

EVIDENCE UPDATE ON OBESITY PREVENTION Across the lifecycle

Prepared for NSW Ministry of Health

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EXECUTIVE SUMMARY

This Evidence Update, prepared for NSW Ministry of Health, provides a summary of evidence on the prevention of overweight and obesity in order to guide the development of the NSW State Obesity Plan 2012–2015. The evidence update builds on previous literature reviews conducted by the Prevention Research Collaboration at Sydney University with regard to obesity prevention. It was conducted as a comprehensive and rapid review, drawing upon a broad range of research studies and policy analyses, including current national and state-wide strategies, to inform policy and practice.

A solutions-focused approach to identifying promising strategies across different stages of the life course has been applied. The report considers evidence from studies and reviews on factors contributing to weight gain across the life course, in addition to evidence of effectiveness of interventions in terms of weight status and mediating factors. The extent and strength of the evidence, as well as other factors pertinent to the NSW context including existing policy and practice, feasibility, sustainability, and population, were considered.

The evidence is presented using a consistent template for each target age group. This template includes a rationale for action, a description of the policy and practice context, an assessment of the intervention evidence and indication of the most promising approaches for action and areas for further research. Implementation issues are discussed where appropriate.

Despite gaps in evidence for some target groups (and how to reach them), settings and behaviours, and limitations in available evidence in some cases (for example, short implementation periods of existing programs) there is sufficient evidence from a variety of sources to help guide selection of the most promising approaches to promote healthy weight at the population level at each stage of the life course, key implementation settings are identified. This report identifies the most promising approaches for action based on the range of evidence across the key settings: childcare, schools, workplaces, home/family, primary health care and community. These promising approaches are summarised in Table 1. This summary table includes a number of actions for which the evidence of effectiveness is currently limited, but where the rationale to proceed is, based on determinants and the evidence, particularly strong; although ongoing research and evaluation is recommended. A substantial number of other areas for further research and investigation are also identified throughout the report.

SUMMARY OF PROMISING APPROACHES

This table provides a summary of the most promising areas of action for intervening to reduce obesity at the population level based on a comprehensive review of the current policy and practice context, the rationale for action, and the research evidence of effectiveness. Actions or approaches for which evidence of effectiveness is currently limited are also included in this summary table (in italics) where there is a strong rationale for action based on the good evidence; these approaches should be accompanied by rigorous evaluation. Some of the specific promising areas for action mentioned in the body of the review are summarised in this table, for conciseness.

SETTINGS	Preschoolaged children (0-5 years)	Primary schoolaged children (5-12 years)	Adolescents (13-18 years)	Young adults (18-34 years)	Adults (35-60 years)	Older Adults (60-75 years)
Childcare/ Schools/ Workplaces	<p>Ongoing teacher development for FMS⁴ and active play</p> <p>Innovative strategies to reduce EDNP² foods in lunchboxes</p> <p>Specific programs with supported playgroups and CALD³ and indigenous childcare settings</p>	<p>Ongoing teacher development for PE/FMS teaching</p> <p>Marketing of healthy choices in school canteens</p> <p>Whole-of-school multi-strategic programs in schools with high proportion of CALD students</p> <p>Subsidised F&V programs for disadvantaged children (also via community)</p> <p>Innovative strategies to reduce EDNP foods in lunchboxes (including communication to parents)</p>	<p>Ongoing teacher development for effective PE/FMS teaching</p> <p>Optimal implementation of healthy school canteens</p> <p>Multi-component PA programs in schools targeting girls and boys separately & differently</p> <p>Whole-of-school multi-strategic programs in schools with high proportion CALD students</p> <p>Peer support strategies for healthy dietary behaviours</p>		<p>Workplace nutrition and physical activity programs with large, blue collar industry workplaces</p> <p>Workplace awards/incentives for environmental changes supportive of healthy lifestyles</p> <p>Active travel supportive programs</p> <p>Telephonebased information and support</p> <p>Tailored risk communication strategies</p> <p>Communication to employers (benefits of healthy workforce)</p>	
Home/ Family	<p>Targeted home visiting (0-2yrs)</p> <p>Communication to parents via childcare (healthy lunchboxes,</p>	<p>Social marketing to parents on home availability of EDNP foods and soft drinks</p> <p>Communication to</p>	<p>Social marketing to parents on home availability of EDNP foods and soft drinks</p> <p>Promoting family meals</p>	<p>Social marketing (using social media) on reducing sweetened drinks and fast foods consumption, and promoting physical</p>	<p>Social marketing promoting physical activity</p> <p>Risk communication related to weight,</p>	<p>Social marketing and public education promoting strength based exercise as well as walking and other</p>

SETTINGS	Preschoolaged children (0-5 years)	Primary schoolaged children (5-12 years)	Adolescents (13-18 years)	Young adults (18-34 years)	Adults (35-60 years)	Older Adults (60-75 years)
	<p>active transport, reduced screen time)</p> <p>Social marketing to parents on specific eating and physical activity behaviours (home availability of EDNP foods and soft drinks active play family activity)</p>	<p>parents to increase awareness of physical activity/screen time recommendations for children</p>	<p>(without TV on) and no TV in bedrooms</p> <p>Social marketing e.g. social media on reducing sweetened drinks(boys), breakfast consumption (girls), and reducing small screen recreation</p>	<p>activity</p>	<p>physical activity and nutrition</p> <p>Telephone and web based lifestyle behaviour change programs for people with chronic disease and high risks for chronic disease</p>	<p>physical activity</p> <p>Risk communication on sitting and TV viewing</p> <p>Telephone and web based lifestyle behaviour change programs for people with chronic disease and high risks for chronic disease</p>
Community	<p>Playgrounds green open space</p> <p>Front-of-pack interpretive food labelling</p>	<p>Interventions through and with community sports (coaches, canteens, sponsorship, subsidised participation)</p> <p>Green open space, playgrounds</p> <p>Land use zoning near schools and public playgrounds</p> <p>Front-of-pack interpretive food labelling</p>	<p>Menu labelling in quick service restaurants</p> <p>Interventions through and with community sports (coaches, canteens, sponsorship, subsidised participation)</p> <p>Land use zoning near schools and public playgrounds</p>	<p>Menu labelling in quick service restaurants</p> <p>Walkable active urban design</p>	<p>Menu labelling in quick service restaurants</p> <p>Front-of pack interpretive food labelling</p> <p>Walkable active urban design</p> <p>Specific food availability interventions in disadvantaged communities</p>	<p>Physical activity programs (including broadening of falls prevention programs to focus on increasing PA)</p> <p>Walkable active urban design</p> <p>Community based lifestyle behaviour change programs for people with chronic disease and high risks for chronic disease</p> <p>Specific healthy food access and availability interventions in disadvantaged communities</p>
Range of communitywide policy and program approaches						

SETTINGS	Preschoolaged children (0-5 years)	Primary schoolaged children (5-12 years)	Adolescents (13-18 years)	Young adults (18-34 years)	Adults (35-60 years)	Older Adults (60-75 years)
Primary health care	Communitybased mothers' groups promoting breast feeding and infant healthy eating practices	Familyfocusedweight management programs	Familyfocusedweight management programs	Guidelines for weight management during pregnancy Routine weighing and discussion of weight management at all antenatal visits Individual/group lifestyle interventions with high risk women during pregnancy	Brief advice for physical activity, nutrition and weight management Moderate intensity lifestyle behaviour change programs for people with chronic disease and high risks for chronic disease	Brief advice for physical activity, nutrition and weight management Moderate intensity lifestyle behaviour change programs for people with chronic disease and high risks for chronic disease Health checks at retirement age

¹FMS- Fundamental movement skills²EDNP- energydense, nutrientpoor foods;³ CALD- culturally and linguistically diverse⁴PA- physical activity

1. INTRODUCTION

1.1 Purpose of this report

The purpose of this Evidence Update is to provide a summary of evidence on prevention of overweight and obesity in order to guide the development of the NSW State Obesity Plan 2021-25.

1.2 Background

This summary of evidence for the NSW Ministry of Health builds on a series of previous reviews relating to obesity prevention conducted by the Prevention Research Collaborative (PRC) at the University of Sydney. The initial report, *Best Options for Promoting Healthy Weight and Preventing Weight Gain in NSW* (1), set out the rationale for setting based interventions and a portfolio approach to obesity prevention and provided a foundation for subsequent reviews. The later report, by the NSW Centre for Overweight and Obesity, *Building solutions for childhood obesity*, provided a set of evidence modules on the effectiveness of interventions to improve diet, physical activity and sedentary behaviours linked to childhood obesity (2). In 2007 the PRC undertook a review on behalf of the Sax Institute, *Community level strategies to reduce weight gain and obesity: A rapid review* (3) to guide the development of the NSW Government Plan for Preventing Overweight and Obesity in Children, Young People & their Families 2009-2011 (4).

The most recent review, conducted by the PRC for the NHMRC, *“state of the knowledge” assessment of comprehensive interventions that address the drivers of obesity* (2016) (6), focussed on policy and population level actions and has also provided valuable material for this report.

Over the last five years there has been an increasing volume of published international and Australian research studies and reviews on issues associated with the prevention of obesity, as well as many policy frameworks and plans at all levels of government across developed and developing countries. Despite the increasing volume of research and analysis, there is a high degree of consistency in recommended policy approaches.

In Australia the National Preventative Health Task Force developed a national preventative health strategy which recommended a comprehensive set of sequenced actions to prevent obesity (5) was based on a comprehensive review of evidence, and thus provides a rich source of evidence as well as a relevant framework for this report. A subset of the actions recommended by the Preventative Taskforce will be implemented across Australia in the context of the National Partnership Agreement on Preventive Health (NPAPH) developed through the Council of Australian Governments (COAG) as agreed targets for reducing the prevalence of overweight and obesity and related health behaviours, and includes programs for children, communities and workers.

1.3 Methods

This evidence update was conducted as a comprehensive and rapid review drawing on a broad range of research studies and policy analyses to inform policy and practice, not a systematic review. The evidence includes studies and reviews on factors contributing to population weight gain, which is particularly important in identifying the overall scope and nature of solutions, potential intervention points and domains of action. The other key type of evidence comprises reviews and studies on the effectiveness of interventions. The approach used in this report is based on previous PRC work which identified promising interventions, taking account of the ability of that intervention to contribute to achievement of energy balance, as well as the potential population reach of the intervention (1). This approach is similar to that described in the Institute of Medicine framework for bridging the evidence gap in obesity prevention (7).

The approach considers effectiveness in relation to weight and weight-related behaviours and recognises that some interventions act as mediators by enabling or reinforcing the changes achieved by other interventions.

The evidence on the effectiveness of interventions was sourced from recent reviews, as well as high quality Australian studies known to be particularly relevant to the NSW context. Feasibility and other implementation issues were also considered as part of this report. A template that allowed the integration of all the relevant information was applied, in order to assist with consistent assessment of the merit of each intervention within action areas.

Despite the large volume of publications reviewing the evidence relating to obesity prevention, there are many evidence gaps in terms of target groups, how to reach them, settings and behaviours addressed. Many of the reported programs have had short implementation periods with limited follow-up. Nevertheless, sufficient evidence can be obtained from a range of information sources to help guide the selection of the most promising programs to promote healthy weight and prevent weight gain at the population level.

1.4 Current patterns of overweight and obesity in NSW

The NSW Schools Physical Activity and Nutrition Survey (NSW SPANS) 2010 is the most current and comprehensive data source for information on the prevalence and trends in overweight and obesity and related lifestyle behaviours among school aged children and adolescents. Overall, the prevalence of overweight and obesity had stabilised between 2004 and 2010, with 20.8% of school aged children and adolescents being overweight and obese in 2010. Overweight and obesity was found to be more prevalent amongst students from more socioeconomically disadvantaged areas, and certain cultural groups such as students of Middle Eastern descent. Specific information on key obesity related behaviours within school aged children is provided in relevant sections of this review to guide the selection of intervention priorities.

The NSW Population Health Survey found that 54.3% of adults were overweight or obese in 2010, with higher rates in regional health districts compared with metropolitan locations, and amongst those living in more socioeconomically disadvantaged areas compared to more advantaged areas. This survey also includes specific information on nutrition and physical activity behaviours, indicating that only about half of the population of adults undertake adequate levels of physical activity. Other surveys indicate that very few people consume recommended levels of specific healthier foods, whilst consuming excessive quantities of energy dense, nutrient poor foods (EDNPs) and beverages.

1.5 Analysing the problem

Obesity is the result of a complex system of interrelated factors, which means that success in addressing the problem will only come by a program of action that attempts to address multiple factors across the whole of the system.

The most comprehensive assessment of the situation has been undertaken by the World Health Organization in the Expert Report on Diet, Nutrition and the Prevention of Chronic Diseases. This report identified key factors which either increase or decrease the risk of weight gain and was used to guide the report to NSW Health, Best options for promoting healthy weight. Although food intake and energy expenditure ultimately influence energy balance, there is an array of forces that operate at many levels in society which impact directly and indirectly upon these behaviours. The International Obesity Task Force has represented these as a causal web. Exploring the problem further, the Foresight Programme of the UK Government Office for Science expanded on the linear causal web approach by utilising a systems approach to produce a complex conceptual model with 108 variables known as the "obesity systems map" (12).

1.6 Designing and implementing solutions

The analyses of factors contributing to overweight and obesity provide a structured logical means for identifying potential solutions. Together these sophisticated international studies converge to indicate that a "whole-of-system" approach is required to address the problem:

- Involving multiple sectors
- Engaging multiple agencies
- Including multiple strategies, programs and policies
- Targeting multiple population groups
- At multiple stages of life.

Solutions can be identified and described in terms of the specific behaviours addressed, the types of strategies involved, the population group targeted, and the settings in which they are typically implemented (in order to reach specific target groups). In this report the evidence summaries relate to a mix of strategies and programs organised according to stage of life course or target group in addition to community-wide policy and environmental actions. In many cases the community-wide policy and environmental actions have the highest potential to have a wide population impact, as their impacts are not limited to a particular target group as well as having the potential for longer term sustainability.

Similarly, the National Preventative Health Strategy – the roadmap for action (5) proposes nine action areas as follows:

- Early life exposures and growth patterns
- Addressing community understanding and social norms through mass media
- Exposure to marketing of foods and lifestyles
- Improved physical activity and nutrition in everyday life
- Planning healthy active environments
- Food supply
- Food access and availability
- Food purchase and consumption
- Action in high risk groups

The potential solutions and responses covered in the literature considered in the development of this Evidence Update encompass actions designed to address a range of obesity outcomes, including: weight status, physical activity, sedentary and nutrition behaviours, individual factors which influence these behaviours (such as awareness) and environmental features which influence these behaviours (such as menu labelling).

2. INTERVENTIONS AMONG CHILDREN

2.1 Infants 0-2 years

2.1.1 Rationale

In Australia 21% of boys and 18% of girls aged 2 to 3 years are overweight or obese, suggesting a need for obesity prevention to occur during infancy. This is strengthened by data showing that preferences are shaped very early in life, such as the acceptance of different textures and vegetable flavours, which may be tracked into adulthood (2). There is also evidence demonstrating that accelerated weight gain during infancy increases the risk of overweight in later life (3). Some factors that may accelerate weight gain during infancy are early cessation of breastfeeding, early introduction of bottle feeding which influences infant ability to self-regulate intake (4), early introduction of solid high maternal body mass index (BMI) and low socioeconomic status (4-7).

Any obesity prevention strategies during infancy must obviously target parents. Targeting the parent-infant dyad however, may be particularly important given the evidence linking parenting style during infancy with eating behaviour and weight status in later childhood. There is general consensus that excessive parental control over feeding (restriction or pressure) negatively impacts children's eating behaviour (2), although the findings for 2 year olds are mixed (8). Evidence regarding the role of breastfeeding in obesity prevention has been addressed in a previous review for NSW Health (9). Briefly, breastfeeding to at least six months of age has been demonstrated to reduce the risk of overweight or obesity in later life.

2.1.2 Policy and program context

- Munch & Move (in preschools) has been extended to include Long Day Care and Family Day Care services under the NSW Healthy Children Initiative (HCI) thereby reaching 2 year olds.
- Healthy Supported Playgroups also part of the NSW HCI. This program, which has been piloted in South Eastern Sydney & Illawarra Area Health Service (SEIAHS) Sydney South West Area Health Service (SSWAHS) targets those parents of children aged 5 years attending supported playgroups (i.e. disadvantaged families and those not attending mainstream services).

2.1.3 Evidence of effectiveness

Systematic reviews of the literature in this area often focus on 5 year olds, making it difficult to distinguish strategies that may be effective specifically for infants and their parents. The evidence base for 0-2 year olds comprises one recent systematic review, three large trials with Australian infants and their parents, and two international trials. Interventions targeting infancy, some of which were based within the home, have largely aimed to educate parents about good nutrition during infancy. These interventions have been shown to influence infant dietary intake as well as parental attitudes and knowledge about child nutrition, although the findings are based on a small body of poor to fair quality studies (10).

- Healthy Beginnings Trial (HBT) The HBT is a randomised controlled trial of first-time mothers and their infants, randomised to receive either a home-based intervention delivered by trained community nurses, or a usual care condition (11). Compared with the control condition, mothers in the intervention condition achieved a significantly higher median duration of breastfeeding at 12 months and were more likely to delay introducing solids until six months. Mothers initiated infant 'tummy time' (time spent in a postural position, which strengthens neck and back muscles essential for developing the ability to perform more complex movements) earlier and applied it more frequently.
- NOURISH The NOURISH trial is a randomised controlled trial of first-time mothers from Brisbane and Adelaide. It is a community-based intervention addressing feeding practices in early infancy in order to foster healthy eating behaviours in childhood (12). Baseline data from 612 infants (mean 4.3 months of age) regarding the factors influencing weight gain from birth to 47 months have recently been published (6). Factors found to be associated with more rapid weight gain in infancy (which increases the risk of overweight in childhood) were formula feeding and feeding infants on a schedule.
- The Infant Feeding Activity and Nutrition Trial (INFANNT) is a cluster-randomised controlled trial in first-time parents from Melbourne, testing the effect of an early childhood obesity

prevention program(13). The program, delivered to parents in the first 18 months of their infant's life, aims to foster parenting skills that support infant development of positive diet and physical activity behaviours. Recent published findings on this trial have focused on cross-sectional assessments of parental behaviours, including a positive correlation between mothers' and fathers' dietary patterns(14), an association in mothers between poorer diet quality and lower socio-economic status (partially mediated by nutrition knowledge)(15), and that first-time mothers attending parent groups where other mothers have infants of similar age, are more likely to continue breastfeeding infants to six months(16). Some preliminary results indicate the intervention resulted in more favourable maternal beliefs around the influence of television and diet on children(17).

- Special Turku Coronary Risk Factor Intervention Project (STRIP) trial was a randomised controlled trial of a family lifestyle counselling program in Finland aimed at reducing children's saturated fat intake, delivered by a nutritionist at 1 to 3 month intervals from eight months to two years of age, and biannually thereafter. Children in the intervention condition maintained a fat intake of 30% total energy at 10 years, which was lower than in the control condition, without any detrimental effects to vitamin and mineral intake(18).

2.1.4 Areas for further investigation

- Currently there is evidence to support intervention during infancy to promote the development of healthy eating and physical activity behaviours and to prevent above average weight gains which can subsequently lead to overweight in later life. However, experimental trials are now required to determine whether these factors are able to be effectively targeted in obesity prevention programs. Currently, the results from the three longitudinal experimental trials that are being conducted in Australia are being analysed collectively by the EPOCH collaboration which should provide insight into promising approaches for this life stage(19).
- Strategies for obesity prevention in infancy to date have largely been based on good nutrition, as the measurement of physical activity in infancy and its contribution to the development of physical activity behaviour later in childhoods not well understood. Hence further research into measures of activity in infancy and their impact on weight status during childhood is required.
- Evidence in this life stage has focused solely on the parent-infant dyad, which is rational, although there is a lack of evidence regarding the potential influence of other caregivers on infants' nutrition and physical activity behaviour and risk of obesity in later life.
- Further research could also explore the use of social networking to parents as a method of intervention delivery.

2.1.5 Promising approaches

- Targeted home visiting and community-based mothers' groups appear to increase the duration of breastfeeding, improve parental knowledge of nutrition during infancy and may promote activity required for healthy development in infants. It appears feasible to use trained nursing staff in the delivery of such interventions. Efficacy may be enhanced by arranging groups so that they include mothers with infants of a similar age and involving first-time parents, as the outcomes may extend to further offspring.

2.2 Preschoolers 3-5 years

2.2.1 Rationale

- Findings from the 2007 Australian National Children's Nutrition and Physical Activity Survey indicated that 16.2% of girls and boys aged 2 to 4 years were overweight and 3.1% of boys and 3.6% of girls were obese(20). In NSW the 2007 Good for Kids survey showed that 16% of boys and 18% of girls aged 2 years attending childcare services were overweight or obese. A longitudinal study involving 4983 Australian preschool children showed that 15.2% children were overweight and an additional 5.5% were obese(21). In addition, a study of young children aged 2 years in Melbourne and Sydney found that approximately one in six were overweight or obese(22).
- Although overweight and obesity are responsible for a large proportion of morbidity and mortality in adults, longitudinal studies have shown that they have even more significant adverse effects

- when acquired early in life (23). The age of onset and the severity of overweight and obesity in childhood is related to its persistence into adulthood, with obese children having at least a 50% risk of progressing to obesity in adulthood (24).
- Studies show that preschool-aged children are often inactive, spending less than 5% of their day in moderate-to-vigorous physical activity (MVPA) and most of their waking hours in sedentary pursuits (25). In NSW in 2007, 52% of boys and 50% of girls aged two to five years spent more than two hours per day engaging in small screen recreation, predominantly watching TV, DVDs or video (26).
 - Many behaviours linked to inappropriate weight gain, such as eating habits, food preferences, motor skills as well as the enjoyment of physical activity, are formed in the early period of life before school (27). The family/home environment and parental behaviours have strong modifying effects on children's behaviours (28). Preschoolers are also more malleable than school-aged children to modifying lifestyle behaviours.
 - Parents are a key target group for prevention of overweight in preschool children. They are the primary social influence in young children's development, and their involvement is crucial in facilitating real and sustainable behaviour change. Parents are receptive to intervention programs and can be supported to make positive changes to dietary, physical activity and sedentary behaviours of their young children (29).
 - Results from the Longitudinal Study of Australian Children indicated that fathers', but not mothers', parenting behaviours and styles were associated with increased risks of preschooler overweight and obesity. Higher father control scores were associated with lower odds of the child being in a higher BMI category. Compared with the reference authoritative style, children of fathers with permissive and disengaged parenting styles had higher odds of being in a higher BMI category. Paternal dietary and physical activity behaviours were also associated with children's weight, diet, and physical activity, independently or in combination with mothers' behaviours (30, 31).

2.2.2 Policy and program context

- National Early Childhood Framework: The COAG's National Quality Framework for Early Childhood Education and Care (1 January 2012) includes a new National Quality Standard for ECECs in Australia. These standards work towards a nationally consistent approach to the delivery of Early Childhood Education in Australia, and contain particular standards related to nutrition and physical activity. The standards call for healthy eating and physical activities to be embedded in early learning programs for children. This means that the child's nutritional and physical health needs are to be met by the childcare centre and that learning about healthy lifestyles is part of the child's learning experience.
- National 'Get Up and Grow': The government has committed \$1.5 million over five years to the development and distribution of Get Up & Grow: Healthy eating and physical activity for early childhood guidelines and resources. These resources provide practical information and advice to assist early childhood practitioners and families to promote healthy eating and physical activity amongst children aged 0-5 years. The resources were created for application in a range of early childcare settings, including child care centres, family day care and preschools.
- NSW Munch and Move: This program trains and supports early childhood staff to include policies and practices in the centres that encourage and support children's healthy eating, active play and fundamental movement skills (FMS). It has already been extensively implemented in preschools and long day care centres, and is currently being disseminated more widely across the state through the NSW Healthy Children Initiative.
- Nutrition in Schools Policy (Department of Education and Communities; July 2011): All schools including preschools should promote and model healthy eating and good nutrition in school programs and activities relating to or involving food and drink.

2.2.3 Evidence of effectiveness

Overview

- Recent reviews indicate accumulating evidence that multi-component interventions can influence child weight status by addressing nutrition, physical activity, and sedentary behaviours.
- Specific intervention studies in childcare settings with early childcare educators have demonstrated changes in prevalence of overweight and obesity (Romp & Chomp), fundamental movement skills (Munch and Move), Tooty Fruity Veggie (TFV) and fruit and vegetable consumption (TFV).

Evidence regarding program components and implementation processes

Reviews

- A recent systematic review found that interventions that have both direct educational services to children and indirect services through parents are likely to have more beneficial outcomes than those interventions that include direct services to children alone (32).
- The review by Larsen reports that successful strategies to improve nutrition or physical activity outcomes included one or more of the following: integrating additional opportunities for physical activity into classroom curriculum, modifying foodservice practices, providing classroom-based nutrition education, and engaging parents through educational newsletters or activities (33).
- Children who attend childcare centres that provide more opportunities for physical activity through the provision of time for active play, time spent outdoors and time spent in indoor activities, obtain more physical activity than children who do not attend such centres (34). Additionally, children attending centres with high outdoor environment scores (having trees, shrubbery and open play areas) are more active than children in centres with low outdoor environment scores. Also, portable equipment (e.g. balls, wheel toys) is associated with activity, whereas fixed equipment is not. Finally, more space per child on the playground and shorter recess periods are associated with more vigorous activity (34).
- Effective training for staff involved in the delivery of the intervention, cultural sensitivity, sustained moderate to vigorous physical activity, nutritional education for children and parents, active involvement of parents/carers as participants and role models of a healthy lifestyle, combined with education about healthy diets and exercise were identified as key elements for successful interventions in the under fives in a review conducted by Bond (35).
- Programs that include a range of healthy eating and active play strategies, through supportive environments, formal curriculum and parental education, offer promising results (36).
- A systematic review by Skouteris et al (2011) found that teaching parents about nutrition and fostering healthy lifestyle behaviours result in improved knowledge and behaviours that can result in weight improvements for their preschool-aged children (37).

Individual Studies

Early Childhood Setting

- The evaluation of the Munch and Move program in NSW preschools found that a professional development workshop for staff was associated with increased provision of structured physical activity sessions and relative increases in children's fundamental movement skills (compared to control preschools) (38). This study concluded that modifications to the childcare environment, such as additional equipment, specific physical activity policies and teacher training, may have the potential to improve child physical activity outcomes.
- Romp & Chomp, a communitywide, multi-setting, multi-strategy intervention conducted in Geelong, Victoria, focused on community capacity building and environmental changes to increase healthy eating and active play in early childhood care and educational settings. This intervention reduced prevalence of overweight and obesity at 2 and 3.5 years of age. There were also a number of positive outcomes related to capacity building, including the establishment of sustainable partnerships, use of specialist advice, and integration of activities into ongoing formal training for early childhood workers (39, 40). Professional development and workforce training (in nutrition and active play) and training of allied health professionals to support child care workers in early childhood settings were identified as sustainable and potentially effective methods of capacity building.

- The Tooty Fruity Veggie (TFV) program in NSW North Coast (now known as March and Move) increased fruit and vegetable consumption and improved fundamental movement skills in preschoolers using similar intervention strategies to those used in primary schools (41). A more recent evaluation of TFV showed that strategies that were sustained were those that involved experiential activities for the children (e.g. taste testing, PA sessions), those that were easy for the preschool to implement (e.g. newsletter tips) and those that became embedded into the organisational or environmental framework (e.g. increased access to drinking water). Some schools found that structured FMS sessions were too disruptive, time-consuming, too structured or 'there were not enough staff trained'. In-centre engagement of staff and ongoing support could enhance implementation. Parent workshops were not sustained – hindsight indicated that a 'train-the-trainer' strategy for running the parent workshops might be needed, and that enhanced communication to and engagement of parents is necessary within the program.

Role of parents specifically

- A study conducted by Loprinzi and Troiano (43) found that parental support for physical activity had a significant positive influence on physical activity at home but not at child care. This suggests that parents can increase their child's participation in active play at home by playing with their child, providing transportation to parks and other activity-related facilities, and providing reinforcement for physical activity participation. Additionally, parents' perceptions of competence and parental support for physical activity were positively associated with children's physical activity.

2.2.4 Areas for further investigation

More information and interventions specific components need to be identified in the following areas:

- Specific information on the optimal intensity of interventions within childcare settings to achieve substantial changes in policies and practices
- Specific interventions that are effective in reducing energy-dense, nutrient-poor foods brought from home to childcare in pre-schoolers' lunchboxes.
- Interventions which are effective in reaching and communicating with parents about nutrition, physical activity and sedentary behaviours, and how to incorporate these into positive parenting/family practices.

2.2.5 Promising approaches

- Implementation and ongoing evaluation of existing programs in the early childhood setting for this age group with an increased focus on staff development to implement structured active play inside and outside (including development of FMS) and unstructured active play to effectively engage with parents

3. INTERVENTIONS AMONG CHILDREN

3.1 Rationale

In 2010, 23.9% of NSW primary school children were classified as overweight or obese (SPANS 2010) (1). Being overweight/obese during childhood increases the risk of being overweight/obese in adulthood. The most recent NSW data (1) show that there are socioeconomic and cultural inequities in the distribution of weight and weight-related behaviours of primary school-aged children and these factors are important in the design and implementation of interventions.

Specific behaviours have been identified as contributing to the likelihood of childhood overweight and obesity, and as appropriate points of intervention. These include reduced consumption of sugar sweetened beverages (SSBs) (2), reduced consumption of energy dense, nutrient poor (EDNP) foods, increased consumption of fruit and vegetables, increased moderate to vigorous physical activity, and reduced screen/sedentary time.

Diet

The SPANS survey showed that among primary school children

- 44.6% consumed SSB 2 cups/week
- 65% consumed fried potato products ≥1/week
- 72% consumed salty snack products ≥1/week
- 78% consumed confectionery ≥1/week
- 24% consumed take away food products ≥1/week
- 53% consumed other snack food products ≥3 times/week
- 86% consumed ice-cream/ice blocks ≥1/week
- 60% of parents usually/sometimes offer sweets as a reward for good behaviour
- 95.6% met recommended daily fruit intake
- 43.6% met recommended daily vegetable intake
- 30.3% consumed fruit juice ≥ 1 cup/day.

Of particular note is that fruit consumption in primary school aged children is high; the majority of children of this age group meet the recommended intake, although among children in particular socioeconomic groups, fruit consumption may be much lower. The National Survey of Children 2007 showed that 35% of energy intake came from EDNP foods (Rangan et al 2008).

It is well established that children have high exposure to soft drinks through advertising (6,7) and unhealthy food/beverage sponsorship of sport (8). Further, soft drinks are available at many sports centres and canteens (5, 9). Qualitative data show that most SSBs are obtained by children from the home, and that parental role modelling may influence children's SSB consumption (10, 11).

Parental modelling and parental intake are consistently and positively associated with children's fruit, fruit juice and vegetable consumption. There are also positive associations between home availability, family rules and parental encouragement and children's fruit and vegetable consumption (12, 13). The availability of unhealthy food at home appears to be a robust predictor of consumption of EDNP foods (14, 15).

Physical Activity

Important health benefits of physical activity (PA) during childhood include favourable skeletal development, improved metabolic profile and psychological wellbeing, and an increased likelihood of physical activity later in adulthood (16, 17). The proportion of girls who met physical activity guidelines is lower than boys, suggesting different interventions for boys and girls are needed. The majority of public primary schools do not have physical education specialists on staff. In NSW findings on primary school aged children showed:

- Years K/2/4 met the recommended daily physical activity guideline (50.5% boys, 42.2% girls)
- Parent correctly reported the national physical activity guideline for children (31.4%)
- Mastery of many fundamental movement skills (FMS) (5)

Children's participation in physical activity is positively associated with publicly provided recreational infrastructure (access to recreational facilities and schools) and transport infrastructure (presence of sidewalks and controlled intersections, access to destinations and public transportation). At the same time, transport infrastructure (number of roads to cross and traffic density/speed) and local conditions (crime, area deprivation) are negatively associated with children's participation in physical activity (18).

Fundamental Movement Skills

Mastery of Fundamental Movement Skills (FMS) is associated with increased participation in physical activity. Teaching of FMS forms part of the NSW PDHPE Syllabus, and this has been supported through the Get Set Get Active program involving teacher training. There has been no monitoring/evaluation of implementation, dissemination and effectiveness of this program.

Active Transport

Children who walk or bicycle to school have higher daily levels of physical activity and better cardiovascular fitness than do children who do not commute actively to school. A wide range of predictors of children's active commuting behaviours have been identified, including demographic factors, individual and family factors, school factors (including the immediate area surrounding schools), and social and physical environmental factors. Active commuting to school is higher among lower SES groups.

Sedentary Behaviours

Emerging evidence shows that excessive screen time (ST) is associated with poorer metabolic profiles (19, 20). TV watching has been particularly associated with overweight/obesity and an increased likelihood of poorer dietary patterns. In NSW, findings on primary school aged children showed

- Did not meet recommended daily ST guideline (53.7%)
- Median ST (boys 2.3 hrs/day girls 1.9 hrs/day)
- Had a TV in their bedroom (27.4%)
- Had no rules on ST (12.9%)
- Parents who did not know the national ST guideline (49.5%).

A family environment in which after school TV viewing is part of the home culture and homes where children have more autonomy over their own behaviour are associated with an increased risk of watching >2 hours of TV per day after school and spending more >1 hr per day playing computer games.

3.2 Policy and program context

Current national initiatives include:

- National Healthy Schools Canteens Program (superseded by NSW initiatives)
- Active After School Communities: An initiative of the Australian Sports Commission involving regional coordinators and the involvement of local communities to provide access to free sport and other structured physical activity programs in the after school time slot of 3:00-5:00 pm. Grants are available
- Eat Smart Play Smart (Australian Heart Foundation) manual to support healthy eating and active play for children who attend Out of Hours School Care (OOSH)

Current NSW initiatives include

- The Fresh Tastes @ Schools NSW Healthy School Canteen Strategy came into effect in 2005 and is mandatory for all NSW Government schools and strongly supported by CEC and AIS sectors
- The Nutrition in Schools Policy (NSW Department of Education and Communities) commenced in July 2011 for all NSW government schools and preschools. This policy requires schools to extend the principles of the Fresh Tastes @ Schools strategy, by modelling and promoting healthy eating and good nutrition across all school activities that relate to the provision of food and drink, e.g. fundraising
- NSW PDHPE curriculum includes nutrition education as a key learning area, and is mandatory for all children from kindergarten to year 10. Teaching and learning and all class activities in all other key

learning areas should also reinforce healthy eating and good nutrition wherever possible (Part of Nutrition in Schools Policy)

- The Minister for Education and Training announced a ban on the sale of sugar sweetened drinks in NSW schools commencing Term 1, 2007 (now part of Nutrition in Schools Policy)
- Kitchen gardens are supported by the Nutrition in Schools Policy. See information at www.curriculumsupport.education.nsw.gov.au/ered/programs/gardens/index.htm
- Sponsorship Policy In NSW government schools, sponsorships must be consistent with the corporate principles, vision and goals for public education in NSW; sponsorships must align with other NSW Department of Education and Communities policies, e.g. food and beverage company sponsorship must be consistent with the Nutrition in Schools policy
- Live Life Well@ School This program aims to develop teachers' knowledge, skills and confidence in teaching nutrition education and fundamental movement skills as part of the K-6 Personal Development, Health and Physical Education (PDHPE) syllabus
- Crunch & Sip This program has not been evaluated to ascertain whether the fruit/vegetables consumed during this break replace EDNP foods consumed at recess, or are additional foods
- Challenges such as Live Outside the Box (NSW Health and NSW Department of Education and Communities) and Jump Rope for Heart (NSW Heart Foundation)
- NSW Premier's Sporting Challenge: Resources are provided to encourage schools to take part in various 10 week activities and events to support students in recording and increasing their physical activity
- Healthy Kids website The website is a joint initiative of the NSW Ministry of Health, Education and Communities, and Sport and Recreation, as well as the NSW Division of the National Heart Foundation. The site contains recipes, ideas for physical activity and practical ways to improve nutrition, as well as specific factsheets for families and children
- School4u website NSW Department of Education and Communities website offering practical help for parents regarding health and wellbeing (including food and fitness)
- Go4Fun (NSW Health): Healthy lifestyle program for children aged 4-7 years who are above healthy weight
- NSW PDHPE Curriculum includes a requirement that students spend 120 minutes/week in physical activities
- School breakfast programs schools (selected locations) collaborate with local agencies including Australian Red Cross, local youth services, church organisations, P&C associations and local businesses

3.3 Evidence of effectiveness

Overview

Evidence from the most recent Cochrane review on interventions for preventing obesity in children indicates that many studies were able to improve nutrition or physical activity to some extent, with some able to detect an effect on weight status (21). Possible reasons for modest or absent intervention effects on weight outcomes where measured include short time frame or low dose of intervention elements (by design or by implementation failures).

Evidence regarding program components and implementation processes

Meta-analyses and systematic reviews of school-based programs also show that there is insufficient evidence to assess the relative effectiveness of dietary interventions or physical activity interventions within primary schools. This is because intervention studies are typically heterogeneous (program outcomes, measurements, sampling frames) which makes it difficult to generalise about what interventions are effective (2).

Systematic reviews have indicated that characteristics of school interventions that are effective are: duration of more than one year, introduction into the regular routines of the school, parental involvement, nutrition education into the regular curriculum, provision of fruit and vegetables by school food services (23). Additional promising strategies noted by Waters et al include increased sessions for physical activity,

as well as environments that support being active throughout the day and professional development of teachers (21).

School-based physical activity interventions may help children maintain a healthy weight but the results are inconsistent and short-term. The evidence suggests that physical activity interventions may be more successful in younger children and in girls. While the findings are inconsistent, it is recommended that any interventions be whole of school approach, not curriculum-based and that interventions need to combine strategies which focus on improving diet and physical activity. Although those focused on both outcomes will be less effective in increasing PA than those focused on PA alone.

With reference to behavioural change there is a number of promising strategies, as specified below.

Specific evidence related to obesity-related behaviours

Diet

- While some evidence shows that banning soft drinks in primary schools has modest results on decreasing consumption and prevalence of overweight (24,26), other evidence suggests that to have a direct impact on the consumption of SSB and water, governmental laws are required to restrict their at-school availability (27-30). The sale of sugar sweetened drinks in NSW government schools was banned in Term 1, 2007. The CEC and AIS strongly support this ban and will encourage it in their sectors. Currently there is no monitoring of compliance with this policy.
- Evidence suggests that nutrition guidelines and price interventions focused on healthier foods are effective in improving the school food environment and students' dietary intake. One study which did examine the removal of low nutrition items from school canteens showed there was a decrease in consumption while at school with no compensatory increase at home (31).
- Collectively, studies suggest that readily available and easily accessible healthful foods within the home are likely to enhance healthful dietary intake among youth and families (32).
- To date, the majority of nutrition interventions aimed at promoting increased F&V consumption has met with modest success at best (33-35).
- The 2 and 5 campaign conducted across many states promoted fruit and vegetables to parents of school-aged children. Results showed small and modest increases in children's fruit consumption (33-35).
- School-based interventions to promote consumption of fruit and vegetables among children have primarily consisted of multi-component interventions that sometimes included an environmental intervention component. Promising interventions in schools include school gardening programs (36), salad bars using fresh produce from local Farmers Markets, and in-school, free F&V distribution programs (37). Fruit, vegetable and water breaks have been promoted through NSW primary schools, but they have not been evaluated.
- The Eat It to Beat It program, developed and tested by Cancer Council NSW in one region targeted parents of primary school children, and to improve their knowledge, attitudes and consumption of fruit and vegetables. This was a low intensity multi-strategy intervention comprising peer education and communication and promotional activities, including trialling of a fruit and vegetable box as a school fundraiser. The evaluation showed small improvements in attitudes and knowledge, and increased consumption of fruit and vegetables in those participating in the peer education program.
- Interventions designed to influence school-aged children's F&V consumption should target family members and consider incorporating strategies to reach families and promote meal planning activities with the children in their homes (34).

Physical Activity

- To increase levels of MVPA, whole-of-school approaches are more successful than curriculum based education alone. However, no single intervention will fit all schools and populations (22). There is strong evidence of the importance of specialist PE instruction and improving PE curricula, materials and staff development (38, 39). A meta-analysis of an increased focus and

quality of PE at school shows improved levels of physical activity (albeit no improvement on weight status)(40).

- There has been considerable investment to promote PA in primary school settings, but interventions have met with limited success (22,41).
- Play ground markings appear to have some impact on improving children's leisure time PA levels during recess and lunch times, but possibly only in inner city areas which have less green space (Rissel personal communication). The provision of recreational equipment, e.g. skipping ropes, during school playtimes has not been specifically explored.
- Increasing the amount of or access to available green space in schools is likely to increase opportunities for boys and girls to be more physically active (range of enjoyable, competitive, open-ended forms of play, i.e. 'active play') during recess and lunch (42).
- Safe Routes to School and the Walking School Bus are two public health efforts that promote walking and bicycling to school. Although evaluations of these programs are limited, a systematic review of evidence indicates that these activities are viewed positively by key stakeholders and have positive effects on children's active commuting to school (40).

Sedentary/screen time

- The ubiquity and popularity of screen activities make interventions to change ST behaviour challenging. The evidence on the efficacy of interventions aimed at reducing children for reducing BMI is equivocal (43-45). There does appear to be consensus that including ST reduction strategy in a portfolio of interventions is efficacious for reducing body fat (45).
- Interventions to reduce ST in primary schools have included curriculum-based modules, which encourage children to reduce ST, be more judicious in viewing, and self monitoring strategies.
- Family based intervention strategies to reduce sedentary behaviours come from clinical studies, primarily in the treatment of obese children and there is no evidence for whole-population-based interventions targeting ST in the home. Strategies which have been efficacious in the home setting are primarily behavioural interventions which focus on increasing skills by having the child and/or parent develop a television viewing budget or plan, set screen time goals or have the child identify alternative activities (45). Focus group findings indicate that 10 year old children believe that they could reduce their ST and that the resulting reduction would yield benefits. Findings suggest that child centred strategies that focus on self discovery, self reflection and collaboration with parents may hold promise (46). The home screen viewing environment and child autonomy may be malleable targets for changing screen viewing (47).

3.4 Areas for further investigation

- The impact of the current school based programs to increase water consumption, increase healthy eating and increase PA among primary school aged students in NSW requires further evaluation
- Innovative, effective ways to reduce EDNP foods in children's lunchboxes should be examined (48).
- There is scope to reduce the consumption of SSB, increase water consumption and improve access to healthy food options at children's sporting events; however, there is no evidence to support the best ways to do this.
- Few studies have examined how best to reduce the availability of soft drinks and EDNP foods in the home environment.
- The effectiveness of school gardens in changing food consumption patterns.
- The relative effectiveness in disadvantaged communities of subsidised school breakfast programs and other vegetable and fruit promotional programs in improving diet quality.
- There are high levels of participation in community sports; however, there is little evidence to guide interventions to increase participation in sports. Costs of participation are a known barrier, particularly for lower income families (49). In order to examine overall effectiveness, interventions funded and conducted in this area must be linked to a rigorous evaluation strategy including identification of sociodemographic differentials in participation and effectiveness (50).

3.5 Promising approaches

- Comprehensive whole-school programs involving parents and integrated into the school routine.
- Professional development of general teachers to ensure FMS/PA is taught in such a way as to encourage development of individual children's skills, is gender-specific, and ensures that transformational teaching strategies are used to increase self-determination, perception of ability and self-efficacy among primary school-aged students.
- Point-of-purchase promotion of healthy foods in school canteens.
- Subsidised healthy food programs for highly disadvantaged children may be appropriate, particularly the consumption of vegetables, although fruit consumption may also be low in this target group.
- Promoting healthy junior sports including healthy sporting canteens, coach education and sports sponsorship.
- Social marketing to parents regarding specific behaviours such as home availability of soft drinks and EDNP foods, as well as family meals.
- Social marketing to increase parents' awareness of national PA and screen time recommendations for children.

4. INTERVENTIONS AMONG ADOLESCENTS YEARS

4.1 Rationale

In 2010 24.2% of boys and 19.7% of girls in NSW high schools were classified as overweight (1). obese Data from SPANS 2004 show that overweight and obese adolescents, especially boys, are at substantial risk for chronic health conditions (2, 3). Further, overweight/obese adolescents are at high risk of maintaining an unhealthy weight as adults. There is some indication that sedentary behaviours, more than physical activity (PA) behaviour, track from adolescence into adulthood (4). There is a strong imperative to treat adolescent overweight and obesity before lifestyles become entrenched, significant comorbidity intervenes (5).

Participation in nearly all physical activities declines during adolescence (6). PA in adolescence is associated with academic performance (7) and improved mental health (8). Improved dietary habits in adolescence are also associated with improved mental health (9).

The most recent NSW data (1) show that there are and cultural inequities in the distribution of weight and weight-related behaviours of adolescents and these factors are important in the design and implementation of interventions. Specific behaviours have been identified as contributing to the likelihood of adolescent overweight and obesity and as appropriate points of intervention, as presented below.

- **Intake of sugar sweetened beverages (SSB)**
 - › Soft drinks provide empty calories, contribute to weight gain (10) and provide a specific behaviour for intervention. Adolescent boys consume more than girls (70.4% versus 48.3% consume more than 2 cups of soft drink per week) and usually/always soft drink at school for lunch (boys = 28.1% girls = 17.7%). Nearly three quarters of adolescent children live in homes where soft drink is usually or always available. Approximately half of all adolescents usually or always consume soft drink at home (boys = 59.1% girls = 42.6%).
 - › Adolescents have high exposure to soft drinks through advertising (15) and unhealthy food/beverage sponsorship of sport (16). Further, soft drinks are available at many sports events and canteens (13, 17) and there is some evidence that SSB are still available in some NSW high schools (1). The home environment influences adolescents' soft drink consumption both indirectly and directly. Most SSBs are obtained by youth from the home and parental role modelling may influence adolescents' SSB consumption (18, 19).
- **Consumption of energy dense, nutrient-poor (EDNP) foods**
 - › Quality of diet declines from childhood to adolescence, with dietary habits likely to promote fatness being actively adopted (20). In NSW, SPANS has shown that students in Years 8 and 10 report consuming EDNP foods and takeaway foods frequently (11).
 - › The availability of unhealthy food at home appears to be a robust predictor of consumption of EDNP food (20, 21); and collectively, studies suggest that readily available and easily accessible healthful foods within the home are likely to enhance healthful dietary intake among youth and families (21, 22).
- **Consumption of fruit and vegetables**
 - › In NSW, SPANS has shown that 42.1% of students in Years 8 and 10 met recommended daily fruit intake and 20.1% met recommended daily vegetable intake (4).
 - › The evidence consistently shows a positive association between home availability of fruits and vegetables and adolescent consumption of fruits and vegetables (23).
- **Moderate to vigorous physical activity (MVPA)**
 - › Important health benefits of physical activity (PA) during adolescence include favourable skeletal development, improved metabolic profile and psychological well-being, plus an increased likelihood of physical activity in adulthood (4, 25). During adolescence the decline in PA is more prevalent in girls than in boys (6), suggesting that interventions which target girls are needed. There has been considerable investment to promote PA in high school settings, but interventions have met with limited success (3, 2), potentially because only a small

proportion (~30%) of PE lessons are spent in MVPA (28, 29). In NSW, findings for students in Years 8 and 10 showed

- Met recommended daily physical activity guideline (boys 67.9%, girls 58.5%)
- Median daily minutes spent in MVP (boys 87.1 mins/day, girls 72.9 mins/day)
- Correctly reported national physical activity guideline (64.2%) (1).

➤ **Fundamental movement skill development**

- › Developing a high perceived sports competence through object control skill development in childhood is important for boys and girls in determining adolescent PA participation and fitness (30). Findings highlight the need for interventions to target and improve the perceived sports competence of youth.

➤ **Recreational screen time (ST)**

- › Emerging evidence shows that ST is associated with poorer metabolic profiles, low fitness (31, 32) and low fitness TV watching time is particularly associated with overweight/obesity and an increased likelihood of poorer dietary patterns. Watching TV and 'hanging around' are the most common sedentary behaviours of adolescent Australian girls (33). In NSW, findings among students in Years 8 and 10 showed
 - Did not meet recommended daily ST guideline (74.5%)
 - Median ST (boys 3.4 hrs/day, girls 2.7 hrs/day)
 - Had a TV in their bedroom (boys 45.3%, girls 35.5%)
 - Had no rules on ST (36%)
 - Parents who did not know the national ST guideline (48%) (1).

➤ **Family Mealtimes**

- › Sharing 3 or more family meals per week has been associated with a 12% reduction in the odds of being overweight, 20% reduction in the odds of eating unhealthy foods, a 35% reduction in the odds of disordered eating, and a 24% increase in the odds of eating healthy foods (4).

➤ **Eating Breakfast**

- › There is good evidence that daily breakfast consumption is associated with a healthier diet pattern among children and adolescents, including higher intakes of fruit and vegetables and lower intakes of unhealthy snacks (35, 36). Children and adolescents who regularly eat breakfast also have a lower BMI and are at reduced risk of becoming overweight or obese (37, 38). Girls are more likely to skip breakfast, especially during their teenage years and incorrectly perceive this practice as a weight loss strategy (39). In NSW only two-thirds of high school aged students reported eating breakfast daily (1).

4.2 Policy and program context

Current national initiatives include:

- National Healthy Schools Canteen Project (superseded by NSW initiatives)

Current NSW initiatives include

- The Fresh Tastes @ Schools NSW Healthy School Canteen Strategy came into effect in 2005 and is mandatory for all NSW Government schools and strongly supported by CEC and AIS sectors
- The Nutrition in Schools Policy (NSW Department of Education and Communities) commenced in July 2011 for all NSW government schools and preschools. This policy requires schools to extend the principles of the Fresh Tastes @ Schools strategy, by modelling and promoting healthy eating and good nutrition across all school activities that relate to the provision of food and drink, e.g. fundraising
- NSW PDHPE curriculum includes nutrition education as a key learning area, and is mandatory for all children from kindergarten to year 10. Teaching and learning and all class activities in all other key learning areas should also reinforce healthy eating and good nutrition wherever possible (State of Nutrition in Schools Policy)
- The Minister for Education and Training announced a ban on the sale of sugar sweetened drinks in NSW schools commenced Term 1, 2007 (now part of Nutrition in Schools Policy)
- Kitchen gardens are supported by the Nutrition in Schools Policy. See information at www.curriculumsupport.education.nsw.gov.au/eng/programs/gardens/index.htm

- Sponsorship Policy: In NSW government schools, sponsorships must be consistent with the corporate principles, vision and goals for public education in NSW; sponsorships must align with other NSW Department of Education and Communities policies, e.g. food and beverage company sponsorship must be consistent with the Nutrition in Schools policy
- NSW Premier's Sporting Challenge
 - Resources are provided to encourage schools to take part in various activities and events to support students in reaching set targets.
 - Get Active in the Middle Years Programme enhance the engagement of students through sport and physical activity as they progress from primary to secondary school
 - Girls in Sport Intervention and Research Programme promote the participation of girls aged 14-16 years in sport and physical activity
 - Sport Leadership Programme support students in developing the skills to organise, administer, coach, referee or train a variety of sports and modified activities
 - Sports Equipment to Schools Programme provide tied grants to schools to purchase sports equipment.
- Healthy Kids website: The website is a joint initiative of the NSW Ministry of Health, Education and Communities, and Sport and Recreation, as well as the NSW Division of the National Heart Foundation. The site contains recipes, ideas for physical activity and practical ways to improve nutrition, as well as specific factsheets for families and children
- Schoolatoz website: NSW Department of Education and Communities website offering practical help for parents regarding health and wellbeing (including food and fitness)
- Go4Fun@NSW Health): Healthy lifestyle program for children aged 13-17 years who are above healthy weight
- NSW PDHPE Curriculum includes a requirement that secondary school students spend 300 minutes/week in physical activities (Years 7-10)
- School breakfast programs/clubs: schools (selected locations) collaborate with local agencies including Australian Red Cross, local youth services, church organisations, P&C associations and local businesses.

4.3 Evidence of effectiveness

Overview

- Reviews indicate that comprehensive behavioural interventions of medium to high intensity involving cognitive behaviour therapy in the short or long-term (12 months) are effective in achieving weight loss in obese children and adolescents. Involvement of parents is an essential element, although there is a lack of evidence regarding age-specific techniques for optimally engaging them (40-43).
- Most prevention interventions have focused on the school setting
- There has been large variability in the effectiveness of intervention studies. Studies are typically heterogeneous (program outcomes, measurements, sampling frames), making it difficult to generalise about what interventions are effective (72)
- The Cochrane Review on interventions to promote physical activity and fitness by Dobbins et al recommended ongoing PA promotion in schools (14).
- Other reviews have indicated only moderate evidence of effect for educational interventions on dietary behaviour in schools, and limited evidence of effect for multicomponent programs on behaviour among adolescents in European studies (8).

Evidence regarding program components and implementation processes

Physical Activity

- Girls and boys do not necessarily respond similarly to a given intervention. The evidence suggests girls may respond better to educational components based upon social learning support) while boys may be more influenced by structural and environmental changes that facilitate increased physical activity and improved diet intake. Intervention components targeting both adolescent boys and girls through different techniques may be necessary for a single program to have an effective impact on adolescents as a whole (46).

- For girls, gender separate lessons and less emphasis on competition have been found to be effective in promoting physical activity participation (47). An increased focus and quality of PE at school led to improved levels of physical activity but no impact on weight (48).
- Reviews of computer and web based interventions have focused primarily on increasing PA, but the independent effect of this approach has not been established with limited likelihood of high population reach and generalisability low or unknown (49, 50).
- PE teachers need to employ the concept of transformational teaching to provide students with self determination and self efficacy in schools and community settings (51).
- Multi-component school based interventions that also offer Physical Education that specifically addresses the unique needs of girls seem to be the most effective (52).
- Multi-component school based interventions are most successful at increasing PA among adolescents, but if an intervention is aimed to affect other health behaviours then the intervention is less effective in terms of PA (53, 54).
- Qualitative evidence has shown that adolescents generally think they are doing more PA than they are; also that if they engage in PA they can eat whatever they want (55).
- Pedometers have been used successfully in a variety of ways to promote physical activity among youth (56).

Nutrition

- Banning of soft drinks in elementary schools in the US has achieved modest results in decreasing consumption and prevalence of overweight (57-59). Evidence suggests that governmental laws are required to restrict the school availability of SSB in order to have a direct impact on the consumption of SSB and water (60-62). One recent study has suggested that SSB bans in schools may be insufficient to reduce total consumption, as adolescent SSB consumption is influenced by cognitive factors (63), whilst also suggesting that such intervention needs to be accompanied by social marketing and other strategies. The sale of sugar sweetened drinks in NSW government schools was banned in Term 1, 2007. The CEC and AIS strongly support this ban and will encourage it in their sectors.
- Evidence suggests that nutrition guidelines and price interventions focused on healthier foods are effective in improving the school food environment and students' dietary intake during school hours (64). However, there is very little evidence and a lack of consistent findings on the effectiveness of regulations of food and beverage availability; and there are currently few studies which have measured the impact of school food policies on BMI (65).
- While school nutrition policies that include breakfasts, vending machines, snacks and meal services have not been shown to prevent weight gain they can be effective in improving dietary patterns in disadvantaged school children and adolescents (65).
- The Fresh Tastes @ Schools NSW Healthy School Canteen Strategy came into effect in 2005 and is mandatory for all NSW Government schools and strongly supported by CEC and AIS sectors; however, implementation in high schools has been variable.
- There is no evidence regarding effective interventions to reduce SSB and NP foods in the home.
- School based interventions to promote consumption of fruit and vegetables among students in school settings have primarily consisted of multi component interventions that sometimes included an environmental intervention component. To date, the majority of nutrition interventions aimed at promoting increased F&V consumption have met with modest success at best (66).
- Garden based nutrition intervention programs may have the potential to promote increased F&V uptake among youth (71).

Family and community focus

- No solely family based dietary interventions at the population level have been conducted to prevent obesity among adolescents. Intervention has been limited to treatment, primarily primary care based face-to-face sessions with obese adolescents and their parents. Findings from Project EAT (Eating Among Teen) in the US suggest that strategies to increase the frequency and improve the quality of family meals may be promising (72). Similarly, family modelling of healthy behaviours

(e.g. reduced TV watching, healthy eating) may be a useful intervention to improve healthy behaviours of adolescent girls (73).

- Interventions which involve the whole community in complex interventions targeting multiple behaviours as well as environments and upstream determinants appear to be most effective (74).

4.4 Areas for further investigation

- There needs to be a greater focus on dietary behaviours, as well as physical and sedentary activities
- No intervention studies have focused on the home food/eating environment (e.g. family meals, parental modelling of healthy eating, soft drinks at home) or addressed parenting behaviours.
- Behaviour change interventions targeting reductions in sedentary behaviour have all been small pilot studies; more needs to be known about how best to optimise intervention effects (75).
- Reviews of community and family interventions for promoting PA among young people highlighted the scarcity of evidence in this area, hence there is large scope to develop interventions in this arena—perhaps involving peer support (76).
- School friendships, peer support and social cognitive theory could be applied to improve adolescents' dietary behaviours. Social network-based promotion in schools has potential (77). Computer or technology-based and peer modelling strategies are promising, developmentally appropriate approaches.
- Culture-specific influences should be examined as many cultural groups have high rates of overweight and obesity, e.g. Indigenous adolescents and adolescents of Pacific Island (78) and Middle Eastern descent (1).

4.5 Promising approaches

- Incorporate PA in schools with components specifically targeting girls and boys separately.
- Professional development of teachers to ensure PA is taught in such a way as to encourage individual skills development, is gender-specific and ensures that transformational teaching strategies are used to increase self-determination and self-efficacy among adolescents/increase perception of ability.
- Professional development of teachers to increase students' MVPA during PE lessons.
- Social network-based promotion to improve dietary behaviours in schools and home.
- Promote the importance of eating breakfast (a nutritionally healthy one) among girls.
- Carefully designed social marketing campaigns highlighting short (rather than long-term) health issues and addressing social and environmental cues relating to reduced soft drink consumption (particularly boys), EDNP food consumption, fruit and vegetable consumption, and screen time are required.

5. INTERVENTIONS AMONG YOUNG ADULTS

5.1 Young adults overall

5.1.1 Rationale

- Young adulthood has received little attention as a life stage for obesity prevention, as during these years that some obesity protective behaviours tend to wane and average body weight increases
- Recently born cohorts appear to be at greater risk for weight gain than their parents
- Young adults are also an important target group as their lifestyle behaviours at this stage may be carried into adulthood, and they form the next generation of parents.

The weight gains that occur during young adulthood are likely to result from changes in lifestyle behaviours, particularly declines in physical activity (2, 3). Data from the most recent national health survey indicated that only 34% of those aged 18-24 years and 29% aged 25-34 years undertook moderate to high intensity exercise, and less than 4% of 18-24 year olds consumed the recommended amount of fruit and vegetable servings (4). These poorer dietary and physical activity behaviours may be associated with significant lifestyle transitions, such as beginning work or further studies, or leaving the parental home.

Specific risk factors for weight gain among young adults include:

- Declines in physical activity during young adulthood (2)
- Frequent fast food and soft drink consumption (5).
- Frequent fast food consumption and possibly also low intake of fruit, vegetables and dietary fibre in young women (5, 6)

5.1.2 Policy and program context

There are currently no policies or programs at the federal or state level specifically addressing obesity prevention in young adults. Menu labelling in Quick Service Restaurants may be particularly relevant to this age group.

5.1.3 Evidence of effectiveness

Overview

The evidence comprises three recent randomised controlled trials in young adults aged from 17 to 35 years (7-9), and a review of interventions for weight loss during young adulthood (10). Reductions in body weight are most likely to be achieved by addressing energy imbalance through both dietary and physical activity strategies (10).

However, obesity prevention research in young adult populations has largely been conducted in the United States, with small samples of university populations or highly educated and largely female populations, limiting the generalisability of findings. While convenient points of access, colleges and universities are not necessarily appropriate settings for reaching a wide range of population groups.

Evidence regarding program components and implementation processes

- Group sessions that aim to develop self-monitoring skills around body weight, energy intake and amount of physical activity for young adults 18-35 years of age are effective (8).
- Tailored information packages covering diet, physical activity and weight control with subsequent follow-up support by e-mail, phone, group sessions or 'booster' visits with a dietitian may prevent weight gain in women (7).
- In younger 'emerging adults' (18-22 years), combining online educational sessions with self-monitoring of body weight has been found to prevent weight gain in students in university settings in the short term (9).
- Targeting high risk young adults (those with at least one obese parent), and those in 'emerging adulthood' (around 18-22 years, when most weight gains occur) may provide greater benefits than whole group approaches (7, 11)

- Developing young adults' behavioural skills for weight management (i.e. goal setting, self-monitoring) may have additional benefits, particularly for long term weight control, although long term studies in this population are required to confirm this.

5.1.4 Area for further investigation

- Further research is needed before any firm conclusions may be drawn about how best to intervene in this group in Australia.
- Accessing young adults particularly challenging there is scope to investigate TAFE as a setting for reaching young adults
- The delivery of messages and interventions using newer communication technologies (mobile phone and social media), which are widely accessed by wide segments of this target group (not only by more highly educated), warrants investigation.

5.1.5 Promising approaches

- The development of health advice and communication messages specifically designed to be personally relevant and persuasive for young adults is needed which could be delivered by new communication technologies. Potential focus could be on reducing sweetened drinks and fast food consumption and increasing physical activity

5.2 Young adults- pregnancy

5.2.1 Rationale

- Pregnancy is a key time to prevent excessive weight gain improve the health of women and their unborn child as many women are concerned about the health of their babies and are in frequent contact with health care providers (12, 13).
- Young adult women are at high risk for excessive weight gain, with one study reporting that 20% of women gain more than 5 kg by 6-18 months postpartum (14). A cohort study in Brisbane showed that women who gained excess weight during pregnancy had over twice the odds of being overweight and nearly five times the odds of being obese 21 years after the index pregnancy independent of other factors (15).
- High gestational weight gain (GWG) is the strongest predictor of maternal overweight/obesity following pregnancy (16, 17).
- There is also data showing that the prevalence of obesity among women bearing children in Australia is rising and this has important implications for obstetric care (18, 19).

Obesity during pregnancy and excessive weight gain during pregnancy regardless of pregnancy weight, is associated with adverse maternal, neonatal and child outcomes (16, 14, 15, 19, 20), as follows

- Maternal: 3 times higher risk of pre-eclampsia; two times higher risk of gestational diabetes (18); they are also more likely to be induced and require a caesarean section (although the effect on caesarean section disappears when increased rate of induction is accounted for (21); more anaesthesia related complications (22); future obesity
- Foetal and neonatal: increased risk of macrosomia, intrauterine death, still birth, admission to ICU, congenital abnormalities
- Infant: increased risk of obesity and heart disease
- Child: risk of obesity at 7 years of age is increased by 48% in children of women who gained more weight than recommended during pregnancy, compared to those within the recommended limits (17).

5.2.2 Policy and program context

There are currently no policies or programs at the federal or state level specifically addressing obesity prevention in young adults.

5.2.3 Evidence of effectiveness

Systematic Reviews

- Earlier systematic reviews and meta-analyses concluded that the specific elements of interventions that are effective have not been identified (12, 23, 24). However, these evidence summaries came to different conclusions depending on the relative inclusion criteria.
- A recent meta-analysis of 5 controlled intervention trials found no effect of relatively intense, tailored behavioural interventions (12). Another meta-analysis showed that overall, physical activity interventions were effective in restricting GWG (mean difference of 0.61 kg, 95% CI -0.17, -0.06); however, nearly half of the included studies (5/12) showed lower GWG in the control group (25). Gardner et al reviewed 10 published controlled trials of interventions that aimed to reduce gestational weight gain through changes in diet or PA. They concluded that overall, these interventions were effective in reducing GWG but that there was considerable heterogeneity in outcomes (24). Also, a review of 10 clinical trials concluded that dietary advice during pregnancy appears effective in decreasing total GWG and long postpartum weight retention (26).
- More recently, a meta-analysis of four randomised controlled trials showed that antenatal dietary intervention programs were effective in reducing total GWG in obese pregnant women (27).
- A systematic review showed that the provision of a supervised antenatal exercise intervention among overweight or obese pregnant women was associated with lower gestational weight gain (mean difference of 0.36 kg; -0.64 to -0.09 kg) (28). This consistency in the direction and magnitude of effect occurred despite diverse type (walking, cycling, resistance training) and timing of intervention.

Individual Australian studies all 2011

- A randomised trial in Melbourne, in which the intervention group women were given a personalised weight measurement card, advised of their optimal weight gain (based on BMI and the United States Institute of Medicine Guidelines) and instructed to record their weight at periodic intervals during pregnancy, resulted in significantly reduced GWG (mean difference of 0.12 kg/week) among women who were overweight compared to normal weight women, but not in obese pregnant women (30).
- A group-based antenatal care program involving sessions in community health settings has been trialled in South East Sydney and Central Coast (31). Facilitated by two midwives, the program provides women with education on healthy eating and PA in pregnancy; setting of weight management goals; peer support, encouragement and motivational techniques including the WELL diary (Weekly Eating and Lifestyle log). Intervention evaluation showed that it was challenging for midwives to discuss weight with the pregnant women as midwives' own weight status was an issue and an embarrassment and midwives were also worried about the risk of losing rapport with the client. Implementation issues included access (location, time of day, childcare) midwives' time, defensiveness of overweight/obese pregnant women and the need for attractive and informative advertising of the service.
- A trial among disadvantaged women in western Melbourne achieved significantly reduced GWG of 6.8 kg (intervention group gained 7 kg vs 13.8 kg in control group) (14). The intervention involved a 4-step multidisciplinary care: continuity of obstetric provider weighing on arrival at each visit, a brief 5-minute intervention by a food technologist (food intake previous day, reading labels, shopping lists, healthy recipes) and clinical psychological management. The intervention also achieved a significant reduction in gestational diabetes, as well as substantial dietary improvements of increased consumption of water, fresh fruit and home-cooked meals, and a reduction in consumption of soft drinks and fast foods (frozen and fresh).
- The authors of this last study (14) examined the review by Dodd (29) and concluded that, from the 3 successful interventions included in that review plus their own study, repetition of the intervention components is crucial to success. The successful interventions included maintenance of a dietary diary and repeated exposure to a dietitian/food technologist. At-risk women (i.e. existing overweight and obese) require individual education and skills training.
- Two study protocols for randomised controlled trials to prevent excessive GWG have been published recently (31, 32). These will examine dietary and lifestyle advice, setting/self-

monitoring, and support strategies (1) and the effect of continuity of midwifery care on GWG (32); hence both will provide additional insight into strategies for preventing excessive GWG.

International Recommendations

- The Institute of Medicine recommendations on gestational weight gain were revised in 2009 to include different recommendations for GWG according to prepregnancy BMI (3). These revisions include very low GWG recommendations particularly for obese women. The important role of health care providers in the implementation of these guidelines is detailed.
- Since the emergence of the revised IOM guidelines, the need for higher rates of counselling on this issue and also more effective counselling by health care providers on this issue has been identified (34, for example).

Evidence regarding program components and implementation processes

- There are no Australian guidelines on weight gain during pregnancy. In a convenience sample of pregnant women in Canberra, 69.2% had not received advice on their weight from their caregiver (35). Women consider that if the issue of weight was not raised by their health professional then it was not important (17).

Qualitative research in some of the studies has indicated the following barriers to achieving healthy weight gain during pregnancy:

- Weight gain during pregnancy is often viewed as transient and okay, as well as 'beyond control', by women; it gives larger women, and others, the chance to 'let go'. Similarly, assumptions exist about weight gain during pregnancy, such as feeling able to eat with fewer limitations, and overweight being more socially acceptable during this period (12).
- Potential barriers to addressing overweight and obesity in pregnancy which have been identified in Australia include poor uptake of routine pregnancy health activities, inaccurate self-categorisation of weight, unsuccessful weight loss attempts and inadequate advice regarding pregnancy weight loss (36). Inaccurate self-categorisation of weight has also been identified as an issue in the Healthy Beginnings Trial (37).
- Inadequate and often contradictory information from health professionals has been reported; and the information given to pregnant women generally related to healthy eating rather than weight management (12).
- Health professionals are not sure how to raise the issue of weight without stigmatising overweight or obese women (17, 38). Lack of clear guidelines on weight gain in pregnancy or appropriate care for obese pregnant women compounds, and perhaps underpins, the reluctance of staff to raise the issue with women (5, 16).
- Pregnant women with persistent nausea or vomiting or lower back pain, particularly those that are obese, are at risk of not exercising during pregnancy (39).

5.2.4 Areas for further Investigation

- Some of the barriers women have described in achieving healthy weight gain have not been addressed in the studies included in systematic reviews to date (42).
- Specific interventions are needed for women with particular risk of obesity and gestational diabetes during pregnancy, including existing overweight/obese women and Indigenous women. In combination with the recommended strategies indicated below, individual and group interventions in these at-risk groups could be informed by the recent Australian and international studies (40).

5.2.5 Promising approaches

- Incorporate specific 'weight management' advice as part of usual antenatal care.
- Adopt and disseminate a set of evidence-based guidelines on appropriate weight gain during pregnancy such as those by the US Institute of Medicine and National Research Council's Guidelines for weight gain during pregnancy. These guidelines, which have been adopted in Queensland (17), recommend that overweight pregnant women gain between 7 and 11.5 kg, and obese pregnant women gain between 5 and 9 kg during pregnancy.

- Conduct professional development courses to increase the skills of health professionals in discussing weight with pregnant women (34).
- Conduct intensive lifestyle interventions informed by recent studies, among pregnant women who enter pregnancy very overweight or obese.
- Trial community-based strategies which seek to educate and inform the wider family and social network surrounding weight and pregnant women (17). For example, group-based approaches involving peer social support may be effective (47, 41).
- Promote weight management programs for young women who are overweight or obese, prior to pregnancy.

6. INTERVENTIONS AMONG ADULTS 15 YEARS

This section concentrates on the particular setting of 'workplaces'. However strategies described in relation to older adults at risk and parents referred to in the above sections on children and adolescents, are also relevant

6.1 Rationale

- Workplaces have been identified in international and national frameworks, including the National Preventative Health Task Force report, as an important setting for obesity prevention.
- This focus is based on evidence that interventions in this setting can facilitate improvements in behavioural risk factors for obesity and chronic disease and reach large numbers of adults, given that approximately 60% of the Australian population (≥15 years) is engaged in employment.
- Obesity prevention programs in workplaces have potential benefits for businesses in relation to increased employee productivity, presenteeism, reduced absenteeism, and reduced staff turnover (2, 3)
- The organisational culture and physical environment of the workplace should be designed to be conducive to and support desirable health behaviours (3-5). Workplace health interventions are more effective when there is support from senior management (5), therefore population health interventions in the workplace setting need to target both employers and employees (2, 5, 6)
- Of all those employed, around 70% are sedentary or have low levels of exercise (7), with those who have high daily levels of sitting being more likely to be overweight or obese than those with less amounts of being seated at work (8).
- Shift work, long hours and blue collar jobs (among males) are associated with higher levels of obesity (9).

6.2 Policy and program context

The Healthy Workers Initiative (HWI) forms part of the National Partnership Agreement on Preventive Health (NPAPH) and is being implemented from 2011– 2014 by state and territory governments. A Medicare item is available for health checks for adults aged 45 years.

6.3 Evidence of effectiveness

Overview

The evidence is synthesised from reviews of workplace interventions (10, 13). These reviews include research conducted mainly overseas, as Australian studies are scarce (1). Chau et al examined the evidence of effectiveness of workplace health promotion programs to promote physical activity, healthy diet, or both, for prevention of overweight and obesity by synthesising evidence from available reviews and reports (10). In a rapid review, Bellew et al examined the evidence for the type of primary prevention programs in the workplace that are likely to be most effective in (a) changing risk factors for chronic disease and (b) reducing rates of chronic disease (11). Groenveld et al undertook a systematic review of randomised controlled trials that were implemented in the workplace and aimed at increasing physical activity and/or improving diet (13). A very recent review by Bauman et al systematically examined the evidence for the integration of short bouts of physical activity into organisational routine in workplaces (and schools) (7).

- There is strong evidence that workplace programs are effective at increasing physical activity, improving diet and reducing body weight (2, 13).
- Strategies to improve dietary behaviours have focused on the workplace food environment; effective strategies include:
 - › point-of-purchase placement, promotions and signage for healthy foods in workplace canteens, and
 - › increased availability of healthy food choices in canteens and vending machines.
- Effective physical activity strategies include:
 - › prompts to encourage stair use
 - › access to places or opportunities for physical activity
 - › showers, lockers, change facilities

- › bike racks
- › education
- The most effective programs were multi-component interventions that target physical activity, diet, or both, and comprise:
 - › Provision of individual behavioural skills training
 - › Involvement of workers in program development and implementation
 - › Organisational and environmental changes to support positive health behaviours.

Evidence regarding program components and implementation processes

- Targeting changes in the knowledge, attitudes and commitment of employers to workplace health
- Promotion through awareness raising campaigns can lead to organisational changes in culture, policy, practice and the work environment, which support a healthy lifestyle for employees (4, 45)
- Web-based and email interventions have shown to be effective at changing physical activity and dietary behaviour (16), and have potential to reach a large number of workers.
- Pedometer interventions have potential to be practical and effective methods for increasing physical activity in sedentary workers (17, 18). Further studies are required to replicate these types of interventions in a range of workplaces.
- A recent efficacy trial demonstrated that a weight loss intervention with an online component was both feasible and effective in blue collar workers in Australia (19).
- The inclusion of health risk assessment/health checks during work time (with tailored feedback and an incentive to participate) may act as a motivator to engage with programs that offer the opportunity for intrinsic change (20, 12).
- Interventions integrating physical activity (e.g. 'flexibility, exercise, stretching breaks', stair prompts, incidental walking) into organisational routine during everyday life have demonstrated modest but consistent benefits (7). The majority of workplace studies found increases in physical activity (although not measured in many), work-related/performance outcomes, and mood and psychosocial factors; one study achieved positive changes in resting heart rate. These long-term outcomes achieved in these studies compared with individual level studies suggest that physical activity promotion strategies at the organisational level may be more effective, and more sustainable than those aimed at the individual.

6.4 Areas for further Investigation

- Intervention studies targeting individual behaviour change have attracted mainly motivated individuals, who may not be at particular risk of obesity/chronic disease. At the population level, further investigation will be required to identify and attract participation by those most at risk or those who are less likely to participate (22, 23).
- The degree to which workplace interventions shown to be effective in one group can be translated and sustained across different working contexts (such as part-time, casual, blue collar and rural workforce groups), is not known and needs further testing.
- Environmental changes (healthy canteens/vending machines, posters, stair prompts), underpinned by changes to organisational culture are required to achieve a broader reach. Therefore health promotion initiatives need to engage employers as well as employees in order to achieve cultural and organisational change. However, there is little information on optimal methods for reaching employers.
- The Healthy Workplace Guide: Ten steps to implementing a workplace health program has been developed recently by the Heart Foundation, NSW Cancer Council and PAMARQ. This step-by-step guide aims to raise awareness of the need for workplace health promotion and assist businesses in implementing workplace health programs and activities. Evaluation of its effectiveness across a range of businesses will inform this area of research.

6.5 Promising approaches

- There is an opportunity to reach employers through industry associations and mass media campaigns in order to raise awareness of the benefits of supporting employees to eat healthily, move more and maintain a healthy weight (organisational cultural change).

- Promotion and facilitation of employers to implement simple evidence-based environmental interventions in the workplace (e.g. through healthier vending machines, healthy canteens, provision of bike racks, showers, kitchen facilities, posters, stair prompts, walking groups, pedometer programs, short activity breaks) although such interventions alone are unlikely to be sufficient
- Promotion of existing healthy lifestyle support programs such as the NSW Get Healthy Service, through workplaces.
- Targeting blue collar industries will provide the best opportunity for achieving both high reach and targeting those most at risk.

7. INTERVENTIONS AMONG OLDER ADULTS 60-75 YEARS

7.1 Older adults- general

7.1.1 Rationale

- People aged 65 years and over represent about 13% of the total population in Australia (1). By the number is expected to increase from 2.7 million to 6.3 million (24% of the total population) (2).
- Australians in their 50s and 60s continue to gain weight as they age, until the 70s (3). The prevalence of obesity among Australians approaching retirement (55-64 years: 25.5%, 65-74 years: 19.9%, 75+: 12.7%, total 65+ 16.9%) (1) is around 25% with older males more likely to be overweight or obese than older females (2). The prevalence of abdominal obesity is also common among older Australians (2).
- Obesity not only accelerates the aging process, but also leads to premature death from life threatening diseases, physical disability, impaired quality of life and decreased cognitive function (3). This has implications for healthcare costs, for aged care services, and for carers and their wellbeing. Improving older people's health is a national research priority in Australia (4).
- Cardiovascular factors and other health complications associated with obesity increase linearly with increasing BMI until age 75. Therefore, small amounts of weight loss (between 10% of initial body weight) may be beneficial as well as interventions that focus primarily on improving physical function and in preventing medical complications associated with obesity (5,6).
- Regular exercise can minimize the physiological effects of an otherwise sedentary lifestyle and increase active life expectancy by limiting the development and progression of chronic disease and disabling conditions (7). Physical inactivity is common in older Australians (44.9% for those aged 65 years or more), increasing to almost 7 in 10 for those aged 85 years and over. Older females were more likely to be sedentary than older males (8). Only 4.3% of adults (aged 65+ and 55-64 years respectively) meet adequate levels of physical activity (9). Chastin et al report a direct positive relationship between prolonged periods of sedentary behaviour and obesity, with older adults who break up their sedentary time having lower body fat (10). Muscular strength and power predict all cause and cardiovascular mortality, independently of cardiovascular fitness. Thus, avoidance of a sedentary lifestyle by engaging in at least some daily physical activity is prudent (7).
- Many older Australians, especially men, are not consuming adequate amounts of fruit and vegetables. In 2009, 36.8% of people 65 years and over living in NSW consumed less than two fruits a day, and 87% consumed less than five serves of vegetables a day (11).
- Retirement is an important life stage transition.
 - Men who retire from physically active jobs become less active and those with former sedentary jobs often become more active (12).
 - Weight gain and increase in waist circumference among men leaving the workforce were associated with a decrease in fruit consumption and density of the diet, with an increase in eating breakfast and in the consumption of sugary sweetened soft drinks, and with a decrease in several leisure time physical activities (11).
 - Lack of routine and loss of structured time contribute to more snacking, soft drink and alcohol consumption among retirees.
- TV watching increases in older people (13).
- Older adults are driven to become involved in PA by their perception of risk for future health problems associated with advancing age (14).
- Coping self-efficacy is also another important motivational factor for individuals to engage in physical activity (15).
- Focus groups conducted in NSW of older people with and without chronic disease reported that the knowledge of an appropriate exercise program, confidence in their abilities to achieve goals and the availability of social and environmental support were important in order to engage in regular physical activity. For instance, less healthy people preferred to exercise alone while more healthy individuals used physical activity as a social opportunity (16).
- Knowledge about the relationship between the physical environment and physical activity in older adults is limited. The review by van Cauwenberg et al showed inconsistent results but most of the

environmental characteristics studied were reported not to be related to physical activity in older adults, contrary to younger age groups (17).

- King et al indicated that older adults living in more walkable neighbourhoods had more transport activity and moderate-to-vigorous physical activity and lower body mass index relative to those living in less walkable neighbourhoods (18). Additionally, the most mobility-impaired adults living in more walkable neighbourhoods reported transport activity levels that were similar to less mobility-impaired adults living in less walkable neighbourhoods.
- In homebound older adults sensory appeal, convenience and price of foods were the most important factors in food selection (19). Of least importance were ethical concerns, mood and natural content. Older women make choices based on health and sensory appeal while older men make choices based on weight control and mood.

7.1.2 Policy and program context

- The NSW Government's current ageing strategy, 'Towards 2030: Planning for our changing population', includes 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' (20).
- As people over the age of 60 are at increased risk of chronic disease, prevention frameworks and initiatives, such as Lifescripts and Diabetes Prevention initiatives, have particular relevance for older adults

7.1.3 Evidence of effectiveness

Physical Activity- Overview

- A review of effective population health interventions for the primary prevention of musculoskeletal conditions cited walking as the easiest physical activity to implement and maintain in older adults (21).
- The Position Stand of the American College of Sports Medicine concludes (1) a combination of aerobic training/exercise (AET) and resistance training/exercise (RET) 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; (2) 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 metabolic disease; (3) exercise prescription for older adults should include aerobic exercise, muscle strengthening exercises and flexibility exercises. Additionally, individuals who are at risk of falling or mobility impairment should also perform specific exercises to improve balance as well as other components of health-related physical fitness (6).
- 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 lean mass and decreased total body fat mass, have been reported in older adults who participate in moderate or high intensity resistance exercise training (6).

Evidence regarding program components and implementation processes

Physical Activity

- There is consensus that older adults can substantially increase their strength and power after resistance exercise. Marques et al found that both RET and AET resulted in increased static and dynamic balance in community-dwelling older women (22). Despite aerobic training being important for the induction of cardiovascular and metabolic changes, only resistance training showed significant bone adaptation with the potential to reduce fracture risk.
- Tai Chi is recommended as an economic and effective alternative method of physical activity that improves balance, balance confidence and prevents falls in older adults, thus enhancing functional capacity (23, 24, 25). A community-based weekly Tai Chi program in Sydney reduced falls in

- healthy community-dwelling older adults (26). Additional research is needed to examine the effects of Tai Chi on total levels of physical activity.
- Dancing is a mode of physical activity that may allow older adults to improve their physical function, health and well-being. 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 level evidence suggested that dancing might improve older adults' lower body bone mineral content and muscle power, as well as reduce the prevalence of falls and cardiovascular health risks (27).
 - 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 (28).
 - Water aerobics is a feasible alternative to land-based exercise for middle-aged and older adults for improving and maintaining cardio respiratory fitness (29).
 - Multi-component behavioural group interventions showed benefits in improving balance confidence and in decreasing activity avoidance (30).
 - Goal setting and self-monitoring are effective behavioural intervention components in weight loss and physical activity interventions targeting adults aged 50 years and older (31).
 - Individually tailored programs to encourage lifestyle changes in seniors can be effective and applicable to health care and community settings. CHAMPS is a 6-month program encouraging participation in existing community-based physical activity classes and programs as a way to increase physical activity. It was successful in increasing class participation (32). CHAMPS was based on social cognitive theory and included principles of self-efficacy enhancement and readiness to change, as well as motivational techniques. The program resulted in significant physical activity increases and was particularly useful in increasing physical activity for overweight persons (29). A similar program is the Groningen Active Living Model (GALM) which was developed in The Netherlands (3).
 - Additionally, 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 (21).
 - The Step by Step program (34) 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 35 years living in NSW.
 - Programs targeting Aboriginal older women have been successful. The WAVES Program was aimed at inner city women (Eastern suburbs, Sydney) and involved exercise in a private hydrotherapy pool (35). In the other program identified which was aimed specifically at women, circuit classes were identified by the women in Cherbourg, Queensland (The Cherbourg Healthy Lifestyles Program) as the means for increasing physical activity (36). Although identified as a healthy lifestyles program, it appears to involve physical activity components only. Regular fitness assessments assisted continued interest.

Sedentary Behaviour

- A local study in Queensland reported that sedentary time in older adults can be reduced following a brief intervention based on goal setting and behavioural self-monitoring (37).

Nutrition

- Tailored nutrition counselling interventions involving active participation in developing a behavioural health plan, goal setting, motivated participants and self-efficacy show positive outcomes in the nutrition status or nutrition-related outcomes in community-dwelling older adults (21, 38).
- Group learning sessions, peer support and scheduled follow-ups are also characteristics of successful nutrition counselling interventions. Ineffective interventions were found to comprise

those that were not tailored to individual learning needs and had limited personal contact with study participants (38).

7.1.4 Areas for further investigation

There are a large number of gaps in the evidence base to prevent overweight and obesity in this target group; hence there are multiple areas which would benefit from further investigation:

- Older adults are an understudied population in terms of obesity prevention, yet investment in the prevention of weight gain in this group is likely to be highly cost-effective due to the health burden of chronic disease in older adults.
- Retirement is recognised as a major life transition but no interventions were identified that specifically target retirees and this transitional period.
- Physical activity outcomes are often not incorporated into falls prevention programs.
- Nearly all identified interventions were aimed at increasing physical activity rather than reducing sedentary behaviours or improving nutrition.
- The heterogeneity of older people in terms of cardiovascular fitness, muscle strength, performance in activities of daily living, medical comorbidities and psychosocial needs must be taken into account in assessing the effectiveness of interventions.

7.1.5 Promising approaches

- Any physical activity interventions in this target group need to emphasise the benefits of strength training for older people.
- Communication to increase awareness of chronic disease risks.
- Providing support for engaging alternative activities to reduce TV use in older people, or adapting TV to be more interactive. Increasing public awareness of alternatives to watching TV could help to diminish the potential for associated negative health effects in older adults.
- Cross-sectoral work to ensure environmental amenities including access to physical activity facilities, public and community transport to a variety of food retail outlets and other community facilities.

7.2 Older adults at high risk of chronic disease

7.2.1 Rationale

- A high proportion of adults aged over 55 years are at risk of developing diabetes with the prevalence of impaired fasting glucose and impaired glucose tolerance increasing with age, and highest for those aged 55-64 years (39).
- Coronary heart disease and type 2 diabetes were expected to be leading contributors to Australia's overall health burden in 2010 (39).
- The prevalence of non-alcoholic fatty liver disease ranges from 33% in the general population and the prevalence is higher in those who have metabolic risk factors, type 2 diabetes or the metabolic syndrome (40).
- Increasing levels of physical activity and fitness can have positive effects on chronic disease risk factors independent of weight loss (41, 42).

7.2.2 Policy and program context

- The Australian General Practice Network is contracted by the Department of Health and Ageing to implement the National Prevention of Type 2 Diabetes Program from 2008 to 2012.
- A Medicare item for health checks for adults aged 75 years and over is available.

7.2.3 Evidence of effectiveness

Overview

- Meta-analysis shows that weight loss in lifestyle interventions is relatively modest, with an average loss of 2.8 kg at 12 months, whilst higher intensity interventions are associated with greater weight loss (43).
- There is strong evidence from multiple large RCTs 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) (43, 44, 45).
- In patients with nonalcoholic fatty liver disease, interventions targeting weight reduction through dietary change and increases in physical activity can reduce the severity of risk factors associated with progression of the disease including insulin resistance and elevated liver enzymes (46).
 - Improving individual physical activity and dietary behaviours are considered essential components of cardiac rehabilitation care to prevent secondary cardiac events (47). However, in order to ensure equitable service delivery, current cardiac rehabilitation programs need to develop strategies for increasing attendance adherence (48), and tailoring and targeting programs for those with multiple comorbidities (49), culturally diverse populations and Aboriginal and Torres Strait Islanders (50). In NSW, the Physical Activity, Nutrition and Cardiac Health (PANACHE) study has demonstrated positive effects on health behaviours in patients with cardiac disease and has been shown to be cost-effective (51).
 - A review of internet interventions targeting physical activity found that 10 of 16 interventions had significant positive effects on physical activity or weight loss; however, the external validity of published interventions is low, there was uncertainty whether or not reported effects are behaviourable and sustained (52).
 - Telephone for delivery of individualised behaviour change interventions can be effective (53).

Evidence regarding program components and implementation processes

- The primary care setting provides opportunity for identifying, through appropriate screening, older adults who are at high risk for developing chronic disease as well as acting as referral agents to lifestyle interventions (53).
- The intensity and duration of the largest lifestyle interventions vary from 7 to 24 sessions in the initial 12 months.
- In Victoria, the Public Health Diabetes Prevention and Management Initiatives aim to increase the capacity of health organisations and service providers to undertake diabetes health promotion, prevention and management activities through provision of resources and training. The effectiveness of this approach is unknown however.
- The Sydney Diabetes Prevention Program (SDPP), an example of a feasible delivery model for a lifestyle intervention which recruited patients through general practices is currently being implemented and evaluated for effectiveness and reach (54). Initial evaluation indicates modest weight loss at 12 months (about 2 kg) and low referral rates from most participating GPs. Referral by practice nurses compared to referral by GPs has been shown to increase adherence to exercise programs (55).
- Brief counselling interventions, with motivational interviewing delivered by General Practice can produce short-term changes in health behaviours for older adults at risk of chronic disease or with chronic disease; this includes interventions consisting of brief advice (5 minutes) from a general practitioner as well as more intense interventions with six sessions with either a general practitioner or exercise specialist (56). However, there are a number of barriers to implementing lifestyle interventions in general practice including lack of time and/or knowledge, increased workload – not only for those delivering intervention but also for administrative staff and competing priorities (53, 57, 58).

Phone and Internet

- Computer-tailored, internet interventions are effective for weight loss, dietary change, physical activity and management of chronic diseases such as diabetes and can achieve broad population reach (59). However, there is uncertainty about whether reported effects are behaviourable and sustained (52). Attrition rates are high (45-50%) and adherence to the intervention and access of intervention resources is low (69, 60). In some weight loss computer-tailored, internet interventions attrition was associated with less education and lower initial weight (62, 59).
- A recent study reported on the long term effects (2 years) computer-delivered intervention versus a face-to-face weight loss intervention and a control group delivered in general practice

setting. Weight loss was of a similar magnitude at 2 years in both intervention groups (6.1 kg and 5.8 kg) compared to 4.4 kg in the control group (61).

- The computer-tailored interventions with most successful health outcomes, lowest attrition rates and high adherence were those with tailoring according to participants' stage of change (52), engaging platforms, evolving resources and high level of interactivity (59).
- The efficacy is similar for single behaviour or multiple behaviour interventions (62). Although effect sizes are generally small, this type of intervention has potential for distribution to large populations at low cost (25, 63).
- Tailored messaging and social networking functionality has been hypothesised to increase the uptake of internet intervention content but there is no direct evidence of effectiveness with older adults (59). Similarly, there is evidence to support text messaging as a tool for behaviour change; however, further research is required to test this model in older adults (> 55 years) (64).
- Telephone can be used to deliver individual behaviour change interventions, disease management and to encourage appropriate use of health services (65, 66). These interventions can be delivered at convenient times, with privacy, and are lower in cost than face-to-face interventions and can reach at-risk populations (67).

7.2.4 Areas for further investigation

- Further work is required to determine how best to implement lifestyle interventions in diverse populations and community settings (43), as well as the optimal modality and intensity for intervention delivery.
- There is a need to focus on strategies for reaching adults most at risk and motivating them to participate in lifestyle interventions.
- Whilst there have been many efficacy and effectiveness studies of lifestyle interventions, there is a need for further replication trials in a range of settings and populations to address issues of reach in at-risk populations.
- Interventions for older adults with chronic disease need to consider the importance of social, behavioural and contextual factors in promoting opportunities for positive health behaviours. Interventions for older adults with chronic disease need to consider the importance of their physical environment when promoting changes in health behaviours, including their ability to access healthy foods and safe areas to exercise (14).
- Potential benefits of health checks for people aged 65 years.

7.2.5 Promising approaches

- The telephone can be used to deliver individual behaviour change interventions, disease management and to encourage appropriate use of health services (65, 66). These interventions can be delivered at convenient times, with privacy and are lower in cost than face-to-face interventions. Thus ongoing implementation and promotion of telephone-based healthy lifestyle information and support services, such as the NSW Get Healthy Service, is a priority.
- Implement more intensive behavioural lifestyle interventions using group or individual format in primary care, community and other health settings for people at high risk or with chronic diseases (cardiovascular disease, type 2 diabetes and non-alcoholic fatty liver disease).
- Implement computer-tailored internet interventions underpinned by the stages-of-change model.
- Tailored mass media campaigns including risk communications, could be an important part of a set of comprehensive strategies to help prevent and reduce the risk of obesity in adults with specific chronic diseases or at risk of chronic diseases (68, 69).

8. COMMUNITY-WIDE FOOD POLICY AND ENVIRONMENT ACTIONS

8.1 Point of purchase menu labelling

8.1.1 Rationale

Menu labelling has the potential to influence the energy consumed through takeaway and other food outlets.

8.1.2 Policy and program context

Currently, NSW now has regulations in place for the introduction of menu labelling for quick service foods, with other states also indicating that they will introduce consistent regulations. The NSW Food Authority has responsibility for the implementation, including associated community education, for the NSW initiative. They will also coordinate the monitoring and evaluation of the initiative, thus generating important relevant information about community awareness and responses.

8.1.3 Evidence of effectiveness

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 intake behaviour (12).

A rapid review of the literature on this topic was published by the National Heart Foundation of Australia towards the end of 2010 (1). The key findings of this review included:

- 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.
- There is some evidence of consumer support for nutrition labelling on food menus.
- Nutrition information provided on in-store posters or online may not be accessed by consumers.
- 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 food choices later that day. Groups who may benefit most include women and parents choosing menu items for their children.

The impact of calorie labelling is likely to differ by type of chain restaurant. 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 as opposed to including coffee purchases (3). A study with Subway found customers who reported seeing calorie labelling information purchased 52 fewer calories than those who did not see the information (4).

Recent consumer research indicates that consumers have poor understanding of energy and kilojoules in relation to food, suggesting the importance of consumer education as part of the menu labelling initiative (5).

8.1.4 Areas for further investigation

- Evaluate the impact of different approaches to consumer education around 'energy', 'kilojoules' and 'energy intake reference values'.
- Evaluate the impact of menu labelling on consumers' awareness of kilojoules in foods and their understanding of the need for energy balance in relation to food consumption.

8.1.5 Promising approaches

- Implementation of regulations and community education of kilojoule menu labelling with ongoing evaluation in terms of consumer understanding, utilisation and purchasing refinements, as required.

8.2 Front-of-pack nutrition labelling

8.2.1 Rationale

Front-of-pack (FOP) food labelling is proposed as a significant means of providing consumers with accurate, comprehensible information on food products at the point of purchase.

8.2.2 Policy and program context

The preferred national policy approach to front-of-pack food labelling (FOPL) is currently under discussion by Australian Governments, following the Blewett Review (6).

8.2.3 Evidence of effectiveness

The most recent review of evidence regarding FOP labelling schemes (7) indicates that:

- Interpretive nutritional FOPL schemes with traffic light colour coding and food and interpretive text ('high' 'medium' 'low') are more easily understood by consumers in choosing healthier products across sociodemographic groups, compared to non-interpretive schemes such as the monochrome %GDA/DI scheme.
- In some studies a traffic light colour-coded %GDA/DI thumbnail scheme has been preferred to multiple traffic light (MTL) schemes and performed equally well in terms of consumer understanding compared to MTL schemes.
- The monochrome %GDA/DI scheme consistently performs least well in terms of consumer understanding and ability to make healthier choices, particularly among lower-economic and some demographic groups.
- 'Negative nutrients' – primarily fat, but also saturated fat, salt and sugars, and maybe calories are the preferred nutrients for FOPL and are most likely to be used by consumers in making healthier choices (strong evidence). 'Salt' is preferred to 'sodium'. The addition of positive nutrients to a MTL scheme has not been fully examined.
- The presence of multiple nutritional FOPL schemes in the marketplace and on individual products has been found to lead to confusion among consumers. Consumers prefer a single, consistent, credible FOPL scheme applied across all products, at least within a number of product categories; and this is most likely to reduce consumer confusion and difficulty in interpretation.

8.2.4 Areas for further investigation

- There is scope for further research on detailed aspects of front-of-pack schemes and on the effectiveness of community education in increasing utilisation.
- The impact of front-of-pack labelling schemes on product reformulation.

8.2.5 Promising approaches

- Introduction of a mandated traffic light labelling scheme on all packaged food products

8.3 Increasing access and availability of healthier food options and reducing access to fast foods

8.3.1 Rationale

Good access to affordable, healthy food is a prerequisite for a healthy diet. There is also good evidence for the benefits of people limiting their fast food consumption, as these foods contain high levels of saturated fat, sugar and salt, and those consuming large amounts of fast food which have less healthy nutritional profiles.

Access to healthy food choices depends on access to healthy foods in both food retail and food service outlets. Overall, people in NSW with the exception of those in very remote locations have good access to healthy food retail outlets, especially through supermarkets. Food services and catering outlets are among the most important and promising venues for environmental, policy, and pricing initiatives to increase intake of healthy food. There is particular scope for working with small takeaway food service businesses to promote the availability of healthier choices and improve the nutritional profile of food items.

8.3.2 Policy and program context

The density and location of food retail and food service outlets is determined by local government and planning arrangements. With regard to food service outlets, the NSW regulations for menu labelling apply to food outlet chains with more than 20 stores in NSW or more than 50 stores nationally.

8.3.3 Evidence of effectiveness

- There is no evidence evaluating the effects of interventions which specifically reduce access to fast food, such as through local government zoning to prevent the establishment of new fast food outlets.
- The Heart Foundation's 3 Step Guide is currently being disseminated by local government Environmental Health Officers to food service businesses to help them swap to using healthier fats and oils and thus reduce the levels of saturated and trans fat in the supply of food (8).

8.3.4 Areas for further investigation

- Assess the impact of community transport options to supermarkets, such as community vans or shuttles, in areas with high numbers of older and disadvantaged people, or with less access to food retail outlets.
- Food availability audit tools allow local communities to assess the availability and accessibility of foods, and can provide a way of engaging local communities in action to promote healthy food in their community.
- The impact of establishing cooperative grocery stores or food cooperatives in disadvantaged areas, through nongovernment and welfare agencies.
- The impact of mobile food outlets to deliver healthy products to locations near workplaces or more remote towns
- Impact of land use and zoning policies that restrict fast food establishments near school grounds and public playgrounds, or residential communities.

8.3.5 Promising approaches

- Community action research projects involving local audits and action plans to promote availability of healthy food choices
- Community based trials to establish food cooperatives and mobile food vans in small towns, and disadvantaged communities.
- Widespread implementation and support for interventions with small food service outlets to improve the healthiness of food products.
- Require that plain water be available in local government operated and administered outdoor areas as well as other public places and facilities.

8.4 Improving food access for disadvantaged communities

8.4.1 Rationale

Access to affordable healthy food choices is essential for good nutrition. Price is a key barrier for low income groups, and food prices, particularly for fresh foods, tend to be higher in small rural and remote communities who do not have immediate access to a supermarket. Convenience stores in more deprived areas generally have low quality fresh produce compared to stores in more affluent areas. Improving access for disadvantaged communities, where supermarkets would be viable, continues to be a priority and has not been addressed systematically in NSW.

8.4.2 Policy and program context

Improving food access for disadvantaged communities was identified as a priority in the National Preventative Taskforce Roadmap report. Consultations regarding a national Food Policy in Australia and which may address this issue are currently underway.

The Remote Indigenous Stores and Takeaways (RIST) Project, established in 2005 by the SA, WA, NT, QLD, NSW and Australian Government Health Departments to improve access to a healthy food supply for Aboriginal and Torres Strait Islander People in remote communities, aims to establish and improve

standards for 'healthy' remote stores. Resources include checklists on healthy food supply, maximising the shelflife of fruit and vegetables and a freight improvement toolkit.

8.4.3 Evidence of effectiveness

- Community gardens have had positive results among Aboriginal communities including self reported improvements in access to fruit and vegetables, as well as horticultural skill development, employment opportunities, self esteem and social interaction (9).
- In NSW, subsidised fruit and vegetables have been provided through the Fighting Disease with Fruit program whereby families pay \$5 and receive \$40 worth of fruit and vegetables, with the remaining \$35 being subsidised by the Aboriginal Medical Services. The program included sending children fruit at school daily with this action resulting in improved vitamin C status among children with existing vitamin C deficiency (10).

8.4.4 Areas for further investigation

- Applicability of the RIST resources to improve food quality in poorly served areas, as well as remote areas.
- Evaluation of community-based trials to establish food cooperatives and mobile food vans in small towns and disadvantaged communities

8.4.5 Promising approaches

- Subsidised fruit and vegetable schemes in remote and highly disadvantaged communities
- Widespread implementation of community gardens in disadvantaged communities
- Support for community action research projects involving local audits and action plans to promote availability of healthy food choices
- Community-based trials to establish food cooperatives and mobile food vans in small towns and disadvantaged communities.

9. COMMUNITYWIDE URBAN DESIGN AND INFRASTRUCTURE FOR PHYSICAL ACTIVITY

9.1 Rationale

There are several urban form characteristics that are associated with physical activity (1, 2). These include mixed land use and density, footpaths, cycle ways and facilities for physical activity, street connectivity and design, and transport infrastructure and systems which link residential, commercial and business areas. A critical concept is that of active travel or active transport, which refers to physical activity undertaken as a means of transport. This includes walking and cycling. It also refers to the use of public transport, as most public transport trips require a walk or cycle trip at either end.

Recent research in NSW found that people who drove to work were 13% more likely to be overweight or obese than those who walked, cycled or used public transport, regardless of their income level. Additionally, the further people had to drive each day, the greater their weight increase. Cycling (although not walking) was associated with lower weight. International comparisons of active transport and obesity rates yield similar findings (5). Recent studies indicate that brisk walking may be particularly associated with leanness (6).

9.2 Policy and program context

There are many policy documents and plans which support walking, cycling and active travel. These include:

- Australian Government. Our Cities building a productive, sustainable and liveable future. Discussion Paper. Sydney: Major Cities Unit, Infrastructure Australia, 2010.
- Australian Bicycle Council. The Australian National Cycling Strategy 2016. Sydney: Austroads 2010.
- NSW Government. NSW 2021 – A plan to make NSW number 1. Sydney: NSW Government; 2011. (Has State targets for walking and cycling)
- New South Wales Government. New South Wales Bike Plan. Sydney: Premier's Council of Active Living 2010.
- New South Wales Government. Draft Walking Strategy. Sydney: Premier's Council of Active Living (under development).
- Kent et al. Healthy Built Environments Program. Sydney: City Futures Research Centre, UNSW, 2011.

9.3 Evidence of effectiveness

Interventions within this action area focus on providing opportunities and encouragement to undertake physical activity as part of our daily lives in terms of getting to and from work or school or improving incidental physical activity by better community design or by improving access to and quality of recreational spaces.

- The most successful interventions could increase walking among targeted participants by up to 30-60 minutes a week on average, at least in the short term. However, much of the walking research currently provides evidence of efficacy rather than effectiveness at the population level (7). Translation research studies are needed.
- Workplace travel plans have the potential to promote active travel options (walking, cycling, public transport and combinations of these modes of travel) to large segments of the working population at low cost (8). Workplace travel plans are behaviour change interventions designed to increase uptake of sustainable transport modes for commuting and business trips, often at the expense of car driving. They have been deployed extensively throughout Australia, the United States, Canada, the Netherlands and the UK. The ACE Prevention report highlights that a mix of cost effective interventions for increasing physical activity at the population level should include travel plans (8). Nevertheless, the evidence on effectiveness of workplace travel plans remains limited.
- Communitywide promotional activities and improving infrastructure for cycling have the potential to increase cycling by modest amounts, although more evidence is required. Future research should also examine how best to promote cycling in children and adolescents as well as through workplaces (9).

9.4 Areas for further investigation

There are many gaps in the evidence base examining the direct or indirect effects of the built environment on healthy weight. An investment in this research is needed.

9.5 Promising approaches

- Car reduction programs (e.g. TravelSmart)
- Active travel infrastructure (e.g. walkable footpaths, cycleways)
- Workplace organisational travel plans
- Improving access to parks and recreational facilities
- Lockers, showers at work or school
- Building, planning and design codes to foster walking and cycling
- Traffic calming to promote walking and cycling
- Financial or tax incentives for active travel

These are consistent with the review and recommendations to a recent NHMRC review (9).

There is additional evidence that specific strategies to increase cycling increase physical activity. These include:

- Programs to promote social norms around active travel (Ride to Work Day, Walk Safely to School Day) (11, 12).
- Public bike rental facilities (3).
- Training in cycling skills (14).

10. SOCIAL MARKETING AND MASS MEDIA CAMPAIGNS

10.1 Rationale

Social marketing and mass media interventions aim to raise community awareness, inform and change attitudes and influence behaviour. They can also operate indirectly, to influence norms within social networks, and thus exert an influence even where some individuals are not exposed to or persuaded by the campaign itself (1). They can be used to communicate many and varied messages and, with duration, media mix and dose of media exposure. They seek to achieve broad reach across a significant proportion of the target population group; and are often conducted in concert with other community-based initiatives.

While the term 'social marketing' is frequently used to refer to mass media campaigns, it more accurately denotes the application of a broad set of marketing principles and approaches to the promotion of public health and social goals and closely corresponds to more general understandings of 'health promotion'. Mass media campaigns may comprise a component of social marketing initiatives, and tend to be more effective as part of a more comprehensive and integrated social marketing strategy rather than alone.

Although many countries develop and use physical activity and/or nutrition guidelines, messages and related resources, they are not routinely disseminated through social marketing or mass media approaches, and dissemination often relies on health professionals, educators and others. Recent research in NSW indicates that consumers have poor knowledge of some guidelines, such as screen time, physical activity, and poor understanding of terms used to guide frequency of food consumption, such as 'occasionally', 'often' or 'extra foods' and 'sometimes foods', for example.

10.2 Policy and program context

The recent national Measure Up and subsequent SWAP II mass media campaigns specifically address obesity prevention.

In NSW mass media has also been used recently to inform community members about the Get Healthy Information and Coaching Service, and has 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.

The current National Partnership Agreement on Preventive Health involves further commitments for social marketing initiatives at state and national levels.

10.3 Evidence of effectiveness

Overview

Physical activity

- A recent review of mass media campaigns promoting regular moderate intensity physical activity examined 18 adult-oriented campaigns delivered between 2003 and 2010 (2). They varied greatly in overall effects, including in the degree of awareness achieved. There were reported significant increases in PA in 7 of these campaigns, including 10,000 Steps Ghent (but not 10,000 Steps Rockhampton), Wheeling Walks (US), Agita Sao Paulo (Brazil) and Walk to Work Day (Australia).
- The VERB campaign, aimed to encourage children aged 9 to 13 years to be physically active every day, was a substantial initiative with a consistent level of marketing activities maintained from June 2002 through September 2006 using paid television and magazine advertisements, school promotional activities including small grants and community events such as street games at community recreational centres, camps, schools, festivals, and sporting events. After 2 years there were significant population effects on 3 outcomes (time PA during the past week, PA on the day before the interview, and expectations about participating in PA). At 4 years, there was a sustained and high level of awareness and significant dose-response associations for the 3 psychosocial outcomes and for being physically active on the day before the interview. There was

also some evidence of sustained, albeit weakened, effects on a cohort of 17 year olds previously exposed to the campaign (3, 4, 5).

Nutrition

- The '1% or Less' campaign (conducted in the US) promoting a switch from full fat to low fat milk (1% fat or less), was found to be effective compared to a comparison location, as measured by sales data at 6 months follow-up (6).
- The evaluation of the Australian 'Go for 2 and 5' national fruit and vegetable campaign (April 2005), targeting parents of children and youth, found that the campaign generated awareness and some increase in knowledge of recommended levels of vegetable consumption (although still at a low level of 32%). There was no change in parents' fruit consumption and small increases in consumption of any vegetables (remaining well below recommended levels) (7).

Weight status

- A 3-year mass media campaign aimed at preventing weight gain amongst Dutch young adults (25-40 years), with the message (translated as) 'Don't get fat', led to changes in awareness, attitudes and intentions to prevent weight gain, but did not increase risk perception of personal vulnerability to weight gain (8).

Evidence regarding program components and implementation processes

- In general, while short-term changes can be achieved, these are not sustained in the longer term after the cessation of the campaign (9).
- Elements of successful mass media campaigns have been identified and described for obesity prevention and PA: a staged approach with a sequence; clear, specific messages; substantial dose, duration and persistence across stages; and supportive environments and programs. Two physical activity campaigns have been identified as meeting these specifications: the Canadian ParticipACTION campaign 1971 to 2000, with segmented age and group initiatives and Push Play in New Zealand, 1999 to 2009 (9).
- A recent review of approaches for constructing PA messages (tailoring to a target group, framing messages in terms of gains versus losses and designing messages to address efficacy) suggest that all 3 design approaches are promising, but there was insufficient evidence for definitive recommendations (10).
- In addition, there have been substantial analyses of limitations of various campaigns, indicating that in some cases messages do not communicate effectively, are too homogenous for diverse audiences, or fall short because people experience significant barriers in relation to the recommended behaviour (11). Best practice, well targeted messages depend on detailed and careful formative evaluation in the development of the communication messages (11).

10.4 Areas for further investigation

Much of the research conducted in association with the development and evaluation of mass media campaigns is unpublished. This limits the available evidence base regarding the relative effectiveness of different messages and dissemination modalities, and consumers' understanding and utilisation of such messages.

10.5 Promising approaches

- Conduct mass media campaigns as part of more comprehensive social marketing initiatives which involve a range of community based and advocacy strategies. Consistent messages across different agencies or jurisdictions and across various health guidelines and campaigns.
- Best practice and transparent approaches to formulation of campaign messages and implementation, including target group segmentation and sequencing of messages, and campaign evaluation.
- Careful approaches to ensure proposed actions are feasible for target groups and do not promote stigmatisation or victim blaming.

REFERENCES

REFERENCES CHAPTER ONE

1. Gill T, King L, Webb K. (2005) Best options for promoting healthy weight and preventing weight gain in NSW. Sydney; NSW Centre for Public Health Nutrition.
2. King L, Hector D et al. (2008) Building solutions for preventing childhood obesity Sydney; NSW Centre for Overweight and Obesity.
3. Gill T, King L, Hector D, Hattersley L, Farrell L, Chau J. (2007) Community level strategies to reduce weight gain and obesity An Evidence Check rapid review brokered by the Sax Institute (<http://www.saxinstitute.org.au>) for the Centre for Epidemiology and Research. Sydney; NSW Department of Health.
4. NSW Department of Health. (2009) NSW Government Plan for Preventing Overweight and Obesity in Children, Young People & their Families 2009-11. Sydney; NSW Department of Health.
5. National Preventative Health Strategy. (2009) Australia: the healthiest country by 2020. National Preventative Health Strategy- the roadmap for action. Canberra; Commonwealth of Australia.
6. Gill T, King L, Bauman A, Vita P, Caterson I, Colagiuri S, Colagiuri R, Hebden L, Boyd D, Skene A, Dickinson S, Gomez M. (2011) "state of the knowledge" assessment of comprehensive interventions that address the drivers of obesity Report prepared for the NHMRC Prevention and Community Health Committee. Sydney; Boden Institute, University of Sydney
7. Institute of Medicine of the National Academies. (2006) Bridging the Evidence Gap in Obesity Prevention: A framework to inform decisionmaking. Kumanyika SK, Parker L, Sim LJ (eds) Washington DC; The National Academies Press.
8. Hardy LL, King L, Espinel P, Cosgrove C, Bauman A. NSW Schools Physical Activity and Nutrition Survey (SPANS) 2010: Full Report Sydney; NSW Ministry of Health
9. Centre for Epidemiology and Research. (2010) Report on Adult Health from the New South Wales Population Health Survey Sydney; NSW Department of Health.
10. World Health Organization. (2009) Diet, nutrition and the prevention of chronic diseases Report of the joint WHO/FAO expert consultation. WHO Technical Report Series, No. 916 (TRS 916). Geneva; World Health Organization.
11. Kumanyika SK. Minisymposium on obesity: overview and some strategic considerations Rev Public Health 2001;22: 293-308.
12. Vardenbroeck IP, Goossens J, Clemens M. (2007) Tackling Obesity: Future Choices Building the Obesity System Map London; Government Office for Science, UK Government's Foresight Programme. <<http://www.foresight.gov.uk/Obesity/12.pdf>

REFERENCES CHAPTER TWO

1. Lagström H, Hakanen M, Niinikoski H, Viikari J, Rönnemaa T, Saarinen M, et al. Growth Patterns and Obesity Development in Overweight or Normal Weight 13 Year Old Adolescents: The STRIP Study Pediatrics 2008; 122(4):e876-e883.
2. Schwartz C, Scholtens PA, Lalanne A, Weenen H, Nicklaus S. Development of healthy eating habits early in life. Review of recent evidence and selected guidelines Appetite. 2011; 57(3): 796-807.
3. DiSantis KI, Hodges EA, Johnson SL, Fisher JO. The effects of responsive feeding in overweight during infancy and toddlerhood: a systematic review International Journal of Obesity 2011;34(4):480-92.
4. Li R, Fein SB, Grummer-Strawn LM. Do Infants Fed From Bottles Lack Regulation of Milk Intake Compared With Directly Breastfed Infants? Pediatrics 2010;125(6): e1386-e93.
5. Monasta L, Batty GD, Cattaneo A, Lutje V, Ronfani L, Van Lenthe FJ, et al. Early determinants of overweight and obesity: a review of systematic reviews Obes Rev 2010 11(10):695-708.
6. Mihrshahi S, Battistutta D, Magarey A, Daniels L. Determinants of rapid weight gain during infancy: baseline results from the NOURISH randomised controlled trial BMC Pediatrics 2011;11(1):99.
7. Moorcroft KE, Marshall JL, McCormick FM. Association between timing of introducing solid foods and obesity in infancy and childhood: a systematic review Matern Child Nutr 2011;7(1): 3-26.
8. Hurley KM, Cross MB, Hughes SO. A systematic review of responsive feeding and child obesity in high income countries J Nutr 2011;141(3): 495-501.
9. Hector D, Hebden L, Innes-Hughes C, King L (2010) Update of the evidence base to support the review of the NSW Health Breastfeeding Policy (PD2006_012): a rapid appraisal Sydney; PANORG
10. Ciampa PJ, Kumar D, Barkin SL, Sanders LM, Yin HS, Perrin EM, et al. Interventions aimed at decreasing obesity in children younger than 2 years: a systematic review Arch Pediatr Adolesc Med 2010;164(12):1098-104.
11. Wen LM, Baur LA, Simpson JM, Rissel C, Flood VM. Effectiveness of an Early Intervention on Infant Feeding Practices and Tummy Time: A Randomized Controlled Trial Arch Pediatr Adolesc Med 2011;165(8):701-7.

12. Daniels L, Magarey A, Battistutta D, Nicholson J, Farrell A, Davidson G, et al. The NOURISH randomised control trial: Positive feeding practices and food preferences in early childhood as a primary prevention program for childhood obesity *BMC Public Health* 2009;9(1):387.
13. Campbell K, Hesketh K, Crawford D, Salmon J, Ball K, McCallum Z. The Infant Feeding Activity and Nutrition Trial (INFANT) an early intervention to prevent childhood obesity: Cluster randomised controlled trial *BMC Public Health* 2008;8(1):103.
14. Lioret S, McNaughton SA, Crawford D, Spence AC, Hesketh K, Campbell KJ. Feeding patterns are significantly correlated: findings from the Melbourne Infant Feeding Activity and Nutrition Trial Program *British Journal of Nutrition* 2011; published online November 2011 doi:10.1017/S0007114511005757
15. McLeod ER, Campbell KJ, Hesketh KD. Nutrition Knowledge: A Mediator between Socioeconomic Position and Diet Quality in Australian First-time Mothers *Journal of the American Dietetic Association* 2011;111(5):696-704.
16. Cameron AJ, Hesketh K, Ball K, Crawford D, Campbell KJ. Influence of Peers on Breastfeeding Discontinuation Among New Parents: The Melbourne InFANT Program *Pediatrics* 2010;126(3):e601-e7.
17. Hesketh K, Campbell K, Crawford D, Salmon J, Ball K, McBlaus, et al. [Abstract] Cluster randomised controlled trial of an early childhood obesity prevention program: the Melbourne Infant Feeding, Activity and Nutrition Trial (InFANT) program *Epidemiol Community Health* 2011;65 (Suppl)A15-A6.
18. Talvia S, Lagstrom H, Rasanen M, Salminen M, Rasanen L, Salo P, et al. A Randomized Intervention Since Infancy to Reduce Intake of Saturated Fat: Calorie (Energy) and Nutrient Intakes Up to the Age of 10 Years in the Special Turku Coronary Risk Factor Intervention Project. *Arch Pediatr Adolesc Med* 2004;158(1):41-7.
19. Askie LM, Baur LA, Campbell K, et al. The Early Prevention of Obesity in CEPOCH) Collaboration an individual patient data prospective meta-analysis *BMC Public Health* 2010;10:728.
20. AIHW. (2009) *A picture of Australia's children 2009*. Cat. No. PHE 112. Canberra, Australian Institute of Health and Welfare.
21. Wake M, Hardy P, Canterford L, Sawyer M, Carlin JB. Overweight, obesity and girth of Australian preschoolers: prevalence and socio-economic correlates *Int J Obes* 2007;31(7): 1044-51.
22. Zuo Y, Norberg M, Wen LM, Rissel E. Estimates of Overweight and Obesity Among Samples of Preschool children in Melbourne and Sydney *Nutrition and Dietetics* 2006;63: 179-182.
23. Must A, Strauss R. Risks and consequences of childhood and adolescent obesity *Int J Obes Relat Metab Disord* 1999;23(Suppl 2): S211.
24. Guo S, Huang C, Maynard LM, Demerath E, Towne B, Chumlea WC, Siemieniuk RD. Body mass index during childhood, adolescence and young adulthood in relation to adult overweight and adiposity: the Fels Longitudinal Study *Int J Obes Relat Metab Disord* 2000; 24(12):1628-35.
25. Dolinsky DI, Brouwer RJ, Evenson KR, Sigua AM, Østbye T. Correlates of sedentary time and physical activity among preschool children *Prev Chronic Dis* 2011;8(6): A131.
26. Bosca, J. (2008) New stats to help fight childhood obesity. Available from: http://www.health.nsw.gov.au/news/2008/pdf/20081022_00.pdf (Accessed on November 28, 2011)
27. Singh AS, Mulder C, Twisk JWR, Van Mechelen W, Chinapaw MMJ. Tracking of childhood overweight into adulthood: a systematic review of the literature *Obes Rev* 2008;9(5): 474-88.
28. Benton D. Role of parents in the determination of the food preferences of children and the development of obesity. *Int J Obes Relat Metab Disord* 2004;28(7): 858-69.
29. Hesketh K, Campbell KJ. Interventions to prevent obesity in 5 year olds: an updated systematic review of the literature. *Obesity* 2010;18(Suppl 1): S2735.
30. Wake M, Nicholson JM, Hardy P, Smith P. Preschooler obesity and parenting styles of mothers and fathers: Australian national population study *Pediatrics* 2007;120(6): e15207.
31. Freeman E, Fletcher R, Collins CE, Morgan PJ, Burrows T, Callisstein R. Steering and treating childhood obesity: time to target fathers. *Int J Obes (Lond)* 2012 Jan;36(1):12
32. D'Onise K, Lynch JW, Sawyer MG, McDermott CA. Can preschool improve child health outcomes? A systematic review. *Social Science & Medicine* 2010;70(9): 1423-40.
33. Larson N, Ward DS, Neelon SB, Story M. What role can child care settings play in obesity prevention? A review of the evidence and call for research efforts *Journal of the American Dietetic Association* 2011;111(9): 1343-62.
34. Ward DS, Vaughn A, McWilliams C, Hales D. Interventions for increasing physical activity at child care *Academy of Medicine & Science in Sports & Exercise* 2010;42(3): 526-34.
35. Bond M, Wyatt K, Lloyd J, Taylor S. Systematic review of the effectiveness of weight management schemes for the under fives *Obesity Review* 2011;12(4): 242-53.
36. Gill T, King L, Webb K. (2005) Best Options for Promoting Healthy Weight and Preventing Weight Gain in NSW. Sydney NSW Centre for Public Health Nutrition New South Wales Department of Health
37. Skouteris H, McCabe M, Swinburn B, Newgreen V, Sacher P, Chadborn P. Parental influence and obesity prevention in preschoolers: a systematic review of interventions *Obesity Review* 2011;12(5): 315-28.

38. Hardy LL, King L, Kelly B, Farrall J, Howlett S. Munch and Move: evaluation of a preschool healthy eating and movement skill program. *Int J Behav Nutr Phys Act* 2010;7: 80.
39. de Silva Sanigorski M, Bell AC, Kremer P, Nichols M, Crellin M, Smith M. Reducing obesity in early childhood: results from Romp & Chomp, an Australian community-wide intervention program. *American Journal of Clinical Nutrition* 2010;91(4): 831-40.
40. de Groot F, Robertson NM, Swinburn BA, de Silva Sanigorski AM. Increasing community capacity to prevent childhood obesity: challenges, lessons learned and results from the Romp & Chomp intervention. *BMC Public Health* 2010;10: 522.
41. Adams J, Zask A, Dietrich U. Tooty Fruity Veggie in Preschools: an obesity prevention intervention in preschools targeting children's movement skills and eating behaviour. *Health Promot J Austr* 2009;20(2):112-9.
42. Adams J, Molyneux M, Squires L. Sustaining an obesity prevention intervention in preschools. *Health Promot J Austr* 2011;22(1):6-10.
43. Loprinzi PD, Trost SB. Parental influences on physical activity behavior in preschool children. *Preventive Medicine* 2010;50(3): 129-33.

REFERENCES: CHAPTER THREE

1. Hardy LL, King L, Espinel P, Cosgrove C, Baur LA. NSW Schools Physical Activity and Nutrition Survey (SPANS) 2010: Full Report. Sydney: NSW Ministry of Health.
2. Hector D, Rangan A, Louie J, Flood V, Golley P. Soft drinks, weight status and health: a review. Sydney: Cluster of Public Health Nutrition, Prevention Research Collaboration, University of Sydney, Project for NSW Health.
3. Brownell KD, Farley T, Willett WC et al. The Public Health and Economic Benefits of Taxing Sugared Beverages. *N Engl J Med* 2009;361: 1599-1605.
4. Vartanian LR, Schwartz MB, Brownell KD. Effects of Soft Drink Consumption on Nutrition and Health: A Systematic Review and Meta-Analysis. *Am J Public Health* 2007;97: 667-675.
5. Kassem NO, Lee JW, Modeste NN, Johnston PK. Understanding soft drink consumption among female adolescents using the Theory of Planned Behavior. *Health Educ Res* 2003;18: 278-291.
6. Kassem NO, Lee JW. Understanding soft drink consumption among male adolescents using the theory of planned behavior. *J Behav Med* 2004;27: 273-296.
7. Bonfiglioli C, Hattersley L, King L. Australian print news media coverage of sweetened soft drinks sends mixed health message. *Aust N Z J Public Health* 2011;35: 325-330.
8. Kelly B, Baur LA, Bauman AE, King L, Chapman K, Smith BJ. Restricting food sponsorship: Attitudes of the sporting community. *Health Policy* 2011; available online 19 October. doi:10.1016/j.healthpol.2011.10.004
9. Kelly B, Baur LA, Bauman AE, King L, Chapman K, Smith BJ. Examining opportunities for promotion of healthy eating at children's sports clubs. *Aust N Z J Public Health* 2010;34: 583-588.
10. Hattersley L, Irwin M, King L, Allmaral M, Marinelli M. Determinants and patterns of soft drink consumption in young adults: a qualitative analysis. *Public Health Nutr* 2009;12: 1816-1822.
11. Hattersley LA, Shrewsbury VA, King LA, Howlett SA, Hardy LL, Baur LA. Adolescent parent interactions and attitudes around screen time and sugary drink consumption: a qualitative study. *Behav Nutr Phys Act* 2009; 6: 61.
12. Pearson N, Timperio A, Salmon J, Crawford D, Biddle SJ. Family influences on children's physical activity and fruit and vegetable consumption. *Int J Behav Nutr Phys Act* 2009;6: 34.
13. Pearson N, Biddle SJ, Gorely T. Family correlates of fruit and vegetable consumption in children and adolescents: a systematic review. *Public Health Nutr* 2009;12: 267-283.
14. Lytle LA, Seifert S, Greenstein J, McGovern P. How do children's eating patterns and food choices change over time? Results from a cohort study. *Am J Health Promot* 2000;14: 222-228.
15. Campbell KJ, Crawford DA, Salmon J, Carver A, Garnes LA. Associations Between the Home Food Environment and Obesity-promoting Eating Behaviors in Adolescents. *Obesity* 2007;15: 719-730.
16. Janssen I, LeBlanc AG. Systematic review of the health benefits of physical activity and fitness among school children and youth. *Int J Behav Nutr Phys Act* 2010;7: 40.
17. Strong WB, Malina RM, Blimkie CJ et al. Evidence based physical activity for school youth. *J Pediatr* 2005; 146: 732-737.
18. Davison KK, Lawson CT. Do attributes in the physical environment influence children's physical activity? A review of the literature. *Int J Behav Nutr Phys Act* 2006;3: 19.
19. Hardy LL, Dennewilson E, Thrift AP, Okely AD, Baur LA. Screen Time and Metabolic Risk Factors Among Adolescents. *Arch Pediatr Adolesc Med* 2010;164: 643-649.
20. Sisson SB, Church TS, Martin CK et al. Profiles of sedentary behavior in children and adolescents: The US National Health and Nutrition Examination Survey, 2006. *Int J Pediatr Adolesc Med* 2009;4: 353-359.
21. Waters E, de Silva Sanigorski A, Hall BJ, Brown T, Campbell KJ, Gao Y, Armstrong R, Prosser L, Summerbell CD. Interventions for preventing obesity in children. *Cochrane Database of Syst Rev* 2012(12): CD001871.

22. Khambalia AZ, Dickinson S, Hardy LL, Gill T, Baur LA. **Analysis of existing systematic reviews and meta-analyses of school-based behavioural interventions for controlling and preventing obesity** *Obesity Review* 2011; article first published online: 10 NOV 2011, (doi:10.1111/j.1469-7610.2011.00947.x)
23. Silveira JA, Tadeu JA et al. **Effectiveness of school-based nutrition education interventions to prevent and reduce excessive weight gain in children and adolescents: a systematic review** *Pediatr (Rio de Janeiro)* 2011;87(5): 382-392.
24. James J, Thomas P, Cavan D, Kerr D. **Preventing childhood obesity by reducing consumption of carbonated drinks: cluster randomised controlled trial** *BMJ* 2004;328: 1237.
25. James J, Thomas P, Kerr D. **Preventing childhood obesity: two year follow up results from the Christchurch obesity prevention programme in schools (CHOPPS)** *BMJ* 2007;335:762.
26. Sichieri R, Paula TA, de Souza RA, Veiga GV. **School randomised trial on prevention of excessive weight gain by discouraging students from drinking sodas** *Public Health Nutr* 2009;12: 197-202.
27. Haerens L, de B, I, Maes L, Vereecken C, Brug J, Deforche B. **The effects of school-based healthy eating intervention on adolescents' fat and fruit intake and soft drinks consumption** *Public Health Nutr* 2007;10: 443-449.
28. Levy DT, Friend KB, Wang YC. **A Review of the Literature on Policies Directed at the Youth Consumption of Sugar Sweetened Beverages** *Advances in Nutrition: An International Review Journal* 2011;2: 182S-200S.
29. Corinna H. **The Worldwide Battle Against Soft Drinks in Schools** *American Journal of Preventive Medicine* 2010; 38: 457-461.
30. Sturm R, Powell LM, Chiqui JF, Chaloupka FJ. **Soda Taxes, Soft Drink Consumption, And Children's Body Mass Index** *Health Affairs* 2010;29: 1052-1058.
31. Schwatz MB, Novak SA, Fiore SS. **The impact of removing snacks of low nutritional value from middle schools** *Health Education & Behavior* 2009;36: 999-1011.
32. Story M, Kaphingst KM, Robinson Brien R, Glanz K. **Creating Healthy Food and Eating Environments: Policy and Environmental Approaches** *Annu Rev Public Health* 2008;29: 253-272.
33. Carter OB, Pollard CM, Atkins JF, Marie MJ, Pratt IS. **'We're not told we're just told': qualitative reflections about the Western Australian Go for 2&5 fruit and vegetable campaign** *Public Health Nutr* 2011;14: 982-988.
34. Pollard CM, Miller MR, Daly AM et al. **Increasing fruit and vegetable consumption: success of the Western Australian Go for 2&5 campaign** *Public Health Nutr* 2008;11: 314-320.
35. Mangunkusumo RT, Brug J, de Koning HJ, Van Der Lei J, Raat H. **School-based internet-tailored fruit and vegetable education combined with brief counselling increases children's awareness of intake** *Public Health Nutr* 2007;10: 273-279.
36. Gibbs L, Staiger P, Towsend M, Macfarlan C. **Evaluation of the Stephanie Alexander Kitchen Garden Program Melbourne; The McCaughey Centre, University of Melbourne** 2011.
37. French SA, Wechsler H. **School-based research and initiatives: fruit and vegetable environment, policy, and pricing workshop** *Preventive Medicine* 2004;39(Suppl2):101-107.
38. Morgan P, Bourke S. **Non-specialist teachers' confidence to teach PE: the nature and influence of personal school experiences in PE** *Physical Education & Sport Pedagogy* 2008;13: 1-29.
39. Morgan PJ, Hansen V. **Classroom teachers' perceptions of the impact of barriers to teaching physical education on the quality of physical education programs** *Res Q Exerc Sport* 2008;79: 506-516.
40. Harris KC, Kuramoto LK, Schulzer M, Retallack JE. **Effectiveness of school-based physical activity interventions on body mass index in children: a meta-analysis** *Canadian Medical Association Journal* 2009;180: 719-726.
41. Davison KK, Werder JL, Lawson CT. **Children's active commuting to school: current knowledge and future directions** *Prev Chronic Dis* 2008;5: A100.
41. Shaya FT, Flores D, Gbarayor CM, Wang J. **School-based Obesity Interventions: A Literature Review** *Journal of School Health* 2008;78: 189-196.
42. Dymont JE, Bell AC. **Grounds for movement: green schools as sites for promoting physical activity** *Health Educ Res* 2008;23(6): 952-962
43. DeMattia L, Lemont L, Meurer L. **Do interventions to limit sedentary behaviours change behaviour and reduce childhood obesity? A critical review of the literature** *Obes Rev* 2007;8: 69-81.
44. Wahi G, Parkin PC, Beyene J, Uleryk EM, Birken CS. **Effectiveness of Interventions Aimed at Reducing Screen Time in Children: A Systematic Review and Meta-analysis of Randomized Controlled Trials** *Arch Pediatr Adolesc Med* 2011;165: 979-986.
45. Maniccia DM, Davison KK, Marshall SJ, Manganello JA, Dennison BA. **Analysis of interventions that target children's screen time for reduction** *Pediatrics* 2011;128: e193-e210.
46. Sebire SJ, Jago R, Gorely T, Hoyos Cillero I, Biddell SA. **It wasn't the technology then I would probably be out everyday: A qualitative study of children's strategies to reduce their screen viewing** *Preventive Medicine* 2010;53: 303-308.

47. Jago R, Page A, Froberg K, Sardinha LB, Klesges L, Andersen B. Screenviewing and the home TV environment: The European Youth Heart Study. *Preventive Medicine* 2008; 47: 525-529.
48. Horne PJ. Increasing parental provision and children's consumption of lunchbox fruit and vegetables in Ireland: the Food Dudes intervention. *Eur J Clin Nutr* 2009; 63(5): 613-618.
49. Hardy LL, Kelly B, Chapman K, King L, Farrell L. Parental perceptions of barriers to children's participation in organised sport in Australia. *J Paediatr Child Health* 2003; 4: 197-203.
50. Priest N, Armstrong R, Doyle J, Waters E. Policy interventions implemented through sporting organisations for promoting healthy behaviour change. *Cochrane Database Syst Rev* 2008; CD004809.

REFERENCES: CHAPTER FOUR

1. Hardy LL, King L, Espinel P, Cosgrove C, Bauman A. NSW Schools Physical Activity and Nutrition Survey (SPANS) 2010: Full Report. Sydney NSW Ministry of Health.
2. DenneyWilson E, Hardy LL, Dobbins T, Okely AD, Baur LA. Body mass index, waist circumference, and chronic disease risk factors in Australian adolescents. *Arch Pediatr Adolesc Med* 2008; 162: 566-573.
3. DenneyWilson E, Cowell CT, Okely AD, Hardy LL, Ark D, Dobbins T. Associations between insulin and glucose concentrations and anthropometric measures of fat mass in Australian adolescents. *BMC Pediatr* 2010; 10: 58.
4. Biddle SJH, Pearson N, Ross GM, Braithwaite R. Tracking of sedentary behaviours: a systematic review. *Preventive Medicine* 2010; 51(5): 345-51.
5. Steinbeck K. Obesity and nutrition in adolescents. *Adolesc Med State Art Rev* 2009; 20(3): 900-914, ix.
6. Bélanger M, Casey M, Cormier M, Laflamme Fillion A, Martin G, Aubut S, Chouinard P, Savoie SP, Beauchamp J. Maintenance and decline of physical activity during adolescence: insights from a qualitative study. *Int J Behav Nutr Phys Act* 2011; 8: 117.
7. Rasberry C, Lee SM, Robin L, Laris B, Russell LA, Coyle K, Nihiser AJ. The association between scheduled physical activity, including physical education, and academic performance: a systematic review of the literature. *Prev Med* 2011; 52(Suppl1): S1020.
8. Biddle S, Asare M. Physical activity and mental health in children and adolescents: a review of reviews. *Sports Med* 2011; 45(11): 886-95.
9. Jack FN, Kremer PJ, Berk M, de S, Banigorski AM, Moodie M, Leslie ER, Pasco JA, Swinburn PA. A prospective study of diet quality and mental health in adolescents. *PLoS One* 2011; 6(9): e24805.
10. Hector D, Rangan A, Louie J, Flood V, G. (2009) Soft drinks, weight status and health: a review. Sydney Cluster of Public Health Nutrition, Prevention Research Collaboration, University of Sydney. project for NSW Health.
11. Brownell KD, Frisley T, Willett WC et al. The public health and economic benefits of taxing sugary beverages. *N Engl J Med* 2009; 361: 1599-1605.
12. Vartanian LR, Schwartz MB, Brownell KD. Effects of Soft Drink Consumption on Nutrition and Health: A Systematic Review and Meta-analysis. *Am J Public Health* 2007; 97: 667-675.
13. Kassem NO, Lee JW, Modeste NN, Johnston PK. Understanding soft drink consumption among female adolescents using the Theory of Planned Behavior. *Health Educ Res* 2003; 18: 278-291.
14. Kassem NO, Lee JW. Understanding soft drink consumption among male adolescents using the theory of planned behavior. *J Behav Med* 2004; 27: 273-296.
15. Bonfiglioli C, Hattersley L, King L. Australian print news media coverage of sweetened carbonated drinks sends mixed health messages. *Aust NZ J Public Health* 2011; 35: 325-330.
16. Kelly B, Baur LA, Bauman AE, King L, Chapman K, Smith BJ. Restricting unhealthy food sponsorship: Attitudes of the sporting community. *Health Policy* 2011; available online 19 October. doi:10.1016/j.healthpol.2011.10.004
17. Kelly B, Baur LA, Bauman AE, King L, Chapman K, Smith BJ. Examining opportunities for promotion of healthy eating at children's sports clubs. *Aust N Z J Public Health* 2010; 34: 583-588.
18. Hattersley L, Irwin M, King L, Allman-Farinelli M. Determinants and patterns of soft drink consumption in young adults: a qualitative analysis. *Public Health Nutr* 2009; 12: 1816-1822.
19. Hattersley LA, Shrewsbury VA, King LA, Howlett SA, Hardy LL. Adolescent-parent interactions and attitudes around screen time and sugary drink consumption: a qualitative study. *Behav Nutr Phys Act* 2009; 6: 61.
20. Lytle LA, Seifert S, Greenstein J, McGovern P. How do children's eating patterns and food choices change over time? Results from a cohort study. *Am J Health Promot* 2000; 14: 222-228.
21. Campbell KJ, Crawford DA, Salmon J, Carver A, Garnett SP, Baur LA. Associations Between the Home Food Environment and Obesity-promoting Eating Behaviors in Adolescents. *Obesity* 2007; 15: 719-730.
22. Boutelle KN, Fulkerson JA, Neumark-Sztainer D, Story M, French SA. Fast food for family meals: relationships with parent and adolescent food intake, home food availability and weight status. *Public Health Nutr* 2007; 10: 16-23.
23. Neumark-Sztainer D, Wall M, Perry C, Story M. Correlates of fruit and vegetable intake among adolescents: Findings from Project EAT. *Preventive Medicine* 2003; 37: 198-208.

24. Janssen I, LeBlanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *Int J Behav Nutr Phys Act* 2010;7: 40.
25. Strong WB, Malina RM, Blimkie CJ et al. Evidence based physical activity for school youth. *J Pediatr* 2005; 146:732-737.
26. Pate RR, Stevens J, Webber LS et al. Reported Change in Physical Activity in Adolescent Girls. *Journal of Adolescent Health* 2009;44: 275-282.
27. Khambalia AZ, Dickinson S, Hardy LL, Gill T, Baur LA. A synthesis of existing systematic reviews and meta-analyses of school-based behavioural interventions for controlling and preventing obesity. *Obesity Reviews* 2011; article first published online: 10 NOV 2011, (doi:10.1111/j.1469-762X.2011.00947.x)
28. McKenzie TL, Marshall SJ, Sallis JF, Conway TL. Sedentary levels, lesson context, and teacher behavior during middle school physical education. *Research Quarterly for Exercise and Sport* 2000;71: 249-259.
29. McKenzie TL, Catellier DJ, Conway T et al. Girls' activity levels and lesson contexts in middle school PE: TAAG baseline. *Med Sci Sports Exer* 2006;38: 1229-1235.
30. Barnett LM, E van Beurden, et al. Childhood motor skill proficiency as a predictor of adolescent physical activity. *J Adolesc Health* 2009;44(3): 252-259.
31. Hardy LL, Denney Wilson E, Thrift AP, Okely AD, Baur LA. Screen Time and Metabolic Risk Factors Among Adolescents. *Arch Pediatr Adolesc Med* 2010;164: 643-649.
32. Sisson SB, Church TS, Martin CK et al. Profiles of sedentary behavior in children and adolescents: the US National Health and Nutrition Examination Survey, 2001-2006. *Int J Pediatr Obes* 2009;4: 353-359.
33. Hardy LL, Bass SL, Booth ML. Changes in sedentary behavior among adolescent girls: a 25-year prospective cohort study. *J Adolesc Health* 2007; 40(2):158-65.
34. Hammons AJ, Fiese BH. Is frequency of shared family meals related to the nutritional health of children and adolescents? *Pediatrics* 2011; 127(6):e1565-74.
35. Williams P. Breakfast and the diets of Australian children and adolescents: an analysis of data from the 1995 National Nutrition Survey. *Int J Food Sci Nutr* 2007;58(3):201-216.
36. Pedersen TP, Meilstrup C, Holstein BE, Rasmussen M. Fruit and vegetable intake is associated with frequency of breakfast, lunch and evening meal: cross-sectional study of 1-13- and 15-year olds. *Int J Behav Nutr Phys Act* 2012,9(1): 9
37. Utter J, Scragg R, Mhurchu CN, Schaaf-Driessens breakfast consumption among New Zealand children: associations with body mass index and related nutrition behaviors. *Am Diet Assoc* 2007;107(4):570-576.
38. Timlin MT, Pereira MA, Story M, Neumark-Sztainer D. Breakfast eating and weight change in a 5-year prospective analysis of adolescent girls. *Pediatrics* 2008;121(3):e638-e645.
39. MacFarlane A, Cleland V, Crawford D, Campbell K, Timperio A. Longitudinal examination of the family food environment and weight status among children. *Int J Pediatr Obes* 2009;4(4):343-352.
40. Shrewsbury, V. A., K. S. Steinbeck, et al. The role of parents in adolescent and adolescent overweight and obesity treatment: a systematic review of clinical recommendations. *Obes Rev* 2011;12(10):759-769.
41. Butryn ML, TA Wadden, et al. Maintenance of weight loss in adolescents: current status and future directions. *Obes* 2010; 2010:789-280.
42. Whitlock EA, EP O'Connor, et al. Effectiveness of weight management programs in children and adolescents. *Essays Rep Technol Asses* 2008;170: 1-308.
43. Wilfley DE, RP Kolko, et al. Cognitive behavioral therapy for weight management and eating disorders in children and adolescents. *Child Adolesc Psychiatr Clin N Am* 2011;20(2): 271-285.
44. Dobbins, M., De Corby K, et al. School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6-18. *Cochrane Database Syst Rev* 2011;(1): CD007651
45. Van Cauwenberghe E, Maes L, Spittaels H, van Lenthe FJ, Brug J, Oppert JM, et al. Effectiveness of school interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and 'grey' literature. *British Journal of Nutrition* 2010;103(6):781-97.
46. Kropski JA, Keck PH, Jensen GL. School-based obesity prevention programs: an evidence-based review. *Obesity* 2008;16: 1009-1018.
47. Vu MB, Murrie D, Gonzalez V, Jobe JB. Listening to girls and boys about their physical activity behaviors. *Health Educ Behav* 2006;33: 81-96.
48. Slater A, Tiggemann M. Gender differences in adolescent sport participation, teasing, objectification and body image concerns. *J Adolesc* 2011;34: 455-463.
49. Hamel LM, Robbins LB, Wilbur J. Computer-based web-based interventions to increase preadolescent and adolescent physical activity: a systematic review. *Journal of Advanced Nursing* 2011;67(2):251-68.
50. Lau PW, EY Lau, et al. A systematic review of information and communication technology-based interventions for promoting physical activity behavior change in children and adolescents. *Med Internet Res* 2011;13(3): e48.
51. Morton KL, SE Keith, et al. Transformational teaching and physical activity: a new paradigm for adolescent health promotion? *J Health Psychol* 2010;15(2): 248-257.

52. Camacho-Minano MJ, Lavoi NM, BaAnderson DJ. Interventions to promote physical activity among young and adolescent girls: a systematic review. *Health Education Research* 2011; 26(6): 1025-1049.
53. Kriemler S, U Meyer, et al. Effect of school based interventions on physical activity and fitness in children and adolescents: a review of reviews and systematic update. *British Journal of Sports Medicine* 2011;45(11):923-930.
54. Crutzen R. Adding effect sizes to a systematic review on interventions for promoting physical activity among European teenagers. *Int J Behav Nutr Phys Act* 2010;7: 29.
55. NSW Health, internal report, 2010
56. Lubans DR, Morgan PJ, Tudlocke C. A systematic review of studies using pedometers to promote physical activity among youth. *Preventive Medicine* 2009;48(4):307-15.
57. James J, Thomas P, Cavan D, Kerr D. Preventing childhood obesity by reducing consumption of carbonated drinks: cluster randomised controlled trial. *BMJ* 2004;328: 1237.
58. James J, Thomas P, Kerr D. Preventing childhood obesity: two year follow up results from the Christchurch obesity prevention programme in schools (CHOPPS). *BMJ* 2007;335:762.
59. Sichieri R, Paula TA, de Souza RA, Veiga GV. School randomised trial on prevention of excessive weight gain by discouraging students from drinking soda. *Public Health Nutr* 2009;12: 197-202.
60. Haerens L, de B, I, Maes L, Vereecken C, Deborche B. The effects of a middle school healthy eating intervention on adolescents' fat and fruit intake and soft drinks consumption. *Public Health Nutr* 2007;10: 443-449.
61. Levy DT, Friend KB, Wang YC. A review of the literature aimed at the youth consumption of sugar sweetened beverages. *Advances in Nutrition: An International Review Journal* 2011;2: 182-200S.
62. Corinna H. The Worldwide Battle Against Soft Drinks in Schools. *American Journal of Preventive Medicine* 2010; 38: 457-461.
63. van der Horst K, Timperio A, Crawford DE, Roberts R, Brug J, Oenema A. The school food environment: associations with adolescent soft drink and snack consumption. *American Journal of Preventive Medicine* 2008; 35: 217-223.
64. Hattersley L, Heath D. (2008) Building solutions for preventing childhood obesity. Module 3: Interventions to reduce consumption of energy dense, nutrient poor foods. Sydney NSW Centre for Overweight and Obesity
65. Jaime PC, Lock K. Do school based food and nutrition policies improve diet and reduce obesity? *Preventive Medicine* 2009;48: 45-53.
66. Carter OB, Pollard CM, Atkins JF, Marie MJ, Pratt IS. 'We're not told what we're just told': qualitative reflections about the Western Australian Go for 2&5 fruit and vegetable campaign. *Public Health Nutr* 2011;14: 982-988.
67. Mangunkusumo RT, Brug J, de Koning HJ, Van Der Lei J, Raat H. School internet tailored fruit and vegetable education combined with brief counselling increases children's awareness of intake level. *Public Health Nutr* 2007;10: 273-279.
68. Pollard CM, Miller MR, Daly AM et al. Increasing fruit and vegetable consumption: success of the Western Australian Go for 2&5 campaign. *Public Health Nutr* 2008;11: 314-320.
69. French SA, Wechsler H. School based research and initiatives: fruit and vegetable environment, policy, and pricing workshop. *Preventive Medicine* 2004;39(Suppl2):101-107.
70. Pearson N, Atkin AJ, Biddle SJ, Gorely T. A family based intervention to increase fruit and vegetable consumption in adolescents: a pilot study. *Public Health Nutrition* 2010;13: 876-885.
71. Robinson O'Brien, Story RM, et al. Impact of garden based youth nutrition intervention programs: a review. *Journal of the American Dietetic Association* 2009;109(2): 273-280.
72. Neumark-Sztainer D, Larson NI, Fulkerson JA, Eisenberg ME, Story M. Family meals and adolescents: what have we learned from Project EAT (Eating Among Teenagers). *Public Health Nutrition* 2010;13(7):1113-21.
73. Bauer KW, Neumark-Sztainer D, Fulkerson JA, Hannan PJ, Story M. Familial correlates of adolescent girls' physical activity, television use, dietary intake, weight and body composition. *Int J Behav Nutr Phys Act* 2011;8: 25.
74. Hillier F, Pedley C, Summerbell C. Evidence base for primary prevention of obesity in children and adolescents. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2011;54(3):259-64.
75. Biddle SJ, Connell S, Braithwaite RE. Sedentary behaviour interventions in young people: a meta-analysis. *British Journal of Sports Medicine* 2011;45(11):937-42.
76. van Sluijs EMF, Kriemler S, McMinn AM. The effect of community and family interventions on youths' physical activity levels: a review of reviews and updated systematic review. *British Journal of Sports Medicine* 2011;45(11):914-22.
77. Fletcher A, Bonell C, Sorhaindo A. You are what your friends eat: systematic review of social network analyses of young people's eating behaviours and body weight. *Epidemiol Community Health* 2011;65(6):548-55.
78. Teevale T, DR Thomas, et al. The role of sociocultural factors in obesity aetiology in Pacific adolescents and their parents: a mixed methods study in Auckland, New Zealand. *NZ Med J* 2010;123(1326):26-36.

REFERENCES: CHAPTER FIVE

1. Allman-Farinelli MA, Chey T, Bauman AE, Gill T, James WPT. Age, period and birth cohort effects on prevalence of overweight and obesity in Australian adults from 1990 to 2000. *J Clin Nutr* 2008;62(7):898-907.
2. Hankinson AL, Daviglus ML, Bouchard C, Gagnon M, Lewis CE, Sainer PJ, et al. Maintaining a high physical activity level over 20 Years and weight gain. *JAMA: The Journal of the American Medical Association* 2010;304(23):2603-10.
3. Sidney S, Sternfeld B, Haskell WL, Quesenberry CW Jr, Thomas RJ. Seven year change in graded exercise treadmill test performance in young adults in the CARDIA study. *Medicine & Science in Sports & Exercise* 1998;30(3):427-33.
4. Australian Bureau of Statistics (2009) National Health Survey: Summary Results, 2007-2008 (Reissue). Cat. No. 4364.0, Canberra, ABS
5. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college youth: An overlooked age for weight-related behavior change. *Obesity* 2008;16(10):2205-11.
6. Wane S, van Uffelen JG, Brown W. Determinants of weight gain in young women: a review of the literature. *Journal of Women's Health* 2010;19(7):1327-40.
7. Eiben G, Lissner L. Health Hunters: An intervention to prevent overweight and obesity in young high-risk women. *International Journal of Obesity* 2006;30(4):691-6.
8. Gokee LaRose J, Tate DF, Gorin AA, Wing RR. Preventing weight gain in young adults: a randomized controlled pilot study. *Am J Prev Med* 2010;39(1):63-8.
9. Gow RW, Trace SE, Mazzeo SE. Preventing weight gain in first year college students: An online intervention to prevent the "freshman fifteen". *Eating Behaviors* 2010;11(1):33-9.
10. Poobalan AS, Aucott LS, Precious E, Crombie IK, Smith WCS. Weight loss interventions in young (16 to 25 year olds): a systematic review. *Obes Rev* 2010;11(8):580-92.
11. Vella-Zarb RA, Elgar FJ. The 'Freshman 5': A meta-analysis of weight gain in the freshman year of college. *Journal of American College Health* 2009;58(2):161-6.
12. Campbell F, Johnson M, Messina J, Guillaume L, Goyder E. Behavioural interventions for weight management in pregnancy: a systematic review of quantitative and qualitative data. *BMC Public Health* 2011;11:491.
13. Phelan S. Pregnancy: a "teachable moment" for weight control and obesity prevention. *Am J Obstet Gynecol* 2002(2) 135 e18
14. Quinlivan JA, Lam LT, Fisher J. A randomised trial of a stepwise multidisciplinary approach to the antenatal care of obese pregnant women. *Aust N Z J Obstet Gynaecol* 2011;51(2):141-6.
15. Mamun AA, Kinarivala M, Callaghan MJ, Williams GM, Najman JM, Callaway LK. Associations of excess weight gain during pregnancy with long term maternal overweight and obesity: evidence from 21 y postpartum follow up. *Am J Clin Nutr* 2010;91(5):1336-41.
16. Herring SJ, Rose MZ, Skouteris H, Oken E. Optimizing weight gain in pregnancy to prevent obesity in women and children. *Diabetes Obes Metab* 2011; article first published online: 22 NOV 2011, DOI:1111/j.1463-1326.2011.01489.x
17. Davis DL, Raymond JE, Clements V, Adams C, Mollart LJ, Teate AJ, et al. Addressing obesity in pregnancy: The design and feasibility of an innovative intervention in NSW, Australia. *Women Birth* 2011; available online 17 September 2011
18. Athukorala R, Rumbold AR, Willson KJ, Crowther CA. The risk of adverse pregnancy outcomes in women who are overweight or obese. *BMC Pregnancy Childbirth* 2010;10:56.
19. Begum KS, Sachchithanatham K, De Somsubhra S. Maternal obesity and pregnancy outcomes. *Obstet Gynecol* 2011;38(1):14-20.
20. Ramachenderan J, Bradford J, McLean M. Maternal obesity and pregnancy complications: a review. *Aust NZ J Obstet Gynaecol* 2008;48(3):228-35.
21. Green C, Shaker D. Impact of morbid obesity on the mode of delivery and obstetric outcome in nulliparous singleton pregnancy and the implications for maternity services. *Aust NZ J Obstet Gynaecol* 2011;51(2):172-4.
22. Mace HS, Paech MJ, McDonnell NJ. Obesity and obstetric anaesthesia. *Anaesthesia Intensive Care* 2011;39(4):559-70.
23. Skouteris H, Hartley Clark L, McCabe M, Milgrom J, Kent B, Herring SJ, et al. Preventing excessive gestational weight gain: a systematic review of interventions. *Obes Rev* 2010;11(11):757-68.
24. Gardner B, Wardle J, Poston L, Croker C. Changing diet and physical activity to reduce gestational weight gain: a meta-analysis. *Obes Rev* 2011;12(7):e602-20.
25. Streuling I, Beyerlein A, Rosenfeld E, Hofmann H, Schulz T, von Kries R. Physical activity and gestational weight gain: a meta-analysis of intervention trials. *BJOG* 2011;118(3):278-84.
26. Tanentsapf I, Heitmann BL, Adegboye AR. Systematic review of clinical trials on dietary interventions to prevent excessive weight gain during pregnancy among normal weight, overweight and obese women. *BMC Pregnancy Childbirth* 2011;11(1):81.

27. Quinlivan JA, Julania S, Lam L. Antenatal dietary interventions in obese pregnant women to restrict gestational weight gain to institute of medicine recommendations: a meta-analysis. *Obstet Gynecol* 2011;118(6):1395-1401.
28. Sui Z, Grivell RM, Dodd JM. Antenatal exercise to improve outcomes in overweight or obese women: a systematic review. *Acta Obstet Gynecol Scand* 2012;Jan 10. doi: 10.1111/j.1600-0412.2012.01357.x.
29. Dodd JM, Grivell RM, Crowther CA, Robinson JS. Antenatal interventions for overweight or obese pregnant women: a systematic review of randomised trials. *BJOG* 2010;117(11):1316-26.
30. Jeffries K, Shub A, Walker SP, Hiscock R, Permezel M. Reducing excessive weight gain by pregnant women: a randomised controlled trial. *Med J Aust* 2009;191(8):429-33.
31. Dodd JM, Turnbull DA, McPhee AJ, Wittert G, Crowther CA, Robinson JS. Limiting weight gain in overweight and obese women during pregnancy to improve health outcomes: the LIMIT trial. *BMC Pregnancy Childbirth* 2011; Oct 26;11:79.
32. Nagle C, Skouteris H, Hotchin A, Bruce L, Patterson D, Teale G. Continuity of midwifery care and gestational weight gain in obese women: a randomised controlled trial. *BMC Public Health*. 2011; March 22;11: 174.
33. SiegaRiz AM, Deierlein A, Stuebe A. Implementation of the new institute of medicine gestational weight guidelines. *J Midwifery Womens Health* 2010;55(6): 512-519
34. McDonald SD, Pullenayegum E, Bracken K, Chen AM, McDonald H, Malott A, Hutchison R, Haley S, Lutsiv O, Taylor V, Good C, Hutton E, Sword W. Comparison of midwifery, family medicine, and obstetric patients' understanding of weight gain during pregnancy: a minority of women report correct counsel. *Obstet Gynaecol Can* 34(2): 129-135.
35. Callaway LK, O'Callaghan MJ, McIntyre HD. Barriers to addressing overweight and obesity before conception. *Med J Aust* 2009;191(8):425-8.
36. Thompson MW, Nassar N, Robertson M, Shand AW. Pregnant women's knowledge of obesity and ideal weight gain in pregnancy, and health behaviours of pregnant women and their partners. *Aust NZ J Obstet Gynaecol* 2011;51(5):460-3.
37. Wen LM, Baur LA, Simpson JM, Rissel C. Mothers' awareness of their weight status and concern about their children being overweight: findings from first-time mothers in south-west Sydney. *Aust NZ J Public Health* 2010; 34(3):293-7.
38. Schmied VA, Duff M, Dahlen HG, Mills AE, Kolthoff S. Swaying but drowning: a study of the experiences and concerns of midwives and other health professionals caring for obese childbearing women. *Midwifery*. 2011; 27(4):424-30.
39. Foxcroft KF, Rowlands IJ, Byrne NM, McIntyre HD, Callaway LK. Exercise in obese pregnant women: the role of social factors, lifestyle and pregnancy symptoms. *BMC Pregnancy Childbirth* 2011;11: 4.
40. Campbell SK, Lynch J, Esterman A, McDermott R. Pregnancy Predictors of Diabetes in Pregnancy Among Aboriginal and Torres Strait Islander Women in North Queensland, Australia. *Matern Child Health*. 2011; first published online: 30 September. DOI 10.1007/s10996-011-0889-3.
41. Teate A, Leap N, Rising SS, Homer CS. Women's experiences of group antenatal care in Australia: the Centering Pregnancy Pilot Study. *Midwifery*. 2011;27(2):138-45.

REFERENCES: CHAPTER SIX

1. Groeneveld IF, Proper KI, van der Beek AJ, Hildebrandt van Mechelen W. Lifestyle focused interventions at the workplace to reduce the risk of cardiovascular disease—a systematic review. *Scandinavian Journal of Work, Environment & Health* 2010;36(3):202-15.
2. Anderson LM, Quinn TA, Glanz K, Ramirez G, Kahwati LC, Johnson DB, et al. The effectiveness of worksite nutrition and physical activity interventions for controlling employee overweight and obesity: a systematic review. [Erratum appears in *Am J Prev Med* 2010;39(1):104]. *American Journal of Preventive Medicine* 2009; 37(4):340-57.
3. Burton J. (2010) WHO Healthy Workplace Framework and Model: Background and Supporting Literature and Practices. Geneva, Switzerland: World Health Organisation
4. Carnethon M, White LP, Franklin BA, Kershner P, Milani R, Pratt CA, et al. Worksite wellness programs for cardiovascular disease prevention: a policy statement from the American Heart Association. *Circulation* 2009; 120: 1725-41.
5. Della LJ, DeJoy DM, Goetzel RZ, Ozwinski RJ, Wilson MG. Assessing management support for worksite health promotion: psychometric analysis of the leading by example (LBE) instrument. *American Journal of Health Promotion* 2008;22(5):359-67.
6. Linnan L, Bowling M, Childress J, Lindsay G, Baker, Bonk S, et al. Results of the 2004 National Worksite Health Promotion Survey. *American Journal of Public Health* 2008;98(8):1503-9.
7. Barr-Anderson DJ, AuYoung M, Whitover MC, Glenn BA, Yancey AK. Integration of short bouts of physical activity into organizational routine: a systematic review of the literature. *American Journal of Preventive Medicine*. 2011;40(1):76-93.

8. Healy GN, Wijndaele K, Dunstan DW, Shaw JE, Salmon J, Zimmet PZ, et al. Objectively measured sedentary time, physical activity, and metabolic risk: the Australian Diabetes, Obesity and Lifestyle Study (AusDiab). *Diabetes Care* 2008;31(2):369-71.
9. Dorner T, Fodor JG, Allichhammer D, Kiefer I, Lawrence A, Kgeles MS, et al. A heart for Vienna—the prevention program for the big city. *Blutdruck* 2006;156(1920):552-7.
10. Chau J (2009) Evidence module: Workplace physical activity and nutrition interventions. Sydney: Physical Activity Nutrition and Obesity Research Group, University of Sydney
11. Bellow B (2008) Primary prevention of chronic disease in Australia through interventions in the workplace setting: An Evidence Check rapid review. *Work* 2008;31(3):311-20.
12. Goldgruber J, Ahrens D. Effectiveness of workplace health promotion and primary prevention interventions: a review. *J Public Health* 2010;18: 75-88.
13. Groeneveld IF, Proper KI, van der Beek HJ, de Brandt VH, van Mechelen W. Lifestyle focused interventions at the workplace to reduce the risk of cardiovascular disease—a systematic review. *Scandinavian Journal of Work Environment & Health* 2010;36(3):202-15.
14. Groeneveld IF, Proper KI, Absalova S, van der Beek AJ, van Mechelen W. An individually based lifestyle intervention for workers at risk for cardiovascular disease: a process evaluation. *American Journal of Health Promotion* 2011;25(6):396-401.
15. Chu C, Breucker G, Harris N, Stitzel A, Gau X, et al. Health promoting workplaces—international settings development. *Health Promotion International* 2000;15(2):155-67.
16. Plotnikoff RC, McCargar LJ, Wilson PM, Loucaides CA. Efficacy of a workplace intervention for the promotion of physical activity and nutrition behavior in the workplace context. *American Journal of Health Promotion* 2005;19(6):422-9.
17. Borg J, Merom D, Rissén C. Staff walking program: a quasi-experimental trial of maintenance newsletters to maintain walking following a pedometer program. *Health Promot J Aust* 2010;21(1):26-32.
18. Chan CB, Ryan DA, Tuohimäki C. Health benefits of a pedometer-based physical activity intervention in sedentary workers. *Preventive Medicine* 2004;39(6):1215-22.
19. Morgan PJ, Collins CE, Plotnikoff RC, Cook AT, Berthon B, Mitchell S, et al. Efficacy of a workplace weight loss program for overweight male shift workers: the Workplace POWER (Preventing Obesity Without Eating like a Rabbit) randomized controlled trial. *Preventive Medicine* 2011;52(5):317-25.
20. O'Donnell MP. Integrating financial incentives for workplace health promotion programs into health plan premiums is the best idea since sliced bread. *Am J Health Promot* 2010;24(4): iv-vi.
21. Taitel, M. S., V. Haufle, et al. Incentives and other factors associated with employee participation in health risk assessments. *Occup Environ Med* 2008;50(8): 863-872.
22. Lerman Y, Shemer J. Epidemiologic characteristics of participants and nonparticipants in workplace health promotion programs. *Journal of Occupational & Environmental Medicine* 1996;38(5):535-8.
23. Lewis RJ, Huebner WW, Yarborough CM, 3rd. Characteristics of participants and nonparticipants in worksite health promotion. *American Journal of Health Promotion* 1996;11(2):99-106.
24. National Heart Foundation, New South Wales Cancer Council, Physical Activity Nutrition and Obesity Research Group University of Sydney (2011) Healthy Workplace Guide: Ten Steps to implementing a workplace health program Melbourne; National Heart Foundation. Available from: www.heartfoundation.org.au/.../HFWorkplaceHealth.pdf

REFERENCES: CHAPTER SEVEN

1. AIHW. (2007) Older Australia at a glance 4th edition. Cat. no. AGE 52. Canberra: Australian Institute of Health and Welfare
2. Bennett S (MPGD). (2004) Obesity trends in older Australians. Canberra: AIHW.
3. WHO. (2000) Obesity: preventing and managing the global epidemic. Report of a WHO Consultation Geneva; World Health Organization
4. DIISR (2009) National research priorities fact sheet. Canberra: Department of Innovation, Industry, Science and Research; [Accessed 15/11/2011]; Available from: <http://www.innovation.gov.au/Section/AboutDIISR/FactSheets/Pages/NationalResearchPrioritiesFactSheet.aspx>.
5. NSW Centre for Overweight and Obesity (2005) A literature review of the evidence for interventions to address overweight and obesity in adults and older Australians, with special reference to people living in rural and remote Australia and Aboriginal and Torres Strait Islander Sydney; University of Sydney
6. Espinel PT, King (2009) A framework for monitoring overweight and obesity in NSW Sydney: NSW Department of Health and The Physical Activity Nutrition Obesity Research Group

7. Chodzko-Zajko WJ, Proctor DN, Fiatarone Singh MA, Minson CT, Nigg CR, Salem GJ, et al. American College of Sports Medicine position stand. Exercise and physical activity for older adults. *Med Sci Sports Exerc* 2009;41(7):1510-30.
8. ABS(2006) National Health Survey 2005: summary of results, Australia. ABS cat. no. 4364.0. Canberra: Australian Bureau of Statistics
9. Centre for Epidemiology and Research (2011) 2010 Report on Adult Health from the New South Wales Population Health Survey. Sydney NSW Department of Health.
10. Chastin SF, Ferrioli E, Stephens NA, Fearon KC, Greig C. Relationship between sedentary behaviour, physical activity, muscle quality and body composition in healthy older adults. *Age Ageing* 2011; Jul 12.
11. Nooyens AC, Visscher TL, Schuit AJ, van Rossum CT, Verschuren WM, van Mechelen W, et al. Effects of retirement on lifestyle in relation to changes in weight and waist circumference in men: a prospective study. *Public Health Nutr* 2005;8(8):1266-74.
12. Chung S, Domino ME, Stearns SC, Popkin BM. Retirement and physical activity: analyses by occupation and wealth. *American Journal of Preventive Medicine* 2009;36(5):422-8.
13. Depp CA, Schkade DA, Thompson WK, Jeste DV. Age, affective experience, and television use. *American Journal of Preventive Medicine* 2010;39(2):173-8.
14. Caudroit J, Stephan Y, Le Scanff C. Social cognitive determinants of physical activity among retired individuals: an application of the health action process approach. *British Journal of Health Psychology* 2011; 16(Pt 2):404-17.
15. Ayotte BJ, Margrett JA, Hiebert J, Patrick J. Physical activity in middle-aged and young-old adults: the roles of self efficacy, barriers, outcome expectancies, regulatory behaviors and social support. *Health Psychology* 2010; 15(2):173-85.
16. Fuller BG, Stewart Williams JA, Byles JE. Active living: perception of older people with chronic conditions. *Chronic Illn* 2010;6(4):294-305.
17. Van Cauwenberg J, De Bourdeaudhuij I, De Meester F, Van Dyck D, Salmon J, Clarys P, et al. Relationship between the physical environment and physical activity in older adults: a systematic review. *Health Place* 2011;17(2):458-69.
18. King AC, Sallis JF, Frank LD, Saelens BE, Cain K, Conway TL, et al. Aging in neighborhoods differing in walkability and income: Associations with physical activity and obesity in older adults. *Soc Sci Med* 2011;73(10):1525-33.
19. Locher JL, Ritchie CS, Roth DL, Sen B, Vickers KS, Vilas LI. Food choice among homebound older adults: motivations and perceived barriers. *Nutr Health Aging* 2009;13(8):659-64.
20. NSW Government (2008) Towards 2030: Planning for our changing population. Sydney NSW Department of Premier and Cabinet.
21. Parkinson L, and Harris M. (2007) Effective population health interventions for the primary prevention of musculoskeletal conditions: An Evidence Check rapid review conducted by the Sax Institute (<http://www.saxinstitute.org.au>) for the Victorian Department of Health
22. Marques EA, Mota J, Machado L, Sousa F, Coelho M, Moreira P, et al. Multicomponent training program with weight-bearing exercises elicits favorable bone density, muscle strength, and balance adaptations in older women. *Calcif Tissue Int* 2011;88(2):117-29.
23. Wooton AC. An integrative review of Tai Chi research: an alternative form of physical activity to improve balance and prevent falls in older adults. *Orthop Nurs* 2010;29(2):108-16; quiz 178.
24. Leung DP, Chan CK, Tsang HW, Tsang WW, Jones AY. Tai chi as an intervention to improve balance and reduce falls in older adults: A systematic and meta-analytical review. *Altern Ther Health Med* 2011;17(1):40-8.
25. Liu H, Frank A. Tai chi as a balance improvement exercise for older adults: a systematic review. *J Great Lakes Res* 2010;33(3):103-9.
26. Voukelatos A, Cumming RG, Lord SR, Rissel C. A randomized, controlled trial of tai chi to prevent falls: the Central Sydney tai chi trial. *Am Geriatr Soc* 2007;55(8):1185-91.
27. Keogh JW, Kilding A, Pidgeon P, Ashley L, Gillis D. Physical benefits of dancing for healthy older adults: a review. *Aging Phys Act* 2009;17(4):479-500.
28. Roland KP, Jakobi JM, Jones GR. Does yoga engender fitness in older adults? A critical review. *Phys Act* 2011;19(1):62-79.
29. Nikolai AL, Novotny BA, Bohnen CL, Schleis KM, Dalleck LC. Cardiovascular and metabolic responses to water aerobic exercise in middle-aged and older adults. *Phys Act Health* 2009;6(3):333-8.
30. Bula CJ, Monod S, Hoskovec C, Rochat S. Interventions aiming at balance confidence improvement in older adults: an updated review. *Gerontology* 2011;57(3):276-86.
31. Aabers T, Baars MA, Rikkert MG. Characteristics of effective internet-mediated interventions to change lifestyle in people aged 50 and older: a systematic review. *Ageing Res Rev* 2011;10(4):487-97.
32. Stewart AL, Verboncoeur CJ, McLellan BY, Gillis DE, SR Mills KM, et al. Physical activity outcomes of CHAMPS II: a physical activity promotion program for older adults. *Gerontol A Biol Sci Med* 2001;56(8):M465-70.

33. Stevens, M., K. A. Lemmink, et al. Groningen Active Living Model (GALM) at stimulating physical activity in sedentary older adults; validation of the behavioral change model. *Prev Med* 2003;37(6 Pt 1):561-570.
34. Merom D, Bauman A, Phongsavan P, Cerin E, Kassis M, Brown W, et al. Can a motivational intervention overcome an unsupportive environment for walking? Findings from the Step-by-Step Study. *Ann Behav Med* 2009;38(2): 137-46.
35. Cawood C. Aboriginal Waves project [online]. *Aboriginal and Islander Health Worker Journal* 1999;23(5):3-4.
36. Thompson S RC, Williams G, Kelaher M, Ryan N, Jenkin D, Chapman C. Getting fit for family, health and fun: a diary of the Cherbourg Healthy Lifestyles Program. *Aboriginal and Islander Health Worker Journal* 2000;24: 16-9.
37. Gardiner PA, Eakin EG, Healy GN, Owen N. Feasibility of reducing older adults' sedentary behavior. *American Journal of Preventive Medicine* 2011;41(2):174-7.
38. Bandayrel K, Wong S. Systematic literature review of randomized control trials assessing the effectiveness of nutrition interventions in community-dwelling older adults. *Journal of Nutrition Education & Behavior* 2011; 43(4):251-62.
39. AIHW (2010). Australia's health 2010. Australia's health no. 12. Cat. no. AUS 122. Canberra: Australian Institute of Health and Welfare.
40. Marchesini G, Bugianesi E, Forlani G, Cerrelli F, Lenzi M, Manini R, et al. Nonalcoholic fatty liver, steatohepatitis, and the metabolic syndrome. *Hepatology* 2003;37(4):917-23.
41. Wadden TA, McGuckin BG, Rothman RA, Sargent SL. Lifestyle modification in the management of obesity. *Journal of Gastrointestinal Surgery* 2003;7(4):452-63.
42. StGeorge A, Bauman A, Johnston A, Farrell G, Chey T, George J. Independent effects of physical activity in patients with nonalcoholic fatty liver disease. *Hepatology* 2009;50(1):68-76.
43. Norris SL, Zhang X, Avenell A, Gregg E, Schmid CH, Lau J, et al. Long-term pharmacological weight loss interventions for adults with prediabetes. *Cochrane Database of Systematic Reviews* 2005;2.
44. Gillies CL, Abrams KR, Lambert PC, Cooper NJ, Sutton AJ, Hsu RT, et al. Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance: systematic review and meta-analysis. *BMJ* 2010; 334(7588):10.
45. Dombrowski SU, Avenell A, Sniehot FF. Behavioural interventions for obese adults with additional risk factors for morbidity: systematic review of effects on behaviour, weight and disease risk factors. *Obes. Facts* 2010;3(6): 377-96.
46. Targher G, Bellizzi A, Fornengo P, Ciaravella F, Pichiri I, Cavallo Perin P, et al. Prevention and treatment of nonalcoholic fatty liver disease. *Digestive & Liver Diseases* 2010;42(5):331-40.
47. Braverman DL. Cardiac rehabilitation: a contemporary review. *American Journal of Physical Medicine & Rehabilitation* 2011;90(7):599-611.
48. Taylor GH, Wilson SL, Sharp J. Medical, psychological, and sociodemographic factors associated with adherence to cardiac rehabilitation programs: a systematic review. *Journal of Cardiovascular Nursing* 2011; 26(3):202-9.
49. Miketic JK, Hravnak M, Stilley CS, Robertson RJ, Sereika SM. Factors influencing the outcomes of patients with both coronary artery disease and diabetes enrolled in standard cardiac rehabilitation programs: a literature review. *Journal of Cardiovascular Nursing* 2011;26(3):210-7.
50. Haghshenas A, Davidson PM. Quality service delivery in cardiac rehabilitation: cultural challenges in an Australian setting. *Quality in Primary Care* 2011;19(4):215-21.
51. Sangsted, Furber S, Allmaral, Marinelli M, Haas M, Phongsavan P, Mark A, et al. A population-based lifestyle intervention to promote healthy weight and physical activity in people with cardiac disease: the PANACHE (Physical Activity, Nutrition And Cardiac Health) protocol. *BMC Cardiovascular Disorders* 2010;10: 17.
52. Neville LM, O'Hara B, Milat A. Computer-tailored physical activity behavior change interventions targeting adults: a systematic review. *International Journal of Behavioral Nutrition & Physical Activity*. 2009;6: 30.
53. Harris M.(2008) The role of primary health care in preventing the onset of chronic disease, with a particular focus on the lifestyle risk factors of obesity, tobacco and alcohol. *Sydney Centre for Primary Health Care and Equity UNSW*.
54. Colagiuri S, Vita P, Cardone, Marrell M, Singh MF, Farrell L, Milat A, et al. The Sydney Diabetes Prevention Program: a community-based translational study. *BMC Public Health* 2010;10: 328.
55. Dugdill L, Graham RC, McNair F. Exercise referral: a public health panacea for physical activity promotion? A critical perspective of exercise referral schemes; their development and evaluation. *Ergonomics* 2005;48(11-14): 1390-410.
56. Smith BJ. Promotion of physical activity in primary health care: a review of the evidence on interventions. *J Sci Med Sport* 2004;7(1Suppl):67-73.
57. Tulloch H, Fortier M, Hogg W. Physical activity counseling in primary care: who has and who should be counseling? *Patient Education & Counseling* 2006;64(1-3): 6-20.

58. Josyula LK. Barriers in the Implementation of a Physical Activity Intervention in Primary Care Settings: Lessons Learned. *Health Promotion Practice* 2011; Published online before print June 27, 2011; (doi: 10.1177/1524839910392991)
59. Bennett GG, Glasgow RE. The delivery of public health interventions via the Internet: actualizing their potential. *Annual Review of Public Health* 2009;30: 273-92.
60. Arem H, Irwin M. A review of web-based weight loss interventions in adults. *Obesity Reviews* 2011;12(5):e236-43.
61. Appel SJ. Nurse case management with a therapeutic algorithm for people living with diabetes, hypertension and raised LDL cholesterol: after 1 year 22% of those receiving the intervention have all three parameters under control versus 10% of those receiving usual care. *End Based Nurs* 2011; available on line Nov 22 (doi:10.1136/ebnurs-2011-100264)
62. Krebs P, Prochaska JO, Rossi JS. A meta-analysis of computer-tailored interventions for health behavior change. *Preventive Medicine* 2010;51(3-4): 214-21.
63. Norman GJ, Zabinski MF, Adams MA, Rosenberg DE, Yaroch AL, Atienza AA. A review of eHealth interventions for physical activity and dietary behavior change. *Am J Prev Med* 2007;33(4):336-345.
64. Cole-Lewis H, Kershaw T. Text messaging as a tool for behavior change in disease prevention and management. *Epidemiologic Reviews* 2010;32(1):56-69.
65. McBride CM, Rimer BK. Using the telephone to improve health behavior and health service delivery. *Patient Education & Counseling* 1999;37(1):3-18.
66. Eakin E, Reeves M, Winkler E, Lawler S, Owen N. Maintenance of physical activity and dietary change following a telephone-delivered intervention. *Health Psychology* 2010; 29(6):566-73.
67. O'Hara B, Phongsavan P, Venuto C, Bauman A. Characteristics of participants in Australia's Get Healthy telephone-based lifestyle information and coaching service: reaching disadvantaged communities and those most at need. *Health Education Research* 2011;26(6):1097-106.
68. Wakefield MA, Loken B, Hornik RC. Use of mass media campaigns to change health behavior. *Journal of the American Medical Association* 2010; 376(9748):1261-71.
69. Marcus BH, Owen N, Forsyth LH, Cavill NA, Fridinger F. Physical activity interventions using mass media, print media, and information technology. *American Journal of Preventive Medicine* 1998;15(4):362-78.

REFERENCES: CHAPTER 7

1. National Heart Foundation of Australia. (2010) Rapid review of the evidence: The need for nutrition labelling on menus. Melbourne; NHFA.
2. Clegg S, Jordan E, Slade Z for BMRB Social Research Australia. (2009) Evaluation of the provision of calorie information by catering outlets London; Food Standards Agency.
3. Bollinger B, Leslie P, Sorenson A. (2010) Calorie posting in chain restaurants Working Paper series. Vol. w15648. USA; National Bureau of Economic Research.
4. Bassett MT, Dumanovsky T, Huang C, Silver L, Young C, et al. Purchasing behavior and calorie information at fast food chains in New York City, 2007. *Am J Public Health* 2008;98(8): 1457-9.
5. Wellard L, Watson W, Hughes C et al. (2011) Evaluating the potential usefulness of fast food menu labelling. Presentation at PHAA Food Futures.
6. Blewett N, Goddard N, Pettigrew S, Reynolds C, Yeatman H. (2011) *Leading Logic: Review of Food Labelling Law and Policy*. Canberra ACT; Commonwealth of Australia.
7. Hector D, King L. (2011) *Review of front-of-pack labelling* Report for the Sax Institute.
8. National Heart Foundation of Australia. (2010) *The 3 Step Guide. A guide for the Australian Foodservice Industry on reducing trans and saturated fats*. Melbourne; National Heart Foundation of Australia.
9. Health and Medical Research Council of NSW. (2009) *Out of 10 deadly health stories: Fruit and vegetable program and market garden*. AMS Grafton; Australian Department of Health and Ageing.
10. Jones R, Smith F. Fighting disease with fruit. *Australian Family Physician* 2007;36(10):863-4.

REFERENCES: CHAPTER NINE

1. Kent J, Thompson SM, Jalaludin B. (2011) *Healthy Built Environments: A review of the literature*. Sydney; Healthy Built Environments Program, City Futures Research Centre, UNSW.
2. Fraser, SDS, Lock, K. Cycling for transport and public health: a systematic review of the effect of the environment on cycling. *Eur J Pub Health* 2010: doi:10.1093/eurpub/ckq145
3. Wen LM, Orr N, Millett C, Rissel C. Driving to work and overweight and obesity: finding from the 2003 New South Wales Health Survey, Australia. *Obesity* 2006;30(5):782-6
4. Wen LM, Rissel C. Inverse associations between cycling to work, public transport, and overweight and obesity: findings from a population based study in Australia. *Preventive Medicine* 2008;46: 29-32.

5. Bassett DR, Jr., Pucher J, Buehler R, Thompson DL, Sautter N. Walking, cycling, and obesity rates in Europe, North America, and Australia. *Phys Act Health* 2008;5(6): 795-814
6. Murphy MH, Donnelly P, Shibli S, Foster C, Nevill AM. Physical activity, walking and leanness: AN analysis of the Northern Ireland Sport and Physical Activity Survey (SAPAS). *Prev Med* 2012;54(2): 140-144.
7. Ogilvie D, Foster CE, Rothnie H, Cavill N, Hamilton V, Fitzsimons CF, Mutrie N; Scottish Physical Activity Research Collaboration. Interventions to promote walking: systematic review. *BMJ* 2007;334(7605):1204. Epub 2007 May 31.
8. Vos T, Carter R, Barendregt J, Mihalopoulos C, Veerman JL, Magnus A, Cobiac L, Bertram MY, Wallace AL, ACE Prevention Team. (2010) *Assessing Co-Effectiveness in Prevention (ACE-Prevention): Final Report*. Melbourne; University of Queensland, Deakin University.
9. Yang L, Sahlqvist S, McMinn A, Griffin SJ, Ogilvie D. Interventions to promote cycling: systematic review. *BMJ* 2010;341: c5293. doi: 10.1136/bmj.c5293.
10. Gill T, King L, Bauman A, Vita P, Caters C, Colagiuri S, Colagiuri R, Hebden L, Boylan S, Hector D, Khambalia A, Dickinson S, Gomez M. (2011) *"state of the knowledge" assessment of comprehensive interventions that address the drivers of obesity*. Report prepared for the NHMRC Prevention and Community Health Committee. Sydney; Boden Institute, University of Sydney
11. Rose G, Marfut H. Travel behaviour change impacts of a major ride to work day. *Transportation Research Part A* 2007;41: 351-64.
12. Merom D, Tudor-Locke C, Bauman A, Rissel C. Active commuting to school among NSW primary school children: implications for public health. *Health Place* 2006 Dec;12(4):678-87.
13. Rojas-Rueda D, de Nazelle A, Tainio M, Nieuwenhuijsen MJ. The health risks and benefits of cycling in urban environments compared with car use: health impact assessment study. *BMJ*. 2011 August 4, 2011;343:d4521.
14. Telfer B, Rissel C, Bindon J, Bosch T. Encouraging cycling through a pilot cycling proficiency training program among adults in central Sydney. *Aust J Sci Med Sport* 2006 May;9(1-2): 151-6.

REFERENCES: CHAPTER

1. Wakefield MA, Loken B, Hornik R. Use of mass media campaigns to change health behaviour. *Lancet* 2010; 376(9748): 1261-1271.
2. Leavy JE, Bull FC, Rosenberg M, Bauman A. Physical activity mass media campaigns and their evaluation: a systematic review of the literature 2000-2010. *Health Educ Res* 2011;(first published online September 7, 2011): doi:10.1093/her/cyr069
3. Huhman ME, Potter LD, Nolin MJ et al. The influence of the VERB campaign on Children's Physical Activity 2002 to 2006. *Am J Public Health* 2010;100(4):638-45.
4. Huhman ME, Potter LD, Duke JC et al. Evaluation of a national physical activity intervention for children—VERB (TM) campaign, 2002-2004. *Am J Prev Med* 2007;32(1):38-43
5. Huhman M, Bauman A, Bowles HR. Initial outcomes of the VERB campaign: tweens' awareness and understanding of campaign messages. *Am J Prev Med* 2008;34(6S):S24-8.
6. Reger B, Wootan MG, Booth-Butterfield S. Using mass media to promote healthy eating: a community-based demonstration project. *Medicine* 1999;29(5): 414-421.
7. Woolcott Research Pty Ltd. (2007) *Research Report: Evaluation of the National Go for 2&5® Campaign*. Prepared for the Australian Government Department of Health and Ageing. Downloaded from: health.gov.au/internet/healthyactive/publishing.nsf/Content/2&5valjan07, 15 November 2011)
8. Wammes B, Oenema A, Brug J. The evaluation of a mass media campaign aimed at weight gain prevention among young Dutch adults. *Obesity* 15(11):2780-2789.
9. Bauman A, Chau J. The role of media in promoting physical activity. *Phys Act Health* 2009;6(Suppl2):S196-210.
10. Latimer AE, Brawley LR, Bassett RL. Systematic review of three approaches for constructing physical activity messages: What messages work and what improvements are needed? *International Journal of Behavioral Nutrition and Physical Activity* 2010;7: 36.
11. Bauman A, Smith BJ, Maibach EW, Reber N. Evaluation of mass media campaigns for physical activity. *Evaluation and Program Planning* 2006;29(3): 312-322.