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Productivity Commission

Childhood Obesity:
An Economic Perspective

Productivity Commission
Staff Working Paper

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Contents

Acknowledgements	IX
Abbreviations and explanations	X
Key points	XII
Overview	XIII
1 Introduction	1
1.1 Background	1
1.2 Approach of this paper	3
1.3 Childhood overweight and obesity prevalence in Australia	4
2 Obesity in an economic framework	11
2.1 Decision making	11
2.2 Rationales for government intervention	16
2.3 The costs of obesity	27
3 Possible causes of overweight and obesity	35
3.1 Framework for possible causes of overweight and obesity	35
3.2 Child characteristics and behaviours	38
3.3 Parenting styles and family characteristics	44
3.4 Community, demographic and societal characteristics	46
3.5 Summary and conclusion	51
4 Policy options for addressing obesity	55
4.1 Potential policy measures	56
4.2 Summary	66
5 Effectiveness of obesity-related interventions	69
5.1 The evidence base and obesity prevention	69
5.2 Implications for policy	85
5.3 Conclusion	89
A Nature and results of evaluated Australian interventions	95
B Other Australian interventions	127
References	159

Boxes

1.1	The health consequences of childhood obesity	2
1.2	Measuring childhood obesity	5
2.1	Externalities, information failures and behavioural limitations	17
2.2	The efficiency cost of taxation	21
2.3	Access Economics' estimates of the costs of obesity	32
4.1	Assessing the costs of interventions	57
4.2	Self-regulation: the Responsible Children's Marketing Initiative	64
5.1	Evidence-based policy	70
5.2	Interventions for preventing obesity in children (review)	72

Figures

1.1	The approach of this study	4
1.2	Weight classification of Australian children aged 5–17 years	7
1.3	Weight classification of Australian children	9
1.4	Weight classification of Australian children aged 2–18 years	10
2.1	Decision-making framework	13
2.2	The costs of obesity: is childhood obesity a public problem?	28
3.1	Framework for factors associated with obesity and overweight	36
3.2	Potential factors in the rise of childhood overweight and obesity	53
4.1	What is the scope for policy solutions to reduce childhood obesity?	67

Tables

3.1	Summary of evidence presented on factors associated with overweight and obesity	37
5.1	Be Active Eat Well	81
5.2	Characteristics of different policy interventions to prevent childhood obesity	91
A.1	Active After-schools Communities (AASC) program	96
A.2	Be Active Eat Well	98
A.3	Burke et al. 1998	99
A.4	Coalfields Healthy Heartbeat School Project	100
A.5	Dwyer et al. 1983	101
A.6	Eat Smart Play Smart	102
A.7	Engaging adolescent girls in school sport	103
A.8	Fitness Improvement and Lifestyle Awareness (FILA) program	104
A.9	Fresh Kids	105

A.10	‘Get Moving’ Campaign	106
A.11	Girls Stepping Out Program	107
A.12	‘Go for 2&5®’ Campaign	108
A.13	Learning to Enjoy Activity with Friends (LEAF)	109
A.14	Moorefit	110
A.15	Move It Groove It	111
A.16	New South Wales Walk Safely to School Day	112
A.17	Nutrition Ready-to-Go @ Out of School Hours Care (NRG @ OOSH) Physical Activity Project	113
A.18	Program X	114
A.19	Q4: Live Outside the Box 2007	115
A.20	Romp and Chomp	116
A.21	Smart Choices – Healthy Food and Drink Supply Strategy for Queensland Schools	117
A.22	Start Right-Eat Right Award Scheme	118
A.23	Stephanie Alexander Kitchen Garden Program	119
A.24	Switch–Play	120
A.24	(continued)	121
A.25	Tooty Fruity Vegie Project	122
A.25	(continued)	123
A.26	Vandongen et al. 1995	124
A.27	Wicked Vegies	125
B.1	ACT Early Childhood Active Play and Eating Well Project	128
B.2	ACT Health Promoting Schools Canteen Project	128
B.3	Activate NT - MBF Healthy Lifestyle Challenge	129
B.4	Active-Ate	129
B.5	Active School Curriculum Initiative	129
B.6	Around Australia in 40 Days Small Steps to Big Things Walking Challenge	130
B.7	Be Active – Take Steps	130
B.8	Childhood Healthy Weight Project	130
B.9	Cool CAP	131
B.10	Crunch&Sip	131
B.11	CSIRO Wellbeing Plan for Children	131
B.12	Eat Right Grow Bright	132

B.13	Eat Well Be Active	132
B.14	Eat Well Be Active, Healthy Kids for Life – Badu Island	132
B.15	Eat Well Be Active, Healthy Kids for Life – Logan-Beaudesert	133
B.16	Eat Well Be Active, Healthy Kids for Life – Townsville	133
B.17	Family Food Patch	133
B.18	Filling the Gaps	134
B.19	Fit4fun	134
B.20	Fitness Improvement and Lifestyle Awareness (FILA) Program	134
B.21	Foodbank School Breakfast Program	135
B.22	Free Fruit Friday	135
B.23	Fresh Tastes @ School – NSW Health School Canteen Strategy	135
B.24	Fruit ‘n’ Veg Week	136
B.25	Fun ‘n’ Healthy in Moreland	136
B.26	Get Set 4 Life – Habits for Healthy Kids Guide	137
B.27	Get Up & Grow: Healthy Eating and Physical Activity Guidelines for Early Childhood	137
B.28	Girls in sport	138
B.29	Go for 2&5 Campaign	138
B.30	Go4Fun	138
B.31	GoNT	139
B.32	Good for Kids, Good for Life	139
B.33	Growing Years Project	139
B.34	Health Promoting Communities: Being Active Eating Well	140
B.35	Healthy Beginnings Study	140
B.36	Healthy Dads Healthy Kids	141
B.37	Healthy eating and obesity prevention for preschoolers: A randomised controlled trial	141
B.38	Healthy food and drink	141
B.39	Healthy Kids Check	142
B.40	It’s Your Move	142
B.41	Jack Brockhoff Child Health and Wellbeing Program	142
B.42	Jump Start	143
B.43	Just add fruit and veg	143
B.44	Kids – ‘Go for your life’	143
B.45	Kids GP Campaign	144

B.46	Live Fit	144
B.47	Live Life Well @ School	144
B.48	Make Tracks to School	145
B.49	Many Rivers Diabetes Prevention Program	145
B.50	Mend 2-4	145
B.51	Move Well Eat Well	146
B.52	Munch and Move	146
B.53	NOURISH	146
B.54	Nourish-the-FACTS	147
B.55	Obesity Prevention and Lifestyle (OPAL)	147
B.56	Osborne Division of General Practice’s Obesity Program – Healthy Families for Happy Futures	147
B.57	Parental Guidance Recommended Program	148
B.58	Physical Activity and Nutrition out of School Hours (PANOSH)	148
B.59	Physical Activity in Culturally and Linguistically Diverse Communities	148
B.60	Physical Activity Leaders Program	149
B.61	Play5	149
B.62	Premier’s Active Families Challenge	149
B.63	Remote Indigenous Stores and Takeaways (RIST) Project	150
B.64	Right Bite	150
B.65	School’s Out – Open Playground Program	150
B.66	StarCAP & StarCAP2	151
B.67	Start Right Eat Right award scheme	151
B.68	Start Right Eat Right - Tasmania	151
B.69	Start Right Eat Right - Victoria	152
B.70	Stephanie Alexander Kitchen Garden National Program	152
B.71	Stephanie Alexander Kitchen Garden Program – Victoria	152
B.72	Streets Ahead	153
B.73	Talk about weight	153
B.74	The Melbourne Infant Feeding Activity and Nutrition Trial (InFANT) Program	154
B.75	The Responsible Children’s Marketing Initiative	154
B.76	Time2bHealthy	154
B.77	Tooty Fruity Vegie in Preschools	155

B.78	Transferability of a Mainstream Childhood Obesity Prevention Program to Aboriginal People	155
B.79	TravelSMART Schools	155
B.80	Tuckatalk	156
B.81	Unplug and Play	156
B.82	WA Healthy Schools Project	156
B.83	Walktober Walk-to-School	157
B.84	Walk safely to school day	157
B.85	Walking School Bus	158
B.86	Wollongong Sport Program	158

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Abbreviations and explanations

Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
BMI	Body Mass Index
CHPE	Centre for Health Program Evaluation
National Children's Survey	National Children's Nutrition and Physical Activity Survey
NHS	National Health Survey
OECD	Organisation for Economic Cooperation and Development
RCT	randomised controlled trials
SES	socioeconomic status
SSR	small screen recreation

Explanations

Billion	The convention used for a billion is a thousand million (10^9).
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OVERVIEW

Key points

- The weight of Australian children has increased markedly in recent decades, to the point where around 8 per cent are defined as obese (based on Body Mass Index), and 17 per cent as overweight.
- While the prevalence of obesity may have levelled off since the mid 1990s, it is still widely considered to be too high.
- Childhood obesity has been linked to a raft of physical and psychosocial health problems, including type 2 diabetes and cardiovascular disease, as well as social stigmatisation and low self-esteem.
- Simply put, obesity results from an imbalance between energy consumed and expended. But the underlying causes are complex and difficult to disentangle.
 - An economic perspective considers how individuals respond to changes in incentives, and how they make decisions involving tradeoffs between different consumption and exercise choices, including how they spend their time.
- Governments need to consider a range of issues in addressing childhood obesity.
 - Most of the costs of obesity are borne by the obese themselves and their families.
 - Market incentives to provide information about the causes and prevention of obesity are weak, creating a role for government. But unlike alcohol and tobacco consumption, the externalities (spillovers on unrelated third parties) associated with obesity are probably minor.
 - Behavioural limitations can influence how people use available information about preventing obesity — even when it is available — and their responses to incentives and tradeoffs. Children are particularly susceptible to these limitations and have difficulty taking into account the future consequences of their actions.
 - Obesity prevalence varies across the socioeconomic profile of the community, such that there can be important distributional issues.
 - The obese also consume a disproportionate share of medical services, which, equity considerations aside, adds to the costs of our public health system.
- There is only limited evidence of interventions designed to address childhood obesity achieving their goals.
 - This could reflect the inherent complexities and the multiple causes of obesity.
 - But it might also reflect poor policy design and evaluation deficiencies.
- Notwithstanding the lack of evidence of interventions reducing obesity, some studies suggest that they can positively influence children's eating behaviours and levels of physical activity, which in turn might influence obesity over time.
- The complex nature of the problem suggests that policies need to be carefully designed to maximise cost-effectiveness, and trialled, with a focus on evidence gathering, information sharing, evaluation and consequent policy modification.

Overview

In Australia, as in many other countries, the community has become increasingly concerned about the rising prevalence of childhood obesity (box 1). The raft of health consequences for obese children now, and particularly when they are adults, has provided impetus for increased interest in the role for government in obesity prevention strategies.

The prevalence of childhood obesity in Australia began increasing in the 1970s, and by 2007-08 around 8 per cent of children (5 to 17 year olds) were estimated to be obese, and 17 per cent overweight (figure 1). Most of the growth in childhood obesity occurred up until the mid 1990s, with recent research suggesting it might have levelled off sometime since 1995. Despite government and community focus on obesity prevention over recent decades — as far back as the 1980s the ‘Life. Be in it’ campaign sought to influence levels of activity among Australians — the medical literature suggests the current level of obesity among Australian children is too high.

Box 1 What is obesity?

Obesity can be defined simply as the condition where excess body fat has accumulated to such an extent that health may be adversely affected.

Body Mass Index (BMI) is the most commonly used method to measure obesity on a population level for both adults and children. For adults, it is calculated by dividing a person’s weight in kilograms by their height in metres squared. This number is used to categorise adults into one of four widely accepted weight categories: underweight (BMI less than 18.5), normal weight (18.5 to 25), overweight (25 to 30) and obese (over 30) (WHO 2000).

For children aged 2 to 18 years, to account for body composition changes during development, an internationally recognised set of age and gender specific BMI thresholds are used (which merge with the respective adult cut offs at age 18 years) (Cole et al. 2000; Cole et al. 2007).

The concern with childhood obesity arises from its association with poor psychological and social outcomes, as well as physical health problems in the short and long term. For example, obesity in children is linked with reduced self-esteem

Figure 1 **Proportion of children classified as overweight or obese**



^a Ages 7–15 years. ^b Ages 5–17 years.

and depression, and obese children can suffer from social discrimination. The range of physical health problems associated with childhood obesity includes type 2 diabetes, liver disease, impaired mobility, asthma, sleep apnoea, and risk factors for cardiovascular disease. Although some of these health problems are increasingly being seen in children, most health problems arise in later life. International and Australian research indicates that overweight and obese children are at higher risk than normal weight children of becoming overweight and obese adults.

The costs of obesity are borne mostly by the obese

The costs of obesity appear to be substantial but are borne mostly by the obese. For example, Access Economics estimated the total cost of obesity in 2008 to be \$58 billion, comprising \$50 billion in lost wellbeing and \$8 billion in financial costs (such as productivity costs, health system costs, carer costs and transfer costs) (box 2). These estimates reflect the disease burden in 2008, which predominantly relates to adults. But to the extent that today's obese children become obese adults, these costs can also be thought of as the potential future costs for today's obese children.

Box 2 Access Economics' estimates of the costs of obesity, 2008

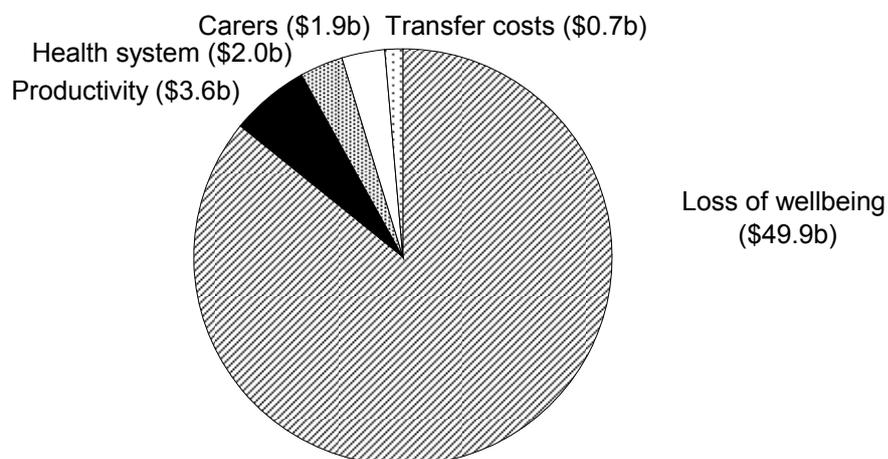
Access Economics estimated the total cost of obesity in Australia was \$58 billion in 2008. This estimate encompassed two types of costs — the 'loss of wellbeing' and financial costs.

The cost of the loss of wellbeing was measured as the dollar value of the burden of disease arising from disability, loss of wellbeing and premature death — and was estimated to be approximately \$50 billion in 2008. This accounted for 86 per cent of the total estimated costs of obesity. This estimate was derived by multiplying the burden of disease attributable to obesity (in terms of disability adjusted life years) by an estimate of the value of a statistical life. These costs are borne by obese individuals themselves.

The financial costs of obesity were estimated to be \$8 billion in 2008, and included:

- health system costs (such as hospital and nursing home costs, GP and specialist services, and pharmaceuticals)
- productivity losses
- carer costs
- transfer costs (that is, the deadweight loss from the higher level of taxation)
- other indirect costs (such as aids, modifications and travel).

Financial costs are borne, to differing extents, by obese individuals, their families and friends, governments, employers and society.



The obese themselves (and their parents) bear most of the costs of obesity, primarily through the loss of wellbeing (due to disability or shorter life span), but also due to them bearing some of the financial costs. Overall, Access Economics estimated that obese people bear 90 per cent of the total costs and 30 per cent of financial costs arising from their obesity.

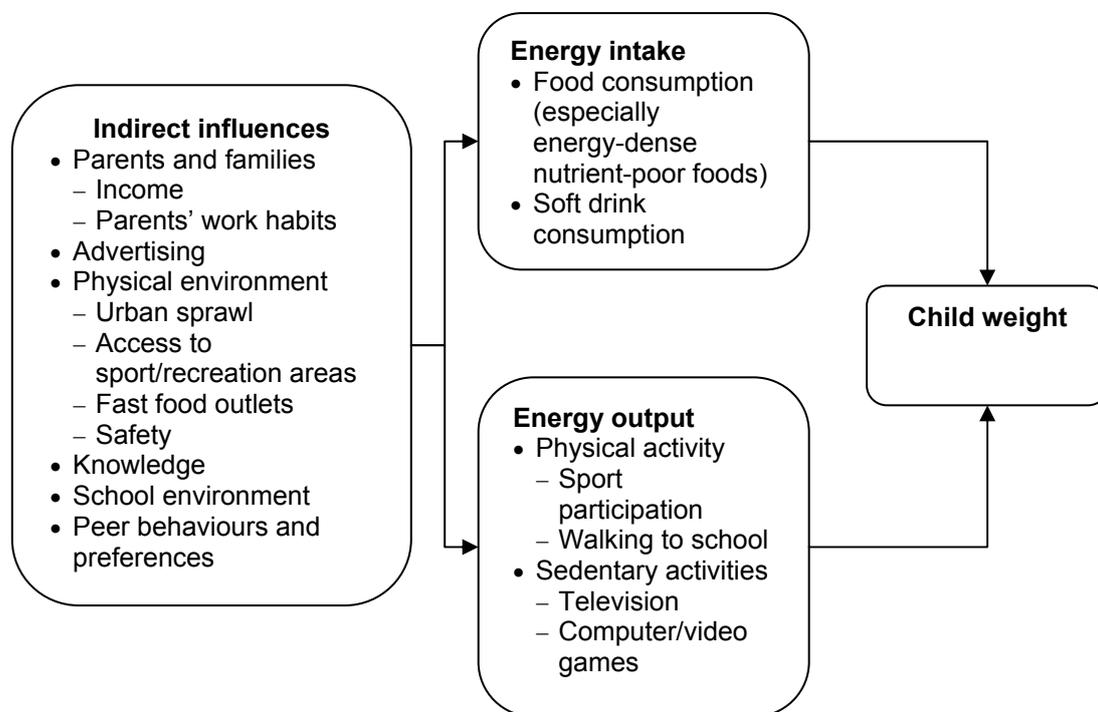
Estimating the costs of obesity relies on a range of assumptions — including the proportion of diseases attributable to obesity and the effects of those diseases on obese people’s quality of life. Some assumptions are more robust than others, with estimates of the value of lost wellbeing being particularly sensitive to the value placed on a human life.

A complex web of factors affect children’s weight

Understanding the causes of childhood obesity is important for explaining the changes in prevalence, and considering if it is a problem that requires, and is amenable to, government intervention.

In simple terms, obesity results from an imbalance between energy consumed and expended. But there is a complex web of factors that affect weight outcomes in children, some of which might account for the increased prevalence of obesity (figure 2). Significantly, not all factors that affect children’s weight outcomes will be completely within their control, and decisions about eating and exercise are not made exclusively with weight in mind. Although there is a genetic component to obesity, the literature suggests this of itself is not likely to explain the recent rise in its prevalence.

Figure 2 **Potential factors in the rise of child obesity**



Some broad trends that might have influenced eating and exercise decisions — increasing the prevalence of overweight and obesity since the 1970s — include real declines in food prices, rising incomes, increasing costs of exercise, and the higher ‘time cost’ of preparing food at home coupled with the increased availability of and access to pre-prepared and takeaway meals. Some authors suggest that these influences may well have combined with genetic programming that encourages humans to store fat in times of plenty to prepare for possible future famines (that have so far not eventuated). Other factors that can affect weight outcomes include behavioural factors such as dietary mix, family characteristics (such as nutritional knowledge), and broader cultural and community practices, which can be related to demographic and societal characteristics (such as socioeconomic status and ethnicity). Changes in societal attitudes about body image may have also had an influence.

In many cases the evidence of the links between these factors and childhood obesity is ambiguous, confounding or non-existent. The following broad conclusions are drawn:

- Australian children’s energy intake appears to have risen since the 1980s.

-
- Australian studies have shown a link between soft drinks, the associated increase in energy intake, and childhood obesity — although the size of the effect is small.
 - Incidental exercise among Australian children appears to have declined, although organised physical activity might not have.
 - Children spend more time watching television and using computers and video games than recommended by health authorities, but research suggests the contribution of these sedentary activities to childhood obesity is modest.
 - Australian children are exposed to a relatively high number of advertisements for energy-dense nutrient-poor foods compared to overseas children. However, while international evidence shows a link between advertising and knowledge and preferences, it is difficult to isolate the effect of advertising on energy intake and thus body weight.

Possible reasons for government intervention

For most adults and children, being overweight or obese is a consequence of a number of decisions over many years regarding food consumption and exercise. An economic perspective considers the decision making framework — by taking into account how individuals (children and parents) respond to changes in incentives, and how they make decisions involving tradeoffs between different consumption and exercise choices, including how they spend their time.

In the case of eating decisions, individuals might consider (even if only intuitively) the potential benefits with the potential costs of eating certain foods. For example, the benefits include intake of life sustaining calories and nutrients, and other benefits such as the (short-term) pleasure of taste or of sharing a meal, which is influenced by family, community or societal characteristics. The costs of eating include the financial cost, the time cost of purchasing and/or preparing food at home, as well as the (longer term) future health effects of that consumption decision. The time cost of purchasing and/or preparing food might be influenced by family income and work arrangements, which in turn can influence children's diet.

To the extent such decisions by individuals were able to take into account appropriate information about the benefits and costs to themselves, as well as any 'spillover' effects imposed on the community, and were rationally made, the resulting weight outcomes could be seen as 'optimal', providing little basis for policy intervention. But there are several reasons why decisions may typically be deficient in these respects.

Decisions may be based on incomplete or incorrect prices and information

Choices about eating and exercise might be distorted if, for example, useful information is not easily available (for example, about the nutritional or energy content of foods). Outcomes may also be less than ideal from a community perspective if an individual makes choices without taking into account costs imposed on others (referred to as an externality or spillover effect).

But looking at the underlying causes of obesity and overweight there appear to be few such ‘market failures’ relating to obesity in children (or adults). There might be a role for government to ensure provision of certain information to help individuals make decisions that increase their own wellbeing, but the abundance of obesity-related information on nutrition and exercise already available suggests that information gaps alone may not be ‘the’ problem. Further, there are few, if any, externalities relating to obesity, unlike other health-related policy matters — such as smoking or drink driving — where there are significant detrimental effects imposed on other people (though see section on health system costs).

Behavioural limitations may prevent people from maximising their own wellbeing

Another potential problem is that decisions may be ‘distorted’ because individuals are unlikely to always fully account for the future health, financial and lifestyle consequences of their actions, nor consistently value the associated costs and benefits (box 3). Even where information is available, behavioural limitations may prevent individuals from maximising their own wellbeing. For example, evidence suggests that when eating in groups the amount people eat is influenced by how much their peers eat rather than their own food intake needs. People also often make decisions and act in a way that is against their own long-term best interests (such as eating more food today but postponing the diet or exercise to counter that higher consumption). This can be thought of as their ‘short-term self’ trumping their ‘long-term self’.

Box 3 Behavioural economics provides insights

Obesity is not something that happens overnight, nor do people consciously decide to be obese. For most people, it is the net result of a series of decisions made over a long time about diet and exercise, that are influenced by such factors as occupation and lifestyle. In making these decisions it might seem reasonable to presume that people weigh up the benefits and costs to themselves of taking different courses of action, both now and in the future, and choose the options that maximises their wellbeing. For example, people might be prepared to tradeoff opportunities to exercise to meet other important objectives such as to travel, undertake study, or spend more time with their children. They may realise that weight gain would be a likely consequence, but if they are cognisant of the risks to their health, this might be the price they are prepared to pay. But calculating the benefits and costs is not always easy, especially when the costs are uncertain and only likely to occur far in the future.

Behavioural economics has emerged as a way of extending economic approaches to policy development by recognising, and wherever possible building in, psychological insights. There are many behavioural biases that can help explain the way people make decisions that can affect their weight. Two key limitations are bounded rationality and bounded willpower.

Bounded rationality refers to the difficulty many people have in weighing up all of the benefits and costs of taking different course of action open to them. For example, they make less than ideal choices because of difficulties in processing information, or because they are sensitive to the context in which decisions are made.

Bounded willpower refers to the difficulty many people have in implementing strategies that they know are in their long term best interests. A very high priority may be given to short-term gains that outweigh long-term effects, leading to overconsumption in the current period and procrastination about taking weight reducing actions, such as starting a diet.

Despite these biases many people develop strategies to address them voluntarily. For example, they may use simple rules of thumb that produce outcomes that are good enough in the circumstances, or they may adopt commitment mechanisms such as buying food in smaller portion sizes, paying up front for membership in a gym, or enlisting peer group support (for example, by joining Weight Watchers).

While there have been relatively few policy interventions that have been explicitly attributed to the findings of behavioural economics, many long standing policies have been based on a view of how people behave in the real world.

The effects of behavioural limitations on children are likely to be greater than on adults. Children might be more prone to peer group pressure, and have even more difficulty in accounting for the future consequences of their actions. So children's vulnerability to behavioural limitations in decision making is twofold — they are affected by the limitations to which their parents are subject, and by their own limitations.

The community costs of health care

Another potential reason for governments to reduce obesity in children is to decrease the health care costs borne by the rest of the community. Although most of the costs associated with obesity are borne by the obese themselves, universal access to healthcare and community rating mean the health care costs of obese people are subsidised by other taxpayers and private health insurance members. Of course, the obese are not the only group in the community that benefits from universal health care and community rating, but that does not lessen the argument for taking action to decrease these costs where it would be practical and cost effective to do so.

When and how should governments intervene?

Governments can employ a range of policy tools including price instruments (such as taxes or subsidies), helping consumers be better informed (education and information), and regulatory measures that influence consumer or producer choices.

Ideally, policies should directly target the source of the problem — for example, information ‘failures’ and behavioural limitations might warrant ‘softer’ style interventions, such as information provision and education. Given that obesity occurs more in some groups of the population than others, such as those in lower socioeconomic groups, there are also important population targeting considerations.

Moreover, the complex, multifaceted causes of obesity — which are yet to be fully understood — suggest that effective policy solutions are likely to involve a mix of tools acting on a range of levels (such as child, family and school, and energy in, energy out). But these tools should be targeted carefully at the causes of obesity and focus on improving individual decision-making over the longer term. Measures that constrain behaviour indiscriminately are rarely effective, equitable, or improve community wellbeing. Bans or taxes on particular energy-dense nutrient-poor foods, for example, face design difficulties, affect all consumers regardless of their weight status, and in the case of taxes, can have perverse budgetary and health effects particularly for the neediest groups.

Importantly, intervention will clearly only be desirable when it delivers a better outcome than not intervening. Any policy options being contemplated should be rigorously assessed to ensure they deliver net community benefits over time.

Evidence of effectiveness of interventions is mixed

Interventions to address childhood obesity include both interventions targeted at reducing childhood obesity and overweight (experimental trials or studies) conducted by governments and others (mostly in school settings), along with broader, community-wide government interventions (such as taxes on energy-dense foods or television advertising restrictions).

International evidence

International evidence on the effectiveness of interventions includes systematic reviews of targeted interventions, along with studies on community-wide government interventions. One of these is a review on behalf of the Cochrane Collaboration, generally regarded as an authoritative voice in systematic reviews in healthcare. Many interventions intended to prevent childhood obesity do not appear to have been effective in preventing weight gain to any significant degree, but show promise in improving lifestyle behaviours (healthy diet and physical activity levels). Better information is needed to understand if this might translate into improved weight outcomes in the future.

Evidence on community-wide interventions is also mixed (box 4).

Box 4 Some international evidence on community-wide interventions

Several studies indicate consumers have limited responsiveness to food taxes, which aim to raise the relative price of energy-dense nutrient-poor foods, although the effects of price instruments have been shown to be stronger for lower socioeconomic groups. Taxing particular foods can affect the consumption of other foods, and have unpredictable health effects. Some studies suggest some consumers are responsive to some degree, but the effects on Body Mass Index (BMI) were generally small.

The evidence suggests that the link between television viewing and childhood obesity is, at most, small in magnitude. Some countries have banned television advertising of energy-dense nutrient-poor foods aimed at children, but there appear to be no firm data to support the effectiveness of the bans. For instance, targeting television advertising might be of limited effectiveness if it does not capture other forms of advertising.

A study of a New York policy on mandatory posting of calorie content on restaurant menus suggested it had led to a small reduction in energy consumption from Starbucks, and a greater reduction for higher energy consumption individuals. The estimated effect on body weight was small, suggesting that reduced energy consumption from posting of energy content on menus would not have a major effect on obesity. In contrast, another study of the same mandatory posting of calorie content found that there was no overall effect on calories purchased from fast-food restaurants in low-income, minority New York communities.

Australian evidence

Australian interventions addressing childhood obesity are primarily of a targeted kind, focusing on providing information, increasing education and influencing physical activity. Few interventions list reducing or preventing obesity in children among their stated objectives, although many seek to influence physical activity or dietary awareness or both. Given that some of these have measured body composition (such as BMI or waist circumference), they provide some insights into how well they work in terms of reducing or preventing obesity.

In general, the interventions studied have had mixed success in improving body composition. But in some cases they were successful in promoting other desirable outcomes, such as increasing the level of physical activity. The results from some other interventions were less positive (box 5). Further, long-term follow up to assess the sustainability of outcomes has not been undertaken for many Australian interventions.

Box 5 Success of selected Australian interventions**Be Active Eat Well**

Be Active Eat Well was one of the first community-based interventions in Australia with an evaluation. Key strategies of the intervention included changing canteen menus, introducing daily fruit, reducing television watching and increasing activities after school. *Be Active Eat Well* delivered positive (short-term) results for most of the body composition measures (for example, waist circumference), though not Body Mass Index (BMI). Long-term results are yet to be reported.

Switch–Play

Switch–Play focused on physical activity through two components — behaviour modification (delivered in classrooms) and/or fundamental movement skills (delivered in physical activity facilities).

Switch–Play had a significant effect on BMI for the children participating in a combined behavioural modification and fundamental movement skills program, directly after the intervention and at the 6- and 12-month follow-ups. This group was also less likely to be overweight or obese between baseline and post intervention and at the 12-month follow-up. No significant change was reported in BMI for the other two intervention groups (one undertaking only behaviour modification and the other undertaking only fundamental movement skills).

Engaging Adolescent Girls in School Sport

Engaging Adolescent Girls in School Sport aimed to increase physical activity by increasing enjoyment of physical activity, perceived competence and physical self-perception. The intervention (which did not measure body composition) succeeded in increasing the target group's enjoyment of physical activity and body image, yet levels of physical activity reportedly declined.

Building the evidence base for effective policy

On balance, the evidence to date suggests that while many interventions to prevent childhood obesity show promise in improving lifestyle behaviours, they have not been effective in stabilising or reducing obesity prevalence to any significant degree. That said, methodological issues may affect the reliability of conclusions drawn from some of the research.

Possible reasons why many interventions do not appear to have been effective include:

- the complexity of the problem and its inherent challenges

-
- policy tools might have been poorly designed, for example not properly targeting the causes of obesity
 - institutional and other constraints mean otherwise well-designed interventions have not been successful
 - effective policy tools might have been designed, but methodological flaws in their evaluation prevent their identification.

For those interventions showing promise, ongoing evaluation will be required before implementing them more broadly, given their costs. This means collecting quality data on effectiveness of pilot programs and, while this too can be costly, it may be crucial to developing sound policy. The current lack of quality data might reflect funding for projects focusing on the intervention rather than evaluation. Careful judgment is required to appropriately balance budget allocation between the intervention itself and evidence gathering, without which a proper understanding of policy effectiveness may remain elusive. Evaluation expenditure should be considered in a cost–benefit framework too, taking into account any potential wasted expenditure if the intervention proves ineffective. Information gathering and evaluations should also be set up in a way to minimise the risk of biasing the results.

Where evidence on benefits remains limited and uncertain, some strategies could help ensure that interventions generate net community benefits:

- experiment first with low-cost programs that have low risks of collateral impacts (‘do no harm’) or undue costs on consumers (including cost increases passed on by producers)
- for programs with potentially high costs, initially implement trials to gather quality evidence on benefits and costs
- roll out programs gradually, which can allow continual evidence gathering and adjustment
- evaluate programs rigorously
- share information to enable wider learning from successes and failures.

1 Introduction

Being overweight or obese as a child has implications for the child's health now and as an adult. It is a policy concern in Australia and for governments internationally. Preventative health policy aims to manage risk factors such as obesity to decrease the incidence and effect of subsequent health problems. However, such expenditure needs to be justified in terms of effectiveness and value for public money. Programs to prevent and reduce childhood obesity can be difficult to design and implement successfully, particularly given the complexity and multitude of different determinants of obesity.

This paper analyses the issue of childhood obesity within an economic policy framework. It also reviews the evidence of trends in obesity in children and provides an overview of recent and planned childhood obesity preventative health programs. In this introductory chapter we discuss the policy background in Australia and outline the approach taken by this paper. Following this the estimated prevalence of obesity in Australian children is reported and discussed.

1.1 Background

Childhood obesity is associated with a range of health problems, emerging in childhood and later adult life (box 1.1). These include psychosocial problems such as social discrimination and reduced self-esteem, and physical health problems such as type 2 diabetes and risk factors associated with cardiovascular disease.

The prevalence of childhood obesity in Australia has been increasing since the 1970s, particularly in the decade from the mid 1980s to the mid 1990s (Norton et al. 2006). While government and community focus on obesity increased from the mid 1990s, broader preventative health programs focusing on physical activity and nutrition date from the 1980s (for example, the iconic 'Life. Be in it' campaign and the National Better Health Program (Lin and Robinson 2005)).

In 1997, the National Health and Medical Research Council released *Acting on Australia's Weight: a Strategic Plan for the Prevention of Overweight and Obesity* (NHMRC 1997).

Box 1.1 **The health consequences of childhood obesity**

Childhood obesity can cause a range of psychosocial (psychological and social) and physical health problems. While most of the health consequences arise in adult life, they are becoming increasingly common in children (Must and Strauss 1999). Further detailed discussion on the health consequences of obesity for adults and children is presented in Lobstein, Baur and Uauy (2004) and WHO (2000).

Psychosocial problems

Psychosocial problems are likely to be more widespread, and more immediate, than physical health problems in children and adolescents (Dietz 1998; Lobstein, Baur and Uauy 2004). Studies have found that obese children are targets for social discrimination (Latner and Stunkard 2003; Richardson et al. 1961). In addition, an inverse relationship between self-esteem and body weight may exist (for example, Franklin et al. 2006; French, Story and Perry 1995; Hesketh, Wake and Waters 2004). Equivocal evidence suggests a relationship between obesity and psychiatric illness, such as depression and anxiety states (Lobstein, Baur and Uauy 2004). Childhood obesity is also a known risk factor for eating disorders such as binge eating disorder and bulimia nervosa (Fairburn et al. 1997; 1998).

Physical health problems

- Cardiovascular risk factors — include high blood pressure, high cholesterol and insulin resistance (WHO 2000). Childhood obesity was found to be associated with cardiovascular risk factors in an Australian study (Garnett et al. 2007). However, international evidence suggests there may not be a direct, independent relationship between childhood obesity and cardiovascular risk factors in adulthood, and instead they may be indirectly related through obesity tracking from childhood to adulthood (Lloyd, Langley-Evans and McMullen 2010).
- Type 2 diabetes — previously mostly occurring in adults, the diagnosis rate in children appears to be increasing (McMahon et al. 2004). It can cause short- and long-term serious health effects including chronic kidney disease and loss of vision (AIHW 2006a). The parallel rise in obesity and (type 1 and 2) diabetes in children suggests a causal relationship may exist (Alberti et al. 2004). An Australian study found that Body Mass Index (BMI) z-score at 5 years was an independent predictor of (type 1 and 2) diabetes at 21 years (a BMI z-score indicates the relativity of a particular BMI to the mean for that age and gender) (Mamun, Cramb et al. 2009).
- Hepatic complications — include hepatic steatosis (fatty liver disease) and cholelithiasis (gallstones). Research suggests a relationship between childhood obesity and these two conditions (Dietz 1998; Rashad and Roberts 2000).
- Other complications — include orthopaedic complications such as Blount disease (Dietz 1998) and musculoskeletal discomfort (such as knee pain and impaired mobility) (Taylor et al. 2006), and pulmonary complications such as sleep disorders (ranging from heavy snoring to sleep apnoea) (Must and Strauss 1999; Lobstein, Baur and Uauy 2004) and asthma (Reilly et al. 2003).

(Continued next page)

Box 1.1 (continued)

Long term

In the long term, the most significant consequence of childhood obesity is adult obesity and its consequences (WHO 2000). International (Singh et al. 2008) and Australian literature (Burke, Beilin and Dunbar 2001; Magarey et al. 2003; Mamun, Hayatbakhsh et al. 2009; Venn et al. 2007) indicate an increased risk of overweight and obese children becoming overweight and obese adults.

Australian Health Ministers agreed that overweight and obesity was a sufficiently significant public health problem to establish a taskforce in November 2002. *Healthy Weight 2008 — Australia's Future* followed, stating the initial focus of the national effort would be on children and young people (National Obesity Taskforce 2003).

More recently, obesity was the subject of a House of Representatives inquiry (House of Representatives Standing Committee on Health and Ageing 2009) and was a focal point of the National Preventative Health Taskforce (2009). The Government released its response to the National Preventative Health Taskforce's report in 2010 (Australian Government 2010).

1.2 Approach of this paper

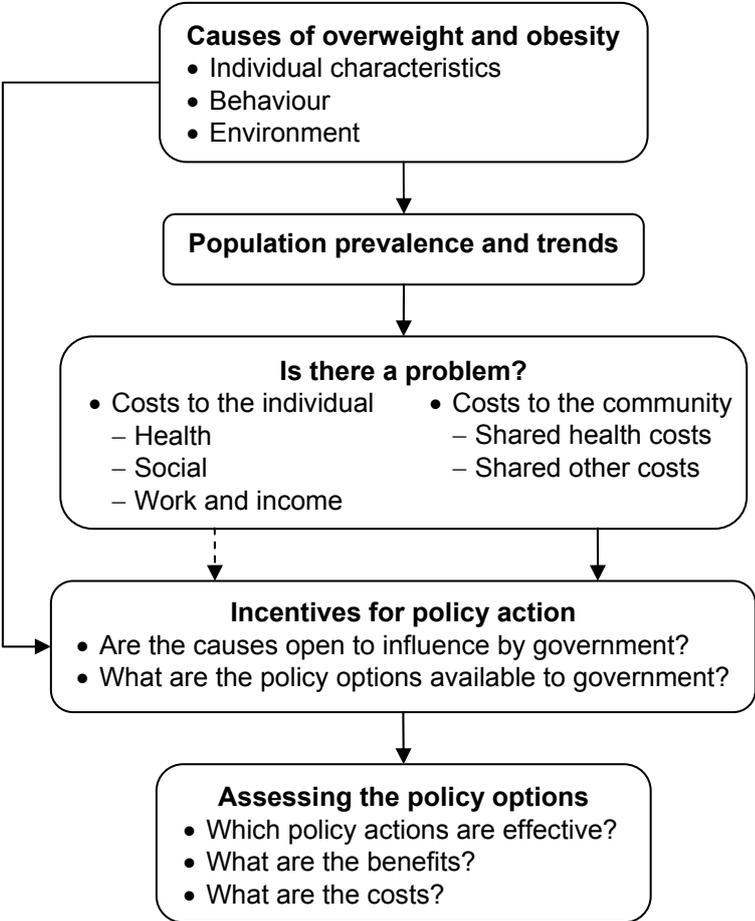
This paper covers five main areas that are important in understanding childhood obesity in Australia and why it might require government intervention (figure 1.1). The causes of overweight and obesity in children are explored, including individual characteristics, such as genetics, that give a predisposition to weight gain, the behaviours of individuals, such as their food consumption and exercise, and environmental factors that influence these behaviours, such as advertising and the physical environment.

Understanding the causes is important for explaining the changes in the prevalence of childhood obesity and considering if childhood overweight and obesity is a problem that requires government intervention. Some of the costs of overweight and obesity are borne by obese individuals themselves (such as the health consequences) and other costs are borne by the community (such as shared costs under a public health system). Both the causes and the consequences of overweight and obesity need to be considered when assessing the problem and deciding if government action is warranted. If there is a case for intervention, the next step is to identify which individual characteristics and behavioural and environmental causes are

amenable to policy influence. Then, consideration needs to be given as to which potential policy options can be used to target them.

When making policy decisions it is important to consider the available evidence or any evidence of the effectiveness of previous interventions, and if the benefits warrant the costs of undertaking the policy option, including the cost of taxation or diverting funds from other programs, and costs that might be imposed on consumers.

Figure 1.1 **The approach of this study**



1.3 Childhood overweight and obesity prevalence in Australia

Assessing the prevalence of obesity in the community requires appropriate measurement and collection of data. The Body Mass Index (BMI) is the most commonly used method to measure overweight and obesity in large

population-level surveys. There are advantages and disadvantages to using BMI (box 1.2), however, it is the measure most commonly used in surveys, mainly due to its ease of measurement.

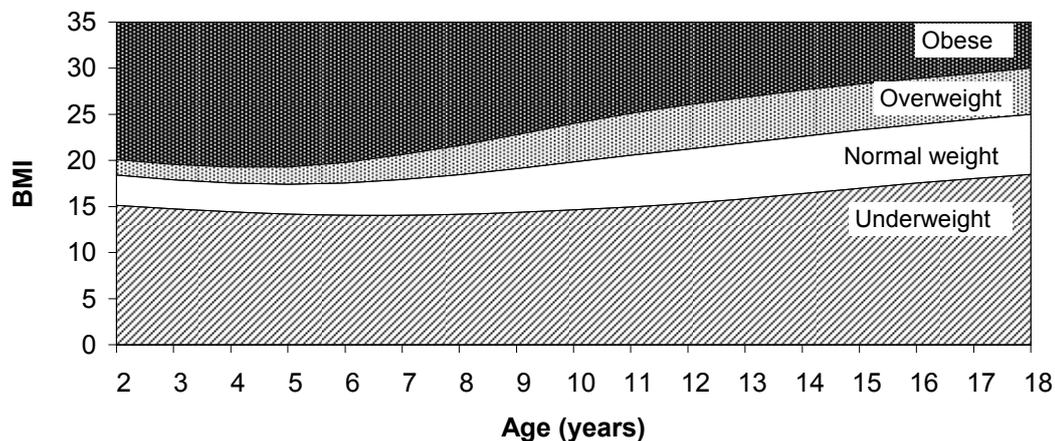
Box 1.2 **Measuring childhood obesity**

Methods used to measure childhood overweight and obesity on a population level include Body Mass Index (BMI), waist circumference and skinfolds. More precise measures of body fat such as Dual X-ray absorptiometry are generally not used on a population level due to their cost.

BMI is the most commonly used method to measure overweight and obesity on a population level for both adults and children. It is calculated by dividing a person's weight in kilograms by their height in metres squared. This number is used to categorise adults into one of four weight categories: BMI less than 18.5 indicates the person is underweight; 18.5 to 25 indicates normal weight; 25 to 30 indicates overweight; and greater than 30 indicates obesity (WHO 2000).

Classifying children into one of the categories is done differently. Internationally recognised age and gender specific cut offs for children were developed by Cole et al. 2000 and Cole et al. 2007, using data from Brazil, Great Britain, Hong Kong, the Netherlands, Singapore and the United States. These BMI cut offs for each age and gender trend towards and merge with the respective adult cut offs for underweight, overweight and obesity at age 18. This is illustrated below for male children.

BMI thresholds for male children



Sources: Cole et al. (2000); Cole et al. (2007).

BMI has many advantages over other measures including:

- it is easier, and considered less invasive, to measure height and weight in a school setting (where most data for large child surveys are collected)
- it is less costly

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Box 1.2 (continued)

- some studies have shown BMI is correlated with body fat in children (for example, Pietrobelli et al. 1998; Schaefer et al. 1998).

However, BMI also has disadvantages, including:

- it does not give any indication of the distribution of fat on a person, such as central fat (central adiposity) versus peripheral fat. Central fat may carry more risk than total body fat (Oken and Gillman 2003)
- it does not quantify body composition — people with high muscle mass, but not necessarily high fat mass, such as athletes, can record BMIs in the obese range
- females with slender frames but significant excess fat may record misleadingly low BMIs (Nevill et al. 2006)
- it is not fully independent of height, especially for children, and is influenced by body proportions (Garn, Leonard and Hawthorne 1986)
- the cut off points for children (Cole et al. 2000) were estimated using mostly Caucasian data and they may not be valid for non-Caucasian children.

The data on overweight and obesity in Australian children are limited and ‘patchy’. (For the purposes of this paper we consider children as anyone under 18 years of age.) There are very few national surveys and they are often at least a decade apart. Since the mid 1990s, many states have completed at least one survey. However, data sets will often include different age groups and have different methodologies. Olds et al. (2009) presents a comprehensive list of Australian measured (as distinct from self-reported) data sources.

Recent national data

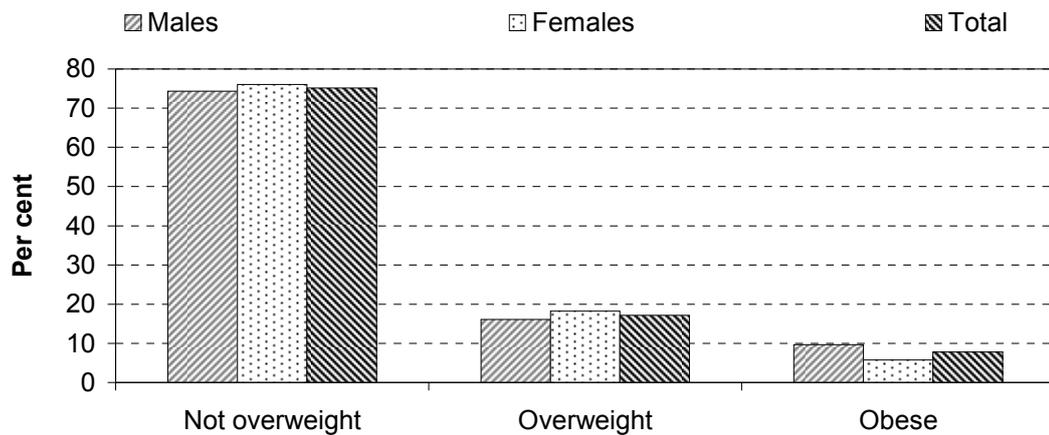
Two recent national surveys of childhood overweight and obesity reveal similar results, except for obesity rates for male children. According to the latest National Health Survey (NHS) for 2007-08 (ABS 2009a), 75 per cent of children were not overweight or obese. The proportion of children classified as overweight was 17 per cent with a slightly higher prevalence of females (18 per cent) than males (16 per cent). Overall, 8 per cent of children were classified as obese, with a significantly higher prevalence for males (10 per cent) than females (6 per cent) (figure 1.2).

The 2007 Australian National Children’s Nutrition and Physical Activity Survey (National Children’s Survey) (CSIRO and University of South Australia 2008a) reported similar results, with 72 per cent of children not overweight or obese. The proportion of children classified as overweight was 17 per cent, with a slightly

higher prevalence for females than males. Overall, 6 per cent were classified as obese, with a slightly higher prevalence of females (6 per cent) than males (5 per cent).

Figure 1.2 Weight classification of Australian children aged 5–17 years, 2007-08

Proportion classified as not overweight, overweight or obese



Source: ABS (2007-08 National Health Survey, Cat. no. 4364.0).

While the two surveys report very similar prevalence rates for overweight in Australian children, the NHS reports a higher obesity prevalence (8 per cent), compared to the National Children’s Survey (6 per cent). This result was driven by a significant difference in the proportion of obese males, which was 10 per cent in the NHS and 5 per cent in the National Children’s Survey, and in particular, the proportion of 13–17 year old males classified as obese in the NHS at 13 per cent.

Differences in the age groups (2–16 years in the National Children’s Survey and 5–17 years in the NHS) and the survey response rates between the two surveys are likely to account for part of the differences in results (ABS 2009c; CSIRO and University of South Australia 2008b).

The prevalence of overweight and obesity is higher in the adult population than in the child population, with 37 per cent of adults being overweight and 25 per cent obese in 2007-08 (ABS 2009a).

Childhood overweight and obesity over time

In the twentieth century, the estimated prevalence of childhood overweight and obesity was relatively constant until the 1970s when it began to increase, and continued to grow for the rest of the century, according to BMI data (Norton et al. 2006). Three national surveys conducted in 1985, 1995 and 2007-08 provide some indication of trends in the prevalence of obesity in recent decades:

- The 1985 Australian Health and Fitness Survey included about 8500 children aged 7–15 years (Magarey, Daniels and Boulton 2001).
- The 1995 National Nutrition Survey, conducted by the ABS, involved about 3000 children aged 2–18 years (ABS 1997; Magarey, Daniels and Boulton 2001).
- The 2007-08 NHS (discussed earlier) included 5000 children aged 5–17 years.

These surveys included different age groups and used different sampling methods, which make it difficult to compare the results. However, the differences are not so substantial as to preclude comparison.

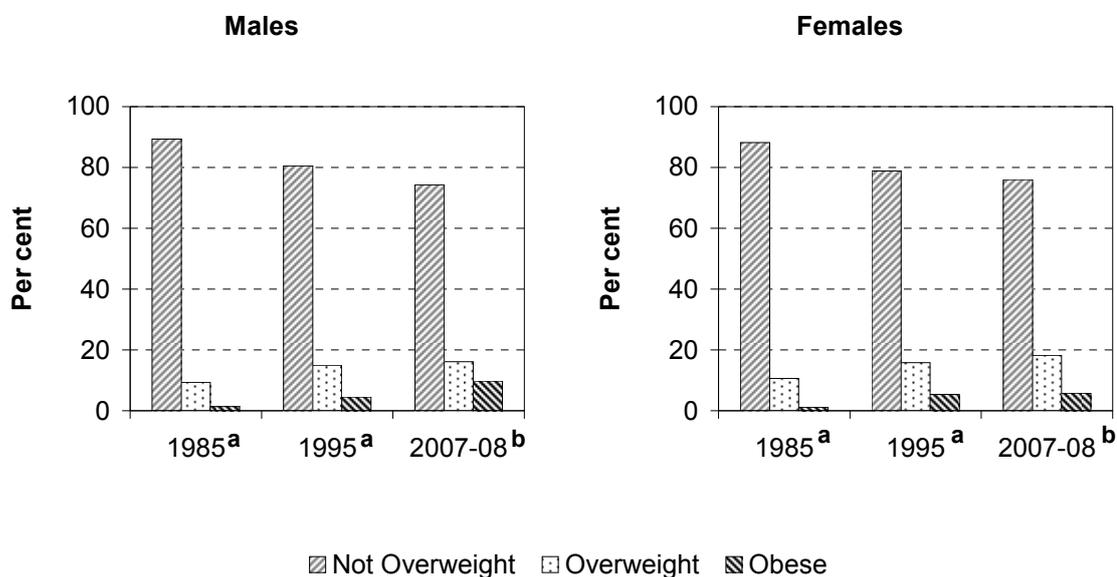
Prevalence estimates for ages 7–15 years for the 1995 data are available that allow for better comparison with the earlier 1985 data. For males, between 1985 and 1995 the prevalence of overweight increased from 9 per cent to 15 per cent, while the proportion of obese increased from 1 per cent to 5 per cent. The 1995 and 2007-08 data involve different age groups. Between 1995 and 2007-08 the prevalence of overweight male children increased from 15 per cent to 16 per cent, while the proportion of male children classified as obese more than doubled from 5 per cent to 10 per cent (figure 1.3).

For females, between 1985 and 1995 the prevalence of overweight increased from 11 per cent to 16 per cent, while the proportion of obese increased from 1 per cent to 5 per cent. Between 1995 and 2007-08 the prevalence of overweight female children increased from 16 per cent to 18 per cent, while the percentage of obese increased from 5 per cent to 6 per cent (figure 1.3).

Is overweight and obesity in children and adolescents still increasing?

These three national surveys indicate that overweight and obesity prevalence in children has been increasing (although generally at a declining rate). However, recently published research suggests it might have levelled off sometime between the 1995 and 2007-08 national surveys. Olds et al. (2009) pooled together 41 different studies that included data on the BMI of Australian children conducted between 1985 and 2008.

Figure 1.3 **Weight classification of Australian children, 1985 to 2007-08**
Proportion classified as not overweight, overweight or obese



^a Ages 7–15 years. ^b Ages 5–17 years.

Sources: ABS (2007–08 National Health Survey, Cat. no. 4364.0); Magarey, Daniels and Boulton (2001).

Although the 2007-08 NHS was not included due to the timing of its publication, its inclusion would not have changed the overall findings (Olds, T.S., University of South Australia, pers. comm., 9 June 2009).

The authors found that since about 1996, the prevalence of children classified as overweight or obese has stabilised, or only slightly increased. The prevalence of obesity in males increased from 1 per cent in 1985 to 5 per cent in 1996 and remained at 5 per cent in 2008. Similarly for females, it increased from 1 per cent in 1985 to 6 per cent in 1996 and was 6 per cent in 2008. For overweight and obesity combined, the prevalence in males increased from 10 per cent in 1985 to 22 per cent in 1996 to 24 per cent in 2008, and for females it increased from 12 per cent in 1985 to 24 per cent in 1996 to 25 per cent in 2008 (figure 1.4).

However, as highlighted later (chapter 3), childhood obesity prevalence is greater in some subgroups than others and Olds et al. (2009) does not report on obesity trends in different subgroups. Regardless of whether childhood obesity prevalence has levelled off, current levels are still considered by many observers to be higher than desirable (Olds et al. 2009).

Figure 1.4 **Weight classification of Australian children aged 2–18 years, 1985 to 2008**

Proportion classified as obese and overweight and obese



Source: Olds et al. (2009).

2 Obesity in an economic framework

For most adults, being overweight or obese is a consequence of a number of decisions they have made over many years regarding food consumption and exercise. If made voluntarily and with full information of the consequences these are largely personal decisions, and there the matter might otherwise rest. But to some extent the decisions some people make are sub optimal. They might have made better choices if they had had the benefit of foresight or had been better informed. Being obese might also have consequences for the rest of the community.

In this chapter we examine obesity in an economic framework to consider the case for government intervention. Even if the basis for intervention in the case of adults is relatively weak, there may be a stronger case for intervening in the affairs of children. We first consider how people make decisions about eating and energy use, before considering why these decisions may be ‘distorted’, for example because of incomplete information or price signals or cognitive and behavioural limitations. The costs of obesity are then considered.

2.1 Decision making

While some people are more predisposed to becoming obese than others (chapter 3), as a general rule people put on weight when the energy in the food they consume exceeds the energy they expend. It is therefore necessary to understand the influences on both sides of this obesity ledger: energy in and energy out.

Considering obesity in a cost–benefit framework can help to explain why a greater proportion of the population have become more overweight or obese over time. At its simplest this could occur where food costs decrease and income rises, where the cost of expending energy through exercise increases, or where people’s preferences change (such that they prefer more or different food and/or less exercise than they previously might). Using an economic framework can also help identify market failures or behavioural limitations that might constrain the potential for individuals to maximise their own wellbeing over time (section 2.2).

People make a myriad of different decisions about the way they live their lives, many of them having implications for their weight. Faced with multiple competing

activities and purchasing choices, rational consumers will make decisions to allocate their scarce resources of time and money to maximise their wellbeing.

In the context of childhood obesity, decision making about eating and exercise is to a large extent made by adults on behalf of children, though not entirely. Moreover, decisions are probably not made to optimise weight per se — rather people make decisions about what and when to eat and how much exercise they do, with weight being a possible factor in these decisions (but weight is certainly an outcome of such decisions).

Eating provides benefits to individuals including providing calories and nutrients that keep them alive and healthy, providing pleasure through taste (palatability) and being an important social activity (figure 2.1). In choosing what, when and where to eat, people will compare these potential benefits against the potential costs of eating, which can include the financial cost of purchasing food, the time cost of purchasing/preparing food and future health effects (mortality, morbidity, quality of life effects). For example, people might purchase energy-dense nutrient-poor takeaway food, even in the knowledge that it may be less nutritious for them than a home prepared meal, because it frees up time to engage in other pursuits (helping the kids with their homework, walking the dog etc) that they value more highly.

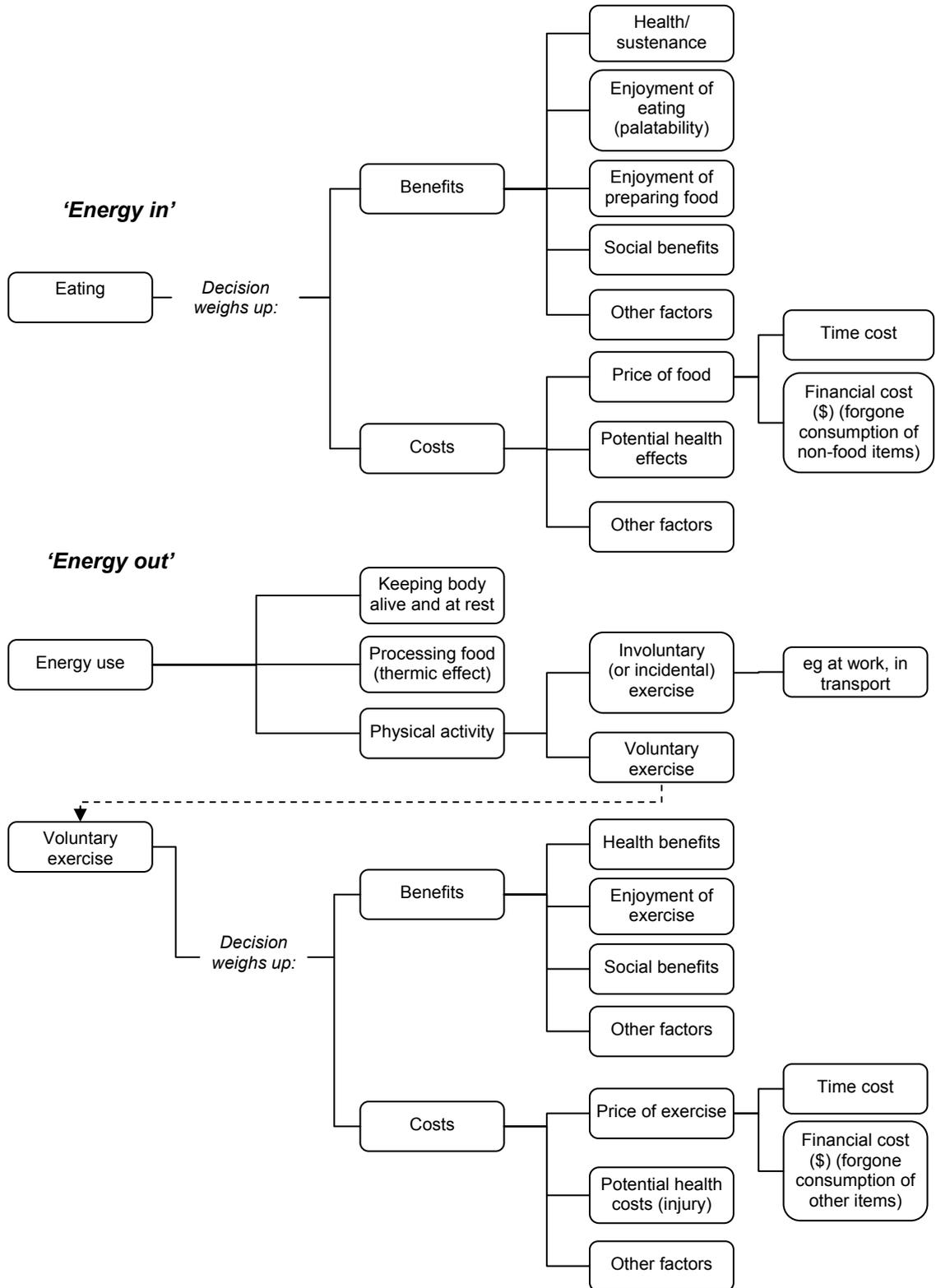
Energy expended is often a function of other decisions and factors (such as the type and location of work, location of home and transport options, and preferred leisure activities) as well as specific decisions to exercise to improve fitness or control weight. Energy expended therefore could be affected by a wide range of factors including technological changes in the workplace, prices of transport and fuel, and prices of housing. Exercise can deliver health benefits, enjoyment and social benefits, but these can be weighed against the time and financial costs of exercise and potential health (injury) risks (figure 2.1).

In making decisions about eating and undertaking exercise, tensions can occur between the benefits and costs. Some people will effectively choose to be overweight and knowingly incur additional health risks as the ‘price’ to be paid for enjoying food/company or undertaking less exercise today. It follows that the optimal prevalence of overweight and obesity in society will not be zero.

The decision-making framework in figure 2.1 is a simplified representation, and the value (or perception of the value) of the benefits and costs of eating and exercise are influenced by many factors. For example, while it is perhaps difficult to talk about the price of ‘food’ in a generic sense in the Australian context, in some countries the price of staples will act as a significant constraint on total food consumption. In

Figure 2.1 Decision-making framework

Obesity is caused by an imbalance between 'energy in' and 'energy out'



Australia, price influences are more likely to involve relative prices between food types (such as the relative prices of fast food and home cooked meals, for which a substantial input is effort and time). People's decisions will also be influenced by their income (better quality foods and more 'outsourcing' to restaurants) and their education, as well as access to information about nutrition, health benefits and risks. Advertising might also influence or 'distort' individual preferences.

As noted earlier, decisions about children's eating and exercise are to a large extent made by adults on their behalf. Nonetheless, to the extent that these factors influence parents' assessment of the benefits and costs of eating and exercise in making their own weight-related decisions, the same factors are also likely to influence parents' decisions on behalf of their children.

As relative prices, income or preferences change, so would the mix of activities that maximises the wellbeing of that person. The following discussion canvasses some possible *broad* trends that might have influenced eating and exercise decisions, increasing the prevalence of overweight and obesity since the 1970s. Specific factors that might cause, or at least are associated with, obesity — such as socioeconomic status, education and advertising — are discussed further in chapter 3.

Price and time cost effects

A decline in the price of food will lead to an increase in consumption, other things being the same. But the demand for food in total is 'inelastic' (that is, consumption is not very responsive to price changes), so the effect of price decreases on total consumption would be expected to be modest. Cutler, Glaeser and Shapiro (2003) cite a price elasticity of demand of -0.6 (indicating that a 10 per cent decrease in the price of food would increase consumption by 6 per cent), but suggest that if this were adjusted for quality effects, the demand for caloric intake would be more inelastic. Similarly, studies on the effectiveness of food taxes suggest demand is not very responsive to price changes (section 5.1, chapter 5).

Even so, Lakdawalla and Phillipson (2002) claim that as much as 40 per cent of the increase in weight of Americans over the period 1976 to 1994 can be attributed to price decreases associated with agricultural innovation.

Furthermore, *relative* prices matter. An increase in the price of one food item can lead to a switch from the relatively higher priced item to lower cost items. Research in the United States indicates that there is an inverse relationship between energy density and energy cost (price per unit of energy), so energy-dense foods may be cheaper (Drewnowski and Specter 2004). If this is the case, consumers face a

tradeoff between buying healthy (and relatively more expensive) foods or buying cheaper energy-dense alternatives and having additional income to buy more of other goods or services.

Similarly, the time costs associated with food preparation will also influence consumption decisions. Cutler, Glaeser and Shapiro (2003) note that ‘... reductions in the time required to prepare food reduced the per calorie cost of food by 29 per cent from 1965 to 1995’ (p. 112). Their research found that the lower time cost of food preparation has led to more frequent consumption of a greater variety of food, and to higher weight, and that this helps explain a ‘good share’ of the observed increase in Body Mass Index (BMI) over the study period (Cutler, Glaeser and Shapiro 2003, p. 110).

The effect of food prices on children’s consumption would be expected to be quite muted, given that they are not usually the ones making household decisions regarding food purchase and preparation. But Cawley (2007) cites evidence that school children are sensitive to changes in the relative prices of high-fat and low-fat foods. French et al. (2001) found similar results through changing prices of low-fat snacks in secondary school vending machines.

The effect of rising incomes

The income elasticity of food is generally regarded to be quite low. As incomes rise individuals reach a point of satiation, and begin to spend their income on other goods and services. However, rising incomes give them access to a wider variety of foods and enable them to consume more food away from home. Rising incomes also increase the opportunity cost of time for preparing food or exercising if it comes at the cost of work.

The effect of income on obesity changes with economic development — while in less advanced countries there is a positive relationship between income and weight, there is evidence that in rich countries there is a negative relationship between obesity and both income and education (refer to chapter 3 for discussion on socioeconomic status). Although technological advancement has led to lower food prices, and may provide some explanation for the rise in obesity prevalence, Philipson and Posner (1999) propose that the growth in obesity as a result of this factor may be self limiting when it makes workers sufficiently well off (and consequently increases the demand for ‘thinness’).

The income effects on children are not direct (as they are unlikely to earn their own income). Rather such effects are likely to arise through their parents’ income, which can also shape the family environment (chapter 3).

The cost of exercise

In addition to the effects of lower prices of food and increases in income, the cost of exercise has increased. Due to production-related technological advancement, workers are less engaged in paid work that entails expending significant physical energy. This shift toward more sedentary jobs corresponds with an increase in the cost of physical activity. Workers were once, in a sense, paid to exercise through their active labour, but in more sedentary jobs they must now forgo their free time to exercise. As well, in some cases, individuals choose to pay to engage in exercise (such as through gym membership). In theory, the higher the wage, the higher is the opportunity cost of time devoted to engaging in exercise, but also the greater the capacity to pay for exercise. That said, people enjoy physical activity to varying degrees, and the cost of forgoing more passive leisure in order to engage in physical activity will also vary. There are many competing demands on children's time, and to undertake exercise can mean giving up other pursuits. Further, it can involve the cost of a parent's time where supervision or transport is required.

Unintended consequences?

Just as obesity may be an unintended side effect of economic development, it may also be an unintended consequence of policy action designed to address other economic, social, or health goals. For example, Chou, Grossman and Saffer (2004) found a positive relationship between the rising prevalence of obesity in adults (in the United States) and cigarette prices. Other research indicates that an increase in cigarette taxes increases female BMI (Rashad, Grossman and Chou 2006). For children, providing a school bus might improve safety, but might reduce the opportunities for children to exercise by walking or riding to school.

2.2 Rationales for government intervention

In making decisions about eating and exercise, people take into account a range of information. This includes current and future market prices of goods and services, the implicit value of their own time and efforts, as well as health and other 'non-price' impacts, such as social interaction and enjoyment.

If information and prices and costs are distorted, then these decisions may not be optimal. For example, food producers might not have an incentive to provide information about the nutritional or energy content of their foods. Taxes or other interventions might distort food prices.

Furthermore, as discussed below, behavioural limitations can mean consumers make decisions about food consumption and exercise that are not in their own best interests (through an inability to process information or by not behaving in rational ways) (see also box 2.1).

That said, the presence of spillovers, information gaps or behavioural limitations is a necessary but not sufficient condition for government intervention. Intervention should only occur if it leads to a better outcome than would occur in its absence, after allowing for the costs of implementing the intervention (chapter 4).

Box 2.1 Externalities, information failures and behavioural limitations

Externality (or spillover) effects occur when consumption or production of a product affects the welfare or production possibilities of unrelated third parties. These effects might be positive or negative. An example of a positive externality is disease immunisation, which protects the individual, but also lowers the general risk of disease for everyone. Examples of negative externalities include passive smoking, and effects on unrelated parties from drink driving related accidents. The presence of externalities can mean that there are private incentives to produce or consume too much (in the case of a negative externality) or too little (in the case of a positive externality) than would be best from a community perspective.

Information failures arise where there is insufficient or inadequate information about such matters as price, quality and availability for firms, investors and consumers to make well-informed decisions.

Even where externalities or information gaps are absent, individuals may behave in ways that limit the returns they might achieve from using the scarce resources (such as income and time) at their disposal. **Behavioural economics** suggests that people can have difficulty weighing up the costs and benefits of different options open to them and instead resort to using rules of thumb, or other heuristics. They may also tend to: discount costs and benefits over time in an inconsistent fashion that leads to procrastination; value losses more than equal-sized gains; and make different decisions depending on the context in which they are making those decisions.

Information gaps

Information failures come in various forms. Information asymmetry — for example, where a firm has information that consumers do not — can lead to consumers purchasing goods that they might not want if they were in possession of full information and were able to process that information. For example, a consumer may unwittingly purchase and consume food containing ingredients that they would rather avoid. Consumers, however, are not always less informed than firms — for

example, consumers purchasing insurance may know more about the risks they face than the insurer.

In the case of obesity, if individuals are to make informed choices they need information on the (eating and exercise) behaviour that can lead to obesity (including the energy and nutritional content of food options), the health risks associated with being overweight or obese, and the likelihood of these risks occurring. The extent to which such information will be effective will be linked to how they convert information to appropriate action, and the ease of engaging in that action.

Children are usually neither well-informed, nor always free to make their own choices, with parents often making decisions about eating and exercise for children. For children who do make decisions (such as at school), or at least influence parental decisions, the potential for information failure is very apparent, as they do not get access to all the necessary information and generally have a reduced capacity to evaluate information about their own health.

When parents make decisions on behalf of children, a special case of the principal-agent problem applies, where the interests of the parent may not align with those of the child's. In this case, where interests conflict, the child has limited ability to define and defend their own interests. In most cases though, parents are expected to act in the best interests of their children. Therefore, any relevant information failure relating to childhood obesity should be addressed by targeting parents (or guardians) and its success would depend on parents acting in the best interests of their children.

There may be a role for government provision and dissemination of information about obesity and exercise, especially if it helps to address the costs to the community of obesity (see below) and meets the cost-benefit test mentioned above. Government may be seen as a more credible source of information than the private sector. Alternatively, government might compel information provision by industry, such as through nutritional labels on food products. Other government roles may include social marketing campaigns about healthy eating patterns and desired physical activity levels for children at school or in the broader community. Regulations may be introduced to prevent misleading advertising of, say, food products or health-related products such as diet products. Different policy instruments are discussed further in chapter 4.

However, even when adequately informed, cognitive limitations may limit the ability of consumers to act on that information to promote their own best interests (see discussion in behavioural considerations section below).

Externalities

Economics defines an externality as the side effects or spillovers of an activity that are not taken into account in an individual's or business' decision and that affect another party's wellbeing. In these circumstances, the social and private marginal costs differ. An individual or business only takes into account the private costs in their decision and ignores the social costs (the private costs plus the cost it imposes on another party). So, in the case of a negative externality, where social costs are greater than private costs, too much of the good is produced or consumed, from a community perspective (a positive externality would result in too little of the good being produced or consumed).

For public policy purposes, it is helpful to distinguish between pecuniary and technical externalities, and between (negative) externalities and costs imposed on the community.

Pecuniary externalities are *generally* defined as externalities that are transmitted through the price system (for more detail see Bohanon 1985). The typical example is where a new, more efficient firm enters a competitive industry, driving down the price received by all existing firms. The harm to the existing firms is more than offset by a transfer of income to consumers.

Technical externalities on the other hand have a direct real effect on a third party, and can result in market inefficiency, potentially warranting corrective action, whereas pecuniary externalities do not have efficiency implications. In the case of health issues such as smoking or alcohol consumption, technical externalities are quite clear, such as the health or discomfort effects of passive smoking, or the injuries or fatalities of others associated with drink driving.

By comparison, overweight and obese people cause few policy-relevant technical externalities, that is, their weight does not materially affect the wellbeing of other people. The loss of personal space that some people might experience sitting next to an obese person on a plane (or on public transport, or at a concert) may be thought of as a technical externality. Such externalities might be partly 'internalised' through affected passengers moving or adjusting their seating position. (Such technical externalities would not normally be an issue with overweight children.)

The response by airlines or theatres to the growing size of their patrons may be to increase the size of seating, reducing the overall number of seats within a given venue, thus increasing the costs to normal weight people using those seats. Alternatively, where a person's weight is an important influence on the cost of providing them with a service, businesses might choose to charge those people a higher price, and/or provide them with a subtly different service. For example, some

airlines have experimented with higher charges for obese people, a recent example being Air France/KLM offering obese people an option to buy a second seat at a 25 per cent discount, refundable if the plane is not fully booked. People who cannot sit comfortably in a single seat and have not reserved an extra seat might not be allowed to board if the flight is full (Air France 2010).

Efficiency costs of higher health care costs

It is also important to distinguish between technical externalities that might be policy relevant in their own right and costs imposed on the rest of the community associated with deliberate policy decisions to provide a minimum level of public health care for all.

On average, obese people consume more health care costs than normal weight people. The obese bear some of these costs themselves, such as a portion of medical costs and possibly lost wages (they may have more work loss days due to ill health), and some of the costs will be borne by others. (Obese people also bear the diminution of their own wellbeing.) Of the costs to others, some are borne through collectively financed systems, such as medical care, sick leave, group life insurance, and retirement pensions. Specifically, the greater healthcare needs of obese individuals will increase health costs for all, either through increased taxes or through increased healthcare premiums (where a policy of community rating applies). These ‘external’ costs, which are sometimes characterised in the literature as an externality (for example, see Bhattacharya and Sood 2005), are more in the style of a pecuniary rather than a technical externality, and might simply be recognised as part of the costs the community is prepared to bear to provide a universal health care system. That is, they might be considered as a transfer from one part of the community to the other. However, there is limited evidence on how significant these obesity costs (for adults or children) might be in the Australian context (although a US study estimated them to be of the order of \$150 per capita (Bhattacharya and Sood 2005)).

But some efficiency costs are also associated with public health care. The efficiency costs arise from the deadweight losses of the additional tax revenue needed to fund the public health system (box 2.2), and through distortions to the price of providing health care services.

In addition, the fact that people do not face the full costs of the health services they consume could be an efficiency issue if it reduces the incentives for people to consider the full costs of obesity in making decisions about their food intake and

Box 2.2 The efficiency cost of taxation

Governments use taxation to raise revenue to meet their funding needs. Most taxes result in some loss of economic efficiency (reduced community wellbeing) by distorting economic behaviour.

The deadweight loss of taxation arises from the reduced incentive effects associated with the additional tax (which drives a wedge between prices paid and received for goods and services — including labour — in the economy). This has been estimated to be 27.5 cents in the dollar (PC 2003).

More recently, the Review Panel on Australia's Future Tax System (2010) reported the marginal welfare losses from major Commonwealth taxes included 24 cents in the dollar for personal tax and 40 cents for company tax. Marginal welfare losses from major state government taxes included 41 cents in the dollar for payroll tax and 34 cents for conveyancing stamp duties.

exercise. Exposing obese individuals to the full costs of their health care might have some marginal effect on obesity, however, on its own it is unlikely to significantly reduce obesity prevalence in the community due to information gaps and behavioural limitations. And there are several reasons that a policy response designed to address this issue might not be practical. Taxing obese individuals, for example, would unfairly single out their health-related risk behaviour for policy treatment against other costly health-related risk behaviour (such as hang-gliding). Additionally, any policy response to ensure obese individuals do face more or all of the costs of the services they consume would negate the intent of publicly funded health insurance programs designed to ensure financial contributions are income-related rather than risk-related.

In summary, there are few substantial technical externalities arising from obesity in adults or children (unlike alcohol or tobacco where effects on third parties can be substantial). But the efficiency costs to the community from having to finance the higher consumption of health care by the obese are an issue. As universal access to health care and community rating have been key parts of the policy platform of Australian governments for many years, this suggests that there may be important dividends to the rest of the community from reducing obesity. However, the fiscal effects of obesity need to be seen in terms of the total amount of community resources that are consumed by the obese, not just health services. For example, the costs of providing age pensions and aged care services may be reduced if obese individuals have shorter life expectancies. The costs of obesity are addressed further in a following section.

Behavioural considerations

The preceding discussion is predicated on the assumption that individuals are rational and act in their own best interests. In other words, individuals have the cognitive skill and motivation to make decisions about how much and what they consume (and how much they exercise) that maximises their own wellbeing, fully accounting for the future health, financial and lifestyle consequences of their actions (Cutler, Glaeser and Shapiro 2003). People who engage in behaviours that have long-term negative effects (such as smoking or overeating) may do so in a fully rational and forward looking way, by weighing up the benefits and the total discounted costs of that activity, including monetary costs and health costs.

However, many individuals have difficulty in consistently making rational decisions — that is, they do not consistently value the costs and benefits of their actions and so do not choose options that maximise their wellbeing, subject to available resources. At least some food consumption does not appear rational — for example, people overeat, or eat the wrong foods, despite wanting to lose weight. To the extent that people make less than ideal decisions about their own wellbeing, the wellbeing of the community generally is less than it might otherwise be.

A large number of behavioural limitations have been described in the literature that help to explain the way people actually behave, but it is difficult to build these into a predictive model of human behaviour. That said, some behaviours are far more predictable than others, and may be useful in helping policy makers develop better approaches to managing obesity.

Behavioural limitations fall into one of three broad categories: bounded rationality; bounded willpower; and bounded self interest. Of these, the last — being the notion that we have some regard for the wellbeing of others when we make decisions about our own wellbeing — is probably the least relevant for obesity policy, and is not discussed further in this paper.

Bounded rationality

Bounded rationality refers to the fact that people have limited cognitive abilities and are not always able to make decisions that maximise their wellbeing, even where they may recognise these limitations and implement strategies to address them. That people have difficulty computing the benefits and costs of all options open to them about their diet and exercise, would come as no surprise to anybody used to shopping, or sifting through the comments in the media on what is good for you and what is not.

Individuals might not act in their own best interests even where adequate information is available. The high ‘cost’ of gathering and processing the information (transactions costs) and the difficulties in processing it, can lead us to take short-cuts, either consciously or unconsciously. We can make decisions that, instead of maximising our wellbeing, are merely satisficing, in the sense that they produce a result that is ‘good enough’.

However, taking such short-cuts might be optimal, if these transactions costs outweigh the additional potential benefits of a different decision. Many people use rules of thumb (or heuristics) to assist decision making. For example, people might consume breakfast cereal high in sugar content in the belief that cereals are generally good for you and a key part of a balanced diet. If they use this rule of thumb, and do not read labelling information on sugar and fat content, they may make poor choices or fail to update their consumption decisions as new (healthier cereal) alternatives come on the market, or new information becomes available. Although such a person may increase their wellbeing — as the transactions costs of reading and processing the nutrition information may be higher than the health benefits from switching to a healthier cereal because of that information — a ‘better’ rule of thumb (say, eating cereal with a tick from the Heart Foundation) might increase their wellbeing even more.

The context or environment in which we make decisions about diet and exercise can have important effects on our ability to make sound decisions (see, for example, Shiv and Fedorikhin 1999 or Ariely 2000). When people eat while undertaking some other activity they spend less effort on monitoring consumption and tend to eat more than they otherwise would (Bertrand and Schanzenbach 2009). They also tend to focus less on future consequences (Shiv and Fedorikhin 1999). Eating while watching television is an example.

The amount people eat is also influenced by the behaviour of those around them including family, peers, or social groups. When eating in groups people tend to eat as much as their peers (Birch and Fisher 2000). While this might lead the obese within that group to reduce their consumption, the others generally increase their consumption (Just 2006).

The amount people eat, or the choices of food they make, can also be influenced by the choices available to them (for example, between healthy and energy-dense nutrient-poor alternatives in a canteen), and the way food is presented. Even when faced with essentially the same choices, people react differently to essentially the same propositions, depending on how they are framed (Gibbs 1997).

The environmental influences on food consumption extend to the way food is packaged and the size of servings. For example, people are subject to ‘unit bias’ (Geier, Rozin and Doros 2006), that is, the amount they consume is related to portion size, or package size (see also, Rolls, Ello-Martin and Carlton Tohill 2004). In commenting on Wansink (1996), Just (2006, p. 214) found that: ‘Doubling portion sizes increases consumption anywhere from 18 to 25 per cent for meal-related foods and up to 45 per cent for snack foods.’ Evidence also supports the idea that people tend to under estimate their calorie consumption (Wansink and Chandon 2006), and that this effect is exacerbated by portion size (Just 2006).

While context is important, so too are consumers’ starting points. Research indicates that people sometimes demand much more to give up something than they would be willing to pay to acquire that same thing. This is called the endowment effect or loss aversion (Kahneman, Knetsch and Thaler 1991). Most people also have a ‘status quo bias’, meaning a reluctance to change from established behaviours (Samuelson and Zeckhauser 1988). These biases can have implications for diet, consumers being willing to add good foods to their diets but reluctant to give up bad foods, making it difficult to reduce overall energy intake.

Bounded willpower

Bounded willpower refers to the fact that people often make decisions and act in a way that they know is against their own long-term best interests. To some degree we all make decisions about tradeoffs between our current and future wellbeing (or between our current selves and our future selves, as some analysts have characterised the decision framework). Thus for example, we might forgo current consumption now given the prospect of greater consumption at some time in the future. This requires some consideration of the costs and benefits of the two options. We might consider that the elevated risks of ill health that arise from, for example, eating energy-dense nutrient-poor foods or smoking, is for some people more than outweighed by the pleasure these pastimes give them in the current period.

The rate at which we trade off current and future wellbeing is what economists call the rate of time preference. This rate can vary between people and for any one person may vary over time. The higher the rate of time preference, the greater an individual values the present over the future.

The standard discounted utility model (Samuelson 1937) assumes a constant rate of time preference over time. This would mean for example, that if someone preferred \$100 today over \$200 in one year’s time, they would also prefer \$100 in ten years’ time to \$200 in eleven years’ time. The choices are the same, just ten years apart.

Research indicates that people value the present over the future differently, which can have implications for obesity. A high valuation of the present over the future (a high rate of time preference) could, for example, lead to more food consumption today at the expense of health in the future. A number of studies have considered the links between the rate of time preference and obesity or risky behaviour. Zhang and Rashad (2008) found some evidence of a positive association between time preference and weight, particularly for males. A Netherlands study (Borghans and Golsteyn 2006) considered the links between body mass and individuals' 'discount rates', and trends over time. The authors found that being 'overweight' might be related to the way people discount future health benefits. However, they did not consider it likely that the trend in increasing body mass in the population could be attributed to an increase in the rate of time preference. They also found the link between time discounting and BMI was stronger for women than for men.

Other research shows that time preference, as measured through certain behaviours such as education, smoking, use of nutritional information, and motivation for accessing or acquiring nutritional knowledge, significantly affects the odds of choosing a risky diet (Finke and Huston 2003). Individuals' degree of impatience may be related to factors such as income or education (Becker and Murphy 1988). Education appears to be a key determinant of eating a healthy diet not just because education helps you to understand the tradeoffs being made, but also because the educated may have lower discount rates (as demonstrated by the decision of many to defer earning a full-time income during studying for the prospect of earning higher incomes later on).

The standard model of discounting our future selves against our current selves can be a rational way to make decisions, provided the individual's discount rate remains consistent over time. But many people seem to apply different discount rates to future benefits at different points in time, that is, their preferences are inconsistent over time.

Typically people will apply a much higher discount rate to near decisions than they do to those that occur in the future. This is called hyperbolic discounting and can be illustrated by a variation of the example used above. If offered the choice between \$100 today and \$200 in one year's time an individual might choose the \$100 today. But when offered the choice between \$100 in ten years' time versus \$200 in eleven years' time, that individual might choose the latter. This displays 'time inconsistent preferences' because although the choices on offer are essentially the same, they are valued differently when a time delay is involved. The inconsistency is highlighted when, ten years later, that individual wants the \$100 'today', and does not want to wait one year for the \$200, as opted for years earlier.

To put this in an obesity context, it is easy to envisage many people deferring decisions over diet because of the cost of forgoing the pleasure of over-eating today. A rational consumer would weigh up the gratification of eating additional food against the costs to their health in the future and also weigh up the ‘cost’ of going on a diet or exercising against the benefits to their health, and reach an optimum body weight. But hyperbolic consumers will consume more food today than is in their long-term interests. This means their short-term self trumps the long-term self, leading to procrastination and deferment of the diet or exercise that might have countered their higher levels of consumption today.

Research indicates that obese dieters can exhibit behaviour consistent with time inconsistent preferences (Scharff 2009), and leads to the conclusion that consumers with hyperbolic time preferences need not only to be educated about the risks of overeating but that they may need to ‘... overcome their temporally inconsistent preferences through the use of commitment mechanisms’ (Scharff 2009, p. 19). However, not all such consumers may need external assistance. Those who are aware of their behaviour may design strategies to help address their tendency to succumb to temptation despite their desire to do otherwise (such as buying limited quantities of unhealthy foods during shopping trips, buying smaller quantities of food per shopping trip, and using a peer group, such as Weight Watchers, to help ensure that commitments are adhered to).

Other research indicates that time preferences are affected by emotional state — positive mood is known to sometimes have effects on cognition and behaviour, and may increase willingness to delay gratification (Gibbs 1997).

Behavioural considerations and children

Adults can exhibit bounded rationality and bounded willpower, which can lead to obesity. But generally speaking these are largely the concern of the individual. On the other hand, parents (or guardians) are often required to make decisions for children, including weight-related decisions. These decisions will normally include what the child eats and to some extent how that child spends their time. As children grow older, they may influence the decisions parents make on their behalf (for example, Turner, Kelly and McKenna 2006), and increasingly make more decisions for themselves. They may also be increasingly influenced by factors outside the family.

Children display many of the same biases as adults, but more strongly. In the absence of supervision, children are more likely to indulge in behaviours that can have consequences for their weight and future health. For example, children may be

more prone to peer group pressure than their parents, and have even more difficulty in accounting for the future consequences of their actions.

The effect on children of cognitive limitations and distortions to decision making is therefore twofold. First, the individual choices made by parents or guardians will be imposed on their children, so any distortions to which parents are subject — through for example, cognitive limitations or advertising — will affect their children. Second, the children themselves will be subject to their own distortions from inside and outside the family.

While the case for hard interventions on the basis of behavioural biases in adults is relatively weak, it is much stronger for young children. But the role of parents and guardians makes for a difficult policy environment. While policy might be directed at minders, and the environment within which children live (for example, by regulating eating and exercise options while at school), it needs also to consider the potential for their behaviour to be influenced by external stimuli when they are largely left to their own devices (for example, while watching television). Policy options for addressing behavioural biases are discussed further in chapter 4.

2.3 The costs of obesity

As the preceding discussion has noted, some costs of obesity can be policy relevant. In this section we explore this issue further by identifying the different types of costs and considering the available evidence. Again, unfortunately, what little evidence there is relates to obesity generally, and not to obesity among children per se.

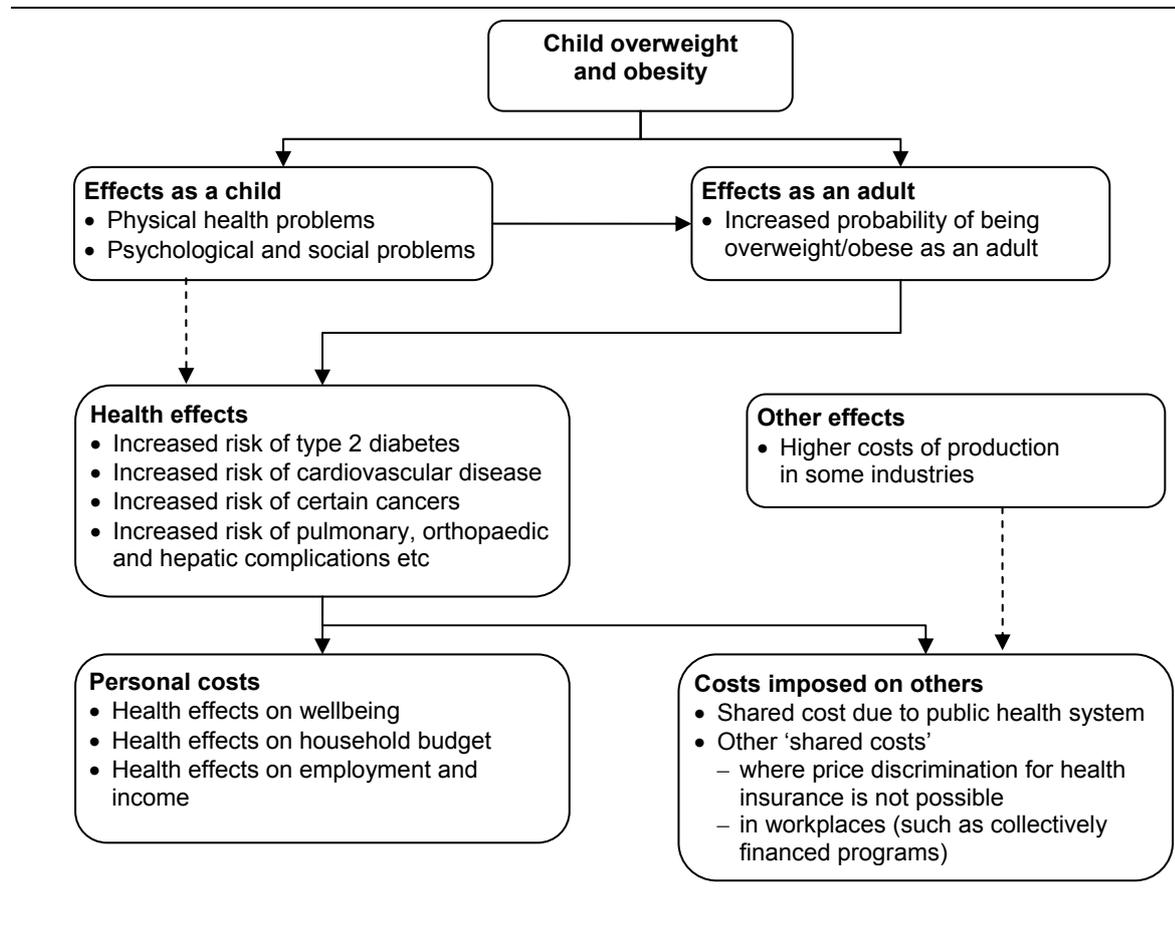
The costs of obesity will vary according to numerous factors including obesity prevalence, the health costs associated with treatment, and the severity of obesity related health consequences.

The economic costs of obesity can be viewed in various ways, including in terms of direct costs, intangible costs and indirect costs, or whether the costs are borne by the obese themselves or by others in the community (figure 2.2).

Direct costs are the costs to the community from diagnosis and treatment (WHO 2000). Direct costs relating to obesity and its consequences can include medical services, hospital-related costs, and personal health care costs (such as medication). Intangible costs are the effects on health and quality of life for the individual and others including family members. The obese tend to suffer more disability (morbidity) than others and die earlier, thus resulting in less wellbeing in aggregate.

Indirect costs are the loss of wellbeing and economic benefits to other members of the community through less goods and services being produced (WHO 2000).

Figure 2.2 The costs of obesity: is childhood obesity a public problem?



Indirect costs can relate to lost output as a result of reduced productivity (due to illness or early death). In the case of childhood obesity, indirect costs might include potential productivity losses incurred by parents (if they were required to spend more time as a carer) but not by the child itself (as generally they are not working). Nonetheless, the specific costs included in each category vary between studies.

Personal costs are those borne by the obese themselves, which in the case of obese children are also borne by their parents. Personal costs include those portions of medical services, hospital-related costs, and personal health care costs incurred by the individual, as well as lost wages. They also include more intangible costs associated with loss of wellbeing from outcomes such as not being able to engage in some physical activities they enjoy and social reactions to their weight.

Costs imposed on others (such as employers, government, and the rest of society) include the costs incurred by the rest of the community as a result of collectively financed programs such as medical costs, insurance and pensions (see earlier discussion under externalities). Costs to employers might include lost output or search and hiring costs to replace lost labour, and workers' compensation (depending on the degree to which employers can pass on costs through lower wages). Costs also include the cost of raising taxation revenue. However, not all costs are financial costs.

While there are substantial costs imposed on others from these pecuniary externalities, it is argued in section 2.2 that there are few pure technical externalities associated with obesity, unlike those related to some other health risk factors such as smoking (passive smoking) and alcohol consumption (violence or road fatalities).

Australian evidence

Estimating the costs of obesity is inherently difficult, as estimates rely on a range of assumptions, some of which may be more robust than others. Data limitations can also constrain the construction of estimates. These deficiencies should be considered when interpreting estimates of the costs of obesity.

There have been several attempts to estimate the costs of obesity in Australia. The Australian Institute of Health and Welfare (AIHW) and the Centre for Health Program Evaluation (CHPE) estimated the total costs of obesity were \$736 million in 1989-90 (cited in NHMRC 1997; DoHA 2009f). This estimate included direct costs of \$464 million and indirect costs of \$272 million (although not all obesity-related conditions were included in the analysis). DoHA (2009f) also cites a later, unpublished, study by Crowley in 1995-96, in which the costs of obesity were estimated at between \$0.68–1.24 billion. Colagiuri et al. (2010) estimated the annual total direct costs due to overweight and obesity (above the costs for normal-weight individuals) for Australians aged 30 years or older (based on BMI or waist circumference thresholds) was \$10.7 billion in 2005. Direct costs included health costs such as ambulatory services, hospitalisation, prescription medication and other costs including transport to hospitals, supported accommodation, home service and day centres, and purchase of special foods. Cost estimates were based on survey responses on health services use and expenditure, including medication use.

A recent report (Access Economics 2008) commissioned by Diabetes Australia estimates the total cost of obesity in 2008 as \$58.2 billion, which even after accounting for the time difference is much higher than that estimated by

AIHW/CHPE. However, part of the difference can be accounted for by the broader classification of costs adopted by Access Economics, including the loss of wellbeing by the obese. Access Economics' total cost estimate comprised \$8.3 billion of financial costs and \$49.9 billion in lost wellbeing.

The financial costs of obesity (adults and children) were estimated to include:

- direct health system costs (\$2.0 billion)
- productivity costs (\$3.6 billion)
- carer costs (\$1.9 billion)
- transfer costs (that is, the deadweight loss from the higher level of taxation) (approximately \$730 million)
- other indirect costs (for example, for aids, modifications and travel) (\$76 million) (box 2.3).

The most direct point of comparison between the AIHW/CHPE and Access Economics figures comes in the estimation of direct health costs, which AIHW/CHPE estimated to be \$464 million in 1989-90 and Access Economics estimated to be \$2.0 billion in 2008.

Access Economics' study included the costs of a broader range of diseases attributable to obesity. Both studies included type 2 diabetes, cardiovascular disease and breast and colon cancer. Access Economics also included costs from osteoarthritis and kidney and uterine cancer. Significantly, Access Economics estimated osteoarthritis accounted for 25 per cent of the direct health costs in 2008 (\$490 million). Further, Access Economics made different assumptions about the proportion of disease attributable to obesity. The differences could also be due to differing prevalence rates, the greater variety of health services now provided for treatment of obesity, and higher unit costs.

Access Economics had also estimated the costs of obesity at \$21.0 billion in 2005 (Access Economics 2006), less than half its estimate three years later. Significantly, the value of lost wellbeing in the 2008 study was almost triple the estimate for 2005 (\$17.2 billion). The differences in the Access Economics' estimates in the cost of obesity are primarily due to:

- changes in the method of valuing a statistical life (for estimating lost wellbeing) — the change in method alone increased the cost of lost wellbeing by 48 per cent
- an increase in the assumed proportion of key diseases attributable to obesity ('attributable fractions'). For example, in the earlier study it was estimated that 10.8 per cent of Type 2 diabetes is caused by obesity; this increased to 23.8 per

cent in the 2008 estimates. The updated attributable fractions are based on revised work from the AIHW (Begg et al. 2007).

Population growth, higher prevalence and cost increases also contributed to the higher estimated costs in the later Access Economics study.

Measurement issues aside, the Access Economics report highlights that the great majority of the costs of obesity are borne by the obese themselves. This occurs primarily through the loss of wellbeing (due to disability or shorter life span) but it also results from them sharing some of the financial costs. Overall, the obese bear 90 per cent of the total costs, and 30 per cent of financial costs (box 2.3).

Box 2.3 Access Economics' estimates of the costs of obesity

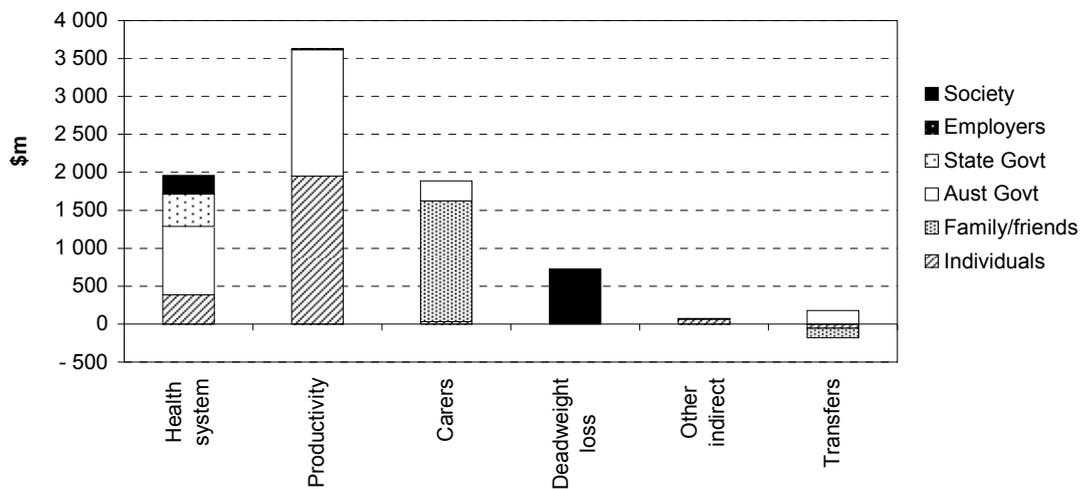
Access Economics estimated the total cost of obesity in Australia was \$58.2 billion in 2008. This estimate encompassed two types of costs: the 'loss of wellbeing' and financial costs.

The estimate of the cost of the loss of wellbeing (measured as the dollar value of the burden of disease — from disability, loss of wellbeing and premature death — excluding the financial costs borne by individuals) of \$49.9 billion, accounted for a substantial majority of the costs of obesity (86 per cent). This estimate was derived from multiplying the burden of disease attributable to obesity (in terms of disability adjusted life years) by an estimate of the value of a statistical life. These costs are borne by obese individuals themselves.

The estimate of financial costs of \$8.2 billion included health system costs (such as hospital and nursing home costs, GP and specialist services, and pharmaceuticals), productivity losses, carer costs, deadweight loss from transfers and other costs.

The estimated financial costs of obesity are borne, to differing extents, by obese individuals, their families and friends, governments, employers and society, as illustrated in below.

Financial costs of obesity, 2008



Source: Access Economics (2008).

The costs of obesity among children

While the preceding discussion suggests that the costs of obesity can be very high, there is little evidence on the costs of obesity among children. A US study suggests that the medical expenses of obese children are not greatly different from other children. Johnson, McInnes and Shinogle (2006) estimate that paediatric obesity

costs in the United States was \$127 million annually. However, they note that overweight children are likely to become overweight adults and that the economic burden of adult obesity is large.

3 Possible causes of overweight and obesity

The previous chapter examined obesity in an economic framework and the decision making about eating and energy use that could lead to an individual becoming overweight or obese. A range of individual, family-level and community-level factors will influence these decisions about eating and energy use by influencing the benefits and costs of each activity that are weighed up when making such decisions. This chapter looks at some of the evidence on these possible causes of childhood overweight and obesity. Understanding these possible causes is important for understanding what causes are amenable to policy influence.

As mentioned earlier, obesity is caused by an imbalance between energy consumed and energy expended, with excess energy stored as fat, and it has numerous health consequences (box 1.1, chapter 1). The increase in childhood obesity in Australia since the 1970s could be a result of an increase in energy intake, a decrease in energy expenditure or, more likely, a combination of the two. It is likely that some of the factors discussed in this chapter have changed over time, changing the value (or perception of value) of the benefits and costs of eating and exercising, leading to the increase in childhood obesity.

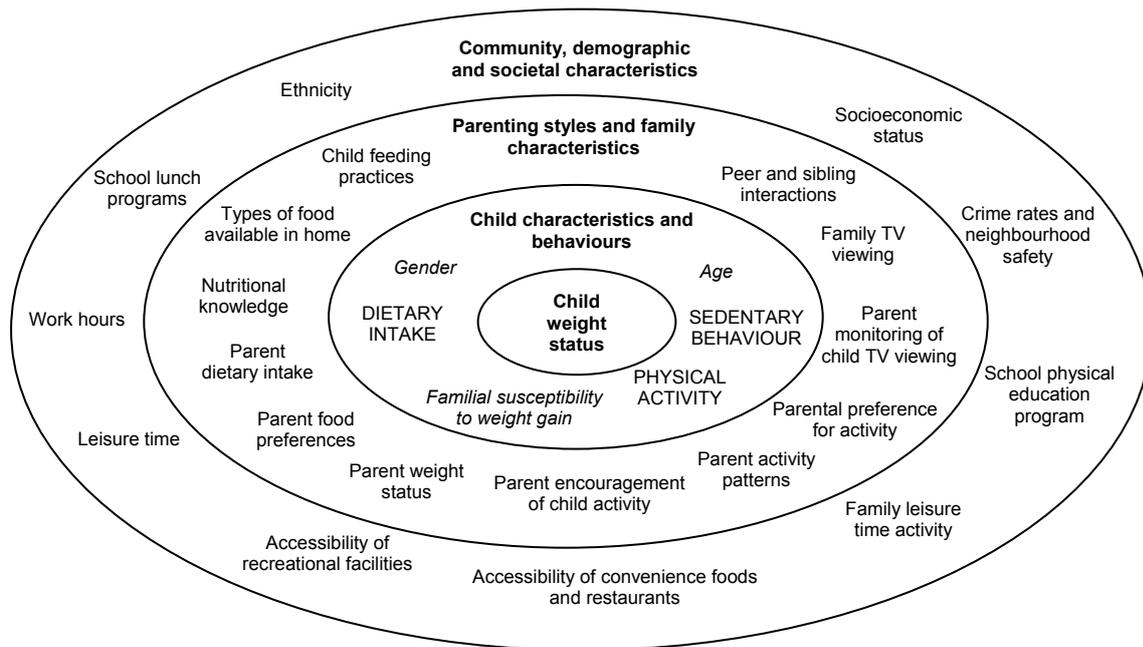
3.1 Framework for possible causes of overweight and obesity

We base our discussion of some of the possible causes of, or factors associated with, childhood overweight and obesity on the framework presented in Davison and Birch (2001) (figure 3.1). The framework sets out three main categories:

- ‘Child characteristics and behaviours’, which includes genetics (child characteristics) and behaviours such as dietary intake, physical activity and sedentary behaviour.
- ‘Parenting styles and family characteristics’, which can affect a child’s behaviour.

- ‘Community, demographic and societal characteristics’, which can influence both parents and families and children’s behaviours — advertising, socioeconomic status (SES), education, ethnicity and the physical environment are discussed here.

Figure 3.1 **Framework for factors associated with obesity and overweight^a**



^a Child behaviours (in upper case lettering) are associated with the development of overweight and obesity. Characteristics of the child (in italics) interact with child behaviours and contextual factors to influence the development of overweight and obesity.

Source: Davison and Birch (2001).

The factors in the outer layers affect those in the inner layers, culminating in the child’s behaviour. For example, SES might influence the types of food available in the home, which can influence dietary intake of children. Or crime rates and neighbourhood safety might directly affect the preparedness of parents to allow their children to partake in discretionary physical activity outdoors.

Much of the data and research presented in this section have limitations. Many studies use self-reported (rather than measured) data to measure some factors (such as dietary intake and physical activity) and rely on proxy measures, as many factors are difficult to measure precisely. Much of the research presented in this section is also cross-sectional in nature. While such research may suggest a correlation between the factor and obesity, the scope to make causal inferences is limited.

Table 3.1 summarises the overall findings of the Australian and international evidence in relation to each possible cause.

Table 3.1 Summary of evidence presented on factors associated with overweight and obesity

<i>Factor</i>	<i>Australian</i>		<i>International</i>	
	<i>Evidence</i>	<i>Studies included</i> no.	<i>Evidence</i>	<i>Studies included</i> no.
Child characteristics and child behaviours				
Genetics	None included	0	Association	14 ^{a,b}
Birth weight	Inverse association with central fat	1	Inverse association with central fat	3
Dietary intake	Ambiguous	2	Ambiguous	Unstated ^{a,b}
Soft drinks	Positive association	2	Positive association	Unstated ^a
Physical activity	Ambiguous	4	Inverse association	56 ^{a,b}
Sedentary behaviour	Ambiguous	3	Positive association	30 ^{a,b}
Parenting styles and family characteristics				
Parental body weight	Positive association	3	Positive association	3
Parenting style and behaviour	Ambiguous	1	Ambiguous	66 ^{a,b}
Mothers working hours	U-shaped association	1	Positive association	1
Family environment	Ambiguous	2	None included	0
Community, demographic and societal characteristics				
Advertising	None included	0	Ambiguous	Unstated ^{a,b}
Socioeconomic status	Ambiguous	7	Ambiguous	35 ^{a,b}
Ethnicity	Association ^c	3	None included	0
Physical environment	Ambiguous	6	Ambiguous	Unstated ^{a,b}

^a Included in sourced international reviews. ^b Includes Australian studies, some of which are discussed separately. ^c Some ethnicities may predispose an individual to being relatively heavier and others relatively lighter.

3.2 Child characteristics and behaviours

Genetics

A strong genetic basis exists for the development of obesity. Numerous genes have been linked with a predisposition to excess fat. At least six very rare mutations of single-genes causing severe early-onset obesity have been identified. In addition, there are also a number of rare syndromes that cause obesity, among other conditions, such as Prader–Willi syndrome and Bardet–Biedl syndrome (Baur and O’Connor 2004). In addition, an international review of twin and adoption studies found that genetics had a strong effect on Body Mass Index (BMI) variation at all ages, and the effect was stronger than that of environmental influences (Silventoinen et al. 2010).

However, biological factors alone, including genetic composition, are unlikely to account for the rise in obesity that has occurred since the 1970s, as it has occurred too quickly to be explained in evolutionary terms (Crawford 2002; Philipson and Posner 2008). It is more likely that the rise is due to changes in the social and physical environment (Baur and O’Connor 2004).

Birth weight

A child’s birth weight appears to be associated with childhood weight outcomes. An international review of the literature concluded that a consistent and positive relationship exists between birth weight and BMI in childhood (Parsons et al. 1999). Most of the studies included in this review used BMI as their indicator of body weight, but as discussed earlier (chapter 1), BMI does not quantify body composition and captures both fat and lean mass.

More recent studies have used measures of body weight that distinguish between fat and lean mass and have found that birth weight was positively associated with lean mass but not fat mass (Labayen et al. 2008; Wells et al. 2005). Other studies found an inverse association between birth weight and central fat (Dolan, Sorkin and Hoffman 2007; Garnett et al. 2001; Labayen et al. 2008; Oken and Gillman 2003). Central fat is associated with risks of cardiovascular disease and may carry more risk than total body fat (Oken and Gillman 2003). Other factors, such as SES, can influence both birth weight and later body weight (Parsons et al. 1999).

Dietary intake

Dietary intake contributes directly to energy consumed. Dietary intake in children may have changed over time, possibly contributing to the rise in childhood obesity in Australia. A number of factors may have influenced the financial and time cost of food consumption, leading to a change over time. First, agricultural and food processing innovation may have led to reductions in both the financial cost of food, and the time cost for preparing food. Second, rising incomes increase the opportunity cost of the time spent preparing food. Third, increasing working hours also increases the time cost of preparing food (chapter 2).

The quantity of food consumed is not the only important consideration. The energy density of food is also important as different macronutrients (such as fat, protein and carbohydrates) contribute different amounts to energy intake. Also, fat, in particular, is stored more readily as fat in the body than other macronutrients (Davison and Birch 2001). Different macronutrients have different satiety effects that will promote or suppress additional dietary intake:

- energy density influences the palatability of food, which will influence consumption
- different macronutrients have different thermic effects, which will influence energy expenditure
- energy storage in the body will be influenced by food composition and the metabolic efficiency of fat (Rodriguez and Moreno 2006).

The recent National Children's Survey provides insights into dietary trends of Australian children (CSIRO and University of South Australia 2008a). Overall energy intake increased with age and the difference between males and females became wider as they got older. Just under half of total energy consumed came from carbohydrates for all age groups. Of this, sugars contributed more to energy intake in younger children, while starch contributed more to energy intake in older children. Dietary fat contributed just under a third to energy intake, with saturated fat contributing more than monounsaturated and polyunsaturated fat. Protein contributed about 17 per cent.

Cook, Rutishauser and Seelig (2001) found that 10–15 year olds in 1995 consumed significantly more energy than 10–15 years olds in 1985. In particular, they consumed significantly more protein, carbohydrates, starch, sugars, and dietary fibre. There was no significant change in intake of fat and cholesterol.

Considering the relationship between different aspects of dietary intake and weight in children in Australia, Magarey, Daniels, Boulton and Cockington (2001), in a

longitudinal study, found that fat intake was directly related, and carbohydrate intake inversely related, to subscapular (bottom point of shoulder blade) skinfolds. However, they were not related to BMI or triceps skinfolds. The authors concluded that macronutrient intake when young did not predict body fatness when older. Another Australian study, Sanigorski, Bell and Swinburn (2007), found significant positive relationships between daily servings of fruit juice/drinks and soft drinks and the probability of being overweight/obese. Surprisingly, children who consumed the highest amount of fruit and vegetables were also more likely to be overweight/obese than children who had consumed no fruit and vegetables the previous day. This result could be due to a number of factors, including overweight/obese children eating a higher overall volume of food, overweight/obese children positively changing their diet in response to their weight, or reporting bias being stronger in parents of overweight/obese children. There was no significant relationships between the proportion of overweight and obese and daily consumption of fast foods and packaged snacks.

An international review (Newby 2007) found that, overall, there is no consistent association between childhood obesity and most dietary factors. The evidence on the relationship between total energy intake and obesity was the most inconsistent, but there was some evidence to support positive relationships between fat intake, and consumption of sugar-sweetened drinks and obesity. However, several methodological weaknesses in the studies covered by the review could at least partly explain the inconsistent findings, including interaction effects with other factors not taken into account, underreporting of dietary intake, genetic influences, different growth stages and generalisability of studies.

Soft drinks

Soft drink consumption is likely to influence obesity. Evidence suggests that people do not compensate for the increase in energy consumed by drinking soft drink, and that soft drinks may provide insufficient satiety signals when compared with solid food (DiMiglio and Mattes 2000). In addition, soft drink consumption can stimulate appetite, as consuming high glycaemic carbohydrates can cause glucose levels to fall (Wolff and Dansinger 2008). Also, when processing soft drink the body may use less energy than when processing other food (lower thermogenesis) (Olsen and Heitmann 2009).

The most recent national Australian data (1995) on soft drink consumption are presented by Gill, Rangan and Webb (2006). They found that about half of all teenagers and 36 per cent of 2–3 year olds had consumed soft drink in the past 24 hours. More recent data for New South Wales for 2004 showed that almost

60 per cent of males and almost 40 per cent of females in years 6, 8 and 10 drank more than 250ml of soft drink daily (Booth et al. 2006). In addition, between 7–12 per cent of males and a smaller proportion of females drank more than 1 litre of soft drink daily (Booth et al. 2006). It appears that male children consume more soft drink than female children (Abbott et al. 2007; Booth et al. 2006; Gill, Rangan and Webb 2006), and soft drink consumption increases with age (Abbott et al. 2007; Gill, Rangan and Webb 2006).

Between 1969 and 1999, soft drink consumption by Australian adults and children more than doubled from an average of 47 litres per person per year to 113 litres per person per year (ABS 2000). A number of factors could explain this increase. First, increased availability of soft drinks, such as more vending machines, making it a relatively more convenient purchase. Second, a reduction in the relative price of soft drinks. Although Australian price data are not available, in the United States relative soft drink prices have decreased and consumption has increased over the past 20 years — soft drink consumption of 6–11 year olds roughly doubled between 1977–78 and 1998, and between 1982–1984 and 2000 the price of soft drinks increased by only 26 per cent, much lower than the overall consumer price index (80 per cent) and the price of fresh fruits and vegetables (158 per cent) (Sturm 2005).

A study conducted in regional Victoria (Sanigorski, Bell and Swinburn 2007) found that 4–12 year olds who consumed three or more servings of soft drink ‘yesterday’ were significantly more likely to be overweight/obese than those who consumed 0–2 servings. Another Australian study (Tam et al. 2006) examined the relationship between soft drink/cordial consumption in mid-childhood (average age 7.7 years) and BMI in early adolescence (average age 13.0 years). The results suggest that increases in soft drink/cordial consumption may have contributed to the development of adolescent obesity.

A large international meta-analysis (Vartanian, Schwartz and Brownell 2007) found a significant correlation between soft drink consumption and energy consumed. However, the average size of the effect was small for children. Evidence for an association between soft drink consumption and body weight was mixed, and was influenced by how body weight was measured. (The authors found that studies that received funding from the food industry on average reported smaller results.)

Physical activity

Physical activity affects children’s weight status through increasing energy expenditure. But it also links directly to children’s health outcomes — for example,

low physical activity in children may be associated with a higher risk of developing cardiovascular disease (Ruiz and Ortega 2009). In adults, physical inactivity and obesity have similar health consequences (Blair and Church 2004). Further, physically active, obese individuals have lower morbidity and mortality rates than those who are normal weight and sedentary (Blair and Brodney 1999). Research also indicates that moderate exercise can improve mental wellbeing (Fox 1999).

Deciding to undertake physical activity involves allocating scarce time and possibly money. For children, undertaking physical activity could be at the expense of studying, relaxing or other activities. How these activities are valued may have changed over time, potentially increasing the costs of undertaking physical activity, leading to reduced energy expended and increased obesity. In addition, concerns about safety and changes to the physical environment (section 3.4) may have also increased the costs of physical activity.

The National Physical Activity Guidelines recommend that children and adolescents aged 5–18 years undertake at least 60 minutes of moderate to vigorous physical activity every day (DoHA 2004a, 2004b). The recent National Children’s Survey found that physical activity guidelines were met by the majority of 9–16 year olds by most methods of measurement. Boys were more likely to meet the guidelines than girls, and older children were less likely to meet the guidelines than younger children (CSIRO and University of South Australia 2008a).

Many claim that physical activity in Australian children has decreased over time (for example, Waters and Baur 2003). However, the evidence and data surrounding physical activity in Australian children over time are sparse and patchy and overall do not point to clear trends. A national study found that organised and informal sport participation rose slightly from 59 per cent in 2000 to 62 per cent in 2006 (ABS 2006a). Further, Okely et al. (2008) found that both the prevalence and minutes per week spent in self-reported moderate to vigorous physical activity in NSW school children increased between 1985 and 2004 (by 12–20 percentage points and 135–175 minutes per week, respectively). However, a NSW study found that in 5–14 year olds the proportion that walked to school dropped substantially and the proportion that were driven to school rose substantially between 1971 and 2003 (van der Ploeg et al. 2008). In addition, some smaller longitudinal studies have observed declines. In a three year study, Cleland, Crawford et al. (2008) found that average moderate to vigorous physical activity was significantly lower three years later. Ball et al. (2009) also observed a decrease in physical activity over a three year period.

Australian studies have examined the relationship between physical activity and childhood obesity. Abbott and Davies (2004) found that physical activity levels

were significantly inversely associated with BMI and body fat. Another study, Ball et al. (2001), found that physical activity level was inversely associated with body fat in boys but not girls. However, Spinks et al. (2007) did not find a significant relationship. A longitudinal study that examined the relationship between the level of compulsory physical activity at school and overweight in childhood and 20 years later, also found no significant relationship (Cleland, Dwyer et al. 2008).

However, an international review found that 12 of 14 longitudinal studies and 25 of 42 cross-sectional studies identified a significant inverse association between physical activity and child and adolescent body weight (Trost 2005).

Sedentary behaviour

Sedentary behaviour includes activities that do not involve physical activity, and could include activities such as watching TV and playing computer/video games (also referred to as small screen recreation (SSR)), or other activities such as reading or studying.

SSR can influence weight outcomes in a number of ways. First, SSR may substitute for more physically demanding activities, reducing energy expended. Second, higher exposure to advertising may result in children choosing more energy-dense nutrient-poor foods (discussed later in this chapter). Finally, more energy-dense nutrient-poor foods may be consumed while engaging in SSR than might have been otherwise (eating as a secondary activity).

Sedentary behaviour may have increased over time due to technological change increasing the variety of SSR activities available, and possibly reducing the relative cost of undertaking SSR. Changes in SSR need to be considered in the decision-making framework discussed in chapter 2. Presumably children are to some extent making choices about the amount of time they spend on SSR after considering the benefits they obtain from it and the tradeoffs they are making.

A recent national survey (CSIRO and University of South Australia 2008a) found that the mean number of minutes 9–16 year olds spent on SSR was nearly double the national guidelines (DoHA 2004a, 2004b). Using the most generous criteria for meeting the guidelines, about a third of children met the guidelines on an average day. The majority of SSR time was watching TV and the mean number of minutes was lower for girls than boys. TV viewing peaked at age 12–14 years. The relationship with age appeared to differ with gender and the type of SSR.

Marshall, Gorely and Biddle (2005) reviewed international trends in TV viewing in youth between 1949 and 2004 and found that, while TV ownership increased

dramatically, TV viewing by youth who had access to a TV remained relatively constant.

Various Australian studies have attempted to estimate the relationship between SSR and weight. Wake, Hesketh and Waters (2003) found a significant cross sectional relationship between watching TV and BMI, but not for playing computer/video games and BMI. However, only 1 per cent of total BMI variance could be explained by watching TV. Bogaert et al. (2003) found no significant relationship between hours of watching TV and weight change in a 12-month study. Hesketh et al. (2007) found in a longitudinal study a significant relationship between SSR and BMI with an extra hour of SSR increasing the odds of being overweight three years later by 3 per cent. The causal effects appeared to go in both directions: higher BMI leading to higher SSR, and higher SSR leading to higher BMI.

Similar results have been found internationally. Marshall et al. (2004), in a meta-analysis, found a significant, but very small, positive relationship between different types of SSR and body fatness. They also found that TV viewing may displace more physically demanding pursuits.

3.3 Parenting styles and family characteristics

Parents shape the family and home environment for their children. Parenting styles and family characteristics can influence children's dietary intake and activity levels.

Parental body weight is often described as a predictor of obesity in children, both in their childhood and adulthood. This is not only due to the shared genetic characteristics between parent and child, which may cause a predisposition to being obese, but also shared attitudes and behaviours of parents with their children.

Australian literature indicates there is a relationship between parental BMI and their children's BMI in childhood and early adulthood. Magarey et al. (2003) found that mother's and father's BMI were shown to be significantly but weakly correlated with children's BMI in some age groups. Another Australian study found that children with overweight or obese fathers or mothers had consistently higher BMIs, and BMI in 18 year olds was significantly predicted by father's and mother's BMI (Burke, Beilin and Dunbar 2001). A study of preschoolers found that children with an overweight mother were nearly twice as likely, and children with an obese mother nearly three times as likely, to be in a heavier BMI category when compared with a child with a non-overweight mother (Wake, Hardy et al. 2007). Other international studies (Lake, Power and Cole 1997; Lee et al. 2006; Whitaker et al. 1997) have also found a relationship.

Parenting style and behaviour are also thought to influence their child's weight status. An Australian study using data on 4–5 year olds found no relationship between mothers' parenting behaviours and style and the odds of their child being in a heavier BMI category, but they did for fathers. For example, children with more controlling fathers had lower odds of being in a higher BMI category. A one point increase in paternal control reduced the odds of the child being in a heavier BMI category by 26 per cent (where control is measured as the frequency with which fathers reported parenting behaviours that set and enforced clear expectations and limits for their children's behaviour, on a Likert scale from 1 (never/almost never) to 5 (all the time)) (Wake, Nicholson et al. 2007).

In adults, education has often been linked to health outcomes, including adult obesity. Higher levels of education might provide greater access to health-related information and improved ability to handle such information, clearer perception of the risks associated with lifestyle choices, and improved self-control and consistency of preferences over time (Sassi et al. 2009). In Australia, an additional year of education was found to be associated with a lower chance of being obese in adulthood. There was no significant difference in the relationship between people of different ethnicity (Sassi et al. 2009). To the extent that higher levels of education provide parents with greater access to information and clearer perceptions of risks of obesity, it might influence their child's weight status as well. Education is also used as an indicator of SES status (discussed below).

An international review found causal evidence that parenting affects children's eating patterns. However, there was insufficient evidence to determine whether or not parenting affected childhood weight status via eating patterns (Ventura and Birch 2008).

Other literature on the influence of parents on childhood obesity has looked at the influence of maternal employment on overweight children. One study in the United States found that children were more likely to be overweight the more hours their mother worked per week. This study was conducted among higher SES families, despite these children being least likely to have weight problems (Anderson, Butcher and Levine 2003). The study found that if a mother in the top income quartile worked an extra 10 hours per week, the child was between 1.4 and 3.8 percentage points more likely to be overweight. A recent study in Australia of children at ages 4–5 years and 6–7 years found the children of mothers who worked part-time watched less TV and were less likely to be overweight than children of mothers who were not employed or who worked full-time (Brown et al. 2010).

An Australian study of 10–12 year olds (using data over three years) found family physical activity and sedentary environments influenced weight status, but results

differed by gender. Among boys, sedentary equipment in the home was associated with greater increases in BMI-z score. (A BMI-z score indicates the relativity of a particular BMI to the mean for that age and gender.) Among girls, sibling physical activity and physical activity items in the home were associated with greater decreases in BMI z-score (Timperio, Salmon et al. 2008).

Another Australian study of primary school students examined whether aspects of the family food environment were associated with weight status. Few significant associations were found. Nonetheless, among older children, more frequent dinner consumption while watching TV was associated with a higher BMI z-score and less frequent breakfast consumption and more frequent fast food consumption at home was associated with higher likelihood of being overweight (Macfarlane et al. 2009).

3.4 Community, demographic and societal characteristics

Advertising

Advertising on TV and other media is often cited as a potential cause of child obesity. Some evidence suggests that Australian children have in the past been exposed to more advertisements directed at them than in many other countries (Dibb 1996). Advertising is thought to influence childhood obesity through influencing children's preference for energy-dense nutrient-poor foods. A recent analysis of Australian TV advertising found that food advertisements made up 31 per cent of all advertisements. Of these, 81 per cent were for 'unhealthy/non core foods'. Overall, advertisements for 'unhealthy/non core foods' accounted for 25 per cent of advertisements between 7am and 9pm on weekdays. The most concentrated timeslot for 'unhealthy/non core foods' advertisements was the early morning timeslot on Saturday (Chapman, Nicholas and Supramaniam 2006).

The development of children's knowledge and understanding of advertising is related to their cognitive development and social maturation. As they age, children develop the ability to differentiate advertising and non-commercial content, and understand and interpret the persuasive intent of advertising (John 1999; Kunkel et al. 2004).

Although the ability to distinguish between TV shows and advertising starts to develop in the pre-school years (ages 3–4 years), this does not necessarily reflect an understanding of the intent and bias behind advertising, which does not usually emerge until ages 7–8 years. However, even if a child understands the intent and

bias of advertising, some research suggests that this knowledge has little effect on a child's desire for advertised products (John 1999; Kunkel et al. 2004).

What is the effect of TV food advertisements on knowledge, preferences, behaviours and obesity? According to Brand (2007), there appears to be evidence of a correlation between advertising and knowledge and preferences. Also, as noted earlier, a number of studies have found a link between TV viewing and obesity, but the size is usually modest and causation has not been established. In addition, it is difficult to isolate the effect of advertising from other factors that affect the TV viewing and obesity relationship, such as the sedentary nature of TV viewing. Carter (2006) has reached similar conclusions.

Socioeconomic status

Socioeconomic status (SES) is linked with obesity. SES is a measure of an individual or group's relative social and economic standing and ideally takes into account income, education and occupation. In Australia, there is a higher prevalence of obesity in low SES groups.

For example, if low energy-dense food were relatively more expensive than less healthy energy-dense food, it may be that low SES groups could not literally afford to be thin. In addition, as discussed in chapter 2, jobs in developed countries have become increasingly sedentary and, as a result, more people are now having to give up alternative pursuits to exercise.

Another explanation might be that being obese in adulthood results in less job opportunities if it affects an individual's ability to do their job, or if there is wage or job discrimination, suggesting a causal relationship from adult obesity to SES. However, there is evidence to suggest that, in Australia, the obese do not suffer a wage penalty (Kortt and Leigh 2009).

Research suggests a link between parent SES and the SES of their child in adulthood, and also a link between parent obesity and child obesity (Sobal and Stunkard 1989). If social mobility is limited, the relationship between SES and obesity may persist.

The recent National Health Survey found that children living in the area of greatest relative disadvantage had higher overweight prevalence, and more than twice the prevalence of obesity, than the least disadvantaged children (ABS 2009b). Many other Australian studies also find this relationship (Booth et al. 2006; O'Dea 2008; Salmon, Timperio et al. 2005; Wake, Hardy et al. 2007), although not all (Garnett

et al. 2005). Some find a link for one gender but not the other (for example, Booth et al. 2001).

An international review (Sobal and Stunkard 1989) found that in developed societies, such as Australia, the relationship between SES and obesity for both male and female children was weak and inconsistent. However, different measures of SES (for example, income or occupation) make comparing the results across studies difficult. A more recent review (Ball and Crawford 2005) studied the relationship between SES and weight change in adults and found that when occupational-based indices (for example, low versus high skilled occupations) were used as an indicator of SES, there was evidence of an inverse relationship for both men and women. The results were more inconsistent when education or income were used as an indicator of SES.

Ethnicity

Ethnicity is also often associated with obesity. The influence on obesity could be through cultural factors. For example, in many western cultures thinness is seen as the ideal and overweight is seen as undesirable, but in many other cultures this is not the case. The influence may also be genetic.

A recent national level survey found significant variation in obesity prevalence for different ethnicities. Pacific Islander and Middle Eastern/Arabic adolescents were most likely to be obese when compared with other adolescents. Anglo/Caucasian and Asian children of all ages were the least likely to be obese (O’Dea 2008). In addition, Wake, Hardy et al. (2007) found that Indigenous 4–5 year olds were 1.5 times more likely of being in a higher weight category than non-Indigenous children. The difference between Indigenous and non-Indigenous weight outcomes appears to be even more pronounced in adulthood (ABS 2006b). Other Australian studies have also found a relationship between ethnicity and obesity (for example, Booth et al. 2006).

These studies all used BMI as their measure of obesity. Evidence suggests that the relationship between percentage body fat and BMI in adults differs among people of different ethnicities, suggesting the general cut-off points for BMI might over or underestimate obesity for people of different ethnicities (Deurenberg, Yap and van Staveren 1998). If this is also true for children it may influence the interpretation of the results of these studies.

O’Dea (2008) also examined weight perceptions and found that there appeared to be a trend towards females of an ethnic background with higher prevalence of obesity

being less likely to perceive themselves as ‘too fat’ than other groups. This could support the idea that overweight is seen as desirable in some cultures.

Physical environment

The physical environment is another potential factor affecting childhood obesity through its influence on levels of physical activity. For example, it is argued that areas with parks and bike paths may facilitate physical activity among residents, whereas areas designed for motorised transport or with few facilities for physical activity, would not. In addition, the urban environment may influence eating habits, if the density and proximity of different food stores in an area affect relative costs and hence dietary choices. The physical environment has changed over time, and this has likely influenced changes in decision making related to dietary intake and physical activity, potentially leading to increased obesity.

While there is a growing body of research in this area, there are some study limitations. A lack of consensus exists on how to measure many environmental variables and the size of the area that influences an individual (Dunton et al. 2009). In addition, people will often spend time in multiple geographic areas, making it difficult to identify the environmental factors that influence an individual. For example, children will spend a lot of their time at home and at school. There is also a wide array of potential physical environmental factors that can be studied. Often the choice of variables is based on data available rather than any theoretical underpinning (Ball, Timperio and Crawford 2006). In addition, due to the design of many of the studies, the direction of the relationship cannot be determined. For example, it may be that, rather than living near a park resulting in people being more active, more active people choose to live near parks.

Australian studies have examined the prevalence of obesity in rural and urban areas. Booth et al. (2001) included data from three surveys and found that, while the prevalence of obese boys was greater in urban areas in two 1997 state surveys, there was no difference for girls. In addition, no relationship was found in the National Nutrition Survey data. However, in a different study, no relationship was found for males, but for females BMI and skinfolds had increased by a significantly greater amount in urban areas relative to their rural counterparts over a five-year period (Dollman and Pilgrim 2005). Several other studies (Dollman, Norton and Tucker 2002; Cleland et al. 2010) found no significant relationship.

Some Australian studies have examined the relationship between specific aspects of the physical environment and childhood obesity. Timperio et al. (2005) examined the link between perception of the local environment and childhood overweight and

obesity. They found that a parental view that there was heavy traffic in their area and concern for road safety was associated with higher overweight and obesity in older children; however, there was no relationship in younger children. Crawford et al. (2008) examined the association between childhood obesity and neighbourhood fast food outlets. This provided little support for the notion that exposure to fast food outlets in the local neighbourhood increased obesity. They found older children who had at least one fast food outlet within 2km of their home actually had significantly lower BMI scores. There was no relationship for younger children.

A recent international literature review found the association between the physical environment and childhood obesity was mixed and differed with factors such as age, gender, population density and SES (it also found that the association differed according to whether reports were made by the child or parent). For adolescents, obesity appeared to be related to urban sprawl, neighbourhood pattern and access to equipment and facilities. There was not sufficient empirical evidence to determine if a relationship existed between obesity and most of the environmental variables considered (Dunton et al. 2009).

Another review found no clear link between urban environment and childhood obesity. However, it did reveal that characteristics of the built environment have an effect on other factors, that in turn are believed to influence overweight and obesity — such as active recreation and ‘active transport’ (such as walking or cycling) (Sallis and Glanz 2006).

While the literature examining the relationship between the physical environment and obesity is quite small, the literature looking at the association between the physical environment and obesity-related factors, such as physical activity and healthy eating, is more expansive. Some Australian studies have looked at these relationships. Timperio et al. (2009) examined the relationship between availability of fast food close to home and on the route to school and children’s intake. They found that only availability of fast food within 800m of home was associated with intake, but it was an inverse relationship. Each additional outlet within 800m was associated with lower odds (3 per cent) of consuming take away or fast foods at least once weekly. This result is consistent with Crawford et al. (2008) (discussed above).

Timperio, Giles-Corti et al. (2008) examined the associations between public open spaces and children’s physical activity and found that overall, there were no clear relationships between many aspects of the closest public open space to where children live and their physical activity. Hume et al. (2009) conducted a longitudinal examination of environmental predictors of children walking or cycling

to school and found that most of the individual preference, social and physical environmental factors had no influence on active commuting over time. However, children whose parents were satisfied with the number of pedestrian crossings were more likely to increase their ‘active transport’, while this was more likely to decrease if their parents perceived there to be insufficient traffic lights.

Davison and Lawson (2006) conducted a review of the relationship between the physical environment and children’s physical activity and found that physical activity appeared to be related to recreational infrastructure, transport infrastructure, and local conditions. However, the findings were more mixed for recreational infrastructure and local conditions compared to transport infrastructure.

3.5 Summary and conclusion

Much of the evidence of the relationships between different possible factors and childhood obesity appears ambiguous. While it is easy to make a theoretical argument for how and why each of these possible factors can affect body weight, the evidence for many is at best limited, often mixed, and sometimes counter intuitive. Methodological and data limitations are also issues with many studies of childhood obesity.

The following broad conclusions are drawn from the literature.

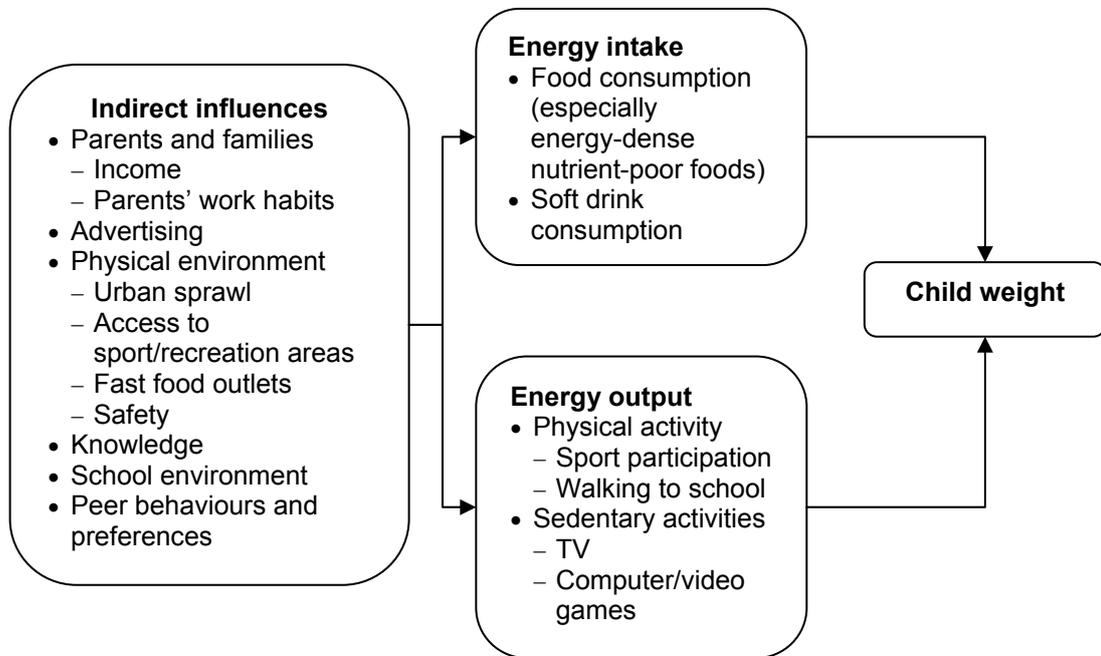
- Australian children’s energy intake appears to have risen since the 1980s, but in most cases the link between diet and childhood obesity is inconsistent. A notable exception is that soft drink consumption in Australia has increased dramatically over the past few decades (possibly in response at least in part to declines in real prices), and Australian studies have shown a link between soft drinks and childhood obesity, making this potentially a promising area for policy attention. However, the international literature is mixed and suggests the relationship is small.
- The relationship between physical activity and obesity may be stronger than for many of the other factors. While organised physical activity in children may not be decreasing, it appears that incidental exercise, such as walking to school, has declined. Further, many Australian children undertake more SSR than recommended by health authorities (potentially at the expense of physical activity). However, the Australian and international evidence suggests that, while there appear to be relationships between different types of SSR and obesity, they appear to be small.
- Parents with high BMIs tend to have children with high BMIs, but this does not say much about causality. Genetics is important, but so are parenting styles and

family characteristics. Eating patterns, such as eating in front of the TV, the working status of mothers, and the degree of parental control may all be important factors.

- Australian children are exposed to a relatively high number of advertisements for energy-dense nutrient-poor foods. But while international research indicates that there is a link between advertising and knowledge and preferences, it is difficult to discern a relationship between advertising and body weight.
- There is a higher prevalence of obesity in Australian children from low socioeconomic backgrounds. However, the international evidence on the link between SES and childhood obesity is mixed. Ethnicity can also be an important influence.
- The physical environment is an area receiving increasing attention in the literature, but it is difficult to disentangle this influence from other factors, such as gender and SES. In addition, evidence on a relationship between the physical environment and obesity-related behaviours, such as eating and physical activity, is not strong. Of particular interest is the seemingly counter intuitive finding that proximity to fast food outlets (which decreases the travel costs associated with purchasing and consuming fast foods) appears not to be associated with obesity.

All the results of the studies looked at suggest that there is no single factor that leaps out for attention. Some factors directly influence energy consumed or expended, while others act indirectly on childhood obesity (figure 3.2). The poor evidence, and the complex interactions between these many factors, warrants a cautious approach to developing policy with an emphasis on experimentation and rigorous evaluation. Keeping in mind the considerable uncertainty that exists about many of these factors, the next chapter looks at policy levers that might be considered.

Figure 3.2 **Potential factors in the rise of childhood overweight and obesity**



4 Policy options for addressing obesity

In chapter 2 the possible rationales for government intervention to address childhood obesity were considered, including information gaps, pricing distortions and behavioural limitations. In this chapter the different policy instruments and factors that should be taken into account when considering alternative areas for intervention are considered.

This can be difficult because obesity occurs in a complex economic and social environment, which makes it hard to isolate and evaluate the effects of interventions. Multiple causes of obesity make the task more difficult because of the potential for interactive effects of various policies and for unintended consequences.

As for any policy intervention, clear specification of policy objectives is essential both to promote appropriate policy design and to facilitate assessment of its effectiveness (involving comparison with other policies). The primary goal should be to increase aggregate wellbeing of the community, taking into account all of the benefits and costs (financial and other), with the best policy option being the one that generates the highest net benefit. The benefits of childhood obesity interventions include the enhanced wellbeing of those obese children whose weight is reduced. The costs include the resources consumed in developing, delivering, monitoring and evaluating the intervention and the efficiency costs of raising revenue (discussed in box 2.2 in chapter 2), and the costs the intervention imposes on others.

Interventions that have the best likelihood of achieving this overall goal will need to be effective, feasible, and have limited unintended consequences. Policy effectiveness will be enhanced by addressing policy objectives as directly as possible, and flexible policies will be more effective under changing circumstances. Feasible policies will be consistent with current legislation and other policy settings, and within the constitutional powers of the jurisdiction involved. For example, State Governments do not have the constitutional powers to tax energy-dense nutrient-poor foods. The risk of unintended consequences will be minimised by matching the instrument to the objective as clearly as possible. This can involve carefully targeting the group that give rise to the social cost, and avoiding those consumers where the policy imposes undue costs, or targeting the foods that give rise to the costs. For example, in the United Kingdom, a regulatory ban on fat,

sugar, and salt in fact unexpectedly reduced the availability of cheese and yoghurt — foods that are valued for their nutritional content.

Because people might value incremental gains or losses differently, the effects of policy measures on different groups might need to be considered. For example, taxes on foods can be regressive (they affect lower income groups more significantly) (Chouinard et al. 2007). But matters of equity and fairness are difficult to assess as they are inherently subjective and perceptions about them vary.

4.1 Potential policy measures

A variety of policy mechanisms can be aimed at directly or indirectly influencing childhood obesity. These mechanisms may include price instruments (such as taxes or subsidies) that seek to change the incentive structure for decision making, measures that seek to make consumers better informed (education and information), or regulatory measures that influence consumer or producer choices.

Relevant obesity-related policy instruments, although not mutually exclusive, can be categorised as follows:

- taxes and subsidies to affect relative prices
- information
- regulation to constrain production or consumption, or enforce particular behaviour.

As obesity results from an imbalance between ‘energy in’ (food and drink) and ‘energy out’ (the energy used to live and undertake physical activity), and not the simple consumption of food, policy instruments may be needed to address each side of this ‘energy equation’.

Discussion of the specific detail surrounding these policy measures is presented below. The effectiveness of policies may depend on whether they target both parents and children. For example, a policy that targets not only children but their families may be more effective if families play a significant role in influencing or controlling food consumption choices. A list of the potential costs of such measures is presented in box 4.1.

Box 4.1 Assessing the costs of policy interventions

Different policy options to address childhood obesity have different costs to government, business and individuals, and different scope for unintended consequences. Further discussion of the costs of policy interventions can be found in the Best Practice Regulation Handbook (Australian Government 2007).

Costs to government can include:

- set-up and implementation costs
- administration costs
- enforcement costs.

Costs to business can include:

- administrative costs ('paper burden') — such as the cost of reporting to government
- fees and charges levied by government (which may offset some of the costs to government)
- changes required in production, transportation and marketing procedures (including training of staff)
- loss of sales revenue — this could be offset by higher sales for other businesses
- costs associated with doing business in multiple states — where there are inconsistent and/or duplicate requirements
- restricted access to markets.

Costs to individuals can include:

- loss of choice
- compliance and participation costs
- risk associated with the intervention being changed or withdrawn
- higher prices of goods and services (including where the costs to business are passed on to the consumer, offsetting some of the costs to business).

Unintended consequences can include:

- distributional effects
- prejudice and stigma
- reduced consumer vigilance ('lulling' effect)
- information overload
- adoption of unhealthy lifestyle habits (for example, extreme dieting)
- poorly targeted taxes may adversely affect demand for goods that might not have adverse health consequences.

Taxes and subsidies

Weight-related consumption decisions, made by parents on behalf of children or by children themselves, may be influenced by prices (see section 2.1 in chapter 2). Taxing or subsidising certain foods (and drinks) is one possible way to attempt to reduce obesity. For example, Taiwan is currently planning to introduce a tax on ‘junk food’. The Bureau of Health Promotion is drafting a bill that would see a special tax on foods containing high quantities of sugar and fat, and on alcoholic drinks (*The Age* 2009).

Taxes can shift preferences away from consumption of certain goods or services, and subsidies can direct preferences towards certain goods or services. For example, a tax may be introduced on energy-dense nutrient-poor foods or a subsidy provided on fresh fruit and vegetables, or in the case of physical activity, a subsidy to increase children’s participation in sport.

Taxes and subsidies on specific goods or services can be a useful tool for addressing significant externalities (negative or positive). From an economic efficiency perspective, an ideal tax aimed to correct for market failure would be set equal to the difference between private and social costs. In the case of smoking, for example, the ideal tax would be set just equal to the marginal externalities associated with smoking, so that the smoker would face the full social costs of smoking. As a result, the subsequent consumption level chosen by the individual would be the socially optimal level of smoking. However, as discussed in chapter 2, there are limited externalities associated with obesity, which can usually be dealt with in low cost ways (such as through passengers moving or adjusting their seating position to address loss of personal space), suggesting taxes and subsidies are not justified on externality grounds.

Implementation issues

To be practically implemented, criteria for determining which goods or services to tax or subsidise would be required. The ease or difficulty of such a task, as well as the effectiveness of the resulting policy, depends on how well defined the links are between the target of the tax and obesity.

Food is a necessity good, and its consumption only results in obesity in some situations. In the case of healthy children with well balanced diets, most, if not all, foods might be ‘healthy’, but for obese children, food high in fat content may be unhealthy no matter what nutrients it contains. The efficiency losses of reducing food consumption by low-risk individuals could outweigh the efficiency gains of reducing food consumption of obese individuals. Also, obesity may arise from

consuming large amounts of food, rather than consuming particular types of food deemed unhealthy and therefore taxable.

Particular foods could be taxed (for example, doughnuts) or, instead, foods with particular characteristics (for example, foods high in sugar). It might be relatively simple to tax well recognised categories of food that play little useful role in nutrition rather than the underlying characteristics of those foods, but this might have unintended consequences (Jacobson and Brownell 2000). For example, taxing an underlying characteristic such as high fat could tax nuts, which have nutritional benefits as well.

For a food tax to improve community wellbeing, policy makers would need to measure the amount of obesity-related social costs attributed specifically to certain foods, compared to other obesity-related consumption or behaviours (such as sedentary lifestyle). Further, any tax considerations would be further complicated if the relationship of costs to consumption is nonlinear. Strnad (2005) observed that for food consumption, at extreme levels (low and high), an additional unit of consumption would likely generate very little increase in disease risk. On the other hand, individuals with medium-level food consumption likely have a higher marginal increase in disease risk for each additional unit of food consumption.

In addition, taxing an energy-dense nutrient-poor food could be a cumbersome way of trying to curb consumption of energy content (such as fat) and may become redundant if changing tastes or changing technologies lead to use of different ingredients. A targeted tax, such as a per kilojoule or per unit of fat tax, may be more appropriate, as obesity and its consequences are more closely correlated with the food itself rather than the cost of food (Freebairn 2010).

The effectiveness of taxes or subsidies will depend on the purchaser's (parent or child) responsiveness to changes in price (consumer price elasticity of demand), and if there are substitute goods available (see section 5.1 in chapter 5). In some cases demand for certain goods will not be responsive to changes in price, meaning that taxes or subsidies will have little effect. A good example (Access Economics 2006) is tap water. In Australia tap water is an essentially free and healthy drink, but its near zero price does not necessarily induce people to drink it rather than more expensive and less healthy alternatives, such as soft drink. Several studies indicate consumers have limited responsiveness to food taxes as a general rule, but with some exceptions (see section 5.1 in chapter 5).

Taxes on energy-dense nutrient-poor food affect consumer demand in two ways — demand for all goods typically falls as purchasing power falls (income effect), and demand for non-taxed food items increases as consumers substitute other foods

(now relatively cheaper) for the newly taxed energy-dense nutrient-poor food (substitution effect). Taxes on foods tend to disproportionately burden the poor (they are regressive) (Chouinard et al. 2007), as food costs make up a higher proportion of household expenditure and consequently the income effect for them is likely to be greater than for others. Taxes on foods may also impose costs on low-risk individuals that moderately consume those foods.

The distribution of costs and benefits resulting from, say, a food tax may also influence the acceptability, and therefore feasibility, of some policies. Internationally, many food taxes have been withdrawn after short periods of time due to industry pressure and popular concern (Caraher and Cowburn 2005).

Information

Effectively functioning markets require information so that people and organisations can make informed decisions. In some cases, for example, parents may not be aware of the health risks associated with the food their children eat. Alternatively, parents may lack the time or cognitive ability to comprehend that information, or consider such an investment in understanding is not warranted by the potential rewards of more informed choice.

Food producers generally have greater access to relevant food product information, and greater certainty about its content than consumers. Further, consumer and producer interests in information may not align. Policies that aim either to increase information, improve the quality of information available, or improve access to information can help people to make informed decisions, according to their own preferences and in their own best interests.

Governments can assist in addressing information deficiencies either through directly providing information (such as pamphlets with nutritional information) or by encouraging (or requiring through regulation) the provision of better information (such as the fat content of food) by businesses or others.

Depending on how it is framed, providing information may have little effect on relative prices and hence be less distortionary than other measures (such as bans on certain products, which reduce choice for everyone). At the same time, it has negligible impacts on those consumers who already make better-informed choices (or for whom such products do not involve health effects).

In the case of labelling, in addition to the administrative costs imposed on government, labelling can impose costs on firms. Costs to firms of food ingredient

labelling would include testing food content as well as the labelling itself (which are likely to be passed on to consumers).

Labelling of food can be simple or detailed and can help disseminate information about products. Labelling by businesses may be introduced either through voluntary means or through regulation (mandatory labelling).

Information provision or education components are common among many obesity prevention interventions targeted at children.

One example of an intervention that includes information provision is 'Get Up & Grow'. This Australian Government funded strategy includes non-mandatory healthy eating and physical activity guidelines for early childhood settings, such as centre-based care, family day care and preschools (DoHA 2009c). The guidelines, aimed at directors/coordinators, staff/carers, and families cover healthy eating (including guidelines on breastfeeding, composition of diet and eating breakfast) and physical activity (including how much active play and sedentary behaviour that children under five years of age should undertake). They encourage childcare and preschool providers to enforce their own guidelines on healthy eating and physical activity, and encourage providers to help parents to make decisions in relation to healthy eating and physical activity when the child is at home.

Other possible interventions include information and guidelines to control children's eating environment. A body of evidence suggests that the eating and food environment can have important effects on our food consumption decisions (chapter 2). Guidelines might encourage schools to have groups of children sit together to eat their lunch, and adjust the size and content of the eating groups to regulate how much children eat (Just 2006).

Other examples of information provision relating to preventing obesity include:

- pamphlets with nutritional information provided to parents on contributory factors to childhood overweight and obesity
- social marketing campaigns that provide fact sheets and communicate the need for a healthy diet or physical activity
- education for parents on preparing healthy food
- voluntary labelling of particular characteristics of foods (for example, '99 per cent fat free')
- obesity education in schools.

Implementation issues

Information can be delivered in various ways (such as through information labels on products or through mass-media advertising) and the best format depends on a number of factors — do consumers generally take notice of labels or advertising campaigns? Do they understand the information, and will they act on it?

Consumers face vast amounts of information, which can create a ‘poverty of attention’. Also, providing more information to consumers can reduce the perceived need for precaution and lead to unintended consequences. New generations or new waves of consumers may not be ‘reached’ unless information strategies are implemented on a repeated basis.

Achieving behavioural change through providing information is likely to work best where it targets behaviour resulting mainly from ignorance, and where consumers are motivated to change once they have that information. Numerous social marketing campaigns have aimed to raise awareness of obesity, and improve lifestyle behaviours associated with obesity (refer to appendixes A and B for Australian policies aimed at addressing obesity in children). Despite this, a high proportion of Australian adults are overweight or obese, a high proportion of Australian *children* are overweight or obese, and half of the overweight Australians think they are healthy (Zurich Financial Services Australia and Heart Foundation 2008). But it is difficult to say how effective these campaigns have been — overweight and obesity prevalence might have been higher in their absence.

The insights from behavioural economics suggest that people may have cognitive limitations (chapter 2) that can limit the effectiveness of information (including labels), or that some ways of providing information may be more effective than others. Information may have limited effect for many reasons — for example, people have limited capacity to process information, even if they have access to it. As a result, policy measures, such as nutrition labelling requirements, can benefit from knowledge about consumers’ abilities to access and compute information. On the other hand, information provision can play an important role in countering distortions to consumer preferences. Australian evidence suggests that a third of consumers refer to labelling information on products when purchasing them for the first time, and referring to labelling was positively related to health consciousness (FSANZ 2008). Some evidence on the effectiveness of labelling is presented in chapter 5 (section 5.1).

Some research indicates that knowledge about health reduces the likelihood of an individual being obese (Nayga 2000), but there is mixed evidence relating to the effectiveness of health information on food consumption and diet. Downs,

Loewenstein and Wisdom (2009) found there is little evidence that information alone affects diet. Higher education appears to be linked to the use of nutrition labels (Kim, Nayga and Capps 2000 in Finke and Huston 2003). The motive to acquire specific nutrition and health knowledge seems to be linked to an individual's rate of time preference, illustrated by behaviours such as exercise, smoking and education (Huston, Finke and Bhargava 2002 in Finke and Huston 2003).

Regulation

Regulation encompasses a broad spectrum of interventions, ranging from self-regulation (such as industry codes of conduct where industry is solely responsible for enforcement), quasi-regulation (such as government-endorsed industry codes of conduct), co-regulation (where government provides legislative backing to industry arrangements), to explicit government regulation of activities (black letter law). Regulation might also require information provision by businesses or other third parties (discussed above).

Regulation may be more or less prescriptive. More prescriptive regulation can provide more certainty about outcomes but it is less flexible to accommodate different or changing circumstances than principles-based or performance-based regulation, which can enable businesses and individuals to choose the most effective way of complying. Principles-based or performance-based regulation often has greater overall benefits.

Examples of regulation relating to preventing obesity include (from those that are designed to inform choice to more 'heavy-handed' approaches that limit choice):

- mandatory labelling of foods (including nutrition information labels or warning statements) (information provision)
- self-regulation to limit children's exposure to unhealthy food and drink television advertising (box 4.2)
- banning television advertising of certain foods to children
- guidelines (where there is pressure from government to comply) to ban certain types of food and drinks from being sold in schools
- standards prohibiting certain types of food and drinks being sold in schools
- nutritional standards limiting the content of specific ingredients in foods
- nutritional standards controlling the types of foods that can be sold.

Box 4.2 **Self-regulation: the Responsible Children's Marketing Initiative**

The *Responsible Children's Marketing Initiative* is a self-regulation initiative of the food and drink industry. The Australian Food and Grocery Council developed the voluntary initiative, which began on 1 January 2009.

Companies participating in the initiative publicly commit to marketing to children under 12 years of age only when it will further the goal of promoting healthy dietary choices and healthy lifestyles.

Core principles include advertising message, use of popular personalities and licensed characters, product placement, use of products in interactive games, advertising in schools and use of premium offers (AFGC 2009). For example, under advertising message, signatories agree not to advertise food and drink products to children under 12 years of age in any media unless those products represent healthy dietary choices, consistent with established scientific or Australian government standards.

Signatories are required to develop and publish individual company action plans, which are subject to monitoring and review processes. Currently 17 companies are participating (AFGC 2010), including Nestlé, Kraft, Cereal Partners, George Weston, Coca-Cola, Pepsico, Cadbury, Patties, Campbell Arnott's, Unilever, Mars, Kellogg, Fonterra, Simplot, Ferrero and Sanitarium. The Advertising Standards Bureau manages the complaints process.

The Australian Food and Grocery Council will regularly monitor food and drink advertising to children, commencing after January 2010. It is also due to undertake a review of the initiative in 2010 (AFGC 2009).

A particular example of regulatory action is 'Fresh Tastes @ School', a NSW school canteen strategy. The strategy aims to encourage students to eat healthier foods, and is a mandatory set of rules regarding what NSW Government school canteens can sell. It has been in operation since 2005 (Healthy Kids Association 2010b; NSW Department of Health and NSW Department of Education and Training 2006). It uses the traffic light colours of red, amber and green to categorise different canteen foods. Green foods are 'fill the menu' foods, which should make up the majority of the canteen menu and be promoted to students as the best choice, amber foods are 'select carefully' foods, which should only be offered for sale on certain days of the week, and red foods are 'occasional' foods, which cannot be sold on more than two occasions in a school term.

Another example is legislation recently introduced in Japan, in response to concerns about rising healthcare costs, setting a maximum waist circumference — 85 centimetres for men and 90 centimetres for women — for all employees over 40 years old. Japan's obesity rate is under 5 per cent, although levels of obesity have risen over the past few decades and total healthcare costs are expected to

account for 11.5 per cent of gross domestic product by 2020. Employees undergo check-ups once a year and employees found to exceed the maximum waist measurement are required to undergo counselling. Companies are required to reduce their number of overweight employees by 10 per cent by 2012 and 25 per cent by 2015. If targets are not met, companies may have to increase their payments into a health fund for the elderly (Nakamura 2009).

Implementation issues

Regulation that reduces obesity will deliver benefits to society, but the net benefit will depend on the costs. The costs associated with regulations — those incurred by government, business and consumers — will depend on their specific nature and their complexity. Regulations will likely involve higher costs if they change the behaviour of some groups that are not the target of regulation, such as physically active children forced to do more sport at the expense of academic study.

Costs to government and business may be more where regulation does not reflect accepted commercial practices. Costs to consumers will depend on how much their choices and preferences are restricted — for example, their costs would be higher under a strategy that restricts the sale of energy-dense nutrient-poor foods than a non-mandatory strategy that encourages reduced consumption of such goods.

Were regulation introduced to restrict sales of certain foods, costs to business would include loss of profit from lower sales, although there may be offsetting gains from the sale of healthier alternatives.

Some arrangements will be more flexible than others. A strategy that allows, say, individual childcare and preschool providers to enforce their own guidelines would be more flexible than one prescribed by government, and would allow different providers to tailor strategies specific to their particular target group (such as children from different cultural backgrounds), and respond to changes that may impact its effectiveness.

Regulation can also have unintended consequences. Mandated changes that seek to reduce individual risk can have adverse consequences if they result in reduced consumer vigilance. For example, Viscusi (1984) found that the ‘lulling’ effect of child-resistant safety caps on aspirin and other drugs negated the otherwise desirable effect of reduced child poisonings, and may have lead to additional poisonings. Currie and Hotz (2004) explored the relationship between childcare regulation and accidental injuries. The authors found that where regulation was introduced, the risk of fatal and non-fatal injuries were significantly reduced for children in childcare, but that the increased expense discouraged some families

from using childcare and increased the risk for those children. Obesity relevant examples include the banning of certain foods in school canteens, resulting in falling profit, or possibly the development of black markets or absenteeism (which might be detrimental to the school and community in other ways).

The effectiveness of regulation aimed at children's eating habits is discussed in chapter 5 (section 5.1).

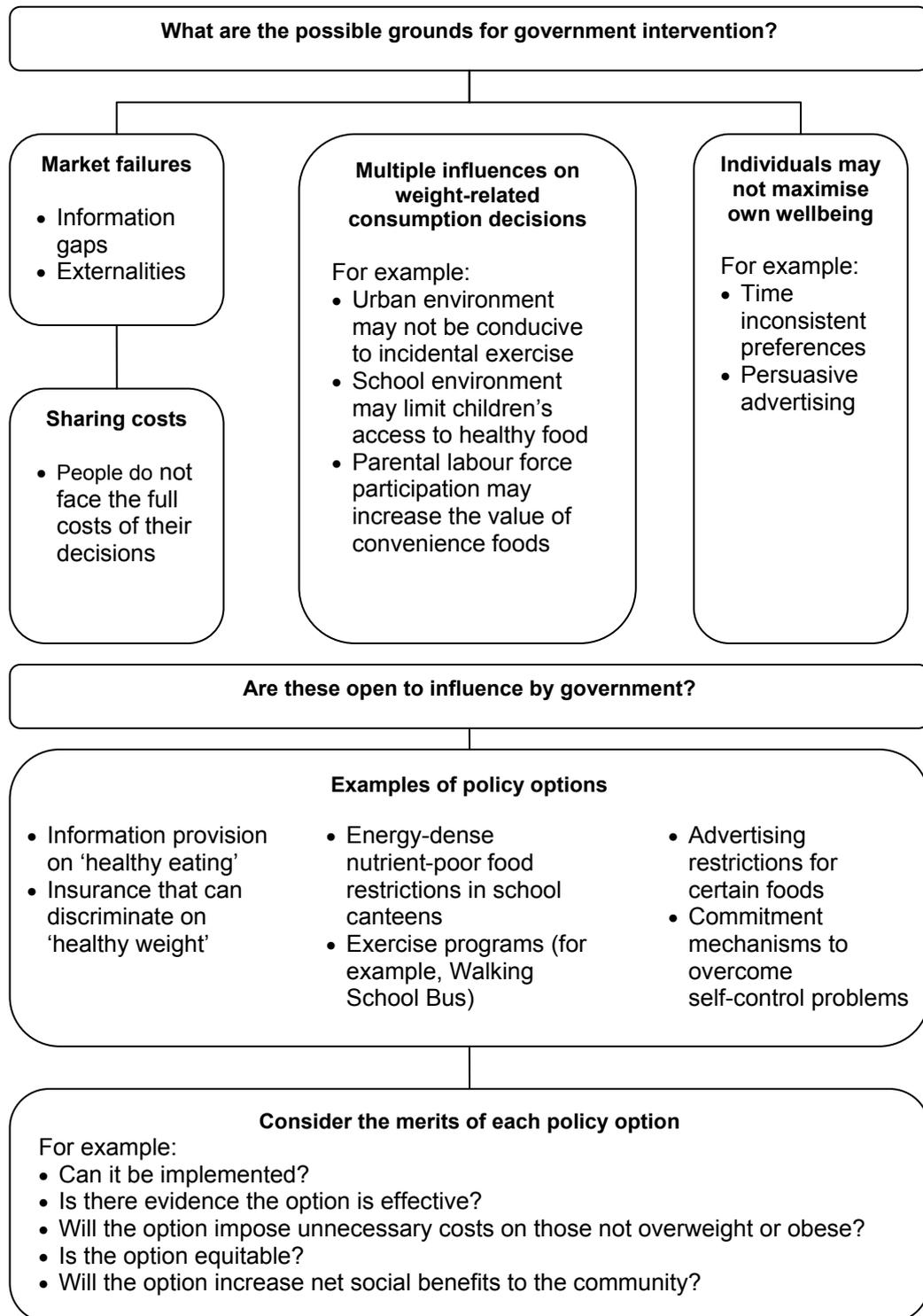
4.2 Summary

This chapter considered different policy instruments and the factors that should be taken into account when considering those alternatives, including their effectiveness (figure 4.1).

The considerable uncertainty about the causes of obesity suggests that hard interventions, such as taxes or subsidies on specific goods and services, would be difficult to justify. Further, the practical challenges of designing taxes on specific goods and services limit the likelihood of them being effective in addressing obesity (and may lead to perverse outcomes). Softer interventions, targeted at addressing information failure and education, appear to be on stronger ground. The complex nature of obesity suggests that multi-pronged strategies addressing multiple risk factors may be more effective than other strategies that focus on a single risk factor.

In the next chapter the evidence base on the effectiveness of past and present interventions to address childhood obesity is considered. Interventions include both targeted interventions conducted by government or others (mostly in school settings), along with broader, community-wide interventions (such as taxes on energy-dense nutrient-poor foods or television advertising bans). In the next chapter the following question is considered: how might policy makers best address the challenge of childhood obesity in the future?

Figure 4.1 **What is the scope for policy solutions to reduce childhood obesity?**



5 Effectiveness of obesity-related interventions

This chapter examines the evidence on the effectiveness of interventions designed to address childhood obesity (both overseas and in Australia). Interventions encompass both measures that target particular groups — whether conducted by government or others — along with broader measures that are rolled out at a community-wide level, such as social marketing campaigns or national television advertising bans (some of these broader initiatives are not just targeted at children), usually delivered by governments. Some implications for future interventions are presented.

5.1 The evidence base and obesity prevention

This section considers the effectiveness of obesity-related interventions, by examining international and Australian evidence. International evidence includes systematic reviews of trials that tested various interventions, along with research on other policy measures (such as advertising bans). Australian evidence includes the outcomes of various interventions, including trials and other studies and programs.

This section also examines methodological issues that may affect the reliability of conclusions drawn from the research. In assessing evidence associated with obesity interventions, it is first necessary to consider the concept of evidence and what constitutes good evidence.

Evidence-based policy

Central to evidence-based policy is the use of rigorous and tested evidence (box 5.1). Good evidence that assesses the effect of policy is required to ensure that interventions are effective and provide net benefits to the community. Some evidence is more relevant than others but can be difficult and/or costly to obtain.

Box 5.1 Evidence-based policy

- Evidence-based policy transparently uses rigorous and tested evidence in the design, implementation and refinement of policy to meet designated policy objectives.
- Features of good policy design and evaluation methodologies include:
 - carefully defining the policy problem and establishing clear objectives
 - developing a range of policy options drawing on a coherent framework of theory
 - using evidence to test those options, in a cost–benefit framework where possible
 - explicitly addressing the counterfactual, that is, what would have happened in the absence of the policy, and considering attribution issues and possible biases
 - examining direct and indirect effects on the economy and the community.
- The choice of methodology depends on the task and the type of evidence available. Hierarchies of evidence can be a useful screening mechanism when there are large volumes of evidence and a need to focus on the most robust. But governments face a wide range of policy problems, and there is no single ‘gold standard’ approach to evaluation that would work best in all circumstances.
- Evidence-based policy requires more than good policy formulation methodologies and data. It requires institutional frameworks that encourage, disseminate and defend good evaluation, and that make the most of opportunities to learn. Where evidence is incomplete or weak, good processes for learning, and for progressively improving policies, become even more important. Some of the institutional features that can assist include:
 - improving transparency
 - building in and financing evaluation from policy commencement
 - using sequential roll-out, pilots and randomised trials where appropriate
 - establishing channels to disseminate evaluations and share results across jurisdictions
 - strengthening links between evidence and the decision-making process.

Source: PC (2010).

Some study designs are more robust than others. This has given rise to the concept of an evidence hierarchy to rank evidence based on different research methods (for example, see Leigh 2009). Systematic reviews of randomised controlled trials (RCTs) are placed at the apex of the hierarchy. Such reviews use systematic and explicit methods to identify, select, and critically appraise research in a comprehensive and unbiased way. Lower down the hierarchy are before–after (pre–post) studies. In some cases, ‘higher’ level evidence will be difficult to obtain, and findings from less robust studies may need to be used as a means of shaping policy.

Effectiveness of interventions in other countries

Various systematic reviews provide an understanding of the success of obesity-related interventions in other countries (and sometimes in Australia), and a range of these focus on interventions that target children. Further research provides an assessment of the likely effectiveness of taxes, advertising bans and mandatory caloric labelling in fast food restaurants. Interventions include those delivered by government and other institutions.

The Cochrane review of childhood obesity prevention interventions

Summerbell et al. (2005) undertook a systematic review (update) of a large number of interventions for preventing obesity in children on behalf of the Cochrane Collaboration (which is generally regarded as an authoritative voice in systematic reviews in healthcare). The study included 22 interventions from 1990 to February 2005, of which 12 were short-term and 10 were long-term. The interventions reviewed included those designed to act on diet and nutrition, exercise and physical activity, and/or lifestyle and social support. Two interventions focused on dietary education (both long-term studies), 6 on physical activity (2 long-term and 4 short-term studies), and 14 on a combination of dietary education and physical activity (6 long-term and 8 short-term studies) (box 5.2). Although many interventions were not effective in preventing weight gain, they were more often effective at improving lifestyle behaviours.

Of the two long-term **dietary related interventions**, one focused on fruit and vegetable intake, and the other on reducing carbonated drink consumption. Neither intervention resulted in statistically significantly anthropometry (body measurement) differences between the intervention and control groups, although there was a reduction in self-reported soft drink consumption in the intervention group in one study.

Of the long-term **physical activity related interventions**, one focused on physical activity for kindergarten children, and the other on a physical education program with a self-management component. For the first intervention, at the short-term follow-up a reduction in obesity prevalence among the intervention groups almost reached statistical significance. In the case of the second intervention, small differences in Body Mass Index (BMI) for girls and boys were observed relative to the control group, although the statistical significance was not estimated.

Box 5.2 Interventions for preventing obesity in children (review)

Summerbell et al. (2005) reviewed 22 interventions that relate to preventing obesity in children. Studies were conducted in a range of countries, but most were US based.

Dietary related interventions — long-term studies

Interventions involving:

- increasing fruit and vegetable intake in US children (with at least one obese parent) to address weight (randomised controlled trial) (Epstein et al. 2001)
- reducing carbonated drink consumption in UK children (randomised controlled trial) (James et al. 2004).

Physical activity interventions — long-term studies

Intervention involving:

- a regimen of exercise for Thai kindergarten children (randomised controlled trial) (Mo-Suwan et al. 1998)
- a physical education program with a self-management component for school children (SPARK, randomised controlled trial) (Sallis et al. 1993).

Combined interventions — long-term studies

Interventions involving:

- a multi-component program addressing body fat in American Indian school children (Pathways, randomised controlled trial) (Caballero et al. 2003)
- a physical activity and nutritional program addressing obesity and promoting physical fitness in US school children (Donnelly et al. 1996)
- a physical activity, nutritional and sedentary behaviour program to reduce Body Mass Index (BMI) and triceps skinfolds of US school children (Planet Health, randomised controlled trial) (Gortmaker et al. 1999)
- a nutritional education and 'active breaks' program for children in Germany (KOPS, randomised controlled trial) (Mueller et al. 2001)
- a multi-disciplinary program targeting UK school children (APPLES, randomised controlled trial) (Sahota et al. 2001a, Sahota et al. 2001b)
- a 20 week physical activity and nutrition program for children in England, involving parents (Be Smart, randomised controlled trial) (Warren et al. 2003).

(Continued next page)

Box 5.2 (continued)

Physical activity interventions — short-term studies

Interventions involving:

- a 12 week physical activity program in the United States, involving dance (randomised controlled trial) (Flores 1995)
- a physical activity program for girls in the United States, with BMI at or above the 75th percentile (New Moves, randomised controlled trial) (Neumark-Sztainer et al. 2003)
- a physical activity program for fourth grade school children in the United States (randomised controlled trial) (Pangrazi et al. 2003)
- a six month education and monitoring program to reduce screen-based activity (randomised controlled trial) (Robinson 1999).

Combined interventions — short-term studies

Interventions involving:

- a program for African-American girls from middle-income families, involving day summer camp (GEMS, pilot randomised controlled trial) (Baranowski et al. 2003)
- a program for African-American girls from low-income families, some involving parents (GEMS, pilot randomised controlled trial) (Beech et al. 2003)
- a program for African-American girls from low-income families, involving dance and reducing television watching (GEMS, pilot randomised controlled trial) (Robinson et al. 2003)
- a program for African-American girls from low-income families, involving after school clubs (GEMS, pilot randomised controlled trial) (Story et al. 2003)
- a program for children in day care centres in the United States (randomised controlled trial) (Dennison et al. 2004)
- a 16 week home visiting intervention for young children (average age 21 months) (pilot randomised controlled trial) (Harvey-Berino and Rourke 2003)
- a Chilean program for children in grades 1 to 8 (Kain et al. 2004)
- a 12 week program for inner-city girls with African-American backgrounds, focusing on mother and daughter pairs (randomised controlled trial) (Stolley and Fitzgibbon 1997).

Source: Summerbell et al. (2005).

Of the short-term studies that focus on physical activity, two reported significant improvements to BMI, although Summerbell et al. (2005) noted the methodology appears weak in one of these. The other successful intervention used education, monitoring and reporting to reduce television and other screen-based recreation. It

reported a statistically significant reduction in BMI and all other measures of body fat. Because there was no assessment beyond six months, it is not known if the outcomes were sustained. Of the two other interventions, one used education, physical activity (such as kick-boxing, self-defence and water aerobics) and social support sessions to increase girls physical activity levels and improve nutrition, and the other promoted play behaviour, used teacher-directed activities and encouraged self-directed activities in girls and boys. Where neither reported significant reductions in BMI, positive changes in behaviours were reported (for example, in the first study, girls were significantly more active in some of the target groups compared to the girls in the control group).

Of the six long-term **combined dietary and physical activity interventions**, Summerbell et al. (2005) noted one as a ‘good quality’, school-based, ‘multi-component’, ‘multi-centre’ RCT, that included family involvement. Nonetheless, this intervention showed no significant differences in BMI (or other related measures) at the end of the three year intervention. Other similar interventions include one aimed at reducing energy, fat and sodium of school meals and increasing physical activity; one ‘high quality’ RCT among ethnically diverse school children aimed at reducing sedentary behaviour; and a multidisciplinary RCT that included modification of school meals. These reported respectively: no impact on obesity on follow-up; obesity reduced among intervention girls but not boys; and no differences in change in BMI between the intervention and control groups. However, in a number of these studies there were positive behavioural changes. For example, the multi-component study found reduced school lunch calorie intake from fat, and another reported improved fruit and vegetable intake (and an associated smaller daily increase in total energy intake) among girls.

Of the short-term combined studies, four are pilot studies and although all reported positive trends in anthropometry, the differences were not significant. Nonetheless, one study reported that on follow-up girls were consuming fewer sweetened drinks, and in another, several significant improvements in dietary practices were observed. The remaining four studies in this group also had some limited success for anthropometry measures. More promisingly, in one study, behaviours such as television viewing were significantly improved (the number of children watching more than two hours per day was lower in the intervention group), and in others, energy intake was reduced.

What do other reviews say about the effectiveness of targeted interventions?

Other reviews of childhood obesity-related interventions have come to broadly similar conclusions.

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- Micucci, Thomas and Vohra (2002) found that interventions were more effective at modifying knowledge than behaviour. They also found a dose response (the relationship between the amount of exposure and the resulting changes), in that effective interventions were longer in duration and had frequent ‘booster sessions’.
 - Thomas et al. (2004) noted that although some interventions found statistically significant improvements, most improvements were very modest.
 - Ammerman et al. (2002) found that interventions appeared to be more successful at positively changing dietary behaviour among populations at risk of (or diagnosed with) disease than among general, healthy populations.
 - Livingstone, McCaffrey and Rennie (2006), in their review of methodological issues, found a strong focus on short-term interventions, rather than longer-term, and the short time frame could limit their scope for changing body weight.
 - In a review of healthy eating interventions, French (2005) found that overall, school-based interventions that target food choice and eating behaviours have had positive results. Salmon and King (2005), in a review of physical activity interventions, found that school-based interventions that aim to reduce sedentary behaviours show promise and they have been found to prevent unhealthy weight gain (although they did not result in increased physical activity). These studies suggest that changing obesity-related behaviours is possible.

Effectiveness of community-wide interventions

The reviews above do not cover the full spectrum of obesity prevention policy tools (outlined in chapter 4). The reviews mostly tend to focus on interventions involving information provision, education, physical activity and nutritional programs. In this section we review the available evidence on the effectiveness of some community-wide interventions.

Food taxes and subsidies

Several studies indicate consumers have limited responsiveness to food taxes as a general rule, but with some exceptions. For example, Kuchler, Tegene and Harris (2005) estimated that demand for snack foods was unresponsive to price change (inelastic), after taking into account quality variation. Some more recent research indicates that relative price changes (between ‘unhealthful’ and ‘healthful’ foods) could only explain about 1 per cent of the growth in BMI and the incidence of being overweight or obese (Gelbach, Klick and Stratmann 2009). In addition, US research using individual-level data and data on state-level soft drink taxes found no

significant association between soft drink taxes and BMI (Powell et al. 2009; Sturm et al. 2010). In contrast, Mytton et al. (2007) found that a carefully targeted ‘fat tax’ could produce modest changes in food consumption (although this research did not extend to its effect on body weight). Furthermore, the effects of price instruments have been shown to be stronger for lower socioeconomic status groups than in other groups in the population (Smed, Jensen and Denver 2007). There is also some evidence that children respond to relative prices of low and high-fat foods (French et al. 1997).

Taxing particular foods can affect the consumption of other foods, with unpredictable health effects (Mytton et al. 2007). A US study of soft drink taxation found that the tax reduced soft drink consumption, but that the consumption of other high energy-dense drinks (such as milk and fruit juice) increased, resulting in no statistically significant reduction in overall energy intake (Fletcher, Frisvold and Tefft 2009, cited in Freebairn 2010).

A recent review (Powell and Chaloupka 2009) of empirical evidence on food and restaurant prices and weight outcomes found that when statistically significant associations were found between food and restaurant prices and weight outcomes, the effects were generally small in magnitude. In some cases, however, they were larger for low socioeconomic status populations and for those at risk of overweight or obesity. The authors concluded that small taxes (or subsidies) are unlikely to produce significant changes in obesity prevalence, although non-trivial pricing interventions might.

The effects of changes in food prices on demand for snacks have been tested in some school-based interventions. One study (CHIPS in French 2005) found that demand for lower fat snacks was responsive to price change, and a related pilot study found the demand for fresh fruit was also price responsive.

A recent seven-month study, exploring the effects of financial incentives (totalling US\$750 over the course of a year) on weight loss, suggests they might be effective, particularly if implemented over a long period (Volpp 2009). At 16 weeks, individuals in the incentive groups had lost significantly more weight than those in the control group. Although the incentive groups regained weight after the study’s completion, they remained at a lower weight than when the study began. The incentive plans were based on small, frequent rewards, which provided immediate and tangible feedback that made it easier for individuals to do in the short term what is in their long-term best interest. The results indicate that interventions that incorporate insights from behavioural economics (such as time inconsistent preferences, discussed in chapter 2) can be effective.

Bans on 'junk food' advertising to children

As outlined in chapter 3, Australian children are exposed to a relatively high number of advertisements for energy-dense nutrient-poor foods. This has led to many calling for a ban on advertising of these foods. Yet, while research shows that television viewing and childhood obesity are related, the direction of causation and the magnitude of the contribution of food advertising to obesity is uncertain. In addition, the link between television viewing and childhood obesity is very small (Carter 2006). While research shows correlations between advertising and children's preferences, there is no strong evidence of a causal relationship between advertising and children's food preferences and weight outcomes. It is also difficult to isolate the effect of advertising from other factors that affect the television viewing and obesity relationship, such as the sedentary nature of television viewing (Brand 2007).

If, as the evidence suggests, the link between television viewing and childhood obesity is tenuous, or at most small in magnitude, it is unlikely that banning the advertising of energy-dense food would significantly address childhood obesity prevalence (Carter 2006).

Where restrictions on television advertising of energy-dense nutrient-poor foods aimed at children have been implemented (Sweden, Norway, the Canadian province of Quebec and the United Kingdom), the evidence is inconclusive. In some places restrictions may have been undermined by a number of factors. For example, restrictions in Sweden and Quebec do not apply to advertising on foreign TV channels, and yet both source much of their TV from outside their jurisdiction. In addition, Sweden's regulations banned advertisements designed to 'attract the attention of children', and Quebec's bans applied to advertisements 'directed at children'. As a result, the intent of the advertising ban could be side-stepped by aiming advertising at people other than children. A lack of national obesity data in Sweden has also limited assessment of the effectiveness of the restrictions (Handsley et al. 2007; National Preventative Health Taskforce 2009).

Mandatory energy content on restaurant menus

Two studies have examined the effectiveness of mandatory posting of calories on menus in chain restaurants in New York, introduced in 2008. Using Starbucks data, Bollinger et al. (2010) found a decrease in calories per transaction, and a greater decrease for higher calorie consumption individuals. However, the decrease was largely driven by food purchases (rather than drinks), and there were no data on whether consumers increased calorie consumption elsewhere. The estimated effect was small in magnitude — the reduction in calorie consumption would reduce body

weight by 1 per cent, and this ‘back-of-the-envelope calculation suggests that average reductions resulting from calorie posting in chain restaurants will not by themselves have a major impact on obesity’ (p. 24). Another study of the same mandatory posting of calories policy (Elbel et al. 2009) found no significant change in calories purchased among adults using data from fast-food restaurants in low-income, minority New York communities.

Effectiveness of interventions in Australia

Most reviews of childhood obesity prevention strategies are international and as a rule they contain few Australian interventions. As a systematic review of all Australian interventions is outside the scope of this study, this section draws on some specific Australian interventions to provide a general indication of their effectiveness.

Interventions

Appendixes A and B list interventions in Australia to address childhood obesity. Appendix A includes interventions for which evaluation reports have been published and appendix B provides a stocktake of the remainder, based on publicly available information. They include research studies and programs that include children. They specifically include prevention-related interventions and exclude those designed to treat obesity. Due to the inconsistency with which organisations publicly release program information and the vast number of interventions that may indirectly affect obesity, it is unlikely to be a definitive list. Nonetheless, the appendixes contain more than 100 interventions. They mostly date from the mid 1990s, although one earlier cluster-randomised trial report is included (Dwyer et al. 1983). It is one of few Australian studies included in international reviews.

Most of the interventions include an education component (for example, nutritional education), and some more directly target behaviour by requiring participation in physical activity. Some interventions attempt to influence consumption of certain foods, for example by influencing school canteen menus or promotions. The funding sources for these interventions are varied and include Australian, state, territory and local governments. They include interventions with multiple components, and a small number of interventions focus on building community capacity.

Although few Australian interventions list obesity prevention among their stated objectives, they relate to obesity because they focus on at least one part of the ‘energy equation’, that is:

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- ‘energy in’
 - ‘energy out’
 - both ‘energy in’ and ‘energy out’.

These interventions include among their stated objectives enhanced physical activity and/or improved awareness of dietary effects (or improved diet), and are largely, although not exclusively, school-based programs.

The measured outcomes included in these interventions can be broadly categorised as:

- body composition
- level of fitness
- behaviours (such as physical activity levels or diet)
- cholesterol or blood pressure
- knowledge or attitudes.

This section examines the effectiveness of these interventions in improving these outcomes.

Attention has been focused on interventions that have been evaluated (appendix A). For the most part the authors’ own results summaries have been relied upon, but these may sometimes tell only one part of the story. The effectiveness of each identified Australian intervention to address childhood obesity (27 in total) is summarised in appendix A. Their comparability is limited by the diversity of the intervention components and measured outcomes.

Most of the target groups are school-aged children, but some programs extended to include family and the broader community. At least half of the interventions focused on primary school children. Fewer focused on high school children, and of these, half focused on girls only, one on boys only, and the rest on both girls and boys. Only one intervention targeted early childhood. Two social marketing campaigns that targeted the community more broadly are also included.

The evaluated interventions varied in their design. Included were two RCTs (pilot studies only), cluster-randomised controlled trials, quasi-experiments, and before–after studies. There were several interventions where data have been collected for one point in time only. Not all interventions were designed specifically to collect evidence of effectiveness. A few were policy programs such as social marketing campaigns that were more difficult to evaluate.

Only about one-third of the prevention interventions measured body composition outcomes, such as BMI or percentage of body fat. About one-half measured physical activity levels, and about one-third measured physical fitness. About one-third also measured dietary habits (behaviours). Three interventions measured cholesterol or blood pressure (factors that are linked to obesity and risk factors for long-term health outcomes associated with obesity, such as cardiovascular disease). About one-third measured knowledge or attitudes, such as beliefs regarding fruit and vegetable consumption. Fewer than one-third measured sedentary behaviour.

Very few interventions considered the potential for unintended consequences.

Few interventions included, or plan to include, a long-term follow-up evaluation to assess the sustainability of the effects of the intervention. Only one intervention included a (planned) economic evaluation.

The Australian interventions have been grouped according to whether body composition was measured or not.

Effectiveness of Australian interventions that measured body composition

Australian interventions that measured body composition results show mixed results and there has been limited long-term follow-up to assess sustainability of short-term outcomes. In some cases, however, these interventions have recorded success for other measured outcomes, such as level of physical activity:

- The Be Active Eat Well multi-strategy intervention (table 5.1) has received considerable media attention (Moynihan 2008). Be Active Eat Well was one of the first community-based interventions conducted in Australia to have an evaluation, and significantly, a long-term follow-up evaluation is apparently underway (long-term follow-up data was collected in 2009). This will include an economic evaluation. Key strategies included changing canteen menus, introducing daily fruit, reducing television watching, and increasing activities after school. It had positive (short-term) results for most of the body composition measures in the intervention group. The intervention group had significantly lower increases than the comparison group in some measures (such as waist circumference and waist/height ratio) over the period. However, BMI results were not statistically significant. The long-term results are yet to be reported.

Table 5.1 Be Active Eat Well

Description	The Be Active Eat Well intervention was a community capacity-building program, which combined nutrition strategies, physical activity strategies and screen time strategies in the aim of promoting healthy eating and physical activity in children in the town of Colac (Victoria).
Funding details	\$400 000
Methods	Design: Quasi-experimental Theoretical framework: Included ideas from determinants of health model, Social ecological model, ANGELO framework, Ottawa Charter and Jakarta Declaration. Number of intervention groups: 1 Number of control groups: 1 Follow up: At the end of the intervention, and a long-term follow-up is planned
Participants	Targeted children, their families and the wider Colac community Evaluation: <ul style="list-style-type: none"> • N (Intervention baseline): 4 preschools, 6 primary schools, 1001 children • N (Intervention post-intervention): 4 preschools, 6 primary schools, 839 children • N (Comparison baseline): 4 preschools, 12 primary schools, 1183 children • N (Comparison post-intervention): 4 preschools, 12 primary schools, 979 children Age: 4–12 year olds Sex: Mixed Ethnicity: Predominantly caucasian
Interventions	Setting: Schools and wider Colac community Provider: Research staff, schools, dieticians, local community Duration: 4 years, 2003–2006 Strategies: Nutrition strategies, physical activity strategies, screen time strategies
Outcomes measured	Body weight Waist circumference BMI Waist/height BMI-z score
Results ^a	The intervention group had statistically significant lower increases in body weight, waist circumference, waist/height ratio and BMI-z score over the period when compared to the comparison group. BMI increased over the course of the intervention in both the intervention and comparison groups with BMI increasing less in the intervention group, but the difference was not statistically significant.

^a Results adjusted for baseline variable, age and height at follow-up, gender, duration between measurements and clustering by school.

Sources: Bell et al. (2008); Sanigorski et al. (2008).

- Promising results were released recently for Romp and Chomp (table A.20), an early childhood intervention. In the intervention group, the proportion of children who were overweight/obese was reduced by 2.5 percentage points in

2 year-olds and 3.4 percentage points in 3–4 year-olds. While these results appear positive, there appears to be no plan for a long-term follow-up to assess their sustainability.

- The body composition changes for Switch–Play (table A.24), which focused on physical activity, varied across the (three) intervention groups subject to different programs. The intervention had a significant effect on BMI for the children subject to a combined behavioural modification and fundamental movement skills program, at post intervention and the 6- and 12-month follow-ups. This group was also less likely to be overweight/obese between baseline and post intervention and at the 12-month follow-up. There was no significant BMI effect for the other two intervention groups.
- The FILA program (table A.8), which focused on physical activity and diet, reported some success with respect to BMI (a smaller increase among the intervention group), waist circumference, and percentage body fat. This was a pilot RCT and of insufficient size to determine if ‘between group’ differences were statistically significant.

The results of some other interventions were less clear-cut.

- The Burke et al. (1998) (table A.3) health promotion intervention in Western Australia focused on physical activity and nutrition for higher risk children. The results were mixed (for example, some results showed different levels of success for males and females). Of the two intervention groups, girls (only) in the ‘enrichment program’ had improved subscapular skinfolds, immediately post-intervention, but these were not sustained at the 6-month follow-up. Body composition did not change for the other intervention group.
- The Vandongen et al. (1995) (table A.26) fitness and nutrition intervention had mixed body composition results across the intervention groups. Only females in the groups with a fitness component showed improved (decreased) skinfolds. It appears no long-term follow-up occurred to determine if these results were sustained.
- A much earlier physical activity related intervention (Dwyer et al. 1983) (table A.5) reported a significant decrease in skinfolds in the intervention groups, although no similar result for BMI was recorded. It appears no long-term follow-up occurred to determine if these results were sustained.

Effectiveness of Australian interventions that did not measure body composition

The Australian interventions that did not measure body composition outcomes varied in terms of objectives. Some focused on enhanced physical activity levels,

increased enjoyment or awareness of the benefits of physical activity, improved health knowledge and fitness, and improved dietary habits (for example, increased fruit/vegetable/water consumption) or awareness. The interventions varied in terms of outcome measures. Some included objectively recorded measures (such as actual physical activity), self-reported behaviours (such as subjects' own report of dietary habits), actual level of physical fitness, and self-perception (such as body image or knowledge). The interventions varied in terms of target population. Two national social marketing campaigns ('Get Moving' and the 'Go for 2&5' campaign) were included. Some aimed at primary school children and some targeted specific groups (such as children in economically disadvantaged areas, adolescents girls, or students from mostly non-English speaking backgrounds). They also varied in terms of study design, and include quasi-experimental designs, pre and post, one pilot randomised controlled trial, and a cluster-randomised controlled trial.

Some interventions showed more positive results for some measured outcomes than others. Selected examples are presented below:

- Engaging Adolescent Girls in School Sport (a pilot study), succeeded in enhancing the target group's enjoyment of physical activity and body image, but while levels of physical activity were higher than the control group, they declined during the period (table A.7).
- Learning to Enjoy Activity with Friends (LEAF) promoted physical activity, and found improved levels of activity among low-active members of the target group. However, there was no effect on levels of non-organised moderate-to-vigorous activity, or sedentary behaviours (such as computer use) (table A.13).
- Tooty Fruity Vegie Project, a long-term intervention, aimed at increasing children's consumption of fruit and vegetables. It resulted in improved fruit and vegetable consumption and improved knowledge and attitudes during phase 1. During phase 2, where there was no significant difference in children's vegetable consumption, there was improved fruit consumption (table A.25).

Effectiveness of community-wide interventions

There is little evidence of the effectiveness of other community-wide interventions in Australia, partly because other than general information and awareness programs, few have been attempted. For example, specific food taxes and mandatory energy content on restaurant menus have not been implemented in Australia (although Victoria recently announced it will introduce mandatory calorie content on menus for certain fast-food outlets in 2012 (VicHealth 2010)). The GST, introduced in July 2000, and its GST-free status of 'basic' food and drinks including fresh fruit and

vegetables, could provide important price sensitivity evidence but there appear to be no research studies on this (this may be because there is no reliable pre and post-data). A range of initiatives are in place to reduce children's exposure to advertising of energy-dense nutrient-poor foods and drinks (Australian Government 2010), including the *Responsible Children's Marketing Initiative* (box 4.2, chapter 4). However, there has been no evaluation on its effectiveness.

Study design and evaluation issues

A range of issues and shortcomings affect the robustness of reported results of the interventions to prevent obesity. Some international systematic reviews found methodological weaknesses in all studies under review. Some study design and evaluation issues included:

- In undertaking obesity prevention interventions, the reliability of results can be compromised as measurement of diet, physical activity and sedentary behaviours is difficult. Measures of variables such as diet and physical activity can be weak estimates of actual behaviour (Summerbell et al. 2005, Campbell and Hesketh 2007). Although objective measures of physical activity now exist, there is no equivalent objective measures of dietary intake (Livingstone, McCaffrey and Rennie 2006).
- Differences in ethnicities and socioeconomic position can also limit the generalisability of some studies (Campbell and Hesketh 2007). For example, an intervention that succeeds in reducing obesity in a well educated group, may not work on other groups.
- Few studies report on sub-groups (Ammerman et al. 2002 and Thomas et al. 2004), and few report on culture (Thomas et al. 2004). Also, average results can obscure relevant variations among the outcomes.
- Many studies are 'under-powered' (Summerbell et al. 2005). Power is the probability a study will conclude a statistically significant difference exists, when a real difference actually exists. For a given size of effect, studies with more participants have greater power. In some cases, the sample size of interventions is not always reported, so those undertaking a review of the studies cannot determine if results are significant (for example, Campbell and Hesketh 2007).
- Many of the studies included in the Summerbell et al. (2005) review have 'unit of allocation' errors and the results of these studies are 'likely to be misleadingly optimistic', as allocation was often by institution (such as school) but assessment was by individual child (p. 34). When participants are randomised by institution, outcomes between individuals can be correlated. Using children as the unit of

analysis when allocation is by school can result in overly narrow confidence intervals. If clustering is not taken into account, it may lead to false conclusions.

- Involvement in a trial alone can induce behaviour change. In many cases the control group is made aware of the study aims — such as through being weighed and their physical activity being monitored for comparison (for example, Summerbell et al. 2005). Results in the intervention group could therefore be underestimated — affecting the control group children’s diet and physical activity patterns in the same direction as those in the intervention group. Potential for selection bias in many studies was identified (Flynn et al. 2006, in Livingstone, McCaffrey and Rennie 2006), including unrepresentative samples.
- ‘Confounding bias’ is also a problem as some studies do not control adequately for relevant contributing factors such as parental weight status and socioeconomic status (Livingstone, McCaffrey and Rennie 2006).

5.2 Implications for policy

The apparent shortcomings of many policy interventions and the limitations of the assessment of their outcomes, to a large extent reflect the inherent complexity and the multiple causes of obesity itself. This complexity poses serious challenges for policy design and can confound attempts to measure the contribution of obesity prevention and reduction strategies. The mixed results of past and current interventions suggest that policy making in this area could benefit from improved data collection and new approaches to their implementation and design.

Policy makers in many instances face insufficient access to, or simply inadequate, data and information. Policy relevant data are important at every stage of the policy cycle, from identifying the policy problem, through assessing policy options, to ex-post evaluation of interventions. Population level data and intervention specific data need to be collected and presented consistently to enable robust comparisons. However, data can be costly to obtain, and interventions require appropriate funding allocation between the intervention itself and evidence gathering. Too, though, the information gathering and evaluation process can form part of the actions affecting outcomes, resulting in misleadingly optimistic results.

- Consistent data are lacking to fully understand childhood obesity prevalence in Australia, and data on obesity among Indigenous children are limited. For example, it was only the most recent ABS National Health Survey (ABS 2009a) that included measured child height and weight data.¹

¹ The National Preventative Health Taskforce (2009) recommended expansion of the national nutrition and physical activity survey, and for it to become a permanent five-yearly study.

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- Consistent data are not always collected at the intervention level (see methodological issues discussed earlier) to properly assess the effectiveness of the intervention.
 - Also, long-term follow-up evidence is necessary to understand the sustainability of any interventions, and data from randomised trials without long-term follow-up data may have limited use (Goode and Mavromaras 2008).

It is important to establish what actually works, on what target group, and take into account all the costs and benefits. Future interventions could be trialled, and include ex-post economic evaluations (for example, Summerbell et al. (2005) noted the lack of economic data and that cost effectiveness was not discussed in the studies under their review), before being rolled out more broadly. Even where interventions are found to be effective, the magnitude of their effect (such as the average reduction in BMI) should be taken into account.

In this respect, some recent developments are promising. The proposed Australian National Preventive Health Agency will, among other things, focus on building the evidence base. It will ‘collect, analyse, interpret, and disseminate information on preventive health’ (Australian National Preventive Health Agency Bill 2009), and the agency ‘will have responsibility for providing evidence-based policy advice ...’ (Wong 2009, p. 7227).² Also, the National Health and Hospitals Reform Commission has recommended a common national approach to the evaluation of all health interventions, involving the consistent evaluation of different interventions, including those in the area of prevention, allowing for informative comparison.

The design and implementation of interventions are critical. Numerous systematic reviews make clear the methodological problems associated with a large proportion of targeted obesity prevention interventions. Feasible interventions ideally should be accompanied by robust evaluations that address methodological weaknesses, and assist policy makers to identify effective childhood obesity prevention strategies.

In some cases, the practical challenges of designing effective interventions (such as taxes on energy-dense nutrient-poor food and drinks) significantly reduce the likelihood of them being feasible or effective.

Evaluations need to examine the impact on different sub-groups. Frequently, different sub-groups have different outcomes (for example, a number of different

Rather promising is the pending ABS Australian Health Survey that will include the National Aboriginal and Torres Strait Islander Health and National Health Surveys, and is planned to include body measurement data (measured and self-reported).

² At the time of writing, the passage through Parliament of the Australian National Preventive Health Agency Bill 2009 had been delayed by the Australian federal election.

reviews found different results for girls and boys), and interventions might be better tailored to the different groups (Micucci, Thomas and Vohra 2002). This also suggests that community-wide interventions may be more effective on some sub-groups than others.

In order to be effective, future interventions may need to be of greater length and intensity to successfully modify weight (Summerbell et al. 2005).

Some of these factors may be influenced by practical limitations, such as the particular nature of research project funding arrangements. For example, funding may not allow for interventions over longer periods, or longer term follow-up. The evaluation component of projects is important — the costs of not evaluating interventions can be greater if in the long run ineffective interventions continue or effective ones are ended — but costs can be substantial. For example, the support and evaluation component was at least 50 per cent of Be Active Eat Well project funds (Bell et al. 2008). Evaluation expenditure should be assessed in a cost–benefit framework, taking into account any potential wasted expenditure if the intervention proves ineffective.

Building supportive environments conducive to behavioural change appear to be important. Most interventions focus on short-term effects and behaviour change rather than body composition change. Interventions imposed on a community are less likely to influence behaviours than those that actively involve that community in their design and implementation.

Greater experimentation may be desirable. Australia’s federal system provides a useful model for experiment, enabling comparison and contrasting of alternative policies across state borders (such as restrictions on television advertising of energy-dense nutrient-poor foods aimed at children).

Policy design should include consideration of potential unintended consequences. For example, targeting a group with a disproportionately high level of obesity may make sense, but there is a risk of stigmatisation and marginalisation. For example, Dobbins et al. (2009) note this in the context of school-based physical activity programs. Care may need to be taken to ensure obesity-related interventions do not contribute to body image issues or eating disorders (O’Dea 2005). Studies included in systematic reviews appear to not identify underweight children (typically these are grouped with normal weight children), so it is not known if the interventions have unintended effects on these children. Van Wijnen et al. (2009) found that very few childhood obesity interventions investigate the effects of their programs on the psychosocial wellbeing of children and adolescents. There may be value in embedding obesity prevention interventions into existing broader programs that already target groups that are high-risk for obesity.

What works?

Although many past interventions to address childhood obesity have struggled to demonstrate effectiveness, there are some early signs that those that are community based, multifactorial, and long-term in nature may prove more effective. The authors of the Cochrane review (Summerbell et al. 2005) stated that the most promising interventions were underway and are yet to report findings, and that more recent studies are conducting trials with more attention to participant involvement and more comprehensive evaluations.

Several recent community-based interventions aimed at preventing obesity in children include these aspects in their design. In Australia, one is the Be Active Eat Well program (mentioned earlier, table 5.1). The intervention was designed and implemented by parents and local organisations (such as schools and community agencies). The strategy includes nutrition strategies, physical activity strategies and screen time strategies to promote healthy eating and physical activity. This long-term intervention ran for several years. As outlined above, the early results were promising, showing significant results for most of the body composition measures in the intervention group.

EPODE (*Ensemble prévenons l'obésité des enfants*, which translates to 'together, let's prevent obesity in children') is a community-based intervention launched in France in 2004. In each town the intervention is led by a committee, and suggestions are received for different community initiatives, activities and diets. Initiatives may include organising games at school playtime, walk to school groups, and learning about vegetables in the classroom. Children aged between 5 and 12 years have their BMI calculated annually, with overweight children, or children at risk of being overweight, being encouraged to see a doctor (Westley 2007).

Half of the towns showed a statistically significant decrease in overweight and obesity combined between 2005 and 2007. Although the results look very encouraging, there is no clear and reliable control group against which they can be assessed (Borys 2008; Westley 2007).

EPODE is in place in a large number of towns in France and has spawned similar interventions in Belgium, Greece and Spain (European Public Health Alliance 2008). Mexico is also launching a new campaign to address obesity, also based on the French model (*The Independent* 2010). Obesity Prevention and Lifestyle (see table B.55), a South Australian intervention, launched in March 2009, was based on EPODE (Hill and Lomax-Smith 2009).

5.3 Conclusion

The available evidence suggests that many interventions to prevent childhood obesity have not been effective in preventing weight gain to any significant degree, although they may have had greater success improving lifestyle behaviours generating other benefits (such as a healthier diet and increased physical activity). This is encouraging, and despite not improving children's weight, may improve their health and wellbeing. However, some of these interventions are very expensive, making it unlikely that their limited benefits outweigh the costs (table 5.2).

On balance, governments appear yet to find a way to effectively intervene to reduce obesity prevalence among children. This may be because, despite some understanding of the factors driving obesity, an effective response to such a complex problem is inherently challenging, or policy tools have been poorly designed (for example, interventions have not properly targeted the causes of obesity). Alternatively, effective policies may not be identified as such because of a lack of robust evaluation. In some cases, potentially effective policies may be being thwarted by institutions or other constraints.

This suggests the need for a measured, incremental approach to intervention in this area, with a focus on program evaluation to weed out ineffective and inefficient programs as well as to identify those that deliver net benefits. While data collection and evaluation can be expensive, pilot programs and trials can help to contain both program and evaluation costs. Successful programs can then be implemented more widely. Evaluation expenditure should be assessed in a cost–benefit framework, taking into account any potential wasted expenditure if the intervention proves ineffective (and that the evaluation itself may influence outcomes).

Where evidence on benefits remains limited and uncertain, a number of strategies can help ensure that interventions generate net community benefits:

- First, experiment with low-cost programs that have low risks of collateral impacts ('do no harm') or imposing undue costs on consumers (including cost increases passed on by producers).
- Second, for programs with potentially high costs, implement trials that allow evidence to be gathered. Even for lower cost programs, gradual roll out can allow continual evidence gathering and adjustment.
- Finally, evaluate to facilitate sharing and thus quicker adoption of successful approaches.

In summary, given the lack of firm evidence that childhood obesity prevention measures have been effective, policies should be designed based on cost-effectiveness, and implemented gradually, with a focus on evidence gathering, information sharing, evaluation and consequent policy modification. A greater commitment to evaluation, with a focus on methodological rigour, may produce more robust and conclusive evidence.

Table 5.2 Characteristics of different policy interventions to prevent childhood obesity

<i>Examples of policy interventions</i>	<i>Probability of success (improvement to body composition)</i>	<i>Costs to government</i>	<i>Costs to business</i>	<i>Costs to individuals</i>	<i>Scope for unintended consequences</i>
Information provision and education					
Public education on obesity	Low, but difficult to assess	Campaign costs	Insignificant	Insignificant	Limited, and no harm to children likely (provided it avoids adding to body image issues, weight stigma, prejudice or eating disorders)
Dietary and/or physical activity education for children	Low	Intervention costs (can be expensive if provided population-wide)	Insignificant (and could be beneficial for certain service providers)	Insignificant, but could have costs to low-risk children where intervention diverts resources from other areas of education	As above
Non-mandatory guidelines to control eating environment to discourage unhealthy eating in schools (for example, moving vending machines to less accessible areas)	Unknown	Administrative costs	Insignificant (but larger, the more effective it is, for producers of less healthy food)	Insignificant	As above
Mandatory labelling (for example, nutrition information for restaurant and takeaway meals)	Low	Administrative and enforcement costs	Compliance costs could be significant	Could be significant if costs to business are passed on to consumers	Possible, could reduce consumer vigilance ('lulling' effect)

(continued next page)

Table 5.2 (continued)

<i>Examples of policy interventions</i>	<i>Probability of success (improvement to body composition)</i>	<i>Costs to government</i>	<i>Costs to business</i>	<i>Costs to individuals</i>	<i>Scope for unintended consequences</i>
Taxes and subsidies					
Tax on energy-dense nutrient-poor foods	Low	Administrative and enforcement costs, may be offset to some extent by tax revenue	Possible, may be loss of sales revenue for sellers of certain foods, but overall there may be no loss (for example, if consumers substitute to healthier alternatives)	Could be significant, distorts choice for all, costs to low risk individuals may outweigh benefits to obese individuals	Possible, taxes on foods can disproportionately burden the poor
Bans and other forms of compulsion					
Banning television advertising of certain foods to children	Low	Administrative and enforcement costs	Possible, may be loss of sales revenue for sellers of certain foods, TV and advertising companies, but overall there may be no loss (for example, if consumers substitute to healthier alternatives)	Insignificant	Limited, and no harm to children likely
Non-mandatory guidelines for types of food and drinks sold in schools ^a	Low, but allows tailored strategies to target groups (unlike blanket prohibition)	Administrative costs	Possible, may be loss of sales revenue for sellers of certain foods, but overall there may be no loss (for example, if students substitute to healthier alternatives)	Could be significant, to the extent that schools restrict choice, costs to low risk children may outweigh benefits to obese children	Possible, could reduce canteen revenue (but overall there may be no loss) or increase absenteeism, but no harm to children likely

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Table 5.2 (continued)

<i>Examples of policy interventions</i>	<i>Probability of success (improvement to body composition)</i>	<i>Costs to government</i>	<i>Costs to business</i>	<i>Costs to individuals</i>	<i>Scope for unintended consequences</i>
Prohibiting types of food and drinks being sold in schools	Unknown	Administrative and enforcement costs	As above	Could be significant, restricts choice, costs to low risk children may outweigh benefits to obese children	As above
National standards controlling types of food that can be sold	As above	High administrative and enforcement costs	Significant, but overall costs to food industry depend on whether consumers substitute to healthier alternatives	Could be significant, restricts choice for all, costs to low risk individuals could outweigh benefits to obese individuals	Possible, could reduce the availability of some foods that are valued for their nutritional content

^a Although non-mandatory guidelines are voluntary, to the extent that schools adopt them they become bans on types of food and drinks sold in schools.

A Nature and results of evaluated Australian interventions

A number of Australian interventions address childhood obesity directly or indirectly by targeting diet and/or physical activity. This appendix includes Australian childhood obesity related interventions for which we have located evaluation reports. Most of the Australian interventions identified date from the mid 1990s. The studies and programs included here focus on prevention, rather than the treatment or management of childhood obesity. (Interventions for which no published evaluations were identified are listed in appendix B.)

The interventions in this appendix result from desk-based research and are based on publicly available information. Due to the inconsistency with which bodies publicly release program information, this is unlikely to be a definitive list.

The information is as complete as possible — information provided for some interventions is more detailed than others. In the case of funding details, funding organisations and funding figures may not reflect the complete picture. Where specific information was not able to be located, it is left blank.

Table A.1 Active After-schools Communities (AASC) program

Description	The AASC program aims to enhance the physical activity levels of primary-school students, provide increased opportunities for participation in physical activity, grow community capacity and stimulate local government involvement in structured physical activity. It provides access to structured after-school (3:00-5:30pm) physical activity for primary-school students.
Funding details	Australian Government – Building a Healthy, Active Australia: Some of \$90m
Methods	Design: <ul style="list-style-type: none">• Computer assisted telephone interviewing: Each cohort had pre- and post-data collected from parents of participating and non-participating children.• Web-based surveys with stakeholders: Each year (2005, 2006, 2007) data was collected from AASC participating children, schools, out-of-school-hours care staff, program staff and program deliverers. Theoretical framework: Unstated Follow-up: Up to 2 years after baseline
Participants	Targeted at primary-school students. Over 400 000 children have participated in the program since its inception. Up to 3250 schools and after-school care centres participate in the program. Computer assisted telephone interviewing: <ul style="list-style-type: none">• N (Cohort 1, 2005–2006, intervention group): 664 parents of participating children• N (Cohort 1, comparison group): 750 parents of non-participating children• N (Cohort 2, 2006–2007, intervention group): 635 parents of participating children• N (Cohort 2, comparison group): 695 parents of non-participating children• N (Cohort 3, 2007–2008, intervention group): 936 parents of participating children• N (Cohort 3, comparison group): 936 parents of non-participating children Web-based surveys with stakeholders: <ul style="list-style-type: none">• N (2005): 542 school and out-of-school hours care staff, 834 participating children, 374 AASC program deliverers, 148 AASC program staff• N (2006): 1158 school and out-of-school hours care staff, 1678 participating children, 1260 AASC program deliverers, 154 AASC program staff• N (2007): 1789 school and out-of-school hours care staff, 1645 participating children, 1074 AASC program deliverers, 162 AASC program staff Age: Primary-school students Gender: Mixed Ethnicity: Unstated

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Table A.1 (continued)

Interventions	Setting: After-school hours care, sporting clubs and organisations, local communities Provider: Australian Sports Commission, research staff Duration: 2005 – until at least 2010 Strategies: Provide free structured physical activity after school for primary-school students.
Outcomes measured	Outcomes measured include: <ul style="list-style-type: none">• levels of and attitudes towards physical activity• children, their parents, and organisations' thoughts on AASC• satisfaction with the AASC program
Results ^a	Children participating in the AASC program almost doubled their structured physical activity hours per week, and significantly increased their total physical activity hours per week. According to 4 in every 5 AASC deliverers, children involved in the program were becoming more positive towards physical activity. Three-quarters of participating children's parents said their children had expressed interest in new sports and activities in the previous 12 months, and two-thirds indicated their children would like to join a new sporting club or organisation. More than 80 per cent of the people and organisations involved in the AASC rated the program as being fun and of high quality and more than 90 per cent rated the program as being safe. Half of the sporting clubs and physical activity organisations involved in the AASC program said that it increased the number of children attending the club or organisation, and more than 70 per cent said that the AASC program had stimulated community involvement in sport and physical activity. More than 80 per cent of participating children and their parents were satisfied with the AASC program.

^a Details given here are of the interim evaluation. The final evaluation was due mid-2009.

Source: Australian Sports Commission (2008); DoHA (2009a, 2009b).

Table A.2 Be Active Eat Well

Description	The Be Active Eat Well intervention was a community capacity-building program, which combined nutrition strategies, physical activity strategies and screen time strategies in the aim of promoting healthy eating and physical activity in children in the town of Colac (Victoria).
Funding details	Department of Human Services (Victoria): \$400 000
Methods	Design: Quasi-experimental Theoretical framework: Included ideas from determinants of health model, social ecological model, ANGELO framework, Ottawa Charter and Jakarta Declaration Number of intervention groups: 1 Number of control groups: 1 Follow-up: At the end of the intervention, and a long-term follow-up is planned
Participants	Targeted at children, their families and the wider Colac community Evaluation: <ul style="list-style-type: none"> • N (Intervention baseline): 4 preschools, 6 primary schools, 1001 children • N (Intervention post-intervention): 4 preschools, 6 primary schools, 839 children • N (Comparison baseline): 4 preschools, 12 primary schools, 1183 children • N (Comparison post-intervention): 4 preschools, 12 primary schools, 979 children Age: 4–12 year-olds Gender: Mixed Ethnicity: Predominantly caucasian
Interventions	Setting: Schools and wider Colac community Provider: Research staff, schools, dieticians, local community Duration: 4 years, 2003–2006 Strategies: Nutrition strategies, physical activity strategies, screen time strategies.
Outcomes measured	Body weight Waist circumference BMI Waist/height BMI-z score
Results ^a	The intervention group had statistically significant lower increases in body weight, waist circumference, waist/height ratio and BMI-z score over the period when compared with the comparison group. BMI increased over the course of the intervention in both the intervention and comparison groups with BMI increasing less in the intervention group, but the difference was not statistically significant.

^a Results adjusted for baseline variable, age and height at follow-up, gender, duration between measurements and clustering by school.

Source: Bell et al. (2008); Sanigorski et al. (2008).

Table A.3 Burke et al. 1998

A controlled trial of health promotion programs in 11 year-olds using physical activity 'enrichment' for higher risk children

Description	This intervention implemented a physical activity program, physical education enrichment program and a nutrition program aimed at children at a higher risk of cardiovascular disease. It was implemented in primary schools in Western Australia.
Funding details	National Health and Medical Research Council Australian Rotary Health Research Fund
Methods	Design: Cluster-randomised controlled trial, randomised at school level Theoretical framework: Unstated Number of intervention groups: 2 Number of control groups: 1 Follow-up: At end of intervention and 6-month post-intervention
Participants	N: 800 students N (Physical activity and nutrition program ('standard program')): 6 schools N ('Standard program' plus physical activity enrichment for higher risk children): 7 schools N (Control): 5 schools Age: 11 year-olds Gender: Mixed Ethnicity: Unstated
Interventions	Setting: Schools and homes Provider: Teachers, research staff Duration: 2 10-week school terms Strategies: The physical activity program included classroom lessons and fitness sessions. The physical education enrichment program included keeping physical activity diaries and establishing goals for increasing physical activity. The nutrition program included class activities and home-based activities such as planning a week's grocery shopping.
Outcomes measured	Physical fitness Leisure-time physical activity Television watching Body Composition Cholesterol Blood Pressure Dietary Intake
Results	Fitness improved significantly in children in the 'standard program' and enrichment program. However, the improvements only persisted 6 months later for females. High risk females in the enrichment group had improved cholesterol immediately post-intervention, and males and high risk females had improved cholesterol 6-months post-intervention. In enrichment schools there was lower sodium intake, and in females only, improved subscapular skinfolds, immediately post-intervention, but not at the 6-month follow-up.

Source: Burke et al. (1998).

Table A.4 Coalfields Healthy Heartbeat School Project

Description	The Coalfields Healthy Heartbeat Project aimed to improve health outcomes in students in 15 schools in the socio-economically disadvantaged area of the Coalfields District of New South Wales (which has rates of cardiovascular disease significantly higher than the average) by targeting healthy eating and physical activity.
Funding details	University of Newcastle
Methods	Design: Quasi-experimental Theoretical framework: Unstated Number of intervention groups: 1 Number of control groups: 1 Follow-up: At end of intervention
Participants	N (Intervention group): 18 schools, 294 students N (Comparison group): 15 schools, 363 students Age: Grade 6 students Gender: Mixed Ethnicity: Unstated
Interventions	Setting: Schools Provider: External agencies, parents and citizens group and Hunter Region School Canteen committee, students from the University of Newcastle, teachers, research staff Duration: 1 year Strategies: Provision of curriculum materials and training for teachers, advice for schools regarding structural change, ongoing support and follow-up, community involvement and public relations.
Outcomes measured	Heart-health knowledge Heart-health attitudes Heart-health self-reported behaviour Health-related fitness
Results	Students in the intervention group reported significant gains in fitness when compared with the comparison group. However, there was no significant change in knowledge, attitudes and behaviours.

Source: Plotnikoff, Williams, and Fein (1999).

Table A.5 Dwyer et al. 1983

An investigation of the effects of daily physical activity on the health of primary-school students in South Australia

Description	This intervention aimed to study the health effects of daily physical activity. It originally involved a 14-week randomised trial of a daily physical activity program in 7 schools in South Australia. Following this first phase the schools decided to adopt daily physical activity as part of the school curriculum (second phase).
Funding details	
Methods	<p>Design:</p> <ul style="list-style-type: none"> • First phase: Cluster-randomised controlled trial, randomised at class level • Second phase: Pre- (pre-data from first phase) and post-data (no control group) <p>Theoretical framework: Unstated</p> <p>First phase:</p> <ul style="list-style-type: none"> • Number of intervention groups: 2 (Skill group and Fitness group) • Number of control groups: 1 <p>Follow-up:</p> <ul style="list-style-type: none"> • First phase: At end of 14-week intervention • Second phase: 2 years after completion of the first phase
Participants	<p>N (First phase): 7 schools, more than 500 students</p> <p>N (Second phase): 5 schools, 216 students</p> <p>Age: Grade 5 students</p> <p>Gender: Mixed</p> <p>Ethnicity: Unstated</p>
Interventions	<p>Setting: Schools</p> <p>Provider: Teachers, research staff</p> <p>Duration:</p> <ul style="list-style-type: none"> • First phase (1978): 14 weeks • Second phase: 2 years, 1978–1980 <p>Strategies: Daily physical activity program.</p>
Outcomes measured	<p>BMI</p> <p>Skinfolds</p> <p>Blood Pressure</p> <p>Endurance fitness</p> <p>Cholesterol</p> <p>Academic performance</p>
Results	<p>First phase:</p> <ul style="list-style-type: none"> • Both skill and fitness groups gained in endurance fitness and the fitness group had a significant decline in skinfolds. There was no significant intervention effect on blood pressure and academic performance. <p>Second phase:</p> <ul style="list-style-type: none"> • The 1980 students had superior endurance fitness when compared with the 1978 students. There was also a significant fall in the sum of 4 skinfolds in the 2-year period. Students in 1980 had lower BMIs, however this difference was not statistically significant. Blood pressure was also lower in the later period, but only diastolic blood pressure was significantly lower.

Source: Dwyer et al. (1983).

Table A.6 Eat Smart Play Smart

Description	Eat Smart Play Smart is a national intervention that aims to promote active play and healthy eating in Out of School Hours Care (OSHC). It includes training for OSHC staff and a manual. The manual was the subject of the evaluation.
Funding details	
Methods	Design: Unstated Theoretical framework: Unstated Number of intervention groups: Unstated Number of control groups: Unstated Follow-up: 10–12 months following the national launch
Participants	N (Baseline): 532 N (Follow-up): 280 Age: Primary-school students and OSHC staff Gender: Mixed Ethnicity: Unstated
Interventions	Setting: OSHC Provider: National Heart Foundation, OSHC staff Duration: 2004 onwards Strategies: Manual and training for OSHC staff.
Outcomes measured	Results of reading the manual
Results	80 per cent OSHC staff said they had learnt new things about nutrition for children and 74 per cent are offering healthier food choices. Over 60 per cent learnt new things about physical activity, and almost 60 per cent are now offering a greater variety of physical activities. OSHC staff also said that the children's cooking skills changed with 85 per cent of staff reporting that children enjoyed the recipes and cooking activities in the manual, and 52 per cent reported that children's cooking skills had improved.

Source: National Heart Foundation of Australia (2006, 2009a).

Table A.7 Engaging adolescent girls in school sport

Description	This intervention aimed to increase physical activity among adolescent girls from predominantly linguistically diverse backgrounds by increasing enjoyment of physical activity, perceived competence and physical self-perception. It was implemented in a school in south-west Sydney.
Funding details	Faculty of Education, University of Wollongong
Methods	Design: Pilot randomised controlled trial (RCT) Theoretical framework: Social cognitive theory Number of intervention groups: 1 Number of control groups: 1 Follow-up: At end of intervention
Participants	N (Intervention group): 17 students N (Control group): 21 students Age: Year 11 students Gender: Female Ethnicity: Predominantly linguistically diverse backgrounds
Interventions	Setting: School Provider: Teacher, research staff Duration: 12 weeks Strategies: 6 fortnightly 90-minute sport sessions consisting of activities such as yoga, pilates, dance, aquatics and tennis in place of regular sports classes.
Outcomes measured	Enjoyment of physical activity Physical self-perception Objectively measured physical activity
Results ^a	The intervention group showed greater improvement in body image and enjoyment of physical activity during school sport over the intervention period, when compared with the control. Physical activity participation during school sports time declined for both intervention and control, however the decline was smaller for the intervention group.

^a This is a pilot RCT and as such is not sufficiently powered to know if between group differences were statistically significant.

Source: Dudley et al. (2009).

Table A.8 Fitness Improvement and Lifestyle Awareness (FILA) program

Description	The FILA program aimed to increase cardiorespiratory fitness, increase physical activity, increase healthy eating and reduce small screen recreation in adolescent males with sub-optimal cardiorespiratory fitness by using behavioural modification techniques. It was implemented in a high school in the western suburbs of Sydney.
Funding details	
Methods	Design: Pilot randomised controlled trial (RCT) Theoretical framework: Social cognitive theory Number of intervention groups: 1 Number of control groups: 1 Follow-up: At end of intervention
Participants	N (Intervention group): 16 students N (Comparison group): 17 students Age: Year 7 students Gender: Male Ethnicity: Unstated
Interventions	Setting: School Provider: Teachers, research staff Duration: 6 months, 2007 Strategies: 1 60-minute curricular session and 2 20-minute lunchtime physical activity sessions per week.
Outcomes measured	BMI Waist circumference Percentage body fat Cardiorespiratory fitness Objectively measured physical activity Small screen recreation time Sweetened drink and fruit consumption
Results ^a	The intervention group had a smaller increase in BMI, greater reduction in waist circumference, greater reduction in percentage body fat, greater increase in cardiorespiratory fitness, greater increase in participation in weekday physical activity and a greater reduction in small screen recreation on weekends.

^a This is a pilot RCT and as such is not sufficiently powered to know if between group differences were statistically significant.

Source: Peralta, Jones, and Okely (2009).

Table A.9 Fresh Kids

Description	The Fresh Kids program was a whole-of-school multifaceted intervention that aimed to evaluate the effectiveness of the Health Promoting Schools (HPS) framework to improve fruit and water consumption in primary-school students. Its aim was to promote healthy eating and reduce childhood obesity-related risk factors. The intervention was implemented in inner-west Melbourne.
Funding details	National Child Nutrition Program Australian Government Department of Health and Ageing Telstra Foundation: <ul style="list-style-type: none">• 2003–05: \$60 000• 2005–07: \$60 000
Methods	Design: Pre- and post-intervention data collected (no comparison group) Theoretical framework: HPS framework Follow-up: At regular intervals up to 2 years
Participants	N: 4 primary schools (2 were evaluated for the whole 2 years, the other 2, 9 months) Age: Primary-school students Gender: Mixed Ethnicity: Mixed
Interventions	Setting: Schools Provider: Community dietician, teachers, research staff Duration: The evaluation went for 2 years, starting from 2001 and the program itself went until at least 2006 Strategies: Strategies included, but were not limited to, season 'Fresh Fruit Weeks', monthly nutritional newsletter and a 'fruit break' scheduled into all classes.
Outcomes measured	Fruit, water and sweet drinks brought to school
Results	Over the course of the intervention there was a significant increase in the proportion of children who brought fresh fruit to school, filled water bottles and a significant decrease in all but 1 school in the amount of children bringing sweet drinks. These results were sustained for the full 2 years of the evaluation.

Source: AIHW (2006b); Laurence, Peterkin and Burns (2007).

Table A.10 'Get Moving' Campaign

Description	The 'Get Moving' Campaign was a national social marketing campaign that aimed to communicate the need for greater levels of physical activity among children, youth and their parents.
Funding details	
Methods	Design: Pre- and post-data collection (no control group) Theoretical framework: Unstated Follow-up: At end of intervention
Participants	Targeted at parents and carers of children and adolescents, children and adolescents N (Baseline survey): 1200 children, 300 parents N (Pre-campaign survey): 202 children, 587 parents N (Follow-up survey): 216 children, 600 parents Gender: Mixed Ethnicity: Mixed
Interventions	Setting: Australian community Provider: Department of Health and Ageing, media Duration: February to April 2006 Strategies: Television commercial, radio advertisements, print advertisements, internet banner advertisements, campaign website.
Outcomes measured ^a	Outcomes measured included: <ul style="list-style-type: none"> • recall of campaign • whether action was taken as a result of the campaign • motivation as a result of the campaign • awareness of guidelines on physical activity and electronic media use
Results	Parents: <ul style="list-style-type: none"> • Significant increase in those who could recall the Get Moving Campaign between pre-campaign and follow-up • About three quarters had seen the television commercial at follow-up • 37 per cent of parents suggested that being exposed to the campaign prompted them to increase their own and their children's physical activity levels, and to decrease screen time • Around 80 per cent of those who took action said the campaign was effective in motivating them and their family to be more active. Children and adolescents: <ul style="list-style-type: none"> • Over 95 per cent of children report seeing at least 1 element of the campaign • No change in organised sport as a result of the campaign • Resulted in decrease in weekend sedentary time • Over 80 per cent of children and teenagers said the campaign prompted them to act • No obvious changes in attitude to physical activity, although attitude was already very positive • Increased awareness of the recommended levels of activity and electronic media use.

^a All of the outcomes measured were self-reported.

Source: Elliot and Walker (2007a).

Table A.11 Girls Stepping Out Program

Description	The Girls Stepping Out Program evaluated the effectiveness and compared daily step count targets (Pedometer group) and time-based targets (Minutes group) for increasing physical activity in adolescent girls. It was implemented in 3 central Queensland high schools.
Funding details	Central Queensland University
Methods	Design: Quasi-experimental Theoretical framework: Unstated Number of intervention groups: 2 Number of control groups: 1 Follow-up: At 6 weeks and 12 weeks
Participants	N (Pedometer (PED) group): 27 students N (Minutes (MIN) group): 28 students N (Control (CON) group): 30 students Age: Year 11 and 12 students Gender: Female Ethnicity: Unstated
Interventions	Setting: Schools Provider: Teachers, research staff Duration: 12 weeks, July–October 2002 Strategies: 12 week physical activity self-monitoring and education program. Students in the PED group logged step counts, and students in the MIN group logged minutes of daily activity.
Outcomes measured	Total activity
Results	When compared with the CON group, at post-intervention the PED group had significantly increased their total activity, however, the MIN group did not.

Source: Schofield, Mummery and Schofield (2005).

Table A.12 'Go for 2&5[®]' Campaign

Description	The 'Go for 2&5 [®] ' Campaign was a national social marketing campaign that aimed to communicate the need for a healthy diet among children, youth and their parents.
Funding details	
Methods	Design: Pre- and post-data collection (no control group) Theoretical framework: Unstated Follow-up: During (follow-up survey 1) and at the end of the intervention (follow-up survey 2)
Participants	Targets: Children and adolescents and their parents and carers N (Baseline survey): 300 children, 1200 parents N (Follow-up survey 1): 96 children, 591 parents N (Follow-up survey 2): 250 children, 1001 parents Gender: Mixed Ethnicity: Mixed
Interventions	Setting: Australian community Provider: Australian Government Department of Health and Ageing, State and Territory health departments, media Duration: April to July 2005 Strategies: Television commercials, radio advertisement, shopping trolley and shopping centre advertisements, media partnership activities formed through the campaign media buy, consumer booklet, poster and media cards, campaign website, fact sheets, 1800 information line.
Outcomes measured ^a	Fruit and vegetable consumption Attitudes and beliefs regarding fruit and vegetable consumption Changes to fruit and vegetable consumption Healthy eating and physical activity campaign awareness Go for 2&5 [®] Campaign awareness Reported action taken as a result of the campaign
Results	Parents: <ul style="list-style-type: none"> • Proportion who ate fruit did not change between surveys • Between surveys there was a significant increase in the proportion who ate more than 4 vegetables per day, and a significant decrease in the amount who only ate 1 serve per day • Attitudes and beliefs about fruit consumption did not change between the surveys, however, there was a significant increase in the knowledge of the recommended consumption level • No improvement in the amount of parents that had attempted to increase family fruit consumption between the surveys • High level of awareness of the 2&5[®] Campaign • A significant amount of parents said they had taken action as a result of the campaign, with the most common action being increasing fruit or vegetable consumption. Children: <ul style="list-style-type: none"> • No significant change in fruit and vegetable consumption • Knowledge about recommended fruit and vegetable intake increased • High level of awareness of the 2&5[®] Campaign and the main message recalled was to eat more fruit and vegetables • Large proportion said they had taken action as a result of the campaign, with the most common action to eat more fruit and vegetables.

^a All of the outcomes measured were self-reported.

Source: Elliot and Walker (2007b).

Table A.13 Learning to Enjoy Activity with Friends (LEAF)

Description	The intervention aimed to assess the impact of an extra-curricular school sports program on physical activity and sedentary behaviour in adolescents by promoting lifestyle and lifetime physical activity.
Funding details	
Methods	Design: Quasi-experimental Theoretical framework: Social cognitive theory Number of intervention groups: 1 Number of control groups: 1 Follow-up: At end of intervention
Participants	N (Intervention group): 50 students N (Control group): 66 students Age: Year 8 and 9 students Gender: Mixed Ethnicity: Unstated
Interventions	Setting: University of Newcastle health and fitness centre Provider: Trained instructors, research staff Duration: 8 weeks, September to December 2006 Strategies: Structured exercise activities, information sessions focused on behavioural modification strategies, self-monitoring using pedometers.
Outcomes measured	Steps per day (mean) Non-organised moderate-to-vigorous physical activity TV Computer Electronic games
Results	Adolescents who were classified as low-active at baseline in the intervention group increased their step counts over the duration of the intervention and accumulated significantly more steps than low-active students in the comparison group. There were no statistically significant differences in any of the other measures.

Source: Lubans and Morgan (2008).

Table A.14 Moorefit

Description	Moorefit aimed to address inactivity in adolescent girls in 1 girls' government high school south of Sydney with students mostly from non-English speaking backgrounds. It incorporated strategies that addressed the formal curriculum, physical environment, social environment, organisational environment and school-home-community links.
Funding details	
Methods	Design: Pre and post data taken on intervention group, pre data only taken on control group Theoretical framework: Health Promoting Schools framework Number of intervention groups: 1 Number of historical control groups: 1 Follow-up: At end of intervention
Participants	Targeted at students (over 800) N (Pre-intervention survey of intervention students): 11 Year 7 students N (Pre-intervention survey of historical control): 127 Year 10 students N (Post-intervention survey): 94 Year 10 students Age: Secondary-school students Gender: Female Ethnicity: 86 per cent from non-English speaking backgrounds, mainly Middle Eastern and Asian backgrounds
Interventions	Setting: School Provider: Teachers, research staff, advisory committee consisting of government, non-government and ethnic organisations Duration: 3 years, 1998–2001 Strategies: Strategies included, but were not limited to, new sports options in the formal curriculum, informal physical activity at breaks, project information in school newsletters.
Outcomes measures	Participation in vigorous summer and winter activities Participation in moderate (adequate) summer and winter activities Participation in inadequate summer and winter activities
Results	The intervention group had a significantly higher percentage who were adequately active, and a significantly lower percentage who were inactive when compared with the historical control group. There was an increase in the participation rates in the non-competitive activities. However, participation in vigorous activities in the intervention group decreased over the course of the intervention.

Source: Cass and Price (2003).

Table A.15 Move It Groove It

Description	Move It Groove It aimed to use Physical Education (PE) lessons to improve child fundamental movement skills and increase physical activity for optimal health. It was implemented in a rural area in New South Wales.
Funding details	NSW Health – Physical Activity Demonstration Grant (Ref. No. DP98/1) Sydney University (Department of Rural Health – Northern Rivers)
Methods	Design: Quasi-experimental Theoretical framework: Incorporated ideas from the Ottawa Charter Number of intervention groups: 1 Number of control groups: 1 Follow-up: At end of intervention, and a 6-year follow-up
Participants	N: 1045 children, of which 276 were assessed at the 6-year follow-up N (intervention group): 9 schools N (control group): 9 schools Age: 7–10 year-olds Gender: Mixed Ethnicity: Unstated
Interventions	Setting: Schools Provider: School project teams (often included teachers), a health worker and upper primary-school students Duration: 1 year, 1999–2000 Strategies: School project teams, a buddy program, professional development for teachers, project website, funding for new equipment.
Outcomes measured	8 fundamental movement skills Moderate-to-vigorous physical activity Vigorous physical activity PE classes' lesson context
Results	At end of intervention: Most of the fundamental movement skills and vigorous physical activity increased significantly for both genders in the intervention group over the duration of the study compared with the control group. Moderate-to-vigorous physical activity also increased but it was not significant. 6-year follow-up: The intervention group had improved their ability to catch, had lost their advantage in throw and kick and maintained their advantage in the other skills when compared with the intervention group. There was no significant difference in physical activity between the 2 groups.

Source: Barnett et al. (2009); van Beurden et al. (2003).

Table A.16 New South Wales Walk Safely to School Day

Description	The New South Wales Walk Safely to School Day was an annual event promoting walking to school with the objectives of reinforcing safe pedestrian behaviour, promoting the health benefits of walking and reducing car usage. Initiated by the Pedestrian Council of Australia.
Funding details	NSW Health
Methods	Design: Survey data collected from parents and schools at the 2002 event, and school participation information collected each year. No comparison group. Theoretical framework: Unstated Follow-up: None
Participants	N (parent survey): 800 households Age: Primary-school students Gender: Mixed Ethnicity: Mixed
Interventions	Setting: Schools and wider community Provider: Pedestrian Council of Australia, schools, research staff Duration: First Friday in April, 2001–2004 Strategies: Strategies included paid media advertising and school kits with suggestions for promoting the event.
Outcomes measured	Outcomes measured included the number of schools and students that participated in the event, and the change in the number of students that walked as a result of the event.
Results	School participation increased by 66 per cent between 2001 and 2004, however schools participation levelled off after the second year. 53 per cent of NSW primary schools participated over the 4 years. Repeat participation was not high (15 per cent). According to school evaluation, about 19 per cent of New South Wales primary-school students participated in the 2002 event. According to parent surveys, 24 per cent of children participated in the 2002 event. There was a relative increase in children walking to school due to this event (31 per cent).

Source: Merom et al. (2005).

Table A.17 Nutrition Ready-to-Go @ Out of School Hours Care (NRG @ OOSH) Physical Activity Project

Description	The NRG @ OOSH Physical Activity Project used a multi-strategy approach to improve opportunities for and participation in physical activity in out-of-school-hours (OOSH) care. The project focused on OOSH services in socially disadvantaged areas of south-eastern Sydney.
Funding details	
Methods	Design: Pre- and post-data collected (no control group) Theoretical framework: Unstated Follow-up: At end of intervention
Participants	N: 44 OOSH care services, approximately 2590 children, 119 staff Age: Primary-school students Gender: Mixed Ethnicity: Unstated
Interventions	Setting: OOSH care Provider: Advisory committee of stakeholders, OOSH care staff Duration: 12 months Strategies: Individual feedback and assistance to OOSH care services, state-wide accredited nutrition and food safety training for OOSH care staff, development of a manual.
Outcomes measured	Outcomes measured included: <ul style="list-style-type: none"> • Proportion of OOSH care services with a physical activity component • Amount of moderate-to-vigorous physical activity • Proportion of children participating in low and high intensity activities
Results	The intervention resulted in a statistically significant improvement in the proportion of moderate or vigorous activities in OOSH care each week. In addition to this, there was a significant shift from children participating in lower-intensity activities to higher-intensity activities. There was also an increase in the number of OOSH care services with physical activity programs and policies.

Source: Healthy Kids (2006); Sangster, Eccleston and Porter (2008).

Table A.18 Program X

Description	Program X was a school-based intervention addressing physical activity, sedentary behaviour, and healthy eating in adolescents, incorporating pedometers and email support.
Funding details	
Methods	Design: Cluster-randomised controlled trial, randomised at the school level Theoretical framework: Social cognitive theory Number of intervention groups: 1 Number of control groups: 1 Follow-up: 6 months from baseline
Participants	N (intervention group): 3 schools, 58 students N (control group): 3 schools, 66 students Age: Secondary-school students Gender: Mixed Ethnicity: Unstated
Interventions	Setting: Schools Provider: Teachers, research staff Duration: 10 weeks, July to September 2007 Strategies: School sport program, weekly messages, pedometers for self-monitoring of physical activity, diaries for dietary monitoring, parent information leaflets, email support.
Outcomes measured	Objectively recorded physical activity Self-reported sedentary behaviour Dietary habits
Results	Intervention group participants increased their mean steps per day. The number of energy-dense nutrient-poor snacks consumed per day decreased significantly in males, but not in females, and the number of fruit serves per day consumed increased significantly in females but not in males. However, the intervention had no significant effect on sedentary behaviour, or water consumed each day.

Source: Lubans et al. (2009).

Table A.19 Q4: Live Outside the Box 2007

Description	Aimed to help school children to develop healthy lifestyles to address overweight and obesity by increasing public awareness and action. It was implemented in Northern Sydney. There have been 3 evaluations conducted. The results of the most recent are presented here, involving the Northern Beaches, Lower North Shore and Hornsby/Ryde/Hunters Hill local government areas.
Funding details	
Methods	Design: Data collected post-intervention (no control group) Theoretical framework: Unstated Follow-up: Post-intervention
Participants	N (Northern Beaches): 19 schools N (Lower North Shore): 8 schools N (Hornsby/Ryde/Hunters Hill): 8 schools Age: Primary-school students Gender: Mixed Ethnicity: Unstated
Interventions	Setting: Communities Provider: Research staff, schools, teachers, Health Promotion Officers Duration: 2 weeks Strategies: Competition style activity – involving completion of a passport. Schools also provided with certificates, prizes and newspaper articles.
Outcomes measured	Parents opinion of program, teachers belief of effectiveness of the program, barriers to implementation and suggestions for improvement.
Results	Northern Beaches teachers suggested passport activity was relatively easy to do, could go for longer, simplifying the layout could make it more child friendly, could use more visual cues, should have information on extra foods and simple scoring system could help. Barriers included the time of year, lack of parent support, difficulty for some people from culturally and linguistically diverse backgrounds in understanding the passport. Over 95 per cent of Northern Beaches parents were involved in the program. The majority found it easy to support their children and 97 per cent of parents rated the program as good or better. 98 per cent of Lower North Shore teachers believed the program was at least effective in raising awareness of overweight and obesity and 98 per cent found it at least easy to implement. The vast majority of Hornsby/Ryde/Hunters Hill teachers believed the program was effective in raising awareness of overweight and obesity and 98 per cent found it at least easy to implement. Comments from teachers in Lower North Shore and Hornsby/Ryde/Hunters Hill were similar to those of Northern Beaches The vast majority of Lower North Shore parents were involved with the program. Over 90 per cent found it easy to support their children and 98 per cent thought the program was good or better. Over 95 per cent of Hornsby/Ryde/Hunters Hill parents were involved in the program. Over 90 per cent found it easy to support their children in the program and over 95 per cent rated the program as good or better.

Source: Wilkenfeld, Haynes and Clark (2007).

Table A.20 Romp and Chomp

Description	The intervention aimed to help Geelong families with young children lead healthy lives through increasing the capacity of the Geelong community to promote healthy eating and active play.
Funding details	Department of Human Services (Victoria), Department of Education and Early Childhood Development (Victoria), City of Greater Geelong, Barwon Health, Deakin University, Leisure Networks, VicHealth and the Australian Research Council: \$111 000 over 4 years (2004–2008)
Methods	Design: Quasi-experimental Theoretical Framework: Unstated Number of intervention groups: 1 Number of comparison groups: 1 Follow-up: At end of intervention
Participants	N: Targeted approximately 12 000 preschool children and their families Age: Children under 5 years Gender: Mixed Ethnicity: Unstated
Interventions	Setting: Included maternal and child health centres, family and long day care, kindergartens Provider: Duration: 2004–2008 Strategies: Strategies included social marketing, establishment of strategic alliances with community partners, drinks policies in kindergartens, Structured Active Play Program in kindergartens.
Outcomes measured	Included: <ul style="list-style-type: none">• BMI• nutrition intake• small screen recreation• environmental changes in Early Childhood Settings
Results	Included: <ul style="list-style-type: none">• In the intervention group overweight/obesity was significantly reduced by 2.5 percentage points in 2 year-olds and 3.4 percentage points in 3.5 year-olds• Intervention group had significantly lower intake of packaged snacks, fruit juice and cordial when compared with comparison group. There was no significant difference in vegetable intake• Intervention group spent significantly less time watching TV/DVDs at follow-up than comparison group• There was no significant difference between the intervention and comparison groups in the number of occasions children were physically active in the previous week and intake of water, milk, chocolates/lollies and cake/muffins/biscuits• When compared to baseline, the intervention group had a statistically significant increase in intake of water, milk, fruit, vegetables and fruit juice, and no significant change in intake of chocolates/lollies, cake/muffins/biscuits and packaged snacks. There was no significant change in the number of occasions children were physically active in the previous week.

Source: Bell (2008); de Silva-Sanigorski et al. (2009); WHO Collaborating Centre for Obesity Prevention (2007, 2008b).

Table A.21 Smart Choices – Healthy Food and Drink Supply Strategy for Queensland Schools

Description	Smart Choices is a mandatory Queensland Government strategy that assists schools to provide healthy food and drinks. It reflects the Australian Guide to Healthy Eating and the Dietary Guidelines for Children and Adolescents in Australia.
Funding details	
Methods	Design: Survey conducted at a point in time <ul style="list-style-type: none"> • Principals completed an online survey • Parents and Citizens Associations (P&Cs) completed a self-administered postal survey • Tuckshop convenors completed a phone interview Theoretical framework: Unstated
Participants	N (evaluation): Principals: 973, P&Cs: 598, Tuckshop convenors: 513 Age: Primary-school students Gender: Mixed Ethnicity: Unstated
Interventions	Setting: Schools Provider: Schools, The Queensland Council of Parents and Citizens' Associations, Queensland Association of School Tuckshops and Nutrition Australia Duration: Announced in 2005, became mandatory from January 2007, evaluation completed in Term 2, 2007 Strategies: Strategies included distribution of resource packs to all schools and information and training seminars for participants. Schools implemented a traffic light system to decide what food and drinks to sell.
Outcomes measured	Support for the strategy and implementation of the strategy
Results	Key findings included: <ul style="list-style-type: none"> • Schools supported rationale for strategy, made significant efforts to implement Smart Choices and accessed resources and attended training sessions • Overall implementation of Smart Choices was high with nearly all principals, P&Cs and tuckshop convenors reporting the tuckshop had implemented the strategy • Smart Choices appeared to have been implemented well across not only the canteen, but the whole school environment.

Source: Department of Education and Training (Queensland) (2009b).

Table A.22 Start Right-Eat Right Award Scheme

Description	An award program that aims to improve food service in the child care industry in line with government policy and regulations. It was developed by Curtin University's School of Public Health and the Department of Health (Western Australia).
Funding details	Department of Health (Western Australia) Health Promotion Foundation of Western Australia
Methods	Design: Surveys at different points in time Theoretical framework: Organisational change stage theory Follow-up: 6 weeks (centres who had registered interest and not participated in the scheme) and 3 and 9 months post-baseline (registered centres)
Participants	N (3 month feedback): 44 centres N (9 month feedback): 51 centres registered without the award and 21 centres with the award Age: Unstated Gender: Mixed Ethnicity: Unstated
Interventions	Setting: Child care centres Provider: Child care staff, working group, trainers, research staff Duration: <ul style="list-style-type: none">• Development of awards scheme: 3 years• Evaluation: 9 months• Program has ran since 1999 Strategies: Included training for staff, existing manual, menu assessment and planning guide.
Outcomes measured	Reasons for registration Perceived benefits of participating in the scheme Perceived barriers to achieving the award
Results	Registered in award scheme but have not earned the award: 3 months <ul style="list-style-type: none">• Reasons for initial registration included wanting assistance to make improvements and seeking endorsement for current practices• Barriers included cost, needing staff to attend training and needing to support staff to attend training in the long term 9 months <ul style="list-style-type: none">• Over 90 per cent thought that Food Service Planning for the Child Care Centre short course was relevant• 90 per cent of coordinators reported making changes to menus• 20 centres had gained the FoodSafe certificate• Barriers included time commitments and need for increased dairy provision. Centres with the award: <ul style="list-style-type: none">• About three-quarters were satisfied with the award and its results• Most said the award had improved nutrition knowledge and food service• 2 centres said it lacked practicality and was too time-consuming• Most centres made changes as a result of being part of the award program.

Source: Pollard, Lewis and Miller (2001).

Table A.23 Stephanie Alexander Kitchen Garden Program

Description	Aims to provide food education to primary-school students by encouraging them to maintain a vegetable garden.
Funding details	Deakin University Department of Education and Early Childhood Development (Victoria) VicHealth Helen Macpherson Smith Trust
Methods	Design: Mixed methods, longitudinal, matched comparison trial, including surveys, focus groups, interviews and participant observation Theoretical framework: Unstated Number of intervention groups: 6 schools Number of control groups: 6 schools Follow-up: 2.5 years post-baseline
Participants	N (both intervention and control groups): 770 children, 562 parents and 93 teachers Age: Grades 3–6 students Gender: Mixed Ethnicity: Mixed
Interventions	Setting: Schools Provider: Teachers, volunteers, research staff Duration: 2.5 years, 2007–2009 Strategies: Students learn to grow vegetables as well as cooking and sharing food.
Outcomes measured	Included: <ul style="list-style-type: none">• willingness to try new foods• food choices and food literacy• enjoyment of kitchen and garden activities• development of cooking, gardening and environmental knowledge and skills
Results	Key results included: <ul style="list-style-type: none">• Children reported their willingness to try new foods increased in intervention schools, and was significantly greater than in comparison schools. However, parents reported a statistically insignificant difference between intervention and comparison schools• There was no evidence of the program influencing children's food choices and food literacy• Children's enjoyment of cooking was significantly greater in intervention schools than in comparison schools. However, there was no significant difference in enjoyment of gardening• Children's gardening knowledge was significantly greater in intervention schools than in comparison schools for most measures. Intervention children had significantly increased confidence in gardening and cooking compared with the comparison children.

Source: SAKG Evaluation Research Team (2009); Stephanie Alexander Kitchen Garden Foundation (2010).

Table A.24 Switch–Play

Description	Switch–Play assessed the effect of a behavioural modification (BM) intervention (focused on time spent in screen behaviours and physical activity, enjoyment of physical activity, fundamental motor skills and weight status), a fundamental motor skills (FMS) intervention, and an intervention combining the two. The aim was to evaluate its effectiveness in preventing excess weight gain, reducing time spent on small screen recreation, increasing participation and enjoyment of physical activity and improving fundamental motor skills. It was conducted in 3 government schools in low-socioeconomic areas in Melbourne.
Funding details	VicHealth
Methods	Design: Cluster-randomised controlled trial, randomised at class level Theoretical framework: Social cognitive theory and behavioural choice theory Number of intervention groups: 3 Number of control groups: 1 Follow-up: At end of intervention, and at 6 and 12 months after end of intervention
Participants	N (BM group): 66 N (FMS group): 74 N (BM/FMS group): 93 N (control): 62 Age: Grade 5 students Gender: Mixed Ethnicity: Unstated
Interventions	Setting: Schools Provider: Teachers, research staff Duration: March–December 2002 Strategies: BM strategy included encouraging participants to switch off their TV for an increasing duration each week, self-monitoring of sedentary behaviour, ‘Switch-Play’ games. FMS strategy included running, throwing, dodging, striking, jumping.
Outcomes measured	BMI Objectively assessed physical activity Self-reported screen behaviours Self-reported enjoyment of physical activity Fundamental motor skills Unintended consequences Food intake

(Continued next page)

Table A.24 (continued)

Results	The intervention had a significant effect on BMI for the children in the BM/FMS group, when compared with the control group, at post-intervention and the 6- and 12-month follow-ups, after adjusting for food intake and physical activity. The BM/FMS group was also less likely to be overweight/obese between baseline and post intervention and at the 12-month follow-up. However, there was no significant BMI effect for the BM and FMS groups. The FMS group also had higher levels and greater enjoyment of physical activity. The BM group had greater levels of physical activity, but the BM/FMS group did not when compared with the control. The intervention did not have any significant effect on sedentary behaviour in the FMS and BM/FMS groups, and had an undesired effect in the BM group. The intervention effects on the enjoyment of and participation in physical activity and fundamental motor skills were moderated by gender.
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Source: Salmon et al. (2008); Salmon, Ball et al. (2005).

Table A.25 Tooty Fruity Vegie Project

Description	<p>It aimed to increase fruit and vegetable consumption among primary-school students. It was implemented in the Northern Rivers region of New South Wales.</p> <p>Phase 1 of the Tooty Fruity Vegie (TFV) project was a 2 year multi-strategy health promotion program.</p> <p>Phase 2 of the TFV Project also went for 2 years and commenced in the second half of 2001.</p> <p>Since the second phase of the TFV project it has been implemented in over 50 schools across New South Wales.</p>
Funding details	
Methods	<p>Phase 1:</p> <ul style="list-style-type: none">• Design: Quasi-experimental• Theoretical framework: Unstated• Number of intervention groups: 1• Number of comparison groups: 1• Follow-up: At end of phase 1 <p>Phase 2:</p> <ul style="list-style-type: none">• Design: Pre- and post-data collected (no comparison group)• Follow-up: At end of phase 2
Participants	<p>Phase 1:</p> <ul style="list-style-type: none">• N (intervention group that participated in evaluation): 9 primary schools• N (comparison group that participated in evaluation): 3 primary schools• Age: Primary-school students• Gender: Mixed• Ethnicity: Unstated <p>Phase 2:</p> <ul style="list-style-type: none">• N: 14 schools• Age: Primary-school students• Gender: Mixed• Ethnicity: Unstated
Interventions	<p>Phase 1:</p> <ul style="list-style-type: none">• Setting: Schools• Provider: Project management teams, research staff, teachers, local community health professionals, parents, volunteers• Duration: 2 years, 1999–2000• Strategies: Included promotion of fruit and vegetables in the school canteen, children’s cooking classes, fruit and vegetable gardens, incorporating fruit and vegetable activities in school curricula. <p>Phase 2:</p> <ul style="list-style-type: none">• Setting: Schools• Provider: Project management teams, research staff, teachers, local community health professional, parents• Duration: 2 years, 2001–2003.• Strategies: Similar to those in Phase 1.

(Continued next page)

Table A.25 (continued)

Outcomes measured	<p>Phase 1 included:</p> <ul style="list-style-type: none"> • overall awareness of the TFV Project • overall attitudes towards the TFV Project • quality of implementation of individual TFV Project strategies • perceived barriers and enablers to implementing the TFV Project • perceived sustainability of the TFV Project <p>Phase 2 included:</p> <ul style="list-style-type: none"> • level and quality of strategy implementation • perceived sustainability • children’s recall and enjoyment of key TFV strategies • teachers’ usage of key TFV strategies • children’s attitudes towards fruit and vegetables • canteens’ usage of fruit and vegetable promoting strategies • children’s fruit and vegetable consumption
Results	<p>Phase 1:</p> <ul style="list-style-type: none"> • The TFV Project reached its target audience and was received positively. It was perceived as being well implemented • The Project improved classroom fruit and vegetable promotion activities, and increased parental interest and involvement in promoting fruits and vegetables in schools, and beyond • Fruit and vegetable knowledge, attitudes, access and preparation skills was significantly improved in children • Fruit and vegetable intake increased in the intervention group over the period by 18 per cent and 14 per cent respectively, while fruit and vegetable consumption in the comparison group decreased by 14 per cent and 4 per cent, respectively. <p>Phase 2:</p> <ul style="list-style-type: none"> • The strategies were perceived to be sustainable with most project management teams intending to continue with many of the strategies • Significantly more children recalled TFV strategies at follow-up than at baseline, and significantly more teachers reported having used TFV strategies, such as fruit and vegetable breaks in class, at follow-up than a baseline • There was no significant difference in children’s attitudes towards fruit and vegetables, access to fruit and vegetables and encouragement to eat fruits and vegetables, at baseline and follow-up, however, they were already high • There was no significant change in teachers’ attitudes to fruit and vegetable promotion before and after, however they were already high • More canteens used fruit and vegetable promotion strategies at follow-up than at baseline • There was a significant difference in children’s fruit consumption at baseline and follow-up, however, there was no significant difference in vegetable consumption.

Source: Adams, Pettit and Newell (2004); Miller et al. (2001); Newell et al. (2004); North Coast Area Health Service (2008).

Table A.26 Vandongen et al. 1995

A controlled evaluation of a fitness and nutrition intervention program on cardiovascular health in 10–12 year-old children

Description	Aimed to improve cardiovascular health by implementing the following programs: school-based nutrition, home-based nutrition, fitness education, combined school-based nutrition and fitness education, and combined school-based nutrition and home-based nutrition. It was conducted in Western Australian schools over the course of a school year.
Funding details	National Health and Medical Research Council (NHMRC) project grant
Methods	Design: Cluster-randomised controlled trial, randomised at school level Theoretical framework: Unstated. Number of intervention groups: 5 Number of control groups: 1 Follow-up: At the end of the intervention
Participants	N: 30 schools, 1147 children Age: 10–12 year-olds Gender: Mixed Ethnicity: Unstated
Interventions	Setting: Schools Provider: Teachers, research staff Duration: 1 school year Strategies: School-based nutrition program, home-based nutrition program, fitness education program.
Outcomes measured	Dietary intake Physical fitness Anthropometry Blood Pressure Cholesterol
Results	For females in the groups with a fitness component, triceps skinfolds and diastolic blood pressure decreased significantly and fitness increased. For females in the 2 home nutrition groups, fat intake decreased significantly and in the combined school and home nutrition and the fitness groups fibre intake increased. For males, sugar intake decreased in the fitness, fitness and school nutrition, and school and home nutrition groups. For both males and females the change in sugar intake correlated negatively with change in fat intake.

Source: Vandongen et al. (1995).

Table A.27 Wicked Vegies

Description	Aims to improve awareness of healthy eating and contribute to the reduction of obesity and other diet-related health problems. Implemented by Cancer Council Tasmania.
Funding details	Tasmanian Community Fund
Methods	Design: Surveys and focus groups conducted at a point in time Theoretical framework: Unstated Number of intervention groups: 1 Number of control groups: 0 Follow-up: None
Participants	N: 5 principals, 7 teachers, 2 canteen managers, 3 community partners and 24 students Age: Secondary-school students Gender: Mixed Ethnicity: Unstated
Interventions	Setting: Secondary schools in Tasmania Provider: Cancer Council Tasmania, teachers, canteen staff, community partners Duration: Trialled 2006–2007, expanded and continued since Strategies: Included an implementation manual, a Wicked Vegies competition, promotion in print media and on radio.
Outcomes measured	Included: <ul style="list-style-type: none">• use of manual• student confidence in food preparation• desire to continue program• student fruit and vegetable purchases• student eating habits
Results	Teacher surveys included: <ul style="list-style-type: none">• Teachers had read manual and found it relevant• Students gained confidence in food preparation. Principals survey included: <ul style="list-style-type: none">• Principals found activities were a good way to educate students on healthy eating• Principals wanted to continue with Wicked Vegies. Canteen managers survey included: <ul style="list-style-type: none">• Wicked Vegies helped to increase healthy food choices in the canteen• Students were more aware of fruit and vegetable options at the canteen• Canteen managers wanted to continue with Wicked Vegies. Community Partners survey included: <ul style="list-style-type: none">• A supermarket manager noted more students purchasing fresh fruit• Community Partners wanted to continue supporting program. Student focus groups included: <ul style="list-style-type: none">• Students learned most through practical activities, and found nutritional theory difficult to retain• Students reported their eating habits had changed marginally• Students enjoyed Wicked Vegies activities.

Source: Cancer Council Tasmania (2008).

B Other Australian interventions

This appendix includes Australian childhood obesity-related interventions for which no published evaluation reports have been identified or located. All of the Australian interventions identified date from the mid 1990s. The studies and programs included here focus on prevention, rather than the treatment or management of childhood obesity. (Interventions for which there are published evaluations are listed in appendix A.)

The interventions in this appendix result from desk-based research and are based on publicly available information. Due to the inconsistency with which bodies publicly release program information, this is unlikely to be a definitive list. Further, it may be that some of these programs have evaluation reports. However, we were unable to readily locate them.

The information is as complete as possible — information provided for some interventions is more detailed than others. In the case of funding details, funding organisations and funding figures reflect those identified through desk-based research and may not reflect the complete picture. Where specific information was not able to be located, it is left blank.

Table B.1 ACT Early Childhood Active Play and Eating Well Project

Also known as the 'Kids at Play – Active Play and Eating Well Project'

Description	Promotes healthy eating and physical activity in 0–5 year-olds through increasing the capacity of the early childhood sector. It is a combined initiative of the ACT Government and the National Heart Foundation ACT.
Funding details	Healthy Active Australia Community and Schools Grants Program: \$64 000 Evaluation funded by Health Promotion and Grants, ACT Health Sport and Recreation Services, and the National Heart Foundation ACT: \$80 000
Duration	3 years, 2007–2010
Location	ACT
Setting	Early childhood sector
Target group	0–5 year-olds
Strategies	Social marketing messages, training for early childhood staff and health professionals, resources on healthy eating and physical activity for young children and parents.
Evaluation	Evaluation planned

Source: ACT Government and the National Heart Foundation ACT (?2007, 2007); ACT Health (2007a); Department of Territory and Municipal Services (ACT) (2006); DoHA (2009e); Healthpact Research Centre for Health Promotion and Wellbeing (2008).

Table B.2 ACT Health Promoting Schools Canteen Project

Description	Aims to increase the amount of healthy food items in school canteens by providing education and training to canteen staff.
Funding details	
Duration	
Location	ACT
Setting	Schools
Target group	School students and canteen staff
Strategies	
Evaluation	

Source: ACT Health (?2009a); DoHA (2007).

Table B.3 Activate NT - MBF Healthy Lifestyle Challenge

Description	Annual program that gives participants in Darwin and Palmerston opportunities to improve their eating and be more active. It is a collaboration between General Practice Network NT, Darwin City Council and the City of Palmerston.
Funding details	MBF
Duration	10 weeks annually
Location	Darwin and Palmerston, Northern Territory
Setting	Community-wide
Target group	Families
Strategies	Strategies include, but are not limited to, community walks, bike rides, exercise sessions, supermarket tours, cooking sessions and health checks.
Evaluation	

Source: General Practice Network NT (2009).

Table B.4 Active-Ate

Description	Collection of resources that aim to promote nutrition and physical activity in primary schools. Developed by the Queensland Health Tropical Public Health Unit Network.
Funding details	Queensland Health
Duration	2003 onwards
Location	Queensland
Setting	Primary schools
Target group	Primary-school students
Strategies	Strategies include, but are not limited to, promoting activities such as picnics, games days, food experiments and developing a restaurant menu, and resources for students, teachers and parents.
Evaluation	Unable to locate evaluation

Source: Department of Education and Training (Queensland) (2009a); Edith Cowan University (2010).

Table B.5 Active School Curriculum Initiative

Description	<i>The Schools Assistance Act 2004</i> required government and non-government education authorities to provide 2 hours a week of mandatory physical activity for primary-school and junior secondary-school students.
Funding details	
Duration	2005–2008. Since 2008 the 2 hours of physical activity requirement has been removed.
Location	Australia-wide
Setting	Schools
Target group	Primary-school and junior secondary-school students
Strategies	Mandatory guidelines required 2 hours of physical activity per week.
Evaluation	

Source: DoHA (2006; pers comm., 26 March 2010).

Table B.6 Around Australia in 40 Days Small Steps to Big Things Walking Challenge

Description	Encourages students to walk the equivalent length of a route around Australia in 40 days, by completing an average of around 10 000 steps a day as part of their daily routine. It is an Australian Government Initiative.
Funding details	
Duration	Term 4, 2007
Location	Australia-wide
Setting	Australia-wide
Target group	Years 7, 8, 9
Strategies	Students formed teams and entered their details and daily step count (measured by pedometers) online. Winning teams won prizes for their school.
Evaluation	

Source: DoHA (?2007, 2008d).

Table B.7 Be Active – Take Steps

Description	Encouraged children to undertake at least 60 minutes of physical activity each day. Developed by the Centre of Health Promotion at the Women’s and Children’s Hospital.
Funding details	Department of Health (South Australia)
Duration	8–10 weeks in 2004
Location	South Australia
Setting	Schools and wider community
Target group	Primary-school students
Strategies	Strategies included using pedometers, diaries for children, resource books for teachers.
Evaluation	

Source: Department of Health (South Australia) (2005).

Table B.8 Childhood Healthy Weight Project

Description	Aims to prevent obesity in Northern Territory children by focusing on childcare and canteens in schools. Managed by the Heart Foundation.
Funding details	Department of Health and Community Services (Northern Territory)
Duration	
Location	Northern Territory
Setting	Childcare centres and schools
Target group	Children
Strategies	
Evaluation	

Source: Department of Health and Community Services (Northern Territory) (2007).

Table B.9 Cool CAP

Description	A school canteen accreditation program run by the Tasmanian Schools Canteen Association aimed at promoting healthy food.
Funding details	
Duration	2000 onwards
Location	Tasmania
Setting	Schools
Target group	Canteen staff and students
Strategies	An awards program is used to encourage school canteens to prepare foods in a safe and hygienic environment, promote healthy foods, and run a well-managed canteen.
Evaluation	

Source: Department of Education (Tasmania) (2008); Tasmanian School Canteen Association (?2009).

Table B.10 Crunch&Sip

Description	Aims to increase fruit, vegetable and water consumption by providing a set break in the school day for students to consume these items. It is implemented by The Cancer Council WA and Diabetes WA in Western Australia, the Healthy Kids School Canteen Association in New South Wales and South Australian Dental Service in South Australia. It is a Go for 2&5 initiative (table B.29).
Funding details	
Duration	
Location	Western Australia, New South Wales and South Australia
Setting	Schools
Target group	School students
Strategies	Set classroom break to eat fruit or vegetables and drink water.
Evaluation	

Source: Department of Health (Western Australia) (2005).

Table B.11 CSIRO Wellbeing Plan for Children

Description	Development of a book containing information on how to positively influence eating and activity habits. Developed by the CSIRO.
Funding details	Development of book: Australian Government: \$2m
Duration	Development of book: 2 years
Location	Australia-wide
Setting	Australia-wide
Target group	Children and their families
Strategies	
Evaluation	

Source: CSIRO (2009).

Table B.12 Eat Right Grow Bright

Description	Encouraged healthy eating and physical activity in children and their families.
Funding details	Federal Government Communities for Children Initiative
Duration	2006–2009
Location	Tasmania
Setting	Community-wide
Target group	Children and their parents
Strategies	Strategies included, but were not limited to, the development of display kits, event organising guide, nutrition activity booklet, posters, expos, media articles and training for childcare workers and family day care workers.
Evaluation	

Source: Eat Well Tasmania (2009a).

Table B.13 Eat Well Be Active

Description	Promotes physical activity and healthy eating with the aim of contributing to healthy weight in children and their families. Implemented by Southern Primary Health of Southern Adelaide Health Service and Murray Mallee Community Health Service of Country Health SA.
Funding details	Department of Health (South Australia): \$2.6m over 5 years
Duration	2005–2010
Location	Morphett Vale and Murray Bridge, South Australia
Setting	Community-wide
Target group	0–18 year-olds and their families
Strategies	Strategies include, but are not limited to, mentoring for canteens, physical activity and nutrition policies, improvements to drinking water facilities, canteen menu improvements and newsletters.
Evaluation	Evaluation planned

Source: Department of Health (South Australia) (2004).

Table B.14 Eat Well Be Active, Healthy Kids for Life – Badu Island

Description	Aims to improve food choices and increase physical activity in Indigenous children living on Badu Island.
Funding details	Health Promotion Council Queensland
Duration	2006–?
Location	Badu Island, Queensland
Setting	Community-wide
Target group	Indigenous children aged 0–12 years
Strategies	Strategies include education and activities aimed at children in the classroom, and parents and the wider community.
Evaluation	Evaluation planned

Source: National Nutrition Networks Conference (2008).

Table B.15 Eat Well Be Active, Healthy Kids for Life – Logan-Beaudesert

Description	Aims to increase healthy eating and physical activity in 0–8 year-old Pacific Islander and African children.
Funding details	PBI Health Promotion Program
Duration	2008–?
Location	Logan-Beaudesert region
Setting	Community-wide
Target group	Pacific Islander and African children aged 0–8 years
Strategies	Strategies included, but were not limited to, a recipe book, a dance and games resource kit and facilities to support cooking and food preparation.
Evaluation	Unable to locate evaluation

Source: Queensland Health (2009a).

Table B.16 Eat Well Be Active, Healthy Kids for Life – Townsville

Description	Provides no cost, simple activities for families in parks and open spaces to encourage physical activity.
Funding details	
Duration	
Location	Townsville
Setting	Community-wide
Target group	Children and their families
Strategies	Strategies included placing hopscotch stencils in parks, providing walking paths, development of a physical activity flipchart and installation of beach volleyball courts.
Evaluation	

Source: Townsville City Council (2010).

Table B.17 Family Food Patch

Description	Involves training of Family Food Educators who promote physical activity and good nutrition in their local community. A partnership between Eat Well Tasmania, Department of Health and Human Services (Tasmania), Child Health Association and Playgroup Tasmania.
Funding details	Tasmanian Community Fund: \$108 200
Duration	
Location	Tasmania
Setting	Community-wide
Target group	Young children
Strategies	Strategies include, but are not limited to, helping develop healthy canteen menus, giving talks to community groups and parents and showing parents and children healthy recipes.
Evaluation	

Source: Eat Well Tasmania (2009b); Tasmanian Community Fund (?2005).

Table B.18 Filling the Gaps

Description	Aims to improve healthy eating and physical activity patterns in children and families in hard to reach, vulnerable communities. A collaboration between The Royal Children's Hospital, The Murdoch Children's Research Institute and the Centre of Physical Activity Across the Life Span at the Australian Catholic University. It is a partner program of Kids – 'Go for your life' (table B.44) under the 'Go for your life' banner.
Funding details	
Duration	
Location	Victoria
Setting	Community-wide
Target group	Children aged 0–12 years and their families
Strategies	Strategies include, but are not limited to, tip sheets, physical activity practical sheets, newsletter inserts, parent kits and School Nurse BMI training sessions.
Evaluation	

Source: Department of Health (Victoria) (2010a).

Table B.19 Fit4fun

Description	A fundraising program that aims to promote healthy lifestyles, by encouraging students to eat healthy, get active and have fun. Run by the Royal Childrens Hospital Foundation.
Funding details	
Duration	1 week in May each year
Location	Queensland
Setting	Schools and wider community
Target group	Children and their families
Strategies	Students set physical activity and healthy eating goals and ask people to sponsor them to achieve these goals.
Evaluation	

Source: Royal Childrens Hospital Foundation (2008).

Table B.20 Fitness Improvement and Lifestyle Awareness (FILA) Program

Description	School-based obesity prevention program aimed to increase cardiorespiratory fitness, physical activity and healthy eating and reduce small screen recreation in adolescent males with sub-optimal cardiorespiratory fitness by using behavioural modification techniques.
Funding details	
Duration	16 weeks in 2006, 6 months in 2007
Location	Independent boys school in Sydney
Setting	School
Target group	Pilot RCT: Year 7 students
Strategies	Pilot RCT: 1 60-minute curricular session and 2 20-minute lunchtime physical activity sessions per week.
Evaluation	See pilot RCT (appendix A, table A.8)

Source: Child Obesity Research Centre (?2009); Peralta, Jones and Okely (2009).

Table B.21 Foodbank School Breakfast Program

Description	Provides school students with breakfast at school with the aim of improving the social determinants of health. Run by Foodbank WA.
Funding details	
Duration	2001 onwards
Location	Western Australia
Setting	Schools
Target group	School students
Strategies	Provides students with breakfast at school.
Evaluation	

Source: Foodbank WA (?2010).

Table B.22 Free Fruit Friday

Description	Provides students in years prep–2 in government schools with free fruit to encourage increased consumption. Under the ‘Go for your life’ banner.
Funding details	
Duration	
Location	Victoria
Setting	Schools
Target group	Students in grades prep–2
Strategies	Provides students with free fruit.
Evaluation	

Source: Department of Education and Early Childhood Development (Victoria) (2009b).

Table B.23 Fresh Tastes @ School – NSW Health School Canteen Strategy

Description	A school canteen strategy that is mandatory in all NSW Government schools. Key partners include the Healthy Kids School Canteen Association and The Federation of Parents and Citizens Association of NSW.
Funding details	NSW Department of Health: \$62 500
Duration	2005 onwards
Location	New South Wales
Setting	Schools
Target group	Students and canteen staff
Strategies	Foods are classified into traffic light categories, which guide how often those foods can be sold in canteens. There are also resources for canteens to help with implementation, and fliers and newsletters aimed at parents and children.
Evaluation	

Source: NSW Department of Health (?2005, 2005).

Table B.24 Fruit ‘n’ Veg Week

Description	Aims to increase consumption of fruit and vegetables by primary-school students in Western Australia by increasing awareness and positive perceptions of fruits and vegetables, increasing opportunities to prepare and taste fruits and vegetables and incorporating a nutrition program into the curriculum. Under the Go for 2&5 banner (table B.29).
Funding details	
Duration	1 week a year since 1990
Location	Western Australia
Setting	Schools
Target group	Primary-school students
Strategies	Consumption of fruits and vegetables is encouraged by various activities run over the course of a week.
Evaluation	

Source: Department of Health (Western Australia) (2009a).

Table B.25 Fun ‘n’ Healthy in Moreland

Description	Primary schools implemented a range of whole-of-school strategies to improve healthy eating, increase physical activity and improve self-esteem by targeting the physical and social environment, school policies, and programs. Under the ‘Go for your life’ banner, and part of the Jack Brockhoff Child Health and Wellbeing Program (table B.41).
Funding details	Moreland Community Health Service Department of Education and Training (Victoria) Department of Sport and Recreation (Victoria) Department of Human Services (Victoria) The Jack Brockhoff Foundation
Duration	5 years, 2005–2009
Location	Moreland City Council area, Victoria
Setting	Schools
Target group	Primary-school students
Strategies	
Evaluation	Evaluation planned

Source: ACAORN (2010); Merri Community Health Services (2009); The Jack Brockhoff Foundation (2009).

Table B.26 Get Set 4 Life – Habits for Healthy Kids Guide

Description	Guide is provided to parents of 4 year-old children who undergo the Healthy Kids Check. It was developed by the CSIRO and provides information on eating, exercise, oral health, speech and language, sun protection, hygiene and sleep patterns.
Funding details	Development of guide: Australian Government Department of Health and Ageing 2008–09: \$2.9m over 2 years
Duration	2008 onwards
Location	Australia-wide
Setting	Australia-wide
Target group	4 year-olds and their parents
Strategies	The guide incorporates practical information for parents and carers of children and animated illustrations for children.
Evaluation	

Source: DoHA (2008a).

Table B.27 Get Up & Grow: Healthy Eating and Physical Activity Guidelines for Early Childhood

Description	Aim to improve healthy eating and physical activity in early childhood settings. Developed by Early Childhood Australia, the Murdoch Children’s Research Institute, the Royal Children’s Hospital Melbourne and the Australian Government Department of Health and Ageing.
Funding details	Australian Government: \$4.5m over 5 years
Duration	Released 22 October 2009
Location	Australia-wide
Setting	Community-wide
Target group	Young children and their parents and carers
Strategies	Guidelines consist of 4 books: <ul style="list-style-type: none">• directors/coordinators book• staff/carers book• family book• cooking for children book. There are also posters, stickers and brochures.
Evaluation	

Source: DoHA (2009d); Early Childhood Australia (2009); Roxon (Minister for Health and Ageing) (2009).

Table B.28 Girls in sport

Description	Aims to increased moderate to vigorous physical activity in adolescent girls.
Funding details	\$300 000
Duration	2008–2010
Location	New South Wales
Setting	Schools and wider community
Target group	Girls in years 8–10
Strategies	Project focuses on factors that impact on physical activity, facilitation of school and community initiatives, skill development, learning opportunities, building local capacity and addressing barriers to girl's sport participation.
Evaluation	Evaluation planned

Source: Department of Education and Training (New South Wales) (2007); University of Wollongong (2008).

Table B.29 Go for 2&5 Campaign

Description	A social marketing campaign that aims to encourage children and their parents to increase their consumption of fruits and vegetables. There was a national campaign and each state and territory had their own campaigns.
Funding details	
Duration	National and state campaigns were conducted at different times
Location	Australia-wide
Setting	Australia-wide
Target group	Children and their parents
Strategies	Strategies included, but were not limited to, television commercials, radio advertisements, shopping trolley and shopping centre advertisements, and a campaign website.
Evaluation	See national campaign (appendix A, table A.12)

Source: Go for 2&5 (nd).

Table B.30 Go4Fun

Description	Aims to encourage children aged 7–13 and their parents to change unhealthy lifestyle habits by providing advice on exercise, nutrition and weight management skills.
Funding details	\$2m
Duration	10 week-long program, 2009 onwards
Location	New South Wales
Setting	Unknown
Target group	7–13 year-olds and their parents
Strategies	Weekly sessions during the school term where they learn about food groups, the causes of obesity, and tips on avoiding overeating. Practical activities are also included.
Evaluation	Evaluation planned

Source: NSW Government (2010).

Table B.31 GoNT

Description	Promotes physical activity in the Northern Territory. It is a whole of government and community initiative, monitored by the Chief Minister's Active Living Council.
Funding details	
Duration	2007 onwards
Location	Northern Territory
Setting	Schools, workplaces and the wider community
Target group	All people in the Northern Territory
Strategies	Strategies have included, but are not limited to, a media campaign and promoting physical activity in schools.
Evaluation	

Source: Department of Health and Community Services (Northern Territory) (2007); Department of Health and Families (Northern Territory) (2008); goNT Secretariat (2008).

Table B.32 Good for Kids, Good for Life

Description	Aims to increase healthy eating, physical activity and reduce sedentary behaviours in children aged 0–15 years in the Hunter New England Area of New South Wales.
Funding details	\$7.5m
Duration	2006–2010
Location	Hunter New England Area of New South Wales
Setting	Schools, child care, community organisations, health services and Aboriginal communities
Target group	0–15 year-olds
Strategies	Strategies include, but are not limited to: training for school and child care staff regarding lunchboxes; menus; physical activity; working with health care providers to identify at-risk children; working with sports clubs to provide more physical activity opportunities; and a social marketing campaign.
Evaluation	Evaluation planned

Source: Hunter New England Area Health Service (?2006); NSW Department of Health (2005; 2007).

Table B.33 Growing Years Project

Description	Nutrition and physical education program targeting mothers and their infants.
Funding details	Health Promotion Queensland (Queensland Health)
Duration	2005–2010
Location	Gold Coast
Setting	
Target group	Mothers and their infants
Strategies	
Evaluation	Evaluation planned

Source: ACAORN (2010); Baillie and Hughes (2007).

Table B.34 Health Promoting Communities: Being Active Eating Well

Description	This is a demonstration project implemented in 6 communities in Victoria which aims to increase physical activity and improve diet.
Funding details	Department of Health (Victoria) Department of Planning and Community Development (Victoria)
Duration	2006–2010
Location	<ul style="list-style-type: none">• Shire of Campaspe (Campaspe PCP)• Clayton South and public housing estates in the city of Bayside (Kingston Bayside PCP)• Central Pakenham (South East Healthy Communities Partnership)• Shire of Southern Grampians (Southern Grampians & Glenelg PCP)• City of Maribyrnong (West Bay Alliance)• North Geelong (Wathaurong Aboriginal Co-operative)
Setting	Community-wide
Target group	0–18 year-olds
Strategies	Strategies include, but are not limited to, incorporating healthy messages and nutrition into school policies, educating children and parents on healthy food, increasing availability of fruits and vegetables and increasing the range of sports offered at schools.
Evaluation	Evaluation planned

Source: Campaspe Primary Care Partnership (?2009); Department of Health (Victoria) (2009b).

Table B.35 Healthy Beginnings Study

Description	Randomised controlled trial of a home visiting intervention for first time mothers to influence behavioural risk factors for overweight and obesity. Implemented in socioeconomically disadvantaged areas in Sydney.
Funding details	National Health and Medical Research Council (ID: 393112): <ul style="list-style-type: none">• 2006: \$118 074• 2007: \$235 236• 2008: \$207 106• 2009: \$89 944
Duration	2007–2010
Location	Sydney
Setting	Homes
Target group	First time mothers and children aged 0–2 years
Strategies	Home visits by a nurse at the gestation age of 30–36 weeks and ages 1, 3, 5, 9, 12, 15 and 24 months, and telephone support.
Evaluation	Evaluation planned

Source: NHMRC (2009); Wen et al. (2007).

Table B.36 Healthy Dads Healthy Kids

Description	Aimed to help fathers demonstrate positive eating and physical activity habits to their children, by helping the fathers to achieve sustained weight loss.
Funding details	Hunter Medical Research Institute
Duration	6 months
Location	University of Newcastle
Setting	University setting
Target group	Overweight or obese fathers of 5–12 year-olds
Strategies	8 sessions are conducted with the fathers (some of these are also attended by their children) where they are given information and undertake activities with their children, that are designed to improve fundamental movement skills.
Evaluation	Evaluation planned

Source: Hunter Medical Research Institute (2008).

Table B.37 Healthy eating and obesity prevention for preschoolers: A randomised controlled trial

Description	Will evaluate the impact of a childhood obesity prevention intervention for parents of preschool children.
Funding details	Australian research council: <ul style="list-style-type: none">• 2010: \$70 000• 2011: \$60 000• 2012: \$70 000
Duration	
Location	
Setting	
Target group	Preschool children and their parents
Strategies	
Evaluation	Evaluation planned

Source: Australian Research Council (?2009a, ?2009b).

Table B.38 Healthy food and drink

Description	Mandatory school canteen guidelines for Western Australia.
Funding details	
Duration	2007 onwards
Location	Western Australia
Setting	Schools
Target group	School children
Strategies	Uses a traffic light system to decide what food can be sold in school canteens.
Evaluation	

Source: Healthy Kids Association (?2010a).

Table B.39 Healthy Kids Check

Description	A basic health check available for all 4 year-old children to help ensure they are healthy before they start school. It usually takes place through local GPs and is funded by Medicare. Arrangements for follow-up are put in place where problems are identified.
Funding details	Australia Government Department of Health and Ageing 2008–09: \$25.6m over 4 years
Duration	2008 onwards
Location	Australia-wide
Setting	Generally at a GPs office
Target group	4 year-olds
Strategies	4 year-olds are given a basic health check.
Evaluation	

Source: Australian Government (2008); DoHA (2008b).

Table B.40 It's Your Move

Description	Promoted healthy eating patterns and regular physical activity in 5 secondary schools and the wider Geelong community. It aimed to build capacity of schools, families and the community to sustain the promotion of physical activity and healthy eating.
Funding details	Department of Human Services (Victoria) National Health and Medical Research Council Australian Government Department of Health and Ageing VicHealth
Duration	3 years, 2005–2008
Location	Geelong, Victoria
Setting	Secondary schools
Target group	13–17 year-olds
Strategies	Strategies included, but were not limited to, social marketing, newsletters, development of 'Food @ School' framework, new canteen menu with 'Traffic Light' system.
Evaluation	Evaluation planned

Source: WHO Collaborating Centre for Obesity Prevention (2006; 2008a).

Table B.41 Jack Brockhoff Child Health and Wellbeing Program

Description	Aims to help close the gap in child health inequalities by focusing on primary health issues such as childhood obesity and poor dental health in disadvantaged communities in Victoria. Launched by the University of Melbourne and the Jack Brockhoff Foundation. Includes the Fun 'n' Healthy in Moreland intervention (table B.25).
Funding details	The Jack Brockhoff Foundation: \$5m
Duration	
Location	Victoria
Setting	Community-wide
Target group	Children in disadvantaged communities
Strategies	
Evaluation	

Source: Sim-Jones (2008); The Jack Brockhoff Foundation (2009).

Table B.42 Jump Start

Description	A randomised controlled trial of a physical activity program for preschool children targeting obesity prevention, physical activity and fundamental movement skills mastery.
Funding details	University of Wollongong, Faculty of Education grant: \$7000
Duration	20 weeks in 2008
Location	
Setting	
Target group	3–5 year-olds
Strategies	3 fundamental movement skills and physical activity sessions were conducted each week.
Evaluation	Evaluation planned

Source: ACAORN (2009); University of Wollongong (2008).

Table B.43 Just add fruit and veg

Description	Resources that encourage people to add more fruits and vegetables to their main meals. Developed by the Heart Foundation in Victoria and the Melbourne wholesale fruit, vegetable and flower market. Under the 'Go for your life' banner.
Funding details	
Duration	
Location	Victoria
Setting	Community-wide
Target group	All Victorians
Strategies	Recipes, posters and tip cards.
Evaluation	

Source: Department of Health (Victoria) (2009c); National Heart Foundation of Australia (Victorian Division) (2008).

Table B.44 Kids – 'Go for your life'

Description	A healthy eating and physical activity program run in primary-schools and early childcare settings in Victoria. It is managed by Diabetes Australia – Victoria and The Cancer Council Victoria.
Funding details	Department of Human Services (Victoria) The Cancer Council Victoria Diabetes Australia – Victoria
Duration	
Location	Victoria
Setting	Primary-schools and early childhood services
Target group	0–12 year-olds
Strategies	Uses awards to promote increased water consumption, reduced sedentary behaviour, increased intake of fruits and vegetables, increased physical activity, reduced intake of 'sometimes' food and increased active transport to school.
Evaluation	Evaluation planned

Source: Department of Health (Victoria) (2010b); Diabetes Australia – Victoria (2008); University of Melbourne (2009).

Table B.45 Kids GP Campaign

Description	Educates children, in the classroom, on healthy eating and physical activity. Run by the Australian Medical Association Queensland.
Funding details	Queensland Government: \$300 000
Duration	2004 onwards
Location	Queensland
Setting	Schools
Target group	School children
Strategies	Strategies include, but are not limited to, presentations given in classrooms by GPs, activity sheets and guides for parents, factsheets and recipes for parents and game ideas for kids.
Evaluation	

Source: AMA Queensland (2007); Beattie (2006).

Table B.46 Live Fit

Description	Aims to improve the health of families by focusing on physical activity, nutritional guidance and psychological issues.
Funding details	Australian Government
Duration	5 months, 2008 onwards
Location	Western Australia
Setting	Trinity College, East Perth
Target group	Children and their families
Strategies	2 1-hour sessions each week include physical activity, nutritional information (including reading food labels and spending food money wisely), and psychological training (including individual consultation with a nutritional psychologist).
Evaluation	

Source: Live Fit (nd).

Table B.47 Live Life Well @ School

Description	Series of professional learning workshops for staff in NSW Government primary-schools, which focus on developing quality nutrition and physical education programs for primary-school students. Joint initiative between NSW Health and the Department of Education and Training (New South Wales).
Funding details	NSW Health: \$6.5 million over 4 years
Duration	2008–2011
Location	New South Wales
Setting	Primary schools
Target group	Primary-school students
Strategies	Strategies include, but are not limited to, 4 days of professional learning workshops, newsletters, email groups, video conferencing and network meetings.
Evaluation	

Source: Healthy Kids (2008b); NSW Government (2007). NSW Department of Health (2008).

Table B.48 Make Tracks to School

Description	Encouraged children in years 5–7 and their families to walk or cycle to school more often. Run by the Heart Foundation.
Funding details	Healthway (Western Australian Health Promotion Foundation) Department of Health (Western Australia)
Duration	October–November 2008 and 2009
Location	Western Australia
Setting	Community-wide
Target group	Children in years 5–7 and their families
Strategies	Included, but was not limited to, a media campaign comprising of press and radio advertising.
Evaluation	

Source: National Heart Foundation of Australia (2010); WA Country Health Service (2008).

Table B.49 Many Rivers Diabetes Prevention Program

Description	Aims to prevent diabetes and obesity in Indigenous young people in Newcastle, Tarro and Kempsey.
Funding details	NHMRC Strategic Award (351 204): <ul style="list-style-type: none">• 2005: \$74 869• 2006: \$374 342• 2007: \$299 474• 2008: \$299 474• 2009: \$299 474• 2010: \$224 606
Duration	2005–2010
Location	Newcastle, Tarro and Kempsey in New South Wales
Setting	
Target group	Indigenous young people
Strategies	
Evaluation	

Source: Hunter Medical Research Institute (2005); NHMRC (2009); NSW Centre for Overweight and Obesity (2009).

Table B.50 Mend 2-4

Description	Aims to prevent childhood obesity by supporting parents to establish healthy behaviours and attitudes to diet and physical activity for themselves and their children.
Funding details	
Duration	10 weeks
Location	Victoria
Setting	Local community centres
Target group	Children aged 2–4 years and their parents
Strategies	10-week healthy lifestyle program.
Evaluation	Evaluation planned

Source: Deakin University (2010).

Table B.51 Move Well Eat Well

Description	Promotes healthy eating and physical activity in primary-school children and contributes to the prevention of a range of conditions such as obesity, heart disease, diabetes, dental decay and some cancers. Run by the Department of Health and Human Services (Tasmania) and the Department of Education (Tasmania).
Funding details	Australian Better Health Initiative
Duration	
Location	Tasmania
Setting	Schools
Target group	Primary-school students
Strategies	
Evaluation	

Source: Department of Education (Tasmania) (2010).

Table B.52 Munch and Move

Description	A games-based program to promote physical activity, healthy eating, and reduced screen-time in NSW preschoolers. A joint initiative between the University of Sydney, the NSW Department of Health and the NSW Department of Community Services.
Funding details	Centre for Chronic Disease Prevention Health Advancement (NSW Health)
Duration	2007–2009
Location	New South Wales
Setting	Preschools
Target group	Preschool children
Strategies	Strategies included, but were not limited to, skill-based active play and learning experiences for children, and parent-focused support materials.
Evaluation	Evaluation planned

Source: Healthy Kids (2008a); NSW Centre for Overweight and Obesity (2009).

Table B.53 NOURISH

Description	A randomised controlled trial promoting feeding practices to support healthy weight and growth in infants.
Funding details	National Health and Medical Research Council (426 704): <ul style="list-style-type: none">• 2008: \$1 166 954• 2009: \$292 284
Duration	About 9 months
Location	Brisbane and Adelaide
Setting	Child health clinics
Target group	First time mothers and their infants
Strategies	Fortnightly sessions conducted by a dietician and a psychologist focused on healthy eating, feeding relationships and healthy growth.
Evaluation	Evaluation planned

Source: Daniels et al. (2009); NHMRC (2009).

Table B.54 Nourish-the-FACTS

Description	The ACT's school guidelines covering best practice in food and nutrition. Developed by ACT Health and the ACT Department of Education and Training.
Funding details	
Duration	
Location	ACT
Setting	Schools
Target group	School students
Strategies	Guidelines cover nutrition, wellbeing, food safety, food in schools, partnerships and healthy food practices.
Evaluation	

Source: ACT Department of Education and Training (2007); ACT Health (2008).

Table B.55 Obesity Prevention and Lifestyle (OPAL)

Description	Promotes good health in children and their families in 6 local council areas in South Australia. Based of the French obesity prevention initiative EPODE.
Funding details	South Australian Government: \$22.3m
Duration	5 years, 2009–2013
Location	South Australia
Setting	Schools and the wider community
Target group	School students
Strategies	Strategies include, but are not limited to, banning junk food from public school canteens, encouraging children to replace junk food and soft drinks with water and fruit, introducing the Premier's Be Active Challenge, introducing Start Right Eat Right healthy food in childcare centres (table B.67), recruiting healthy weight coordinators.
Evaluation	Evaluation planned

Source: Hill (SA Minister for Health) and Lomax-Smith (SA Minister for Education) (2009); South Australian Policy Online (2010).

Table B.56 Osborne Division of General Practice's Obesity Program – Healthy Families for Happy Futures

Description	Promotes behaviour change in children and their families to tackle obesity. Conducted by a clinical psychologist and an accredited practicing dietician.
Funding details	Australian Government 2008-09: \$235 000
Duration	2005–2012 (at this stage)
Location	Osborne, Western Australia
Setting	
Target group	6–12 year-old children and their families
Strategies	Strategies include, but are not limited to, professional development for GPs, talks by GPs in schools and family based workshops.
Evaluation	

Source: Australian Government (2008); Osborne GP Network (nd); Western Australia General Practice Network (?2008).

Table B.57 Parental Guidance Recommended Program

Description	Aims to improve nutritional intake and physical activity of Western Australian children aged 2–12 years, by training nurses and other health professionals to run workshops for parents. Run by Cancer Council WA.
Funding details	Australian Government Department of Health and Ageing's National Child Nutrition Program
Duration	
Location	Western Australia
Setting	Schools, childcare centres and other locations
Target group	Parents and children
Strategies	Workshops focus on nutritional needs, food labels, positive eating behaviours, recipes and barriers to physical activity.
Evaluation	

Source: Cancer Council Western Australia (2009).

Table B.58 Physical Activity and Nutrition out of School Hours (PANOSH)

Description	Series of 4 booklets to assist Outside School Hours Care services to promote healthy food choices and physical activity. Developed by Queensland Health.
Funding details	
Duration	
Location	Queensland
Setting	Out of school hours care
Target group	Children and staff in out of school hours care
Strategies	4 booklets promoting food choices and physical activity: <ul style="list-style-type: none">• Communicating with families• Culture food and physical activity• Food safety• Physical activity and nutrition policies
Evaluation	Unable to locate evaluation

Source: Abbott et al. (2007); Queensland Health (2009b).

Table B.59 Physical Activity in Culturally and Linguistically Diverse Communities

Description	Aimed to improve physical activity-related variables in primary-school students from culturally and linguistically diverse backgrounds.
Funding details	
Duration	
Location	New South Wales
Setting	Schools
Target group	Children from culturally and linguistically diverse backgrounds in years 1, 3 and 5
Strategies	
Evaluation	Evaluation planned

Source: NSW Centre for Overweight and Obesity (2009).

Table B.60 Physical Activity Leaders Program

Description	A cluster randomised controlled trial that provides adolescent boys with the opportunity to become physical activity leaders in their schools and homes.
Funding details	
Duration	Unknown
Location	Unknown
Setting	Schools
Target group	Year 9 male students at an economically disadvantaged secondary school
Strategies	Includes health-related fitness activities, pedometers for self-monitoring, interactive seminars and information for parents.
Evaluation	Evaluation planned

Source: ACAORN (2009).

Table B.61 Play5

Description	Designed to support teachers, parents and community groups in promoting physical activity in children. A randomised controlled trial, evaluation of the program was conducted in 2005–2006.
Funding details	Trial funded by the Telstra Foundation
Duration	Trial: 2005–2006. Play5 resources still available
Location	Trial: Western Australia
Setting	Trial: Primary schools
Target group	Primary-school students
Strategies	Children are supported to play 5 times a day to achieve sufficient daily physical activity.
Evaluation	Unable to locate evaluation

Source: Play5 (nd).

Table B.62 Premier's Active Families Challenge

Description	Encouraged families to spend time together while improving their physical activity levels and health.
Funding details	
Duration	8 March – 19 April 2009
Location	Victoria
Setting	Community-wide
Target group	Families
Strategies	Encouraged people to undertake 30 minutes of physical activity a day for 30 days. Used incentives such as providing all registered families with free YMCA passes, discounts at Rebel Sport stores and the chance to win prizes.
Evaluation	

Source: State Government of Victoria (2009).

Table B.63 Remote Indigenous Stores and Takeaways (RIST) Project

Description	Aims to improve access to healthy foods in remote Indigenous communities. It is overseen by the RIST steering committee and is supported by the National Public Health Partnership.
Funding details	South Australian, Western Australian, Northern Territory, Queensland, New South Wales and Australian Government Health departments
Duration	2005–2008
Location	Various states in Australia
Setting	Remote Indigenous communities
Target group	Indigenous people
Strategies	A set of guidelines that promote access to healthy foods aimed at store owners.
Evaluation	Evaluation planned

Source: Australian Indigenous HealthInfoNet (2009); DoHA (2008c).

Table B.64 Right Bite

Description	Canteen strategy that aims to assist schools in South Australia to select food and drinks to promote health. It is based on the Dietary Guidelines for Children and Adolescents in Australia and The Australian Guide to Healthy Eating.
Funding details	
Duration	2004 onwards
Location	South Australia
Setting	Schools and preschools
Target group	School students and pre-school children
Strategies	Uses a traffic light system to decide what food can be sold in school canteens.
Evaluation	

Source: Department of Education and Children's Services (South Australia) (2009).

Table B.65 School's Out – Open Playground Program

Description	Provides communities with access to school facilities outside of school hours.
Funding details	
Duration	
Location	Queensland
Setting	Schools
Target group	
Strategies	
Evaluation	

Source: Queensland Government (2006).

Table B.66 StarCAP & StarCAP2

Description	Voluntary school canteen accreditation program consistent with the Government Healthy Food and Drinks Policy. It is run by the Western Australian School Canteen Association, Heart Foundation of Australia (WA Division) and the Department of Health (Western Australia).
Funding details	Healthway (Western Australian Health Promotion Foundation) Australian Government Department of Health and Ageing
Duration	1999 onwards
Location	Western Australia
Setting	School canteens
Target group	School children
Strategies	Rewards schools that run healthy, profitable canteens. Staff are required to attend training on the accreditation program.
Evaluation	

Source: Western Australian School Canteen Association (?2009).

Table B.67 Start Right Eat Right award scheme

Description	Promotes healthy eating and good nutrition in child care centres. Managed by South Adelaide Health Service.
Funding details	SA Health
Duration	
Location	South Australia
Setting	Child care centres
Target group	Child care children and staff
Strategies	Strategies include training for child care centre staff, fact sheets, newsletters, menus and recipes.
Evaluation	

Source: Government of South Australia (2004).

Table B.68 Start Right Eat Right – Tasmania

Description	Aims to improve the quality of food and nutrition practices in child care centres in Tasmania. It is based on the Australian Dietary Guidelines for Children and Adolescents and Caring for Children recommendations. Joint initiative between Lady Gowrie and the Community Nutrition Unit.
Funding details	Telstra Foundation
Duration	
Location	Tasmania
Setting	Child care centres
Target group	Child care children and staff
Strategies	Training for child care workers in topics such as nutrition, food safety and meal time environment. Trained carers can then provide parents with information on such topics as food allergies, how much food is enough and label reading.
Evaluation	

Source: Eat Well Tasmania (2009c); Lady Gowrie Child Centre (?2003).

Table B.69 Start Right Eat Right – Victoria

Description	Aims to improve access to nutritious foods and encourage age-appropriate eating patterns in child care centres in Victoria. It is a partner initiative of Kids – ‘Go for your life’ (table B.44) under the ‘Go for your life’ banner and is managed by Gowrie Victoria.
Funding details	Department of Human Services (Victoria)
Duration	
Location	Victoria
Setting	Child care centre
Target group	Child care children and staff
Strategies	Provides training to child care staff by an experienced dietician.
Evaluation	

Source: Department of Health (Victoria) (2009a); Gowrie Victoria (2009).

Table B.70 Stephanie Alexander Kitchen Garden National Program

Description	Aims to provide food education to primary-school students by encouraging them to maintain a vegetable garden.
Funding details	Australian Government: \$12.8m over 4 years
Duration	2009 onwards
Location	Australia-wide
Setting	Schools
Target group	Students in years 3–6
Strategies	Students learn to grow vegetables as well as cooking and sharing food.
Evaluation	See evaluation of Victorian program (appendix A, table A.23)

Source: Australian Government (2008; 2009); Stephanie Alexander Kitchen Garden Foundation (?2009b).

Table B.71 Stephanie Alexander Kitchen Garden Program – Victoria

Description	Aims to provide food education to primary-school students by encouraging them to maintain a vegetable garden. More recently implemented by The Department of Education and Early Childhood Development (Victoria) and the Stephanie Alexander Kitchen Garden Foundation. Under the ‘Go for your life’ banner.
Funding details	Victorian Government: \$2.5m
Duration	2001 onwards
Location	Victoria
Setting	Schools
Target group	Students in years 3–6
Strategies	Students learn to grow vegetables as well as cooking and sharing food.
Evaluation	See appendix A, table A.23

Source: Deakin University (2007); Department of Education and Early Childhood Development (Victoria) (2009a); Stephanie Alexander Kitchen Garden Foundation (?2009a).

Table B.72 Streets Ahead

Description	Aims to increase 4–12 year-olds physical activity by increasing their active transport. Based on the Victorian Walking School Bus intervention.
Funding details	VicHealth: \$1.7m over 3 years.
Duration	July 2008–June 2011
Location	6 councils in Victoria: <ul style="list-style-type: none">• Greater Bendigo City Council• Brimbank City Council• Cardinia Shire Council• Darebin City Council• City of Greater Geelong• City of Wodonga
Setting	Communities
Target group	4–12 year-old children
Strategies	
Evaluation	Evaluation planned

Source: VicHealth (?2009a, 2008).

Table B.73 Talk about weight

Description	Aims to educate concerned parents on topics to help them manage their child's weight.
Funding details	
Duration	2 week program run at various times throughout the year
Location	ACT
Setting	Various locations including family centres
Target group	Parents of 2–12 year-old children
Strategies	2 week program that covers healthy eating, physical activity and dealing with weight issues.
Evaluation	

Source: ACT Health (?2009b).

Table B.74 The Melbourne Infant Feeding Activity and Nutrition Trial (InFANT) Program

Description	Aims to develop positive diet and physical activity and reduce sedentary behaviours in infancy. Delivered to first-time parents over the first 18 months of the child's life.
Funding details	National Health and Medical Research Council (NHMRC) (425 801): <ul style="list-style-type: none">• 2008: \$171 150• 2009: \$366 489• 2010: \$163 970
Duration	18 months
Location	Victoria
Setting	Maternal and child health centres
Target group	First-time parents and their infants
Strategies	Group sessions delivered at 3 month intervals which will include the use of group discussion and peer support, exploration of perceived barriers, text messaging and mailouts.
Evaluation	Evaluation planned

Source: Campbell et al. (2008); NHMRC (2009).

Table B.75 The Responsible Children's Marketing Initiative

Description	Companies publicly commit to marketing to children under 12 years only when it will promote healthy dietary choices and healthy lifestyle. Joint initiative of the food industry and the advertising industry.
Funding details	
Duration	1 January 2009 onwards
Location	Australia-wide
Setting	Television media
Target group	Children under 12 years
Strategies	Each participant develops an action plan that identifies how they will meet the core principles of The Responsible Children's Marketing Initiative.
Evaluation	

Source: Australian Food and Grocery Council (2008).

Table B.76 Time2bHealthy

Description	An online program aimed at parents of overweight, or at risk of becoming overweight, preschoolers promoting healthy, active lifestyles.
Funding details	Australian Health Management: \$77 000
Duration	2007 onwards
Location	Australia-wide
Setting	Homes
Target group	Parents of preschoolers
Strategies	A 9-week program with 5 modules focusing on meals, snacks, drinks, physical activity and screen time. Includes a communication forum, a weekly planner, and goal setter and review system.
Evaluation	Evaluation planned

Source: emlab (?2007); University of Wollongong (2007).

Table B.77 Tooty Fruity Vegie in Preschools

Description	Addressed diet, movement skills and overweight indicators in preschool children in New South Wales.
Funding details	The Australian Better Health Initiative
Duration	2006–2007
Location	New South Wales
Setting	Preschools
Target group	Preschool children
Strategies	Strategies included, but were not limited to, displaying posters at preschool, improving access to drinking water, workshops for parents and a games-based fundamental movement skills program.
Evaluation	Unable to locate evaluation

Source: Adams, Zask and Dietrich (2009).

Table B.78 Transferability of a Mainstream Childhood Obesity Prevention Program to Aboriginal People

Description	Investigating the effectiveness of South Australia's Eat Well Be Active (table B.13), a community-based physical activity and nutrition intervention for Indigenous people.
Funding details	SA Health
Duration	2008–2011
Location	Murray Bridge and Morphett Vale, South Australia
Setting	
Target group	Indigenous children and their families
Strategies	Eat Well Be Active strategies.
Evaluation	Evaluation planned

Source: Cooperative Research Centre for Aboriginal Health (2009).

Table B.79 TravelSMART Schools

Description	Aimed to encourage active transport in primary-school students. Piloted in Victoria.
Funding details	
Duration	
Location	Victoria
Setting	Primary-schools and routes children travel to school
Target group	Children in years 5–6
Strategies	Strategies included, but were not limited to, information sessions about the program, professional development program for teachers, classroom activities, bike servicing, and promotion of the program through the local community.
Evaluation	

Source: Department of Human Services (Victoria) (2006).

Table B.80 Tuckatalk

Description	School newsletters aimed at parents that provide information on nutrition. Partnership between ACT Health and the Department of Education (ACT).
Funding details	
Duration	3 years from 2005
Location	ACT
Setting	Schools and homes
Target group	Parents of school children
Strategies	Newsletters with information about nutrition.
Evaluation	

Source: ACT Health (2007b); National Obesity Taskforce (2005).

Table B.81 Unplug and Play

Description	Aims to increase parents' awareness of the need for children to spend less time in small screen recreation and more time in active play. Implemented by the Heart Foundation in partnership with the Cancer Council WA and Diabetes WA.
Funding details	Department of Health (Western Australia)
Duration	2008–?
Location	Western Australia
Setting	Homes
Target group	Parents and their children
Strategies	Strategies included giving parents ideas for active play, encouraging parents to tally how much time children spend using electronic entertainment and encouraging families to have an electronic entertainment family agreement.
Evaluation	

Source: National Heart Foundation of Australia (2008; 2009b).

Table B.82 WA Healthy Schools Project

Description	Healthy School Coordinators work with at-risk schools to implement best practice nutrition and physical activity initiatives. Coordinated by Child and Adolescent Community Health and the WA Country Health Service.
Funding details	Australian Better Health Initiative
Duration	2007–2010
Location	Western Australia
Setting	Schools
Target group	Children at schools most at risk of poor health outcomes
Strategies	Strategies include, but are not limited to, incorporating physical activity and healthy eating into school policies and facilitating school and community-based activities.
Evaluation	

Source: Department of Education (Western Australia) (2010); Department of Health (Western Australia) (2009b, nd).

Table B.83 Walktober Walk-to-School

Description	Aims to highlight the social and broader health benefits of walking by encouraging students to walk to school. Developed by Kinect Australia and VicHealth.
Funding details	
Duration	1 day in October each year
Location	Victoria
Setting	Community-wide
Target group	Primary-school students
Strategies	Encourages schools to organise a walk to school day with prizes for individuals and schools.
Evaluation	

Source: VicHealth (?2009b); Walktober (?2009).

Table B.84 Walk safely to school day

Description	Walk Safely to School Day is an annual, national event to raise awareness of the benefits of physical activity, in particular walking and other forms of active transport, and to encourage primary-school students to walk safely to school.
Funding details	Multiple funding sources
Duration	Australia-wide since 2004
Location	Australia-wide
Setting	Primary schools
Target group	Primary-school students
Strategies	Media and PR activities to promote the event and dissemination of promotional materials to schools.
Evaluation	See evaluation of the New South Wales Walk Safely to School Day (appendix A, table A.16)

Source: DoHA, pers. comm., 26 March 2010.

Table B.85 Walking School Bus

Description	Encourages children to walk to school with parent volunteers by using a 'Walking School Bus'.
Funding details	ACT: ACT Health Promotion Grants Program: <ul style="list-style-type: none">• 2008-09: \$85 000• 2009-10: \$87 530• 2010-11: \$90 156 Victoria: VicHealth: \$200 000
Duration	Different states started at different times
Location	ACT, Northern Territory, South Australia, Victoria, Tasmania and Western Australia
Setting	Routes children walk to school
Target group	Primary-school students
Strategies	The 'Walking School Bus' has 2 parent volunteers who pick up children along a specific route and walk them to school. In addition to this, there are special walking events throughout the year and a newsletter.
Evaluation	

Source: ACT Health (?2008; 2008); TravelSmart (2007); VicHealth (2001).

Table B.86 Wollongong Sport Program

Description	A randomised controlled trial evaluating the effectiveness of a sports program in preventing unhealthy weight gain and promoting physical activity in prepubescent children.
Funding details	
Duration	30 weeks
Location	Illawarra, New South Wales
Setting	School
Target group	8–11 year-olds
Strategies	The program will run twice a week for 2 hours and will include homework club, healthy afternoon snacks and moderate-to-vigorous physical activity.
Evaluation	Evaluation planned

Source: ACAORN (2009).

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