Proceedings of the Nutrition Society (2005), **64**, 255–261 DOI:10.1079/PNS2005425

Obesity prevention: necessary and possible. A structured approach for effective planning

Timothy Gill*, Lesley King and Ian Caterson
NSW Centre for Public Health Nutrition, Medical Foundation Building K25, University of Sydney, NSW 2006, Australia

Obesity is a serious public health problem that has important social, economic and health consequences. The prevalence of obesity is rising rapidly throughout the world in both rich and poor countries, and it affects all sections of society. There are several important reasons for addressing the prevention of obesity, rather than its treatment or management. The prevention of weight gain (or the reversal of small gains) and the maintenance of a healthy weight are likely to be easier, less expensive and potentially more effective than the treatment of obesity after it has fully developed. A structured planning framework for the identification of potential interventions for the promotion of healthy weight and the prevention of weight gain is clearly required. However, detailed reviews of the scientific literature have revealed that the body of research is too small to provide firm guidance on consistently-effective interventions for adults or children. Ultimately, a broader approach to evidence of effectiveness needs to be adopted. The present paper proposes a structured planning approach that utilises the portfolio model and allows the selection of interventions to be based on the best available evidence, while not excluding untried but promising strategies.

Obesity prevention: Weight gain: Portfolio model: Health policy: Health planning

Very few countries have escaped the dramatic increase in population mean body weight that Australia has recently experienced (Catford & Caterson, 2003). As a consequence, overweight and obesity are now recognised as global public health problems with immense health, social and economic implications. There is a wealth of evidence to show that the relationship between excess weight and risk of ill health is strong and consistent and begins at relatively low levels of BMI, and numerous health consequences of obesity have now been identified. These consequences include an increased risk of premature death, the development of serious chronic conditions, such as diabetes, hypertension, CVD and certain cancers, as well as several non-fatal but disabling complaints that reduce the quality of life. In addition, the accumulation of excess fat around the abdomen has been found to further increase many of these risks to health (see Table 1; World Health Organization, 2000*a*). Obesity also places enormous financial burdens on governments and individuals, and accounts for $\leq 6\,\%$ of the total healthcare expenditure in some developed countries (Wolf & Colditz, 1998). In the USA in 1995, for example, the overall direct costs (hospitalisations, outpatients, medications and allied health professionals' costs) were approximately the same as those for diabetes, 1·25 times greater than those for CHD, and 2·7 times greater than those for hypertension (Finkelstein *et al*. 2003). Obesity is fast approaching cigarette smoking as the major preventable cause of mortality in the USA (Mokdad *et al*. 2004).

Prevalence rates are increasing in all parts of the world, both in high- and low-income nations. According to World Health Organization (2003) estimates, approximately one billion of the world population were overweight in 2002, of whom >300 million were obese. In addition, the problem is now affecting all age-groups. A recent report by the International Obesity Task Force (Lobstein *et al*. 2004) has calculated that overweight and obesity now affects one in every ten schoolchildren throughout the world, and about 45 million of them have an increased risk of developing diabetes, heart disease and other illnesses before they leave their teens. Overweight, obesity and its associated illness are now so common that they are replacing the more traditional public health concerns such as undernutrition and infectious disease as the most

***Corresponding author:** Dr Tim Gill, fax +61 2 90363184, email t.gill@mmb.usyd.edu.au

Table 1. Relative risk of health problems associated with obesity (adapted from World Health Organization, 2000*a*)

Greatly increased (relative risk >3)	Moderately increased (relative risk 2–3)	Slightly increased (relative risk 1–2)
NIDDM	CHD	Certain cancers (post- menopausal breast cancer, colon cancer)
Hypertension	Gallbladder disease	Reproductive hormone abnormalities
Sleep apnoea	Osteoarthritis (knees)	Polycystic ovary syndrome
Insulin resistance	Hyperuricaemia and gout	Impaired fertility
Breathlessness	Dyslipidaemia	Low back pain as a result of obesity
	Endometrial cancer	Increased anaesthetic risk
		Fetal defects associated with maternal obesity

NIDDM, non-insulin-dependent diabetes mellitus.

important contributors to global ill health. According to World Health Organization (2000*b*) estimates the major non-communicable diseases of today are responsible for ≥40 % of all deaths in developing countries and 75 % of all deaths in industrialised countries, in which CVD is the first cause of mortality and cancer is the third. By the year 2020 non-communicable diseases will account for about three-quarters of all deaths in the developing world.

The treatment of individuals with an existing weight problem is an important strategy in controlling the impact of obesity at an individual level, but the long-term effectiveness of current treatment strategies are limited and the proportion of the population that is either overweight or obese is now so large that the cost of offering treatment to all is likely to be unacceptable. Thus, the prevention of weight gain (or the reversal of small gains) and the maintenance of a healthy weight offer the only potentially-effective options for tackling this epidemic.

Despite the enormous present and future burden to the health and welfare of the communities across the world, very few countries have a coherent programme of action to prevent further weight gain in the population and manage obesity. This reluctance may be attributed, in part, to the perceived lack of evidence concerning the effectiveness of population level interventions to address obesity. Systematic reviews of intervention to prevent weight gain and obesity in both adults (NHS Centre for Reviews and Dissemination, 1997; Douketis *et al*. 1999) and children (Campbell *et al*. 2002; NHS Centre for Reviews and Dissemination, 2002) have revealed a paucity of controlled intervention trials. Many of the studies included in these reviews have been poorly conducted, are of short duration and have a small sample size, making it difficult to produce any reliable and consistent findings. Faced with such information many governments and healthcare planners have opted for inaction, on the basis that they cannot invest resources without strong scientific evidence of the effectiveness of proposed actions.

The challenge of evidence-based practice in obesity prevention

Evidence-based decision-making is now widely accepted as the most appropriate process for determining where to apply resources when addressing health problems. However, there remains much debate about how this process should be best applied to decision-making for public health and health promotion programmes (McQueen, 2002; Reychetnik, 2003). A central element to this debate concerns the nature and definition of evidence, and how quality of evidence and effectiveness is determined. Evidence-based medicine has developed a rigid hierarchy of rules for assessing the quality of scientific evidence that relates to the nature of study design (Sackett *et al*. 1996; National Health and Medical Research Council, 1999). This system has proved effective in enabling comparisons of the relative merit of single clinical interventions, but many commentators suggest that this approach to defining and grading evidence is far too narrow to be directly applied to public health and health promotion. The complex, interactive and social nature of the health promotion interventions make them markedly different from physiological or clinical interventions in which there is a higher extent of control and little influence from social factors (Green, 2001; McQueen & Anderson, 2001).

In addition, both Green (2001) and Reychetnik *et al*. (2002) argue that evidence of effectiveness is not sufficient by itself to guide appropriate decision-making. They argue that it is inappropriate to assume that evidence from one population or situation gathered in a controlled trial is directly applicable and transferable to another situation. Green (2001) specifically recommends that planners apply 'best processes' (of health promotion planning) to allow the development of programmes of action that fit specific circumstances.

Applying a planning framework to the development of obesity prevention

It is widely accepted that the planning process is crucial to the success of any public health intervention. In developing a structured plan of action to address obesity in NSW, the planning process was based on the National Public Health Partnership (2000) Planning Framework for Public Health Practice (see Table 2).

Although observational and experimental studies contribute valuable evidence to guide decision-making throughout this planning framework, it is clear that a wider body of evidence is required to address all stages of

https://doi.org/10.1079/PNS2005425 Published online by Cambridge University Press

Table 2. Stages in the planning and practice framework (adapted from National Public Health Partnership, 2000)

Identify the determinants of overweight and obesity
Identify potential intervention points based on analysis of determinants
Identify and assess the intervention options
Decide on the best mix of interventions (a portfolio) using explicit criteria
Implement the intervention mix
Review the interventions

the process. Thus, in developing a framework for a comprehensive programme of action on obesity it is believed to be appropriate to draw on the following additional forms of evidence:

Process evidence, i.e. information from process evaluation of programmes indicating that promising interventions can be implemented as planned;
Impact evidence, i.e. information from non-experimental impact evaluations of obesity prevention programmes showing an effect on presumed intermediate variables (knowledge, attitudes etc.);
Parallel evidence, i.e. information from the evaluation of programmes that address a behaviour or environmental issue of relevance to obesity (a parallel programme), e.g. skin cancer prevention programmes, or a demonstration of influencing factors, e.g. advertising of toys to children and their subsequent increase in sales;
Indirect or intuitive evidence of likely effect, i.e. inferring effects based on actions by other sectors, e.g. the investment by food companies in TV advertising;
Expert opinion, i.e. the considered opinion of experts who have the expertise to be able to understand and interpret the policy implications of the scientific literature as well as appreciating the context in which it will be applied.

Identifying the determinants of overweight and obesity

Many analyses have attempted to define the key determinants of obesity, and there remains some controversy about which factors have made the greatest contribution to the recent rise in the rates of obesity in Australia today. The most comprehensive assessment of the situation has been undertaken by the WHO, and their report (World Health Organization, 2002) examined the current literature and has identified a range of key factors that either increase or decrease the risk of weight gain and the development of obesity (see Table 3).

Identifying potential intervention points based on analysis of determinants

Potential intervention points can be identified from the list of determinants presented in Table 3, with particular attention to those factors that have a high level of evidence to support their role in the development of obesity (i.e. probable or convincing). When choosing intervention points it is also important to consider those factors that are amenable to change and to consider the relevance of these factors to the local situation. Obvious intervention points relate to behaviours that influence: (a) energy intake; (b) energy expenditure; (c) sedentariness. However, it is important to understand that addressing the obesogenic environment is critical to achieving sustained changes to eating and physical activity patterns (Egger & Swinburn, 1997). Physical, social, political and economic environments have a profound effect on the way individuals live and behave. Each day individuals interact with a wide range of services, systems and pressures in settings such as schools, the workplace and home, and commercial settings. In turn, these settings are influenced by laws, policies, economic imperatives and the attitudes of governments, industry and society as a whole. Each of the features of this complex system has the capacity to inhibit or encourage appropriate dietary and physical activity patterns.

Deciding where to invest limited time and resources in obesity prevention is a difficult task, but finite health resources make this decision a necessity. While decisions about who to target will often need to be made at a local level after a thorough community assessment, there are some general principles that will apply. Overweight and obesity are public health problems of relevance to the whole community. Strategies are needed that focus on population-wide change rather than attempting to address individuals or very small groups in isolation from the community in which they live. However, it is difficult to formulate interventions that reach the whole community in a meaningful and substantial form, and thus for practical purposes interventions are often designed to reach specific population groups or segments. There is a strong argument that children should be a major focus of any obesity prevention strategy. A primary reason is that a high proportion of overweight or obese children will become obese adults (Must *et al*. 1992). Also, childhood (particularly young childhood) is a period in which prevention efforts have a higher chance of success, since children grow rapidly and increase the level of lean body mass as they age. Thus, reducing or keeping fat mass constant allows the normalisation of weight over time. However, children have little direct control over the environment in which they live, and decisions concerning food availability and opportunities for activity are mostly controlled by parents and other caregivers, so a family focus is an appropriate avenue for influencing their behaviour. In addition, there are certain groups within the population that are at higher risk of developing overweight and obesity, and certain critical life stages at which individuals are more prone to gain weight. These groups may also warrant special attention.

Identifying and assessing the intervention options

The potential intervention points and related target groups provide a large menu of options for generating intervention possibilities. Comparisons of these possible interventions

https://doi.org/10.1079/PNS2005425 Published online by Cambridge University Press

Table 3. Summary of the strengths of evidence on factors that might promote or protect against weight gain and obesity (World Health Organization, 2002)

Evidence	Decreases risk	Increases risk
Convincing	Regular physical activity High dietary fibre intake	High intake of energy-dense foods* Sedentary lifestyles
Probable	Home and school environment that supports health food choices for children Promoting linear growth	Heavy marketing of energy-dense foods and fast foods outlets Adverse social and economic conditions in developed countries (especially for women) Sugar-sweetened soft drinks and juices
Possible	Low glycaemic index foods Breast-feeding	Large portion sizes High proportion of food prepared outside of homes Rigid restraint and/or periodic disinhibition eating patterns
Insufficient	Increased eating frequency	Alcohol

*Energy-dense foods are high in fat and/or sugar and energy-dilute foods are high in fibre and water such as vegetables, fruits, legumes and wholegrain cereals.

with those interventions that have been trialled and tested enable planners and researchers to identify research gaps and generate innovative approaches.

An assessment of the literature of published studies is the most effective method for assessing interventions to address obesity. However, a great many obesity prevention initiatives are not appropriately evaluated or written up for publication. In addition, a large number of other studies will not be published in scientific journals but presented in local or regional reports, necessitating scans of 'grey' literature. Currently, there are only a limited number of systematic reviews of reported programmes addressing the prevention of obesity, and each of these reviews contains only a small number of studies. The most rigorous review of obesity prevention initiatives in children is a Cochrane review conducted by Campbell *et al.* (2002). This assessment was only able to identify ten studies that met their criteria for inclusion and only seven of these studies had a follow up of ≥12 months. Another review by Reilly *et al.* (2002), which also adopted strict inclusion criteria, includes only three studies.

The authors of these systematic reviews have concluded that there is simply too small a body of research conducted in a limited number of settings to provide firm guidance on consistently effective interventions. However, reviews of initiatives for the prevention of childhood obesity have indicated that certain approaches appear to be associated with greater success. Intensive interventions in small groups and the involvement of the whole family have been successful as a management strategy in children. A number of studies have found that reducing levels of inactivity is successful at both treating and preventing weight gain, but interventions that increase the time spent in formal physical activity are only moderately successful in controlling weight gain. Although intensive short-term interventions addressing one or two issues show the greatest change in weight status in children, multi-component programmes that address a range of strategies are deemed to hold the most promise.

Reviews of interventions to prevent obesity in adults are even more limiting. Systematic reviews by Douketis *et al.* (1999) and Glenny *et al.* (1997) have only been able to identify three to four studies, none of which were successful in preventing weight gain in adults. A review by Fogelholm & Kukkonen-Harjula (2000) of the influence of physical activity on weight gain prevention has also found inconsistent results, although some evidence was found to support a positive benefit of regular physical activity on weight maintenance in adults. A wider body of information is provided by non-systematic reviews, which often include reports of interventions that would be excluded by the strict criteria employed in systematic reviews. Although questions remain about the reliability of such evidence it can still be used to identify potential interventions that show promise. The consensus of these reviews is that interventions that include environmental strategies as well as behavioural change components are required and should be trialled and evaluated. These actions will support the adoption of behaviours conducive to weight control and reduce reliance on simple educational and behavioural approaches.

As there are only a small number of published randomised trials of interventions specifically aimed at the prevention of obesity, it is difficult to formulate conclusions about the most useful interventions from this information alone. Thus, the evidence base for the identification of the best options for the prevention of weight gain must also draw from studies that examine weight gain or weight loss as an intermediate outcome, from extrapolation from action in other public health areas and from studies on specific weight-related nutrition and physical activity behaviours.

Dealing with uncertainties: balancing risk and return

Given the limitations of the available evidence on effective programmes for preventing weight gain, innovative

https://doi.org/10.1079/PNS2005425 Published online by Cambridge University Press

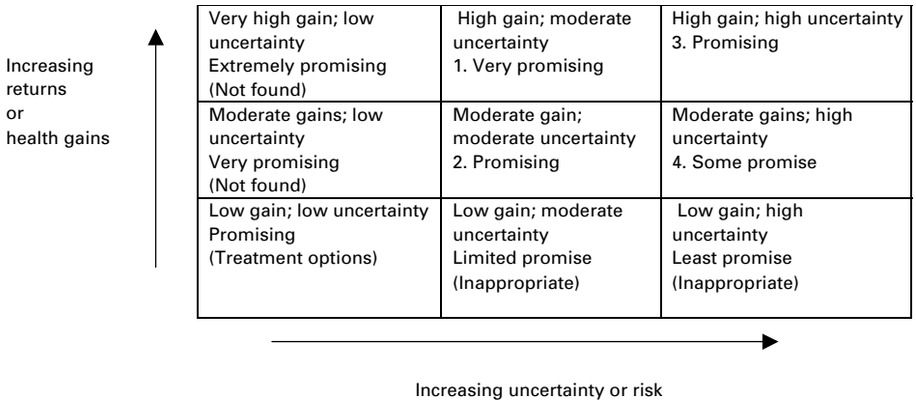

Fig. 1. The modified process for weighing up potential gains and risks, in a portfolio planning approach. (Adapted from Hawe & Sheill, 1995.)

approaches need to be applied to planning a strategy that has the highest chance of success. The portfolio model proposed by Hawe & Shiell (1995) offers a particularly valuable tool for selecting intervention options in this situation, as it allows the selection of interventions to be based on the best available evidence (while not excluding untried but promising strategies) by explicitly incorporating judgements about the level of risk and potential return associated with their implementation.

In the field of financial planning (and other business areas), developing a balanced portfolio of potential strategies (including some high-risk but high-return strategies together with reliable low-risk low-return strategies) is seen as the most prudent option for producing the best returns on investments. Utilising the health promotion portfolio approach in the development of obesity prevention programmes ensures that a similar decision-making framework is applied to investments in actions to address obesity prevention. A balanced portfolio for addressing obesity will contain a broad range of strategies that range from intensive interventions within small groups or individuals that may be assessed as low-risk low-return through to potentially high-return strategies that impact on the whole community but where little evidence is currently available to judge their effectiveness (making them high risk).

Under the portfolio approach, potential interventions can be graded according to their level of promise (Fig. 1). The concept of 'promise' is useful, as it provides a more accurate description of the judgements that are being made and presents the suggestion that an intervention is deemed worthy of systematic implementation and evaluation. The term creates links rather than opposition between the urgency to get on with implementation and recognition of the value of building further evidence.

It is important to note that the classification of interventions within various levels of promise is fluid. As experience in the effective prevention of weight gain grows and more evidence is produced on strategies addressing weight gain, it will be possible to reassess the level of risk or uncertainty that proposed interventions carry. In addition, local environments, resources and priorities could influence how proposed programmes are classified under this system.

Decide on the best mix of interventions (a portfolio) using explicit criteria

In a report on the best options for the promotion of healthy weight (Gill *et al*. 2004), these planning stages have been applied together with a process of weighing up potential gains and risks of a range of intervention options identified through the literature search. In view of the limited number of intervention studies reported in the literature, particularly those addressing the whole community, it is not surprising that no existing interventions could be graded as providing very high health gains at low risk or uncertainty. In addition, the only low-risk interventions that have been identified through a literature review are clinical interventions in individuals and are thus ruled inappropriate for population prevention approaches. A settings approach has been used as the basis for organising and comparing interventions, as it provides a sound, integrated and familiar way of addressing social, environmental and individual intervention points and reaching specific target groups (King, 1998). Thus, the following action areas have been identified as the basis for developing and implementing appropriate interventions for the promotion of healthy weight and the prevention of weight gain in NSW: families and communities; early childhood care; school community; worksites; health services.

Schools and childcare settings offer enormous potential for the promotion of healthy weight and the prevention of weight gain and have been the setting most frequently used in studies reported in the literature. Although no consistently effective strategy has been identified by systematic reviews, programmes that have addressed TV watching, soft drink consumption and time spent in physical education have produced meaningful improvements in children's weight status. However, care must be taken to address a range of action areas and not focus only on schools. Children spend a considerable amount of time in school and it is an important learning environment; however, programmes also need to address the out-of-school

https://doi.org/10.1079/PNS2005425 Published online by Cambridge University Press

influences on eating and exercise behaviours. Unfortunately, very few studies on obesity prevention have been conducted in a family or community setting. Programmes that have sought to increase physical activity through a combination of education and improving access to spaces for exercise have also shown great promise, as have programmes addressing parental skills and family food environments. Worksites and healthcare facilities also offer important opportunities for addressing health and behaviour issues associated with obesity, but again few programmes have utilised these settings.

The promising interventions within each setting-based action area focus predominantly on changing inappropriate dietary and physical activity behaviours and on altering the environments in which decisions about these behaviours are made. However, there are broader systems and structures that usually operate at a regional or national level that will exert enormous influence on efforts to address the problems of obesity within each setting. Potential 'enabling' action areas that must be addressed if obesity-related interventions are to be implemented effectively are: mass media and social marketing; environmental, system and policy change; management, coordination and support.

The end result of applying the planning stages and a portfolio approach is a broad menu of intervention options that can be discussed and considered in relation to policy, community, and organisational requirements. Interventions identified as very promising (Fig. 1; quadrant 1 of the modified model) should take a high priority in the initial construction of a portfolio. In practice, there are further considerations related to implementation issues in planning for a specific setting and situation, such as acceptability to the community and availability of appropriate resources.

The broad menu of intervention options can be used to guide intervention planning and provide an agenda for policy-driven research. In fact, by drawing on a broad knowledge base a menu of intervention options developed in this way provides direction for research on well-designed complex community interventions.

Conclusion

This planning framework is being used by regional health authorities as the basis for the development of a systematic programme of action to address obesity in New South Wales, Australia. The application of this approach enables health promotion planners to move ahead with the development of evidence-based obesity prevention initiatives while recognising the limitations of the current evidence base.

References

Campbell K, Waters E, O'Meara S, Kelly S & Summerbell C (2002) *Interventions for Preventing Obesity in Children. Cochrane Database of Systematic Reviews* CD001871. Oxford: Update Software.

Catford J & Caterson I (2003) Snowballing obesity: Australians will get run over if they just sit there. *Medical Journal of Australia* **179**, 577–579.

Douketis J, Feightner J, Attia J & Fieldman WF (1999) Periodic health examination, 1999 update: 1. Detection, prevention and treatment of obesity. *Canadian Medical Association Journal* **160**, 513–525.

Egger G & Swinburn B (1997) An 'ecological' approach to the obesity pandemic. *British Medical Journal* **315**, 477–480.

Finkelstein EA, Fiebelkorn IC & Wang G (2003) National medical spending attributable to overweight and obesity: how much, and who's paying? *Health Affairs* **W3**, 219–226.

Fogelholm M & Kukkonen-Harjula K (2000) Does physical activity prevent weight gain – A systematic review. *Obesity Reviews* **1**, 95–111.

Gill T, King L & Webb K for NSW Centre for Public Health Nutrition (2004) *Best Options for Promoting Healthy Weight and Preventing Weight Gain in NSW*. Sydney, NSW: NSW Health.

Glenny AM, O'Meara S, Melville A, Sheldon TA & Wilson C (1997) The treatment and prevention of obesity: a systematic review of the literature. *International Journal of Obesity and Related Metabolic Disorders* **21**, 715–737.

Green L (2001) From research to best practice in other settings and populations. *American Journal of Health Behavior* **25**, 165–178.

Hawe P & Shiell A (1995) Preserving innovation under increasing accountability pressures: The health promotion investment-portfolio approach. *Health Promotion Journal of Australia* **5**, 4–9.

King L (1998) The settings approach to achieving better health for children. *NSW Public Health Bulletin* **9**, 128–129.

Lobstein T, Baur L & Uauy R for the International Obesity Task Force Childhood Obesity Working Group (2004) Obesity in children and young people: A crisis in public health. *Obesity Reviews* **5**, Suppl. 1, 4–85.

McQueen D (2002) The evidence debate. *Journal of Epidemiology and Community Health* **56**, 83–84.

McQueen DV & Anderson L (2001) What counts as evidence: issues and debates. In *Health Promotion Evaluation: Principles and Perspectives. WHO Regional Publications, European Series*, no. 92, pp. 63–81 [I Rootman, editor]. Copenhagen, Denmark: WHO Regional Office for Europe.

Mokdad AH, Marks JS, Stroup DF & Gerberding JL (2004) Actual causes of death in the United States, 2000. *Journal of the American Medical Association* **291**, 1238–1245.

Must A, Jacques PF, Dallal GE, Bajema CY & Dietz WH (1992) Long-term morbidity and mortality of overweight adolescents. *New England Journal of Medicine* **327**, 1350–1355.

National Health and Medical Research Council (1999) *A Guide to the Development, Implementation and Evaluation of Clinical Practice Guidelines*. Canberra, ACT: NHMRC.

National Public Health Partnership (2000) *Public Health Planning and Practice Improvement: A Planning Framework for Public Health Practice*. Canberra, ACT: National Public Health Partnership.

NHS Centre for Reviews and Dissemination (2002) *The Prevention and Treatment of Childhood Obesity. Effective Health Care*, vol. 7, no. 6. York: University of York/Royal Society of Medicine Press Ltd.

Reilly JJ, Wilson ML & Summerbell CD (2002) Obesity: diagnosis, prevention and treatment – evidence-based answers to common questions. *Archives of Disease in Childhood* **86**, 392–394.

Reychetnik L (2003) Evidence-based practice and health promotion. *Health Promotion Journal of Australia* **14**, 133–136.

Reychetnik L, Frommer M, Hawe P & Sheil A (2002) Criteria for evaluating evidence on public health interventions. *Journal of Epidemiology and Community Health* **56**, 119–127.

Sackett DL, Rosenberg WM, Gray JA, Haynes RB & Richardson WS (1996) Evidence based medicine: what it is and what it isn't. *British Medical Journal* **312**, 71–72.

Wolf AM & Colditz GA (1998) Current estimates of the economic cost of obesity in the United States. *Obesity Research* **6**, 97–106.

World Health Organization (2000*a*) *Obesity: Preventing and Managing the Global Epidemic. Report of a WHO Consultation*. Geneva: WHO.

World Health Organization (2000*b*) *World Health Report 2000*. Geneva: WHO.

World Health Organization (2002) *Diet, Nutrition and the Prevention of Chronic Diseases*. Geneva: FAO/WHO.

World Health Organization (2003) *Information Sheet on Overweight and Obesity*. Geneva: WHO.