the 1-year follow-up, they regained approximately 63% of their post-treatment weight loss, which suggests that maintenance of these positive lifestyle changes need greater attention (Carels et al. 2004).

Another study in the US examined the effects of exercise on metabolic risk variables in overweight/ obese postmenopausal women (Frank et al. 2005). Sedentary women (n = 173) aged 50-75 years who were overweight or obese were randomised to 12 months of exercise (≥45 minutes of moderate-intensity aerobic activity 5 days/week; n=87; mean age: 60.7 ± 6.7 years) or to a stretching control group (n=86, mean age: 60.6 ± 6.8 years). Exercisers had a 4% decrease in insulin concentrations from baseline to 12 months compared to a 12% increase in the control group. Leptin concentrations also decreased by 7% among exercisers and remained constant among controls. The exercise effect on insulin was modified by changes in total fat mass.

The *Women's Healthy Lifestyle Project Clinical Trial* randomised 275 premenopausal women living in the US into an assessment only group and 260 women into an intervention group (mean age=47 years) for a 5-year cognitive-behavioral program aimed at preventing an increase in LDL cholesterol levels and weight, and increasing LTPA (Kuller et al. 2001). An intensive group program for 6 months was followed by individual/group sessions to 54 months. Calorific intake goals and weight goals were identified. LDL cholesterol, triglycerides and glucose increased significantly more in the assessment-only group than in the intervention group; weight decreased 0.2 lb in the intervention but increased 5.2 lb in the assessment-only group, and waist circumference decreased more in the intervention compared to the assessment-only group.

The *Women's Wellness Program* in south-east Queensland was a 12-week RCT of a multimodal intervention to improve postmenopausal women's cardiovascular risk factors (Anderson et al. 2006). 36 out of the 90 participants were provided with a consultation with a registered nurse, at which time

biophysical cardiovascular risk measures were taken and health education was provided in verbal and written forms. They were also encouraged to review their smoking, nutrition, and water intakes and to commence an exercise program that included aerobic fitness exercises. The intervention was effective in improving aerobic exercise activity, decreasing smoking, WHR, BMI, diastolic blood pressure, and measured weight.

4.3.7 Target group: Sedentary older adults

The *Physically Active for Life (PAL)* project in the US was an RCT comparing the efficacy of brief physician-delivered physical activity counselling to usual care on self-reported physical activity levels among sedentary, middle-aged, and older adults in primary care medical practices (Goldstein, Pinto et al. 1999). After 6 weeks, subjects in the intervention condition (n=181) were more likely to be in more advanced stages of motivational readiness for physical activity than those in the control condition (n=174); the effect was not maintained at 8 months' follow-up (Smith 2004).

A *post- hoc* subgroup analysis of a large cluster-RCT in NZ reported that the *Green Prescription* physical activity counselling program – consisting of a written prescription with activity goals, plus a follow-up telephone support over 3 months by trained exercise specialists – showed improved activity, energy expenditure, health-related quality of life, and reduced hospitalisations for older sedentary primary care patients (n=270) aged ≥65 years after 12-months (Kerse et al. 2005). Another RCT in Auckland, NZ, assessed the long-term effectiveness of a telephone counselling intervention on physical activity and health-related quality of life in low-active older adults (n=186, aged ≥65 years) recruited through their primary care (Kolt et al. 2007). Eight telephone counselling sessions were given over 12 weeks. After 12 months, moderate LTPA increased by 86.8 min/wk more in the intervention than the control group, and more participants in the intervention group reached 2.5 hours of MVLTPA per week.

A randomised trial evaluated three strategies to promote physical activity among inactive patients aged 50-70 years attending two general practices in Brisbane (Armit et al. 2009). 136 patients were randomly allocated to one of three intervention groups: (1) the general practitioner (GP) group received 'brief' advice; (2) the GP+ES group also received behaviour change advice from an exercise scientist (ES); and (3) the GP+ES+P group also received a pedometer. At week 24, all interventions produced positive results but the most intensive intervention, GP+ES+P, resulted in higher reporting of meeting PA guidelines than the GP group.

4.4   COMMUNITY LEVEL PROGRAMS

4.4.1 Population physical activity interventions

The evidence supporting the effectiveness of intervention in promoting PA for the general population of older people is similar to that for people at higher risk of chronic disease. A recent narrative review (based on six studies) found that GPs play a central role in the promotion of physical activity to older adults (Hinrichs and Brach 2012). The use of behavioural change strategies and collaboration with specialised allied health professionals is recommended (Hinrichs and Brach 2012). Individually-tailored, intense, high impact exercise programs that include warm-up, endurance, jumping, strength and flexibility training, and professional advice and guidance with continued support (of at least six weeks duration), can encourage adults in the general community to be more physically active in the short to mid-term (Parkinson and Harris 2010). Physical activity interventions aimed at improving the self-

perception of exercise self-efficacy can have positive effects on confidence and the ability to initiate and maintain physical activity behaviour, but how self-efficacy is optimally developed needs to be determined (Lee et al. 2008).

Although there is limited evidence concerning the scaled-up effectiveness of counselling older adults in General Practice, a number of RCTs have produced promising results. For instance the *Step Test Exercise Prescription Stages of Change* counselling study was a 12-month cluster RCT run among healthy, community-dwelling older adults recruited from 40 family practices across 4 regions in Canada (n=193 intervention; n=167 control; mean age: 64.9 years). Intervention physicians were trained to deliver a tailored exercise prescription and a transtheoretical behaviour change counselling program; physicians in the control group were trained to deliver the exercise prescription alone. The intervention led to improved fitness and activity and lowered systolic blood pressure but this was not significantly different between groups, except that women in the intervention group showed significantly higher levels of fitness (Petrella et al. 2010).

A review of interventions focusing on walking endurance, strength, flexibility and balance reported that implementing structured forms of physical activities (i.e. aerobic activity, resistance training) on a regular basis can be a useful strategy for enhancing mobility in community-dwelling older adults. Types of interventions that were shown to be effective for promoting mobility included aerobic exercise, walking, and strength/ balance/ flexibility training or a combination of multiple types of alternative activity such as Tai Chi. The typical dose of the physical activity prescription is 20–60 min of aerobic activity three times weekly. Adherence to physical activity recommendations by older adults can be followed up by in-person interview or use of mobility monitoring tools such as an exercise diary or log (Yeom et al. 2009).

Another review of 46 RCTs described interventions to improve balance confidence in older community-dwelling persons. Different exercise types were often combined, including strength, balance, endurance, flexibility and Tai Chi. Although no clear superiority of one type of exercise over the others was apparent, the combination of strengthening and balance exercise was the most frequently used. In general, findings indicated that positive and sometimes sustained improvement in balance confidence and reduction in activity avoidance can be achieved by various multi-component behavioural group interventions (Büla et al. 2011).

Given the established effectiveness of various types of physical activity, there is also an accumulating body of evidence on the implementation of physical activity programs at the community level. Examples of physical activity interventions in the community that have shown positive results include:

- *CHAMPS* was a 1-year RCT in the US encouraging participation in existing community-based physical activity classes and programs as a way to increase physical activity (Stewart et al. 2001). It was successful in increasing class participation. *CHAMPS II* was based on social cognitive theory and included principles of self-efficacy enhancement and readiness to change, as well as motivational techniques. 164/173 randomised subjects (95%; mean age 74 years (65-90)) completed the trial. The program resulted in significant physical activity increases (p values <.05), and was particularly useful in increasing physical activity for overweight persons. A similar program is the *Groningen Active Living Model* (GALM) developed in The Netherlands (Stevens et al. 2003). This 18-month intervention (n=96 participants) increased physical fitness and recreational sports activities but not overall physical activity or LTPA.

- *The Active Plus* programme (Netherlands) consisted of two theory- and evidence-based tailored physical activity promotion interventions, comprising three tailored letters delivered over four months and aimed at raising awareness of insufficient physical activity, and stimulating physical activity initiation and maintenance among the over-fifties (mean age: 64 years) (van Stralen et al. 2009). The basic intervention targeted psychosocial determinants of physical activity, and the second also provided additional tailored information about physical activity opportunities in the specific environment in which the older adults lived. This environment-based component also provided access to a forum and e-buddy system on a website. Tailoring was successful in attaining and enhancing awareness, initiation and maintenance of physical activity among older adults; but the environmental component did not result in an additional increase in physical activity.

- *The California Active Ageing community grant program,* was a choice-based, telephone-assisted physical activity program for older adults implemented in 13 diverse local agencies in California, US (Hooker et al. 2005). Participants (mean age: 68 ± 8.6 year; n=447) developed their own physical activity programs through an individualised planning session based on preference, health status, readiness to change, and availablility of community resources. They also received regular telephone calls over a 1-year period from a trained staff member or volunteer support buddy. Additional resources such as health education workshops, newsletters, and group-based physical activities were made available. There was a significant increase for total weekly self-reported caloric expenditure and moderate or greater weekly caloric expenditure from baseline to mid-intervention and intervention endpoint. Weekly physical activity duration and frequency also increased.

- *Active for Life (AFL),* a 4-year translational initiative of the Robert Wood Johnson Foundation (US) aimed to examine whether evidence-based physical activity programs could reach large numbers of adults aged 50 years and over, have similar impacts to earlier efficacy studies, and be sustained over time within existing community or clinical settings (Wilcox et al. 2008). Two physical activity programs at seven distinct sites from 2003 to 2007 were: (1) *Active Choices*, a 6-month telephone-delivered program (n=2503, mean age: 65.8 years); and (2) *Active Living Every Day (ALED)*, a 20-week group-based program (n=3388, mean age: 70.6 years). Significant increases in MVPA, total physical activity, and satisfaction with body appearance and function, and decreases in BMI resulted from both programs.

- Financial incentives have been used in a trial in the US to successfully increase the time spent in aerobic exercise among sedentary older adults aged 50+ (Finkelstein et al 2008). Relative to the control group who received a fixed payment of $75, the intervention group, who received $50 base payment plus up to $25 per week depending on the amount of aerobic activity, achieved 4.1 hours compared to 2.3 hours. Average extra payment was $17.50. The authors considered that financial incentives are a cost-effective way to engage older adults in physical activity.

- *The Cherbourg Healthy Lifestyles Program* in Queensland, was aimed at increasing physical activity in Aboriginal women (Thompson et al. 2000). A 1-hour class combining low impact aerobics and circuit training was run at the local church hall for 6 months. The program was very successful in the local community, so much so that some men joined the classes. A new venue was allocated at the Community Sports Centre where classes were offered for another year, and an on-site training program in fitness instruction was offered to a local woman and two local men who wanted to support their community. Although identified as a healthy lifestyle program, it appears to involve physical activity components only.

Type-specific physical activity programs

Walking

Walking has been cited as the easiest physical activity to implement and maintain in older adults (Parkinson and Harris 2010). It is free, requires no training or special equipment, and potentially overcomes many barriers to regular active lifestyle (Voukelatos et al. 2011). Health benefits of regular walking in later life described in the literature include a reduced risk of all-cause mortality, of developing cardiovascular disease, of cognitive decline, and functional limitations (Voukelatos et al. 2011).

Tudor-Locke et al (2011) reviewed the evidence-based approach to converting step count data into minutes of active time congruent with public health guidelines. Results suggested that, in apparently healthy older adults, taking approximately 7,000-10,000 steps/day under free-living conditions is equivalent to accumulating 30 minutes/day of MVPA (as detected by accelerometer) (Tudor-Locke et al. 2011). Overall, cross-sectional studies have shown that 4,500-5,500 steps/day was associated with higher HRQoL scores, compared to that associated with better measures of immunity (> 7,000 steps/day), metabolic syndrome (8,000-10,000 steps/day), or BMI-defined weight status (8,000-11,000 steps/day) (Tudor-Locke et al. 2011).

Easy Steps to health: a self-guided walking program for older adults is designed to help older adults achieve the recommended level of physical activity needed for health benefits and reduce the risk of falls. A sample of 484 healthy, inactive adults aged 65 years and older living in NSW have been recruited. The intervention consists of a series of three manuals and telephone coaching conducted over 12 months. The self-guided walking program promotes four steps: Step 1 – '*Walk more, sit less*'; Step 2 – '*Walk longer*'; Step 3 – '*Pick up the pace*'; Step 4 – '*A lifestyle of walking*'. Results are not yet available (Voukelatos et al. 2011).

Water-based exercises

A review of the effects of water-based exercise training on physical fitness parameters in healthy older adults indicated strong evidence supporting its use for the improvement of aerobic capacity and muscle strength and endurance, and some moderate evidence supports its use for flexibility improvements (Bergamin et al. 2012). Literature suggests a minimum of twice per week water-based exercise sessions performed at moderate-high intensities to see improvements in aerobic capacity; however, to obtain significant improvements in both aerobic capacity and muscular strength, three sessions per week (combined aerobic and resistance training) are required. A study by Nikolai et al (2009) reported that water aerobics was a feasible alternative to land-based exercise for middle-aged and older adults for improving and maintaining cardio-respiratory fitness.

A study evaluating the effectiveness of a well-rounded exercise program performed in water found that this type of exercise is very safe and beneficial (Takeshima et al. 2002). This intervention was a 12-week program targeting older women (60-75 years old), consisting of 20 minutes of warm-up and stretching exercise, 10 minutes of resistance exercise, 30 minutes of endurance-type exercise (walking and dancing), and 10 minutes of cool-down exercise in the water. Significant improvements in cardio-respiratory fitness, muscular strength, body fat, and total cholesterol were observed. Another study in older women (aged 62-65 years) compared the effectiveness of a water-based exercise program to a 'walking-on-land' program (Bocalini et al. 2008). While both programs improved the cardio-respiratory and neuromuscular fitness of participants, the water exercise program was more powerful in inducing

changes in physical fitness (upper and lower body strength and upper and lower body flexibility) compared to the walking-on-land program.

The *Sedentary Women Exercise Adherence Trial 2* conducted in Western Australia compared the effects of swimming and walking on fitness, body weight, lipids, glucose, and insulin in sedentary women aged 50 to 70 years (Cox et al. 2010). Participants were randomly assigned to swimming (n=56, mean age: 55.8 ± 4.5 years) or walking (n=60, mean age: 55.2 ± 4.8) plus usual care or a behavioural intervention, and completed 3 sessions per week of moderate-intensity exercise, supervised for 6 months then unsupervised for 6 months. Compared to walking, swimming improved body weight, body fat distribution and insulin levels compared at 6 months, and body weight and lipid measures at 12 months.

The *WAVES* Program aimed to reduce cardiovascular disease and diabetes in Aboriginal communities by offering one hour exercise classes in a private hydrotherapy pool (Cawood 1999). It targeted Aboriginal older women living in the Eastern suburbs of Sydney, Australia; and was well received by the participants and community.

Aerobic and resistance training

Both aerobic and resistance-type exercise training have been shown to improve the rate of decline in muscle mass and strength with age. In contrast to aerobic exercise training, resistance exercise training appears to have a larger effect on augmenting muscle mass and strength and attenuates the development of sarcopenia (Burton and Sumukadas 2010).

Marques et al (2011) found that both resistance training/exercise (RET) and aerobic training/exercise (AET) resulted in increased static and dynamic balance in community-dwelling older women. Despite aerobic training being important for cardiovascular and metabolic changes, only resistance training showed significant bone adaptation, with the potential to reduce fracture risk. Lower limb strength in particular has been identified as the most important factor to the maintenance of stability and postural balance (Rubenstein 2006). Improvements in muscle strength can be achieved with as little as one resistance exercise training session per week (Burton and Sumukadas 2010).

Only two evaluated programs to encourage strength-based exercise among older adults were identified at the community-level in Australia:

- In Tasmania, Bird et al (2011) conducted a multi-component exercise intervention in healthy older adults (n=33; mean age: 67.1 years) to assess long-term changes in balance, strength, mobility and activity levels after participating in a flexibility and resistance training program in a community gymnasium. Twelve months post-intervention improvements persisted in some measures of balance and mobility for those in the initial intervention. More than 50% of the exercisers performed resistance training regularly over the 12 months post-intervention. Those participants who continued to exercise had significantly larger strength gains within the intervention, and higher perceptions of the benefit of the program (Bird et al. 2011).

- In NSW, *BEST (Balance, Exercise and Strength training) at Home* was a program aimed to increase strength, balance and physical activity and reduce risk of falling by introducing strength and balance exercises that participants completed at home, together with a walking component (Bates et al. 2011). An evaluation of the pilot program in the Wollongong and Sutherland areas (n=167, mean age 69 years) showed significant improvements in all measures of strength and balance in people aged 60 years and over.

Cycling

There is no evaluation research on cycling in older adults in terms of increased physical activity and health and well-being. One study, based in the US, compared the effects of three different 16-week resistance-training programs using a mechanically braked cycle ergometer (fixed bike) to increase muscle strength, power and selected functional ability in 31 healthy 65-74 year old women (Macaluso et al. 2003). All training groups significantly increased force, power, and functional abilities (maximal treadmill walking speed, vertical jumping, and box stepping) at week 8, with no further improvement at week 16 (except maximal treadmill walking speed), but no significant differences were observed between the three groups.

Dancing

Dancing may allow older adults to maintain cognitive function, and improve their physical function and well-being. Regular dancing can provide a way to be active, have fun and connect socially with others, which is critical to helping older people maintain mental wellbeing and quality of life (Burkhardt and Rhodes 2012). Grade B-level evidence indicated that older adults can significantly improve their aerobic power, lower body muscle endurance, strength and flexibility, balance, agility, and gait through dancing. Grade C evidence suggested that dancing might improve older adults' lower body bone-mineral content and muscle power, and may also reduce the prevalence of falls and cardiovascular health risks (Keogh et al. 2009).

A German study investigated the effects of salsa dancing on balance and strength performance in older adults. An 8-week progressive salsa dancing program (intervention group n = 14, mean age: 71.6 ± 5.3 years; control group n = 14, mean age: 68.9 ± 4.7 years) showed high program compliance and there was a tendency towards an improvement in the selected measures of static postural control in the intervention group. This study suggests that age-related deficits in measures of static and particularly dynamic postural control can be mitigated by salsa dancing in older adults (Granacher et al. 2012).

A randomised controlled trial is currently being conducted in NSW to investigate whether folk or old-time dancing can improve balance and strength in older Australians. The study, *Effectiveness of social dancing as a strategy to prevent falls in older people,* aims to recruit 450 seniors to take part in a 12-month dance program consisting of twice-weekly ballroom dancing classes at 13 aged-care centres across Sydney (Merom et al, NHMRC funded research study).

Yoga

Yoga is considered an effective complementary approach to health maintenance and promotion for older adults and has been demonstrated to support many dimensions of psychological wellbeing (Bonura 2011). Additionally, a review of the physical fitness and function benefits of yoga revealed moderate improvements for gait, balance, upper/lower body flexibility, lower body strength, and weight loss. However, more evidence is needed to determine its effectiveness as an alternative exercise to promote fitness in older adults (Roland et al. 2011).

Tai Chi

Systematic reviews have shown that Tai Chi is an economic and effective alternative method of physical activity that improves balance, balance confidence, enhances functional capacity and prevent falls in older adults (Wooton 2010; Leung et al. 2011; Liu and Frank 2010; Church et al. 2011); although one meta-analysis concluded that there is insufficient evidence to determine whether Tai Chi is effective in decreasing fall rate, fear of falling or improving balance in older people (Logghe et al. 2010). It also has an impact on metabolic risk factors – for example, Chen et al (2010) showed that Tai Chi, when practiced

for 12 weeks three times per week, compared with time-matched aerobic dance activity, can significantly reduce triglyceride levels, CRP levels and oxidative stress biomarkers in obese older adults. In Sydney, a 16-week community-based Tai Chi program for 1 hour per week (n=702, mean age: 69 years) reported a reduction of falls in healthy community-dwelling older adults (Voukelatos et al. 2007). Additional research is needed to examine the effects of Tai Chi on total levels of physical activity.

Falls prevention programs

There is clear evidence that a targeted supervised home exercise program of strength and balance exercise and walking practice, prescribed by a trained health professional, can prevent falls among older community dwellers (Sherrington et al 2004). The minimum dose of exercise to protect an older adult against falls is 50 hours (Sherrington, Whitney et al. 2008). For community-dwelling older adults, a progressive exercise program that focuses on moderate to high-intensity balance exercises appears to be one of the most effective interventions to prevent falls (Shubert et al 2011). A number of interventions for falls prevention has taken place in NSW. However, most of them tend to target older old adults (aged 70+ years) and focus only in reducing falls and not overall levels of physical activity; hence, this has generally not been measured as an outcome.

Volunteerism to increase personal physical activity among older adults

In the US, *The Experience Corps Baltimore City (EC)* was designed to increase physical, cognitive, and social activity among seniors through specially designed volunteer roles in public elementary schools (Fried, Carlson et al. 2004). Designers of this initiative theorised that a minimum of 15 hours of volunteering a week would promote a significant amount of physical activity through travel to and from, as well as activity within, a school. Volunteer roles in EC were purposefully designed to be valued by school principals and feasible and attractive to older adults with a wide variety of educational levels. The roles are particularly suited for "natural helpers" from the community: supporting general literacy and maths skills, library and computer laboratory use, and violence prevention through a conflict resolution intervention. A pilot randomised trial with 128 volunteers aged 60-86 years old was conducted in Baltimore in 1999. 92% of volunteers were females, and 95% were African Americans. At 4-8 months follow-up, physical activity, strength, people one could turn to for help, and cognitive activity, increased significantly, and walking speed decreased significantly less, in participants compared to controls. The Experience Corps program was expanded to over 18 cities and two nations.

Peer-led physical activity programs

Evidence suggests that using trained senior volunteers to inform peers about a variety of health-related topics is an important strategy for promoting healthy ageing (MacLeod & Associates 1997). A wide variety of programs has used older adults as peer educators to provide information about medication management, to counsel on the mental health needs of older adults, for chronic disease self-management for conditions such as arthritis and osteoporosis, to promote wellness and quality of life, to encourage healthy eating and increased physical activity, to support preventive health screening, as well as to advise about fall prevention (Peel and Warburton 2009).

- *The AAMP (Active Adult Mentoring Program)* study in the US tested the impact of having mentors provide support (encouragement, feedback, support, goal setting) for participants' learning of self-management skills for physical activity initiation and maintenance. This resulted in increased levels of physical activity at 18 months' follow-up compared to the standard community intervention (basic education about physical activity, access to an exercise facility, pedometer for self-

monitoring) in which participants' physical activity had returned to baseline levels (Buman et al. 2011).

- The *Ageing Well and Healthily* program in the Netherlands combined health education by a peer educator with low-intensity exercises taught by a professional physical activity instructor. Results showed improvements in mean physical activity score for the least active participants. Sixty per cent of respondents reported still doing the exercises regularly at home 4-6 months later (Hopman-Rock and Westhoff 2002).

- *Just Walk It* was a community-based physical activity program run in Queensland, Australia. It aimed to enhance regular participation in a low-intensity walking program through community groups led by volunteer trained leaders or 'guides'. Educational resources and procedures (information kit) were available to 'guides' to help them develop a community walking group within their suburb; they also received regular support from a centrally-based coordinator (Fisher et al. 1998).

- A neighbourhood-based walking project for those aged 55 and over was conducted over 12 months in Melbourne, Victoria. In *The Neighbourhood Project* group leaders or 'activators' were recruited by community advertising and they further recruited family, friends, neighbours and strangers by word-of-mouth to join their group. Activators arranged meeting times and places for future walks. At the end of 4 months, 213 participants were involved, mainly female and aged 55-65 years. Most groups comprised 3 people. Forty-nine per cent reported walking on average five days a week (Jones and Owen 1998).

The Senior Health and Physical Exercise (SHAPE) project examined the effectiveness of a 6-month peer-led neighbourhood walking program among older adults (aged 65+, mean age: 74 years) in a metropolitan area of Portland, Oregon, US (Fisher and Li 2004). Residents in the control group received health education and information by mail. Intervention neighbourhoods significantly improved scores on the three QOL indicators, and significantly increased levels of walking in comparison to the control neighbourhoods.

Peers have also been used successfully in falls prevention programs. For example, Healy et al (2008) and Peel and Warburton (2009) indicated that, to promote program adherence, falls prevention interventions should use a variety of forms of social encouragement that engage older people in interventions, and include peer role models to illustrate the social acceptability, safety and multiple benefits of participation.

4.4.2 Interventions aimed specifically to reduce sedentary behaviour

There is a scarcity of interventions directly aiming to reduce sitting time and sedentary behaviour among older adults. Only one evaluated intervention among older people was identified in the literature.

A study in Queensland examined the feasibility of an intervention to reduce and break up sedentary time in older adults. Fifty-nine participants aged 60 years and over received one face-to-face goal-setting consultation and one individually tailored mailing providing feedback on accelerometer-derived sedentary time. Participants decreased their sedentary time, increased their breaks in sedentary time per day, and increased their light-intensity physical activity (Gunay et al. 2006) and MVPA (Gardiner et al. 2011).

4.4.3 Nutrition interventions

Nutrition education

Young et al (2011) reviewed 23 randomised-controlled studies, five of which reported a nutritional education-only program; however ,in the majority of cases nutrition education was part of a more complex health promotion intervention targeting older people. Participants varied from healthy older adults to those with specific chronic diseases. The interventions assessed were often multi-faceted and varied in both length and type. All but one intervention was delivered by health professionals, with ten being delivered solely by nurses. Overall, findings of the review indicated that nutritional education or advice, sometimes as part of a complex intervention, can positively influence diet, improve physical function, and improve depression. There was also evidence that some biomarkers were positively affected; however, evidence on the impact on weight change was inconclusive, and there was no evidence of an improvement in anxiety, quality of life, use of services, cost of care or mortality.

Another systematic review included 15 RCTs evaluating nutrition interventions for community-dwelling older adults (mean age ≥55 years, healthy) (Bandayrel and Wong 2011). Ten of these studies involved nutrition education and counselling, and five involved nutrition supplementation interventions. Characteristics of successful nutrition counselling interventions include *group learning sessions, peer support and scheduled follow-up meetings*. On the contrary, ineffective interventions included those that were not tailored to individual learning needs and had limited personal contact with study participants**.**

A framework for nutrition education for older adults proposes nutrition messages that are limited in number, simple, targeted, practical, and reinforced; involve the use of incentives; have regular contact with health professionals; and involve hands-on activities (Sahyoun et al. 2004). This research also recommended that participants take part in setting goals and remain committed to assessing those goals throughout the intervention.

Only a few single intervention studies aimed at improving nutrition among older people in the community that were not included in the reviews were sourced:

- The *Eat and Learn Nutrition Program* was a small community program run in the US by nursing students and public health nurses aiming to increase knowledge of nutrition and promote healthy eating among the residents of an older adult, low-income, urban housing community (Klinedinst 2005). Program participants (n=25, mean age: 75 years) gained knowledge related to their nutritional needs, in spite of a short period of time (3 sessions only).

- *Cooking for One or Two* was a program run by the Department of Veterans Affairs in Australia which aimed to increase confidence and skills in food preparation and food safety among older adults, particularly among males and those living alone (Research Centre for Gender, Health and Aging 2006). A total of 118 participants took part in weekly 2-hour classes over a 6-week period. The participants were veterans and/or war widows (75% male, mean age: 71 years). The program showed an improved ability to shop, cook and feed one's self, fruit, vegetable and meat consumption, nutritional knowledge and kitchen competency.

- An experimental study in Victoria explored perceptions of dietary recommendations for fruit and vegetables, and barriers and opportunities for increasing consumption among 38 adults aged 50 to 64 years who reported low vegetable consumption (Dixon et al. 2004). The intervention consisted

of a focus group session to demonstrate recommended fruit and vegetable servings (week 1), then a home delivery of a week's supply of fruit and vegetables and recipes (week 2), followed by a second focus group discussion (week 3). Findings revealed that pleasure-seeking rather than nutrition knowledge appears to be a major driver of eating behaviour. People seem to enjoy looking at, handling, and selecting the foods that they eat, therefore they had little interest in using delivery of fruits and vegetables themselves. However, for some, the presence of the fruit and vegetables provided was a motivator to eat more fruit and vegetables, particularly for some very low fruit consumers.

- The use of peer educators in nutrition interventions with older people has been evaluated. In northeast England, a sample of 22 people aged ≥60 were trained using an accredited course for Community Nutrition Assistants, which included basic nutrition and group skills (Hyland et al. 2006). Peer educators were paid to work in a 20-week food club intervention for older people consisting of food preparation, food tasting and sharing information and ideas about food.

Community based food delivery

In the US there has been several evaluation studies aimed to increase fruit and vegetable intake in homebound older adults. The *Seattle Senior Farmers' Market Nutrition Pilot Program* delivered bi-weekly market baskets that included a variety of fresh, locally grown produce to 480 low-income Meals on Wheels participants (aged 60+) and found that seniors receiving the baskets reported consuming an increase of 1.04 serving of fruit and vegetables (Johnson et al. 2004). A qualitative study of the program indicated that recipients appreciated the variety and quality of the fresh fruits and vegetables, and some would have not otherwise had access to fresh fruits and vegetables. Additionally, the home-delivered baskets of fresh fruits and vegetables brought participants joy, stimulated interest in healthy foods, and improved quality of life (Smith et al. 2004). The *Veggie Mobile* was another initiative seeking to increase intake of fruits and vegetables in limited-income seniors, where a van travelling to low-income neighbourhoods sold fruits and vegetables at a fraction of the regular supermarket cost (Abusabha et al. 2011). There was a significant increase in vegetable intake (from 1.98 ± 1.71 serves/day to 2.58 ± 1.4 serves/day), but change in fruit intake was not significant.

Meal programs, both home-delivered meals and congregate dining, make it possible for older people to keep living in their homes and maintain their independence. The meals on wheels home meal delivery program has been shown to improve or maintain nutritional risk for vulnerable older adults and prevent health and quality of life declines (Keller 2006). Congregate meal programs provide also an opportunity for socializing among high-risk older persons (Krondl et al. 2008). Meals on wheels services in New Zealand are perceived to provide social contact and meals of high nutritional value, although repetitive menu cycles and similarity to hospital meals are negative perceptions of the service (Wilson and Dennison 2011). An evaluation of the *Elderly Nutrition Program (ENP)* in the US found that, compared to non-participants, ambulatory and homebound ENP participants were better nourished and achieved a higher level of socialisation. These findings are also supported by other similar Meals on Wheels programs delivered to seniors living in the US and Canada (Roy and Payette 2006; Millen et al. 2002).

Most Meals on Wheels and Food Service organisations in NSW are run by local management committees, made up of volunteers from the community. Almost all Meals on Wheels organisations receive funding from the Home and Community Care (HACC) program to run their services. The HACC program is a cost shared program between the commonwealth and state governments. About 4.5 million meals are delivered by 35,000 volunteers in NSW each year (Nakamura et al. 1999; NSW Meals on Wheels Association website).

4.4.4   Multi-component nutrition and physical activity population-oriented interventions

The Study of Exercise and Nutrition in Older Rhode Islanders (SENIOR) Project was based on the Transtheoretical Model (TTM) of Health Behavior Change and consisted of a 12-month stage-tailored intervention which included manuals, newsletters, expert system assessments and reports, and telephone coaching aimed to increase exercise and fruit and vegetables consumption. The study found that individuals (n = 834, 65% response rate; age ≥60 years) who received the exercise intervention were more likely to progress in stage (of change), and individuals who did not receive the exercise intervention were more likely to regress or remain stable in stage. The intervention was more effective in individuals who were not considering becoming physically active at the start of the study (Greaney et al. 2008). The diet intervention group increased fruit and vegetable intake by 0.5 to 1.0 serving more than the control group over 24 months (Greene et al. 2008).

The *Physical Activity and Nutrition for Seniors (PANS)* pilot program evaluated the effectiveness of a 12 week home-based postal and telephone intervention for 65-74 year old adults living in Perth, Western Australia (Lee, Jancey et al. 2011). The PANS program was designed and developed for people at retirement age and included 248 subjects (114 participants and 134 controls, mean age: 72 years). There was a significant gain of 27 minutes per week of walking for recreation among PANS participants. Participants achieved a significant increase in fibre intake but not fat reduction.

The *NSW Get Healthy Information and Coaching Service (http://www.gethealthynsw.com.au/)*, a free Government-funded, population-based, telephone-based information and coaching service was launched in 2009 to support NSW adults not meeting population recommendations for healthy eating, physical activity and healthy weight. It offers a personalised 6-month telephone-coaching program and participants receive evidence-based supporting print materials and engage in a maximum of 10 coaching telephone calls. The Australian Capital Territory and Tasmanian Governments have also joined the *Get Healthy Information and Coaching Service* (Haghshenas and Davidson 2011). Initial reports found that users of the GHS in the first 18 months were representative of the NSW adult population in relation to education, employment status and Aboriginal status. However, more women, middle-aged, English-speaking, rural and disadvantaged adults participated in this service. Around 41% of GHS users were aged 50-70 years old (O'Hara et al. 2011). After controlling for other demographic variables and source of referral, those aged 50-59 years were significantly more likely to enrol in health coaching compared to those aged 18-29 years (OR=1.33, CI 1.15-1.54). After controlling for other demographic variables, self-efficacy, source of referral, health status and health risk profile, those aged 50-59 years and 60-69 years were significantly more likely to complete health coaching (OR=2.27, CI:1.48-3.48, OR=1.82, CI:1.09-3.03 respectively (Prevention Research Collaboration, Sydney, unpublished data).

4.4.5   Physical environment/ urban design and planning

Land use and walkability

Although there is strong rationale for increasing the walkability and physical environment (cf. section 3.2.1), intervention evidence is mixed about the impact of changes in the environment on increasing overall physical activity, largely due to methodological difficulties of measuring outcomes but also because of the complexity of psychosocial factors interacting with the effect of the physical environment among older adults.

In a Canadian study, while land use mix access, street connectivity, and aesthetics were predictors of transportation-related physical activity in the neighbourhood, only aesthetics was associated with local recreational physical activity (Kaczynski 2010). An American study examined measured and perceived environmental associations with physical activity of older adults residing across different neighbourhood types (Strath et al. 2012). Individuals residing in high-walkable neighbourhoods on average engaged in 45 minutes more of LIPA per day and 11 minutes more of MVPA per day than individuals residing in low-walkable neighbourhoods. Overall, environmental attributes jointly accounted for 38% of total activity, 35% of time spent in light intensity activity, and 54% of time spent in MVPA, after accounting for age, gender, body mass index, years lived in residence, and driver's licence/car ownership. Proximity to non-residential destinations was a common association with physical activity at the individual resident level.

Various studies have indicated that older adults who had, and who perceived to have, destinations such as retail, services and entertainment close by were likely to be more physically active (Strath et al 2012; Michael et al. 2010). Other studies have also reported positive associations between living within walking distance of specific types of businesses and facilities and individuals' physical activity level (Nagel et al. 2008; King et al. 2005). Para et al (2010) indicated that among older adults in Bogota, residents from areas with higher park density and high land-use mix were more likely, while those from areas with high connectivity were less likely, to report active park use. An inverse relationship between connectivity and physical activity highlighted the potential need for interventions in the realm of traffic and pedestrian safety.

Using data from the *Senior Health and Physical Exercise* (SHAPE) walking program, researchers identified and analysed social-ecological factors mediating and moderating changes in walking activity among older adults in the US (Michael et al. 2010). Social cohesion, walking efficacy, perception of neighbourhood problems, and neighbourhood walkability were assessed. Contrary to expectations, the intervention was not associated with a positive change in social cohesion or in neighbourhood perceptions. In fact, the intervention was associated with a significant increase in perceived neighbourhood problems. This was explained as regular walkers being more familiar with problems in the neighbourhood and thus more likely to report these problems.

Key aspects to address regarding walkability include: street network, mixed uses and local destinations for people to walk to, densities, open and public space, public transport accessibility, walk and cycle routes, community space, attractive and high quality public realm and connectivity. The Heart Foundation has designed the *Neighbourhood Walkability Checklist* to help Australians survey their local walking environment, identify issues and suggest local council areas for improvements. This checklist evaluates walker friendliness, comfort, safety, and convenience and connectedness (Heart Foundation website).

Park design
Evidence is accumulating to suggest that park planning may affect physical activity in adults generally, but little is known for older adults specifically. For example, Giles-Corti B et al (2005) conducted an environmental audit in Perth, Western Australia, and personal interviews with 1803 adults (aged 18 to 59 years). They reported that parks developed with more facilities and supporting amenities, such as restrooms, bicycle racks, and attractive landscaping, appear more likely to attract users for active purposes. Larger public open spaces generally had more attributes that make them more attractive to users (Giles-Corti et al. 2005).

Focusing on older people, a Japanese study examining the association of neighbourhood built environment and physical activity of Japanese older adults reported that some characteristics of the environment, such as population density and presence of parks or green spaces, may facilitate leisure time sports activity, but not increase the total walking time (Hanibuchi et al. 2011).

4.5   INTERVENTION AT THE SOCIETAL LEVEL

4.5.1 Health policy

Planned health assessments can improve the detection of behavioural risk factors and increase people's readiness to change, as well as produce actual behavioural changes, such as increased frequency of physical activity (Bouleware et al. 2009). The effectiveness of such assessments is greater for those at high risk.

In Australia, Medicare specifically supports health assessments for people aged 45-49 years in the general practice context. A small study found that this health check was associated with short term improvement in diet and physical activity behaviours (Amoroso et al. 2009). However, a qualitative study exploring the delivery of lifestyle behavioural risk factor screening and management by GPs within a 45-49 year old health check consultation reported that diet and physical activity were often inferred from appearance, and were only assessed if the patient was overweight (Ampt et al. 2009).

Although there is no specific evidence indicating that health assessment at age 45-49 years is advantageous over checks at other ages, there is a rationale for similar planned health assessments at other ages, particularly for an older age group with higher levels of risk factors. The retirement transition may provide an opportunity for a planned health assessment, as it is a time when people are making other lifestyle changes and likely to have more flexible and available time. For any planned health assessments it is crucial to consider GPs' attitudes, normative influences from both patients and the profession, and perceived external control factors (time, cost, availability and practice capacity), as they all influence management of behavioural risk factors. Health provider education, community awareness raising, support and capacity building may improve the uptake of lifestyle modification interventions (Ampt et al. 2009).

Funding initiatives have been employed to increase capacity and service delivery for older adults. For example, in Australia, *The Rural Primary Health Services (RPHS) program (*http://www.health.gov.au/ internet/main/publishing.nsf/Content/Rural-Primary-Health-Services-Program) aimed to improve access to a range of primary and allied health care services and activities for rural and remote communities. The RPHS program gives community-based primary health care services greater flexibility in the range of services they can offer, including health promotion and preventative health activities. Primary health care services encompass active treatment, screening programs, health education on individual health risks, and more broadly, efforts to address health concerns for the entire community through preventative health activities. Additional funding has been provided under the Preventative Health Initiative (PHI) for preventative health projects to some RPHS, which target the rural, remote and very remote communities meeting these criteria. It is recognised that meeting service provision demands for treatment can limit an organisation's capacity to undertake preventative health projects. The PHI funding will enable these RPHS organisations to work with communities to undertake a planned approach to preventative health in order to address health issues. This program is likely to reach older adults, but it is difficult to evaluate the overall impact on preventive health.

4.5.2 Community education

Mass media campaigns are widely used to expose high proportions of large populations to messages through routine uses of existing media, such as television, radio, and newspapers. There is evidence that mass media campaigns can produce positive changes or prevent negative changes in health-related behaviours across large populations, especially with the existence of a supportive environment that enables individuals to make those behaviour changes (Randolph and Viswanath 2004). However, assessment of campaigns to promote nutrition and physical activity, like those promoting tobacco control, shows that while short-term changes can be achieved, sustained effects are difficult to maintain after the campaigns end (Wakefield et al. 2010).

While older media campaigns in Australia related to diet frequently focused on reducing fat intake, more recent campaigns focused on increasing consumption of fruit, vegetables and low-fat milk. These campaigns have shown to be more successful, especially when people were provided with access to healthy foods or had health disorders for which changes in diet would be beneficial (Matson-Koffman, Brownstein et al. 2005; Pomerleau et al. 2005; Snyder et al. 2004). Campaigns with mass media components aimed at changing physical activity behaviours have shown short term increases in physical activity, mainly in highly motivated individuals (Cavill and Bauman 2004).

Although specific media campaigns targeting older adults are limited; successes have been observed with community-wide walking campaigns targeting older adults (Williams et al. 2008; Finlay and Faulkner 2005). Other examples of mass media campaigns targeting older adults are described below.

- *The Wheeling Walks* was a media-based community physical activity campaign to encourage walking among physically non-active 50-65 years old adults living in the city of Wheeling, West Virginia (US). It used an ecological approach that included extensive paid mass media, media relations and community involvement strategies. An initial campaign was conducted for 8 weeks, used multiple communication channels (television, radio and newspaper advertisements, public relations events, and public health education activities at worksites, churches and local organisations) and recommended at least 30 minutes of moderate-intensity daily walking. A booster campaign was conducted during month 11. A 16-week free walking clinic was also started and a column promoting walking was written in the Sunday newspaper for 12-months. The penetration rate of the target population was close to 90% during the 12-month intervention. Wheeling respondents reported higher proportions of sufficient active walking than residents from the control city over time. The most sedentary non-walkers at baseline showed the highest increases: 17% vs. 31% (3 months) and 18% vs. 32% (12 months) (Reger-Nash et al. 2005; Reger et al. 2002).

- A national daily television program called '*The Netherlands on the Move!' (NOM-tv)* was introduced in the Netherlands in 2000. NOM-tv was designed to target people aged 55 and over and included information on low intensity exercises as well as healthy-lifestyle tips. NOM-tv attracted at least 21% of the physically non-active people at baseline to viewing the program. Attitude, social influences and self-efficacy were the best determinants of behavioural intention. The program had a small effect in terms of the participants' knowledge of health and physical activity issues. It was particularly appealing to older women who already had a reasonable knowledge of the benefits of exercising, and had low levels of perceived barriers to participation (Hopman-Rock, Borghouts et al. 2005).

- In Australia, the current National Partnership Agreement on Preventive Health involves further commitments for social marketing initiatives at state and national levels. Several recent national

mass media campaigns, *Measure Up* (http://www.measureup.gov.au) and subsequent *SWAP IT (http://swapit.gov.au),* specifically addressed obesity prevention.

- The *To Be Young at Heart – Stay Active Stay Independent (SASI)* campaign was an 18-months multimedia campaign, implemented in rural NSW, to reduce falls among seniors by promoting physical activity. This campaign featured active ageing messages aimed at generating 'strength', 'balance', 'coordination' and 'flexibility', and included a variety of high-quality information, education and communication resources. Central to this campaign was the promotion of accessible and affordable physical activity opportunities in the region, including Tai Chi, aqua aerobics, group exercise, swimming and Lifeball. This campaign particularly promoted everyday activities, such as walking, gardening and household chores, and also offered older people an opportunity to socialise and have fun. In the community intercept survey, of the 36% respondents that recognised the campaign, 21% of them reported seeking information on physical activity, 33% reported increased intention to be more active and 22% reported becoming more active as a result of this campaign (John-Leader et al. 2008).

- In NSW, mass media have also been used recently to inform community members about the *Get Healthy Information and Coaching Service (http://www.gethealthynsw.com.au)*, and have been the most effective form of promotion. Previously, NSW and other Australian states undertook mass media and other promotional efforts for fruit and vegetable consumption (*Go for 2 and 5*) and physical activity ('*Find 30'*; and the Active Australia campaign '*Exercise — you only have to take it regularly, not seriously'*).

- *Choose Health: Be Active: A physical activity guide for older Australians* was a print resource developed by the Department of Veterans' Affairs to encourage physical activity among older veterans (Brown et al. 2005). Following involvement from the Department of Health and Ageing the booklet was expanded to include information on falls prevention and nutrition. From June 2005 – May 2006, 24,000 booklets were printed. Feedback from 324 respondents was very positive. The sections on incidental exercise opportunities, personal daily activity levels, and the exercise planner elicited most responses. Two hundred and twenty three respondents asked for more information on how to become more active.

4.5.3 Other public policies

Menu labelling

In general, studies have found that the impact of menu labelling is modest and varies across demographic groups, with the majority of studies showing some positive impact on intent or behaviour (National Heart Foundation 2010; Clegg et al. 2009). However, the specific benefits for older people are unknown and may be limited, as older people report less frequent consumption of fast foods.

A rapid review of the literature published by the National Heart Foundation of Australia (2010) found that consumers often underestimate the amount of negative nutrients (energy, total fat, saturated fat and sodium) in unhealthy foods, although the content of these nutrients in healthier foods may be slightly underestimated or overestimated. Labelling the amount of energy (measured in calories in the US) on restaurant menus may provide a calorie reduction in the range of 15 to 250 calories, and may also influence subsequent food choices that day. Groups who may benefit most include women and parents who choose menu items for their children. For example, a study using transaction data from 222 *Starbucks* coffee stores in New York City pre- and post-introduction of calorie labelling found that average calories per transaction decreased by 6% overall, or by 14% for food alone as opposed to

including coffee purchases (Bollinger et al. 2010). Another study with *Subway* found customers who reported seeing calorie labelling information purchased 52 fewer calories than those who did not see the information (Bassett et al. 2008).

Although there is some evidence of consumer support for nutrition labelling on food service menus, recent consumer research indicates that consumers have a poor understanding of energy and kilojoules in relation to food, suggesting the importance of consumer education as part of the menu labelling initiative (Wellard et al. 2011).

Workforce participation

Over the past decade, Australian governments have developed a series of policies and initiatives aimed at increasing participation among older workers, by encouraging workers to stay in the workforce longer or re-enter the workforce, and by supporting employers to attract experienced and reliable staff or retain the skills and experience of existing mature age workers (http://www.deewr.gov.au/ Employment/Programs/ExpPlus/Pages/supportformatureagejobseekers.aspx), namely:

- The *Experience+* suite of programs promote the viability of retraining and re-skilling mature aged employees. The most recent program *Investing in Experience* (Skills Recognition and Training) is part of *Building Australia's Future Workforce – Skills to promote increased participation*, and replaces the *More Help for Mature Age Workers* initiative from July 1, 2012. It aims to assist mature age workers (aged 50 years and over) to gain formal recognition of their current competencies and receive training to fill any knowledge or skills gaps so that they can obtain a nationally recognised qualification at the Certificate III to Advanced Diploma level.

- A *Jobs Bonus of $1000* is available from 1 July 2012 to employers who recruit an eligible mature age job seeker, aged 50 years or over.

- *Corporate Champions* are employers who make a public commitment to move toward better practice in employing mature age people. They receive a package of tailored support to help them achieve the better practice standards, as outlined in the *Investing in Experience* program.

- A *'mature age participation-job seeker assistance'* program will be available from 1 January 2013 to provide eligible job seekers aged 55 years and over with a peer-based environment in which to develop their IT skills, undertake job-specific training and prepare for work.

- The *Experience$^+$ Career Advice* service provides professional career counselling and a resume appraisal service to mature age Australians aged 45 years and over.

The State of QLD has published a booklet (*Valuing older adults*) to support businesses to successfully adjust to an ageing workforce. It affirms that "employing and retaining older workers is not just inevitable. Rethinking attitudes that adapt your business to Australia's ageing workforce can translate into significant savings in recruitment, training and productivity". It suggests, as one of the strategies, the introduction of flexible work arrangements to create an environment that encourages employees to balance their work and personal responsibilities (Queensland Government 2005):

- Develop flexible employment opportunities for older workers, especially those in high-skill occupations or those with carer responsibilities. This can provide a phased transition to retirement and reduced responsibilities at work.

- Create a pool of experienced people who have retired but are willing to work during peak periods or on special projects, replace people on leave or coach new managers.

- Monitor take-up rate and impacts of flexible work arrangements. See if an initiative is contributing to improved productivity and meeting the needs of both the business and employees.

- Recognise and manage human nature issues that are often associated when an older worker chooses to work part-time and accepts a lower level of responsibility.

5 SUMMARY OF EFFECTIVE APPROACHES TO REDUCE CHRONIC DISEASE RISK AMONG OLDER ADULTS

5.1 SCOPE OF THE EVIDENCE

There is a substantial body of evidence for effective approaches for chronic disease prevention among older people. Table 13 summarises the scope and extent of the evidence. The evidence predominantly relates to physical activity promotion, and there is considerably less evidence for programs targeting improved nutrition/diet. There is almost no evidence on ways of reducing sedentary behaviours among this target group. A number of promising approaches are included in Table 13, indicating intervention approaches for which there is less evidence of effectiveness but where these is a strong rationale for intervening, and/or for which there is parallel evidence related to similar issues. There are also significant gaps in the evidence, which warrant further investigation.

Table 13 Scope of the evidence (PA – physical activity)

Level of intervention	Effective intervention approaches	[1]Promising intervention approaches	[2]Gaps in the evidence
Individual	Brief advice and moderate intensity lifestyle (particularly PA) counselling by GPs and other health professionals (face-to-face (individual or group), telephone based, internet-based) Nutrition education	Lifestyle counselling and weight management programs via community pharmacists	Impact of Falls Prevention programs on total PA Interventions to reduce sedentary behaviours, including TV time Interventions targeting eating and dietary behaviours Promotion of gardening and incidental PA
Community	PA group programs Peer-led PA programs	Home delivery of fruit and vegetables* 'Walkability' and changes to physical environment Volunteering as a means to an active lifestyle	Cooking and nutrition skills Community gardens Healthy food in local clubs Impact of community transport on healthy food accessibility/ consumption
Society	Social marketing	Policies to ensure access to appropriate health services Health assessments around retirement	Workplace interventions targeted to 55+ year olds Better information on urban design and transport for older adults

[1] *Promising interventions are those for which evidence is accumulating or for which there is a strong rationale for action and/or parallel evidence*
[2] *Gap areas are those which determinants research indicates are likely to be useful areas in which to intervene but for which there is currently little research evidence of effectiveness/few interventions*
* Can act against physical activity

Overall, the body of research evidence is incomplete, particularly in terms of information on the generalisability, feasibility and potential population reach of interventions. While some research provides evidence about the overall applicability of interventions in the NSW context, most research studies tend to be conducted with self-selected people and groups, and thus provide a positive bias, so that the reported effectiveness or impact may not apply when the intervention is implemented at the population level.

5.2   SUMMARY OF THE EVIDENCE

5.2.1 Effective approaches

At the individual level:

Provision of brief advice and moderate intensity lifestyle and chronic disease prevention programs delivered via primary care (by GPs, nurses or other allied health practitioners, such as dieticians)

- Effective modes of delivery include brief face-to-face counselling involving motivational interviewing, and telephone, internet or computer-based programs. Interactive technology (internet-based websites and mobile phones) is an expanding area of research and is showing promise in terms of providing exercise programs and dietary guidance for weight loss and improved function as part of extended care options. Although these modes of delivery are highly interactive, engaging, and non-threatening for older adults, it is not clear whether older people with less computer training and/or little experience of mobile phone use can make use of such program components.

- The considerable barriers faced by GPs in delivering lifestyle programs via the primary care setting (time, competing priorities, lack of knowledge, unclear guidelines, increased workload, limited reimbursement for preventive counselling) need to be addressed. Thus, workforce issues need to be addressed. Referral opportunities and pathways are needed.

- Self-efficacy, goal setting and self-monitoring, underpinned by social support, are the specific components shown to be effective in supporting weight loss and physical activity participation among adults 50 years and older. Physical activity programs in particular should address negative anticipation of exercise among older adults.

At the community level:

Nutritional education interventions run by community health professionals

- Many brief advice nutrition interventions can be delivered to patients in an opportunistic way whilst they receive other nursing care. Nutrition education (sometimes as part of a complex intervention) can positively influence diet, improve physical function and reduce depression, but there are inconclusive findings about its impact on weight change.

- Nutrition messages should be limited in number, simple, targeted, practical, and reinforced; uses incentives. Regular contact with health professionals; and hands-on activities are also important. Other characteristics of successful nutrition counselling interventions include group learning sessions, peer support and scheduled follow-up meetings.

Community programs promoting physical activity and exercise training

- Professional advice and guidance with continued support (of at least six weeks duration) can encourage adults in the general community to be more physically active in the short to mid-term.

- A wide variety of physical activity programs has shown to be effective in reducing obesity and improved physical functioning, among other health benefits, among older adults. Apart from walking, aerobics, and strength training, other types of physical activity have shown to be effective in improving older adults' physical function and well-being. These include water-based exercises, yoga, tai chi and dancing.

- Physical activity interventions aimed at improving the self-perception of exercise (self-efficacy) can have positive effects on confidence and the ability to initiate and maintain physical activity behaviour. Additionally, programs that include some behavioural techniques (goal-setting, self-monitoring, prompting, feedback) and have a community extension or connection are more likely to result in sustained increases in activity. For instance, three simple studies reviewed indicate that peer-led programs in the community can provide an important social and emotional support influence to help inactive individuals to participate and engage in physical activity.

At the society level:

Social marketing including mass media campaigns

- Mass media campaigns can produce positive changes or prevent negative changes in health-related behaviours across large populations, especially where there is a supportive environment that enables individuals to make changes. However, assessment of campaigns to promote nutrition and physical activity shows that, while short-term changes can be achieved, sustained effects are difficult to maintain after campaigns' end.

- Although specific media campaigns targeting older adults is limited, selected social marketing campaigns (printed and TV) targeting this age group have been shown to be effective in increasing knowledge about the health benefits of physical activity and in promoting physical activity participation. In particular, community-wide walking campaigns targeting older adults have been successful.

5.2.2   Promising approaches

At the individual level:

Use of community pharmacists in weight management

- While the involvement of community pharmacists has shown promising results as they are a trusted and easy accessible point of contact for older people, population wide implementation may be limited by costs. However, this approach may be cost-effective, feasible and acceptable in rural, and perhaps regional, areas.

At the community level:

Programs to increase accessibility to fruits and vegetables

- Home delivery of fruits and vegetables lead to increased vegetable intake, but are relevant only to older adults who are socioeconomically disadvantaged or have a physical limitation that restricts them from shopping for food. Older adults generally like to shop for their food and this has other benefits, such as decreasing social isolation and increasing physical activity.

Increase neighbourhood walkability

- A large body of evidence indicates a strong link between neighbourhood walkability and other aspects of the physical environment and older people's physical activity levels. However, the relationships are complex, and measurement issues have prevented conclusive evidence on what particular changes are conducive to physical activity participation among older adults. However, there is evidence that environmental changes are necessary and can even be sufficient to improve physical activity levels in this target group. Further research is necessary to build on the growing evidence base in this area.

Use of peer supporters

- There is scope for using volunteers and lay people to implement a wide range of community interventions to promote healthy behaviours in older people. For example, older people can be trained to lead dietary interventions (such as cooking skills) and increasing participation in community-based physical activity initiatives.

At the society level:

Planned health assessments

- There is some indication that the health check for 45-49 year olds can lead to short term improvement in diet and physical activity behaviours, especially in those individuals at high risk. There is, therefore, a rationale for similar planned health assessments for older adults, who are likelier to have higher levels of risk factors. Although the retirement transition may provide an opportunity to conduct a health check, as people are making other lifestyle changes and likely to have more flexible and available time, it is important to keep in mind that many barriers in the general practice setting can influence the uptake of this assessment.

Accessibility to healthier choices

- There is very limited evidence, especially among older adults, about the impact of food policy interventions such as menu labelling and front-of-pack food labelling on dietary behaviours. Evaluation of recent government policy will inform this evidence base.

5.2.3 Gaps in intervention research

There is a large number of gaps in the scope and extent of research into approaches to reduce obesity and chronic disease risk among older people. Several of the most prominent gaps are indicated below.

- **Extension of falls prevention programs** – Falls-prevention programs have been shown to be effective in increasing balance and strength, but they have generally not been linked to, or aimed at, increased total physical activity. More research is needed to show whether these initiatives help

older adults to meet physical activity recommendations and how such programs may be expanded to make sure that they do achieve this additional outcome.

- **Sedentary behaviours** – There is almost no evidence relating to interventions to reduce sedentary behaviour among older adults and this is an important gap. A recently-funded NHMRC intervention study involving individual goal-setting and volunteer mentors to overcome sedentary lifestyles in older adults at risk of cognitive decline, may inform the evidence base. Much of the evidence indicates that older adults may not be aware of the negative health effects of prolonged TV watching/sitting time. Providing support for engaging activities can reduce TV use in older people, or adapting TV to be more interactive, may also be beneficial. Increasing public awareness of alternatives to TV watching could help to diminish the negative health effects and be a focus for social marketing to older adults.

  Similarly, there is almost no evidence (one social marketing campaign) on promoting gardening and/or incidental day-to-day physical activity among older adults.

- **Improving dietary behaviours** – At the community level, there is very limited research about improving dietary behaviours. Only one program was found to specifically target skills in food preparation and food safety among older adults. Similarly, there is limited evidence about access to community gardens and their impact on physical activity and healthy eating among older adults. The promotion of healthier foods in local clubs has not been fully evaluated; issues around sustainability will need to be overcome.

- **Land use mix, walkability and park design** – Specific design aspects of land use relating to walker friendliness for the older adult requiring further research include: connectivity and street networks, mixed land use and local destinations, housing density, open and public space, public transport accessibility, walking trails, aesthetics and safety.

- **Public and community transport** – There are few evaluation studies examining the impact of community and public transport options on improving access to healthy food.

- **Workplace interventions** – At the society level, there are emerging policies regarding flexible working arrangements for people close to retirement; but there are no workplace interventions specifically targeting 55+ year olds.

- **Lifestyle clinics** – As adherence to a healthy diet, reduced sedentary time and participation in physical activity is protective of a range of chronic diseases; the implementation of 'lifestyle clinics' (such as that established at the University of New South Wales) to which primary care practitioners can refer older adults who have a range of morbidities, including diabetes, cardiac rehabilitation, and obesity, could be a cost-effective way to deliver lifestyle programs. This would involve investment in infrastructure and workforce (exercise physiologists and dieticians) but could have extensive reach, if implemented alongside appropriate referral systems, and long-term gains across a large sector of the older population. Research into the potential for this approach is warranted.

6   RECOMMENDATIONS FOR ACTION

6.1   RECOMMENDED ACTIONS BY DOMAIN

The list of recommended approaches indicated below is based on a comprehensive review of the research evidence on determinants and interventions. They are gleaned from a mix of approaches, drawing on those where there is sufficient evidence of effectiveness, as well as approaches which are promising either because there is a strong rationale for a particular approach (from determinants and epidemiological evidence) or where there is emerging evidence.

6.1.1   Health sector

- Include assessment of weight and lifestyle behaviours as part of regular GP visits (requires financial incentives to GPs); provide and promote routine health checks for people aged over 55 years.

- Brief lifestyle advice by primary health care providers (i.e. GPs, practice nurses, dieticians) to at risk older people.

- Workforce skills development for health professionals in providing health checks and brief advice.

- Encourage GPs to utilise current MBS Items to refer older people to appropriate physical activity (including a mix of aerobic, strength-based and flexibility exercises) and dietetic services. Develop specialised referral patterns and referral links among primary health care providers and allied health professionals. Develop clinical pathways and protocols for weight management services for older people. Utilise community pharmacists as providers of healthy lifestyle programs, especially in rural and regional areas.

- Provide an integrated approach for obesity and chronic disease prevention and management, e.g. 'lifestyle services' or 'lifestyle clinics', to provide more specialised, high intensity lifestyle programs regardless of the diagnosis (e.g. type 2 diabetes, cardiac rehabilitation, obesity, cardiovascular disease).

- Implement telephone, internet-based and face-to-face moderate intensity lifestyle and chronic disease prevention programs (individual and group based). Continue to promote and implement the *NSW Get Healthy Information and Coaching Service*; consider including a specific module for late-middle aged and older adults.

- Consider ways in which existing health financing systems could facilitate people with established risks to use self-management approaches to improve their health.

- Include waist circumference as an indicator in NSW Population Health Survey (and other health surveys appropriate for older adults in NSW) [cut-offs for older adults need further investigation before reporting].

6.1.2   Community programs

- Workforce planning and development for community-based staff to provide general information and advice on physical activity and nutrition.

- Provide, publicise and support the implementation of community-based physical activity programs for older people; include a peer support component wherever feasible.

- Adapt exercise sessions designed for falls prevention to promote physical activity recommendations, reach a wider target group and include a broader range of activities, while retaining falls prevention benefits.

- Train accredited fitness leaders to conduct appropriate physical activity programs for older people (including a mix of aerobic, strength-based and flexibility exercises).

- Offer low-cost active living programs such as gardening, therapeutic dance programs, exercise programs, and walking programs for older people of many ages and abilities to enhance their physical, psychological and social health.

- Promote community kitchens, food co-ops, community gardens and cooking groups as social ways to teach nutrition and cooking skills, to encourage regular eating and better diets, and to promote regular social contact, especially for those older adults living alone.

- Develop and implement programs promoting healthy menu options in clubs and other food services popular with older people. Develop and implement healthy catering guidelines amongst agencies and services working with older people.

- Promote peer advocacy, peer education, peer support, self-help groups and mutual aid approaches as a central part of an effective program.

- Continue to promote volunteerism among older people.

6.1.3 Information and communication

- Promote the health benefits of physical activity (including a mix of aerobic, strength-based and flexibility exercises) and reduced sedentary behaviour to older people (and health risks of low physical activity /sitting).

- Deliver information and education for older adults, their families, health professionals, other service providers and community members more generally about the needs of older people and their caregivers, risk factors they experience and programs available. Recognise the diversity of older people's experiences of health and ageing, when providing health information.

- Develop and conduct a series of social marketing campaigns involving communication of risks and promoting healthy behaviours, segmented for different target groups across the older population. The different target group segments could comprise:

  - 45 to 54 years, where there is considerable potential to prevent weight gain during and following menopause and other life changes.
  - 55 to 64 years, where there is potential to emphasis the value of healthy lifestyle as part of other lifestyle changes occurring around retirement.
  - 65 years plus, where there are multiple health and social benefits from engaging in physical activity, especially strength training.
  - Older adults who have reduced functional capacity, and require modified or tailored activity services.

- Disseminate information about nutrition and physical activity guidelines and healthy weight recommendations for older people to the community and agencies working with older people. Ensure consistency in messages.

- Use volunteer and community networks to communicate health information to older people.

6.1.4 Urban development, housing and transport services

- Strengthen implementation of existing planning guidelines for residential areas to ensure good access to services and facilities.

- Design parks and community recreational facilities appropriate for older adults' participation.

- Design housing for optimal functioning of older people.

- Increase availability and accessibility of public and community transport services, ensuring collaboration between industry, communities and local government.

6.1.5 Research and evaluation

- Develop a strategic body of research on a range of prevention initiatives targeting older adults.

- Evaluate effectiveness, reach, and implementation barriers of prevention programs.

- Develop and evaluate programs promoting healthy menu options in food services/outlets popular among older adults.

- Investigate ways to broaden falls prevention programs to increase total level of physical activity.

- Investigate sedentary behaviour patterns of older adults and identify social marketing strategies to promote physical activity and reduce sitting/TV watching among older people.

- Investigate snacking in older adults and ways of reducing snacking and increasing fruit and vegetables consumption.

- Implement and evaluate the impact of environmental planning guidelines for residential areas (e.g. healthy urban checklist items relevant to older persons) on older people's physical activity and lifestyle.

- Evaluate feasibility and implications of implementing a health check around retirement age.

- Investigate cost-effective ways of implementing integrated approaches to the prevention and management of obesity and chronic disease in primary care (e.g. 'lifestyle services/clinics').

- Provide segmented analysis of health-related topics (weight status, nutrition, physical activity, sedentary behaviours) by age and gender in ongoing population health monitoring, and in the evaluation of programs and interventions.

- Make use of existing databases, such as the *45 & Up Study*, to explore older persons' health-related behaviours and contributing factors to obesity and chronic disease in this age group.

6.2   IMPLEMENTATION CONSIDERATIONS

A portfolio of interventions is likely to offer the most effective strategy for reducing chronic disease risk across the older population. This would include a mix of environmental change and policy initiatives, communication and individual behaviour change initiatives. This will require collaborative partnerships across government, non-government and the private sector, within and outside of the health sector. Consistency in messages is paramount.

In implementing evidence-based interventions, additional planning to ensure maximum reach, participation and adherence to programs is required. Information on generalisability, feasibility and potential population reach of interventions is not always available; and while the research evidence indicates effective approaches, many interventions predominantly reach the 'interested', so that those groups likely to benefit most may not be reached at all. Further, older adults are not a homogeneous population, and within the age range of 55-74 years, people are experiencing different life stages and circumstances (menopause, retirement, empty nest, widowhood) that will need to be taken into consideration when planning and implementing programs. Additionally, programs should be tailored for older people in rural and remote areas, older people who are socioeconomically disadvantaged, older Indigenous Australians, older people from culturally and linguistically diverse backgrounds, and people ageing with a longstanding disability.

There is scope to develop small-scale community-based projects to support healthy ageing; for example, similar to the current Healthy Communities Initiative but with a focus on the older population.

There is currently a lack of infrastructure to implement local prevention and lifestyle programs, which could address the small number of behavioural risk factors common to multiple chronic diseases. In the future, a range of new implementation systems will be required to meet the needs of the ageing population.

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Table A1: Summary of physical activity recommendations for older adults – American College of Sports and Medicine/American Heart Association (Chodzko-Zajko, Proctor, et al. 2009)

TABLE 1. Summary of ACSM/AHA physical activity recommendations for older adults.

The current consensus recommendations of the ACSM and AHA with respect to the frequency, intensity, and duration of exercise and physical activity for older adults are summarized below. The ACSM/AHA Physical Activity Recommendations are generally consistent with the *2008 DHHS Physical Activity Guidelines for Americans*, which also recommend 150 min·wk^{-1} of physical activity for health benefits. However, the DHHS Guidelines note that additional benefits occur as the amount of physical activity increases through higher intensity, greater frequency, and/or longer duration. The DHHS Physical Activity Guidelines stress that if older adults cannot do 150 min of moderate-intensity aerobic activity·wk^{-1} because of chronic conditions, they should be as physically active as their abilities and conditions allow.

Endurance exercise for older adults:

Frequency: For moderate-intensity activities, accumulate at least 30 or up to 60 (for greater benefit) min·d^{-1} in bouts of at least 10 min each to total 150–300 min·wk^{-1}, at least 20–30 min·d^{-1} or more of vigorous-intensity activities to total 75–150 min·wk^{-1}, an equivalent combination of moderate and vigorous activity.

Intensity: On a scale of 0 to 10 for level of physical exertion, 5 to 6 for moderate-intensity and 7 to 8 for vigorous intensity.

Duration: For moderate-intensity activities, accumulate at least 30 min·d^{-1} in bouts of at least 10 min each or at least 20 min·d^{-1} of continuous activity for vigorous-intensity activities.

Type: Any modality that does not impose excessive orthopedic stress; walking is the most common type of activity. Aquatic exercise and stationary cycle exercise may be advantageous for those with limited tolerance for weight bearing activity.

Resistance exercise for older adults:

Frequency: At least 2 d·wk^{-1}.

Intensity: Between moderate- (5–6) and vigorous- (7–8) intensity on a scale of 0 to 10.

Type: Progressive weight training program or weight bearing calisthenics (8–10 exercises involving the major muscle groups of 8–12 repetitions each), stair climbing, and other strengthening activities that use the major muscle groups.

Flexibility exercise for older adults:

Frequency: At least 2 d·wk^{-1}.

Intensity: Moderate (5–6) intensity on a scale of 0 to 10.

Type: Any activities that maintain or increase flexibility using sustained stretches for each major muscle group and static rather than ballistic movements.

Balance exercise for frequent fallers or individuals with mobility problems:

ACSM/AHA Guidelines currently recommend balance exercise for individuals who are frequent fallers or for individuals with mobility problems. Because of a lack of adequate research evidence, there are currently no specific recommendations regarding specific frequency, intensity, or type of balance exercises for older adults. However, the ACSM Exercise Prescription Guidelines recommend using activities that include the following: 1) progressively difficult postures that gradually reduce the base of support (e.g., two-legged stand, semitandem stand, tandem stand, one-legged stand), 2) dynamic movements that perturb the center of gravity (e.g., tandem walk, circle turns), 3) stressing postural muscle groups (e.g., heel stands, toe stands), or 4) reducing sensory input (e.g., standing with eyes closed).

The ACSM/AHA Guidelines recommend the following special considerations when prescribing exercise and physical activity for older adults. The intensity and duration of physical activity should be low at the outset for older adults who are highly deconditioned, functionally limited, or have chronic conditions that affect their ability to perform physical tasks. The progression of activities should be individual and tailored to tolerance and preference; a conservative approach may be necessary for the most deconditioned and physically limited older adults. Muscle strengthening activities and/or balance training may need to precede aerobic training activities among very frail individuals. Older adults should exceed the recommended minimum amounts of physical activity if they desire to improve their fitness. If chronic conditions preclude activity at the recommended minimum amount, older adults should perform physical activities as tolerated so as to avoid being sedentary.

Table A2: Role of physical activity in the prevention and management of chronic disease (Chodzko-Zajko, Proctor et al. 2009)

TABLE 3. Summary of the role of physical activity in the prevention, management, and treatment of chronic disease and disability.

Disease State	Preventive Role	Therapeutic Role	Effective Exercise Modality	Other Considerations
Arthritis	Possible, via prevention of obesity	Yes	AET RET Aquatic exercise	Low impact Sufficient volume to achieve healthy weight if obese
Cancer	Yes, AET in epidemiological studies	Yes, for QOL, wasting, lymphedema, psychological functioning, breast cancer survival	AET RET	
Chronic obstructive pulmonary disease	No	Yes, for extrapulmonary manifestations	AET RET	RET may be more tolerable in severe disease; combined effects complementary if feasible Time exercise sessions to coincide with bronchodilator medication peak Use oxygen during exercise as needed
Chronic renal failure	Possible, via prevention of diabetes and hypertension	Yes, for exercise capacity, body composition, sarcopenia, cardiovascular status, QOL, psychological function, inflammation, etc.	AET RET	Exercise reduces cardiovascular and metabolic risk factors; improves depression RET offsets myopathy of chronic renal failure
Cognitive impairment	Yes, AET in epidemiological studies	Yes	AET RET	Mechanism unknown Supervision needed for dementia
Congestive heart failure	Possible, via prevention of coronary artery disease and hypertension	Yes, for exercise capacity, survival, cardiovascular risk profile, symptoms, QOL	AET RET	RET may be more tolerable if dyspnea severely limits AET activity Cardiac cachexia targeted by RET
Coronary artery disease	Yes AET and RET now shown to be protective	Yes	AET RET	Complementary effects on exercise capacity and metabolic profile from combined exercise modalities Resistance may be more tolerable if ischemic threshold is very low because of lower HR response to training
Depression	Yes, AET in epidemiological studies	Yes	AET RET	Moderate- to high-intensity exercise more efficacious than low-intensity exercise in major depression Minor depression may respond to wider variety of exercise modalities and intensities
Disability	Yes, AET in epidemiological studies, muscle strength protective	Yes	AET RET	Choice of exercise should be targeted to etiology of disability
Hypertension	Yes, AET in epidemiological studies	Yes	AET RET	Small reductions in systolic and diastolic pressures seen Larger changes if weight loss occurs
Obesity	Yes, AET in epidemiological studies	Yes	AET RET	Sufficient energy expenditure to induce deficit RET maintains lean tissue (muscle and bone) better than AET during weight loss
Osteoporosis	Yes, AET in epidemiological studies	Yes	AET RET Balance training High-impact exercise	AET should be weight-bearing High-impact, high-velocity activity (e.g., jumping) if tolerable RET effects are local to muscles contracted Balance training should be added to prevent falls
Peripheral vascular disease	Yes, AET via treatment of risk factors for PVD related to exercise	Yes	AET Resistance	Vascular effect is systemic; upper limb ergometry may be substituted for leg exercise if necessary RET has positive but less robust effect on claudication May need to exercise to the limits of pain tolerance each session to extend time to claudication
Stroke	Yes, AET in epidemiological studies	Yes	AET, treadmill training RET (treatment)	Most effective treatment modality not clear
Type 2 diabetes	Yes, AET in epidemiological studies RET protective for impaired glucose tolerance	Yes	AET RET (treatment)	Exercise every 72 h Moderate- to high-intensity exercise most effective

AET, aerobic exercise training; RET, resistance exercise training; QOL, quality of life.

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