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## Obesity prevention in young children: what does the evidence say?

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## Introduction

The financial cost of obesity in Australia was estimated to be \$8.3 billion in 2008.<sup>1</sup> These costs are likely to increase dramatically over the next two decades as projections suggest that 4.6 million (or 18 per cent) of Australians will be obese by 2025. Recent reports that more than 1 in 3 preschool girls in some parts of Australia are either overweight or obese suggest that the problem begins in early childhood.<sup>2</sup> Questions are now being asked about whether or not the current cohort of ‘tubby toddlers’ will become obese children and adults, and if so, what should be done to prevent it.

A range of policy proposals have been made. Some preschools have banned foods, such as chocolate frogs, lollies, cakes and fruit roll-ups; they inspect lunch boxes and send home any food deemed unhealthy.<sup>3</sup> Some state governments have proposed compulsory exercise programs in childcare centres, and routinely monitoring the weight of children from birth.<sup>4</sup> One group of Australian researchers has recently recommended extending the Healthy Kids Check (which provides Medicare rebates for health checks on 4 year olds) so that all children, or at least those identified as being overweight or obese, would be eligible for these health assessments.<sup>5</sup>

There is a large body of evidence on obesity prevention in adults and school-aged children, but very little focusing solely on younger age groups. Most childhood obesity prevention programs aim to shape children’s food preferences and activity habits and therefore are targeted towards older children. Unlike school-aged children and adults, young children have little control over their diet and physical activity levels. Instead, they are largely determined by parents and child care centres, if they are in care. Therefore, most obesity prevention programs and policy proposals are not particularly relevant to younger children.

This paper discusses the main issues relating to overweight and obesity prevention in early childhood (that is children aged between 0 and 5 years). It examines trends in the prevalence of overweight and obesity in Australian preschoolers; comments on the evidence suggesting that obesity in early childhood increases the risk of adult obesity; considers the challenges

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1. Access Economics, ‘*The growing cost of obesity in 2008: three years on*’, report by Access Economics Pty Ltd to Diabetes Australia, Canberra, 2008, viewed 22 April 2009, <http://www.accesseconomics.com.au/publicationsreports/getreport.php?report=172&id=219>
  2. Y Zuo, M Norberg, LM Wen, C Rissel, ‘Estimates of overweight and obesity among samples of preschool-aged children in Melbourne and Sydney’, *Nutrition and Dietetics*, vol. 63, no. 3, 2006, pp. 179–182.
  3. H Edwards, ‘Chocolate birthday cake is out, lunch-box checks are in’, *Sun Herald*, 13 August 2006.
  4. Editorial, ‘No time to lose in obesity fight’, *The Daily Telegraph*, 08 July 2006; S O’Brien, ‘Fat police for tubby tots’, *Herald Sun*, 02 September 2009.
  5. K Cogdon, ‘Weigh-in plan for toddlers’, *Herald Sun*, 30 August 2007.

associated with measuring weight in young children; and summarises the evidence underpinning obesity prevention and treatment options commonly used for young children.

## Childhood obesity in Australia: prevalence and trends

There are several studies measuring the prevalence of overweight and obesity in young Australian children. The most recent data comes from the [Australian National Children's Nutrition and Physical Activity Survey](#), which was conducted in 2007 by the Commonwealth Scientific Industrial Research Organisation and the University of South Australia.<sup>6</sup> The survey measured the height, weight and Body Mass Index (BMI) of 2000 children aged between 2–3 years and 4–8 years.

Table 1 below shows that 17 per cent of boys and 14 per cent of girls aged 2–3 years were overweight. Four per cent of boys and girls of the same age were obese. In the older aged group, 4–8 years, 13 per cent of boys and 15 per cent of girls were overweight, and 5 per cent of boys and 6 per cent of girls were obese.

**Table 1: Prevalence of overweight and obesity in Australian children (%), 2007**

	Overweight	Obese
2–3 year old boys	17	4
2–3 year old girls	14	4
4–8 year old boys	13	5
4–8 year old girls	15	6

Source: Australian National Children's Nutrition and Physical Activity Survey 2007

The [National Nutrition Survey](#) conducted in 1995 also estimated the prevalence of overweight in young Australian children, but the International Obesity Taskforce has since developed new definitions that specify BMI cut-off points for overweight and obesity for boys and girls in each age group between 2 and 18 years.<sup>7</sup> Table 2 below shows the prevalence of overweight and obesity in 1995 using these new definitions, the same ones

6. Australian Government Departments of Health and Ageing, Agriculture, Fisheries and Forestry, and the Australian Food and Grocery Council, 'Children's Nutrition and Physical Activity Survey: Main Findings', prepared by the Commonwealth Scientific Industrial Research Organisation (CSIRO) Preventive Health National Research Flagship, and the University of South Australia, Canberra, 2007, viewed 21 April 2009, <http://www.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-strateg-food-monitoring.htm#07survey>.
7. In 2000, the International Obesity Taskforce proposed new definitions of overweight and obesity in children using sample data from 6 countries. Previously, cut off points were more arbitrary, extrapolated from adult BMI measures and often only based on United States, TJ Cole, MC Bellizzi, KM Flegal, WH Dietz, 'Establishing a standard definition for child overweight and obesity worldwide: international survey', *British Medical Journal*, vol. 320, no. 7244, 2000, pp. 1240–1246.

used in the Australian National Children’s Nutrition and Physical Activity Survey discussed above.<sup>8</sup> It shows that nearly 15 per cent of boys and 16 per cent of girls aged 2–3 years were overweight. Just over 2 per cent of boys and 6 per cent of girls in the same age group were obese. In the 4–6 year old age group, just over 10 per cent of boys and 15 per cent of girls were overweight, while 3 per cent of boys and 4 per cent of girls were obese.

**Table 2: Prevalence of overweight and obesity in Australian children (%), 1995**

	Overweight	Obese
2–3 year old boys	14.6	2.4
2–3 year old girls	16.5	6.1
4–6 year old boys	10.4	3.0
4–6 year old girls	15.3	4.2

Source: AM Magarey and others, [International Journal of Obesity](#), 2003.

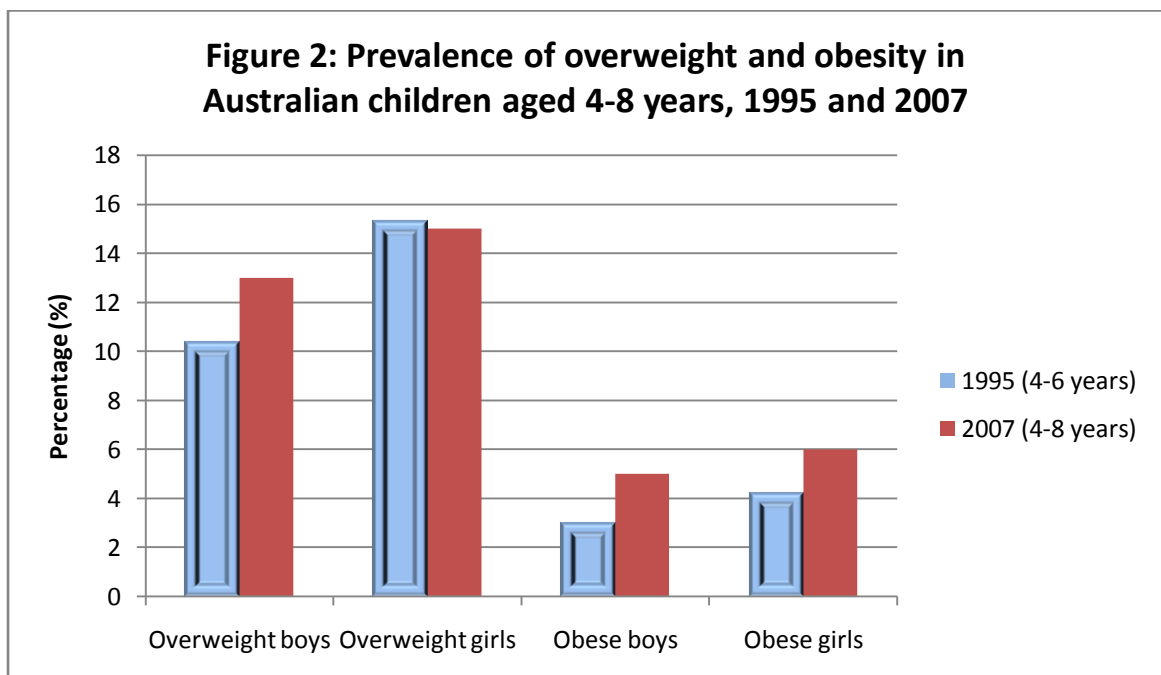
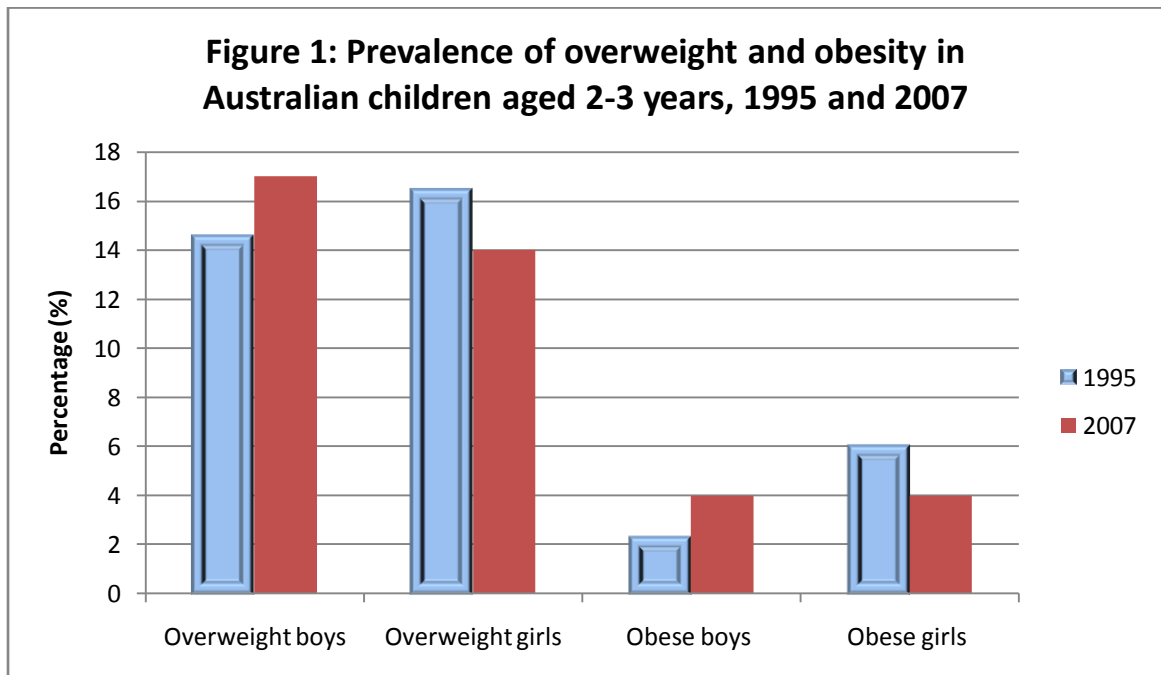
The following figures show changes in the prevalence of overweight and obesity over the last decade in Australia using data from the 1995 and the 2007 surveys. Figure 1 shows that between 1995 and 2007, the prevalence of overweight 2–3 year old boys increased by 2.4 per cent while the prevalence of overweight girls decreased by 2.5 per cent. The prevalence of obesity in 2–3 year old boys increased by 2.0 per cent between 1995 and 2007, and decreased for girls by 2.1 per cent.

Figure 2 shows changes in the prevalence of overweight and obesity for children between 4 and 8 years.<sup>9</sup> It shows that the prevalence of overweight boys increased by 2.6 per cent, while the prevalence of overweight girls decreased by 0.3 per cent. However, the prevalence of obesity between 1995 and 2007 in this age group increased in both boys and girls. In boys it increased by 2 per cent and for girls by 1.8 per cent.

Figures 1 and 2 reveal that the prevalence of overweight and obesity in young girls (2–3 year olds) has improved slightly over the last decade, but worsened for boys. Except for a minor decrease in the prevalence of overweight 4–8 year old girls, the trend in this age group has been an increasing prevalence of overweight and obesity for both boys and girls.

8. AM Magarey, LA Daniels, TJ Boulton, RA Cockington, ‘Predicting obesity in early adulthood from childhood and parental obesity’, *International Journal of Obesity*, vol. 27, no. 4, 2003, pp. 505–513.

9. The two surveys are not directly comparable because the 1995 survey only considers children aged 4–6. The 1995 survey, however, is the best available data. It is therefore used as a baseline point for comparisons.



## **Do obese young children become obese adults?**

Many studies published in the last decade demonstrate a link between obesity in childhood and adulthood.<sup>10</sup> However, there is no consensus on the age at which childhood weight becomes an accurate predictor of adult weight status.

One of the earliest studies tracking weight status over time found that in children under 3 years of age, the parents' weight was the best predictor of adult obesity not the child's.<sup>11</sup> In children over 3 years, the child's and parents' weight were equally important predictors of adult obesity. As the child aged, its weight status became the best predictor. Based on these results, the authors cautioned against treating overweight children under 3 years of age. Unless one or both parents are obese, overweight young children are unlikely to become obese.

A small longitudinal Australian study published in 2003 had different results but came to similar conclusions about treating overweight young children.<sup>12</sup> The researchers in this study found that even though there were considerable fluctuations in young children's weight until the age of 6, the majority (82 per cent) of children who were overweight at 2 were also overweight at 20. Even though they concluded that weight status in the early years was a useful predictor of adult weight and supported the idea of obesity prevention for early school-age children, they argued that interventions should be targeted towards children with overweight parents.

The strongest evidence linking childhood and adult weight status comes from a [systematic review](#) of the literature conducted in 2005.<sup>13</sup> After assessing 18 relevant studies, the researchers came to the conclusion that children had an increased risk of becoming obese adults if between the ages of 3 months and 2 years they had rapid weight gain, were at the higher end of the distribution for BMI, or were classified as obese. Unlike other researchers, they argued that obesity prevention should begin during, or even before, infancy.

The evidence presented above makes it clear that obesity in older childhood increases the risk of obesity in adulthood. It does not, however, make it clear that being overweight as an infant

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10. See for example RC Whittaker, JA Wright, MS Pepe, KD Seidel, WH Dietz, 'Predicting obesity in young adulthood from childhood and parental obesity', *The New England Journal of Medicine*, vol. 337, no. 13, 1997, pp. 869–873, and SS Guo, WC Chumlea, 'Tracking of body mass index in children in relation to overweight in adulthood', *American Journal of Clinical Nutrition*, vol. 70 (supp), 1999, pp. 145S–148S.
  11. Whittaker and others, pp. 869–873.
  12. Magarey and others, pp. 505–513.
  13. J Baird, D Fisher, P Lucas, J Kleijnen, H Roberts, C Law, 'Being big or growing fast: systematic review of size or growth in infancy and later obesity', *British Medical Journal*, vol. 331, no. 7522, 2005, pp. 929–935.

or toddler is in an independent risk factor for obesity later in life. Therefore, the available evidence does not help resolve important policy questions, such as whether or not obesity prevention should target all preschool age children, all overweight preschool children, or only those with overweight or obese parents. It is also unclear about the most appropriate age to begin obesity prevention programs for young children.

## **The challenges of diagnosing overweight and obesity in young children**

Labelling or diagnosing children under five as overweight or obese is contentious. Many in the community consider being overweight at younger ages is desirable. Others believe that excess weight in early childhood is just ‘puppy fat’, or that children will grow out of it.<sup>14</sup> Many parents also object to their children being labelled as overweight because often they do not perceive them to be so.

A group of [Australian researchers](#) measured BMI of 324 four year old children in Victoria in 2002.<sup>15</sup> They subsequently asked their mothers whether they were concerned that their child was overweight now or would become so in the future. While 19 per cent of the children in the study were classified as overweight or obese, only 5 per cent of all mothers reported that they were concerned that their child was overweight. Only 17 per cent of the mothers whose children were overweight said they were concerned about it. Most surprisingly, however, 71 per cent of mothers with overweight children reported that their children were of similar weight to their peers, and only 16 per cent of all mothers surveyed reported they were concerned their children would become overweight in the future.

From these results, the researchers concluded that widespread public concerns about growing levels of obesity in society often do not translate to the individual level. They suggest that the rising prevalence of obesity may have normalised the condition so that parents can no longer recognise that their own child is overweight.

Despite this, many health professionals are reluctant to label young children as overweight or obese. Some have concerns about the validity of the BMI for diagnosing overweight or obesity.<sup>16</sup> Many experts argue that the BMI is a population screening tool that is unsuitable for use as a diagnostic tool at the individual level. They explain that it is a measure of weight adjusted for height, not a direct measure of body fat. Therefore, a high BMI does not

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14. M Nichols, ‘Romp and Chomp: Obesity, the environment and children under 5’, *vhetta journal*, vol. 44, no. 2, 2005, pp. 13–17.

15. MWC Campbell, J Williams, A Hampton, M Wake, ‘Maternal concern and perceptions of overweight in Australian pre-school aged children’, *Medical Journal of Australia*, vol.184, no. 6, 2006, pp. 274–277.

16. KM Flegal, CJ Tabak, CL Ogden, ‘Overweight in children: definitions and interpretation’, *Health Education Research Theory and Practice*, vol. 21, no. 6, 2006, pp. 755–760. An alternative test can be used, which measures skin fold thickness using callipers. It is not commonly used because it is more difficult to do, especially in young children.



necessarily mean that a child has a clinically significant condition. They also explain there are problems determining the level at which a child's BMI score should be considered as 'high'. What is currently considered as a high childhood BMI may change, and will not necessarily lead to negative health consequences in the future.<sup>17</sup>

Concerns about the validity and interpretation of BMI scores need to be considered, particularly when assessing young children, because of the potential of causing harm by labelling children as overweight or obese. One Australian researcher, Professor Jennifer O'Dea from The University of Sydney, points out that obesity prevention programs for children that focus on the individual may have unintended negative consequences, such as:

- an unhealthy focus on body image and weight
- encouraging dieting, disordered eating and a fear of food
- encouraging children and/or their parents to adopt 'quick fixes' (for example fad diets and the use of diet product), that are unsuitable for growing children
- further stigmatisation that may exacerbate existing problems with self-esteem and unhealthy eating patterns
- making overweight children more sensitive about their weight and less likely to participate in physical activity.<sup>18</sup>

## **Preventing and treating overweight and obesity in young children: the options and evidence**

The National Institute for Health and Clinical Excellence (NICE), an organisation in the United Kingdom responsible for producing independent health advice, conducted a comprehensive [review of the evidence on obesity](#) in 2006.<sup>19</sup> It included a review of the international evidence on obesity prevention in young children, and came to the conclusion that the evidence was very limited and inconsistent.

The following section provides an overview of some of the evidence on obesity prevention in preschool age children. It also summaries some of the evidence made available since the NICE review was published. It concentrates on three areas of current policy debate in

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17. For further information see, A Biggs, *Overweight and obesity in Australia*, E-Brief, issued 5 October 2006, Parliamentary Library, Canberra, 2006, viewed 22 April 2009, <http://www.aph.gov.au/library/intguide/SP/obesity.htm>.

18. JA O'Dea, 'Prevention of child obesity: First, do no harm', *Health Education Research Theory and Practice*, vol. 20, no. 2, 2005, pp 259–265.

19. National Institute for Health and Clinical Excellence (NICE), *Obesity: the prevention, identification, assessment and management of overweight and obesity in adults and children*, NICE, London, 2006, viewed 22 April 2009, <http://www.nice.org.uk/Guidance/CG43>; the Cochrane Collaboration has also conducted a review of the evidence on preventing obesity in children, but it does not identify studies that focus on preschool aged children.



Australia—obesity prevention programs for preschoolers, family-based prevention programs, and monitoring and managing obesity through general practice.

## **Prevention of obesity through diet and physical activity**

The NICE review identifies seven studies of obesity prevention using physical activity or dietary education programs. Only three of these had been completed and were considered to be high quality (randomised controlled trials). Two of them were Finnish studies assessing the effectiveness of a dietary intervention. One examined the impact of educating parents over a five year period on the importance of reducing fat intake in the diet of young children.<sup>20</sup> Results indicated that this intervention was effective in reducing children's fat consumption. The other [study](#) evaluated the impact of dietary education on cholesterol levels and found it was effective in lowering cholesterol levels in young children.<sup>21</sup> Neither study measured the children's weight or BMI.

The third completed study tested the effectiveness of a program that combined dietary education and physical activity, but it was published in a Chinese journal that is unavailable in Australia.<sup>22</sup> The NICE review reports that the program was effective in preventing weight gain in young children.

From these studies, NICE concluded that there was limited evidence on the effectiveness of obesity prevention for preschoolers using diet and physical activity programs. It did, however, cautiously suggest that these types of programs may help young children maintain a healthy weight.

Studies published since the NICE review have done little to strengthen the evidence on the effectiveness of obesity prevention programs in young children. One study examined the impact of a diet and physical activity programs implemented in child-care centres in the United States.<sup>23</sup> The program was called 'Hip-Hop to Health Jr'. A subsequent study

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20. H Lagström, E Jokinen, R Seppänen, T Rönnemaa, J Viikari, I Välimäki, J Venetoklis, A Myyrinmaa, H Niinikoski, H Lapineimu, O Simell, 'Nutrient intakes by young children in a prospective randomized trial of a low-saturated fat, low-cholesterol diet', *Archives of Pediatric and Adolescent Medicine*, vol. 151, February, 1997, pp. 181–188.
  21. L Rask-Nissilä, E Jokinen, P Terho, A Tammi, H Lapineimu, T Rönnemaa, J Viikari, R Seppänen, T Korhonen, J Tuominen, I Välimäki, O Simell, 'Neurological development of 5 year old children receiving a low-saturated fat, low-cholesterol diet since infancy: a randomized controlled trial', *Journal of the American Medical Association*, vol. 284, no. 8, 2000, pp. 993–1000, viewed 22 April 2009, <http://jama.ama-assn.org/cgi/reprint/284/8/993>.
  22. Y He, 'Effects of a comprehensive on simply obesity of children in kindergarten', *Chinese Journal of Pediatrics*, vol. 24, 2004, pp. 333–336.
  23. ML Fitzgibbon, MR Stolley, L Schiffer, L van Horn, K Kauffer-Christoffel, A Dyer, 'Two-year follow-up results for Hip-Hop to Health Jr.: A randomized controlled trial for overweight prevention in preschool minority children', *Journal of Pediatrics*, vol. 146, no.5, 2005, pp. 618–625.

evaluated the effectiveness of the same program in another setting.<sup>24</sup> Results show that while the Hip-Hop to Health Jr. program led to significantly smaller increases in BMI over time for Afro-American preschool children, it did not have the same effect with Latino children. The researchers commented that the Latino children enjoyed the program, but it appeared changes were needed if it was to be successful for a wide range of children.

The NICE review identified only one study that looked at the impact of a physical activity program alone, but the results had not been published at the time. [Results](#) have been published since. It found that a structured physical activity program implemented in Scotland, which involved three 30 minute exercise sessions over 24 weeks and home-based education of parents, did not lead to reductions in BMI in preschool aged children.<sup>25</sup> The researchers explain that although their study was the most rigorous to date, it might not have had an impact on BMI because: the nursery (preschool or child care centre) staff may not have had sufficient training; the ‘dose’ of physical activity may not have been enough to have an impact on children’s overall physical activity levels, and; the BMI may not have been the most sensitive outcome measurement.

Despite the lack of evidence that obesity prevention programs are effective in early childhood centres, staff believe they have an important role to play. A recent survey of early childhood staff in NSW (the Weight of Opinion Study) found that many centres had adjusted their programs so that they had time for more physical activity.<sup>26</sup> Staff believed this was especially important for children in care 5 days a week. As noted earlier, some have taken other actions as well, including banning junk food.

## **Family-based obesity prevention interventions**

The NICE review discusses a [systematic review](#) on the effectiveness of trials that included the family in weight control interventions for young children.<sup>27</sup> The review included 16 randomised controlled trials. All were conducted prior to 1994, most were done in the United States, and many had design faults (for example comparing interventions that were only

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24. ML Fitzgibbon, MR Stolley, L Schiffer, L van Horn, K Kauffer-Christoffel, A Dyer, ‘Hip-Hop to Health Jr. for Latino preschool children’, *Obesity*, vol. 14, no. 9, 2006, pp. 1616–1625.
  25. JJ Reilly, L Kelly, C Montgomery, A Williamson, A Fisher, JH McColl, R Lo Conte, JY Paton, S Grant, ‘Physical activity to prevent obesity in young children: cluster randomised controlled trial’, *British Medical Journal*, vol. 333, no. 7577, 2006, pp. 1041–1046, viewed 22 April 2009, <http://www.bmj.com/cgi/reprint/333/7577/1041>.
  26. D Pagnini, R Wilkenfeld, L King, M Booth, S Booth, ‘Early childhood sector staff perceptions of child overweight and obesity: the Weight of Opinion Study’, *Health Promotion Journal of Australia*, vol. 18, no. 2, 2007, pp. 149–154.
  27. N McLean, S Griffin, K Toney, W Hardeman, ‘Family involvement in weight control, weight maintenance and weight loss interventions: a systematic review of randomised trials’, *International Journal of Obesity*, vol. 27, no. 9, 2003, pp. 987–1005, viewed 22 April 2009, <http://www.nature.com/ijo/journal/v27/n9/pdf/0802383a.pdf>.

subtly different, or using only small sample sizes). As a result, the reviewers concluded that there was a lack of high-quality evidence in this area.

More recent research, however, suggests that the evidence-base on the use of family-based obesity prevention in young children is strengthening.

One recent [American study](#) examined the impact of a parent–focused child obesity prevention program for preschoolers.<sup>28</sup> It compared outcomes for two health clinics using different obesity prevention programs. One clinic ran bi-monthly group education sessions for parents with children aged 2 to 4 years. They also attended individual sessions with nutritionists once every 6 months. The other clinic (the intervention clinic) ran a similar program, but trained staff to focus specifically on six key health behaviours: increasing physical activity; monitoring meal time behaviour; limiting household TV viewing; offering children water instead of sweetened drinks; consuming five serves of fruit or vegetables daily, and; increasing family activities to promote fitness. The clinic also encouraged staff to promote healthy lifestyle behaviours, and ensured other local agencies (such as the public library and parenting classes) received and distributed their educational material.

The researchers found that parents attending the intervention clinic were more likely to encourage play with children and offer water instead of sweetened drinks. The clinic program did not lead to any significant improvements in the other four key areas of interest. From this the researchers concluded that it was possible to influence parents' behaviour and promote healthier eating and activity in preschool aged children. While the study had some flaws—the most significant was that both clinics were running fairly similar obesity prevention programs—it provides some evidence that parental education sessions can be beneficial if they focus on areas requiring behavioural change.

Another [review article](#), published in 2005, found that what parents do at home has considerable influence on children's eating preferences.<sup>29</sup> It reports that children are more likely to eat foods they are repeatedly exposed to, even if they initially dislike them, and that they prefer to eat foods readily available in the home. It also found that the food preferences of children as young as two are strongly associated with those of their parents. These findings are consistent with the growing body of evidence demonstrating the similarities between parents' and children's food acceptance and preferences, intake, and willingness to try new foods.

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28. E McGarvey, A Keller, M Forrester, E Williams, D Seward, DE Suttle, 'Feasibility and benefits of a parent-focused preschool child obesity intervention', *American Journal of Public Health*, vol. 94, no. 6, 2004, pp. 1490–1495, viewed 22 April 2009, <http://www.ajph.org/cgi/reprint/94/9/1490>.

29. H Patrick and TA Nicklas, 'A Review of Family and Social Determinants of Children's Eating Patterns and Diet Quality', *Journal of the American College of Nutrition*, vol. 24, no. 2, 2005, pp. 83–92, viewed 22 April 2009, <http://www.jacn.org/cgi/reprint/24/2/83>.

## **Managing obesity through primary care**

The NICE review does not identify any studies where obesity prevention programs for young children have been run in a primary health care setting. It is an important policy issue in Australia because some researchers are urging the government to extend the Medicare rebate for child health checks so that GPs can monitor weight from birth. At present, Australian GPs do very little in the way of active management for overweight and obesity in young children.<sup>30</sup>

Another Australian study evaluated the cost and impact of a program where GPs did actively manage overweight and obesity in young children (the study was of children aged between 5 and 9 years, but the findings would likely to be the same for younger children).<sup>31</sup> The program trained GPs to offer advice on healthy eating and physical activity to parents of overweight or mildly obese children. The GPs provided four education sessions over a three month period. The study found that the education sessions cost \$873 per family but lead to no significant improvement in the children's BMI when measured 9 and 15 months after the education sessions. As a result, the researchers concluded that resources provided for managing overweight and obesity in GP surgeries could be better spent on other obesity prevention or public health initiatives.

## **Conclusion**

The rising prevalence of overweight and obesity in preschool children in recent years has alarmed many Australians. Although there are some signs that the problem is abating (for instance, overweight and obesity prevalence rates decreased for 2–3 year old girls in the last decade), data suggests that the trend has yet to be reversed.

Policymakers responsible for developing obesity prevention programs for young children face many challenges. Health professionals question the validity and significance of BMI measurements in this age group, many parents do not perceive their children to be overweight (even when they are) and experts are unsure whether being overweight in the early years has any long-term, adverse health consequences.

There is also very little high-quality evidence on the effectiveness of obesity prevention programs for young children. Studies on the impact of diet and physical activity programs have produced inconsistent results, and Australian research has found that managing obesity

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30. Australia data from 2002 to 2006 shows that GPs only actively managed 1 in every 320 diagnosed cases of overweight or obesity in 2 to 3 year old children. MA Cretikos, L Valenti, HC Britt, LA Baur, 'General practice management of overweight and obesity in children and adolescents in Australia', *Medical Care*, vol. 46, no. 11, 2008, pp. 1163–1169.

31. M Wake, L Gold, Z McCallum, B Gerner, E Waters, 'Economic evaluation of a primary care trial to reduce weight gain in overweight/obese children: the LEAP trial', *Ambulatory Pediatrics*, vol. 8, no. 5, 2008, pp. 336–341.

through general practice is expensive and there is little evidence that it is effective. The most compelling evidence available to date suggests that parent-focused education programs might be the best way to prevent overweight and obesity in young children. However, much more research needs to be done before policymakers can act with any certainty.

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