9
Health Promotion to Prevent Obesity
Evidence and Policy Needs

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This chapter uses the International Obesity Taskforce framework on evidence-based obesity prevention and highlights key areas of evidence debate in this very important global epidemic. The existing evidence on the burden of obesity is sufficient to warrant action and the evidence on the determinants of obesity is also informative on *what* to do. The priority target groups (*who*) are mainly children and adolescents and high risk adults and schools are the favoured setting (*where*) although multiple settings are preferable. The strategies (*how*) also need to be multi-pronged with communications, programs, and policies being the main approaches. The evidence on effective interventions is quite limited although it is growing rapidly and a summary of recent literature reviews is included.

Primary school interventions dominate although the evidence suggests that multiple strategies across multiple settings are more likely to have a sustainable beneficial impact than single actions alone. While program interventions are more readily measured for effectiveness, environmental approaches are usually more sustainable and often have a greater effect on behaviour. An environment-centred approach often needs policy basis to initiate change.

Access to the target group and ability to introduce and measure the impact of specific interventions is paramount and this has created a strong "settings bias" (especially for schools) in the scientific evidence. This has limited the information available to policy-makers which means that the traditional definitions of "evidence-based policy or practice" are too narrow to be of use in areas of public health like obesity prevention where the need for action is high but the evidence base is limited.

Lastly, we suggest that in the absence of strong scientific evidence for *proven* strategies, action on obesity prevention can progress using an investment paradigm of *promising* strategies. In the absence of "safe" (evidence-based), "high-return" (very effective) "investments" (interventions), a portfolio of strategies could include a mixture of safe, low-return investments and "higher risk" (more uncertain), potentially high-return initiatives. Choosing the right portfolio of investments is the art and science of priority-setting and this ideally uses the best technical information available (including modelled estimates of effectiveness), but must also must include an appropriate process with stakeholders and incorporate informed, expert opinion.

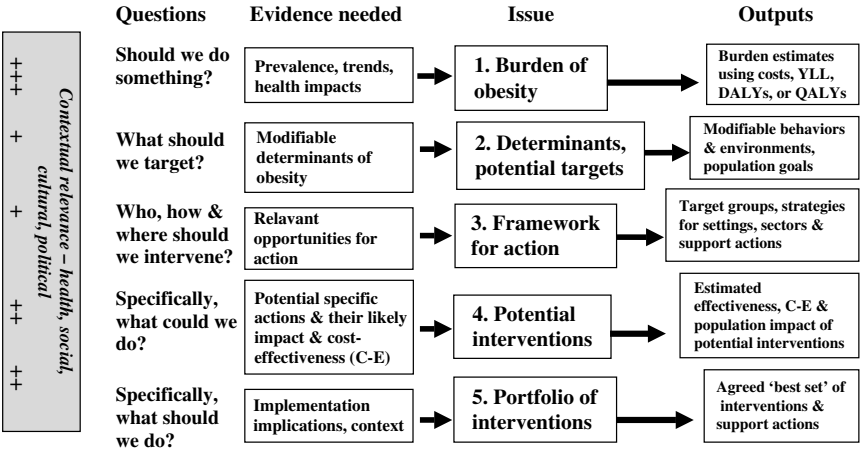

FIGURE 9.1. The international obesity taskforce framework for evidence-based obesity prevention.

Introduction

Obesity prevention is caught between the demands for action because obesity is a rapidly rising epidemic with serious health consequences and the demands that the programs, policies and practices implemented to counter the epidemic are evidence-based. The paradigm of evidence-based public health which grew from evidence-based medicine has brought with it both an awareness of the need to apply rigorous evidence more systematically to public health and an awareness that public health interventions are usually more complex than clinical interventions and less susceptible to randomised, controlled trials.

In an effort to clarify the role of evidence in obesity prevention, the International Obesity Taskforce (IOTF) published a framework (Swinburn, Gill & Kumanyika, 2005) which identified the key questions to be answered, the types of evidence needed and outputs produced, and the role of contextual factors (Figure 9.1). In the process of building this framework, there were a number of general concepts and specific issues to emerge about evidence as it applies to obesity prevention. These will be covered below along with a summary of the evidence from the literature for interventions in specific settings.

Definitions and Hierarchies of Evidence

Evidence, in its widest sense, is information that can provide a level of certainty about the truth of a proposition (Rychetnik, Hawe, Waters, Barratt & Frommer, 2004). This is a very broad definition, more along the lines of the legal, rather than the medical, concept of evidence and implies that this breadth of information is

important and valid for decision-making. For the purposes of addressing the questions on obesity prevention, the IOTF framework grouped evidence into observational, experimental, extrapolated, and experience-based sources of evidence and information (Swinburn et al., 2005). Examples of these are outlined in Table 9.1.

Each type of evidence has its own strengths and weaknesses. Each can be judged on its ability to contribute to answering the question at hand. In practice, there is wide variation in the quantity and quality of information available in

TABLE 9.1. Examples of 'admissible evidence' for obesity prevention (adapted from Swinburn, Gill & Kumanyika, 2005)

Evidence	Examples
Observational	
Epidemiological studies that may involve comparisons of exposed and non-exposed individuals	Cross-sectional, case-control, or cohort studies of sweet drink consumption and obesity
Population monitoring data that can provide time series information	Trends in obesity prevalence, food supply data, car and TV ownership
Experimental	
Intervention studies where the investigator has control over the allocations and/or timings of interventions	Controlled trials of exercise programs among individuals, groups or whole communities
Program evaluation – assessing processes, impacts and outcomes	Health promotion programs to change behaviours, attitudes, environments, or policies
Extrapolated	
Modelling causative pathways to identify assign causality, size of effect, or intervention options	Structural modelling of influences that determine, mediate or moderate the relationship between TV viewing and obesity
Modelling effectiveness of interventions	Estimates of an education program's efficacy, uptake and population reach or the impact of farm policies on agricultural production, pricing, purchasing and consumption patterns
Modelling costs, cost-effectiveness, or cost-utility	Costs and cost-effectiveness of an ongoing program across a population
Information allowing an inference ('indirect evidence')	Continued, high investment in food marketing to children infers that such marketing increases children's consumption of those foods
Experience	
Evidence of intervention effectiveness from comparable fields ('parallel evidence')	The impact of taxes, social marketing, environmental changes in changing smoking prevalence
Expert and informed opinion from practitioners and stakeholders with practical experience	Input from paediatricians, marketing agencies, parents, school principals about the feasibility and sustainability of interventions
Theory and program logic	Regulations that ban vending machines from schools or TV advertising to children or health claims on products will result in those outcomes

respect of different settings, approaches and target groups for interventions to prevent obesity. There is virtually no evidence concerning the potential effects on obesity of altering social and economic policies, such as agricultural production policies or food pricing policies, while much more evidence is available on localised attempts to influence the consumer through educational and program-based approaches.

Traditional hierarchies of evidence are based on rankings of internal validity (certainty of study conclusions). These tended to be less valuable in the IOTF framework because of the tension between internal validity and the need for external validity (applicability of study findings). The importance of context on evidence and the need for external validity is greater in some areas than others (left-hand bar in Figure 9.1). It is especially important at the priority setting stage (issue 5), and this is where the informed opinions of stakeholders is paramount.

Modelled estimates of effectiveness and informed stakeholder opinion also become important sources of information where the empirical evidence is complex, patchy, and needs to be applied to different contexts. This means that assumptions and decisions must be made explicit and transparent. The acceptance of modelled estimates of effectiveness and informed opinion in the absence of empirical evidence means an acceptance of the best evidence *available* not just the best evidence *possible* (as occurred in systematic reviews with strict inclusion criteria).

Evidence on the Burden and Determinants of Obesity

These are the first two issues in the IOTF framework (Figure 9.1). In general, the size and nature of the obesity epidemic has been well enough characterised to have created the case for action. Of course many gaps and debates still remain such as the prevalence and trends in poorer countries, the psycho-social impacts of obesity in children, and the effect of the epidemic on life expectancy. Research will continue to build better pictures of the burdens of obesity.

Evidence on the determinants of obesity is very strong in most areas, although to date, most is focused on the more proximal biological and behavioural determinants rather than the more distal, but very powerful, social and environmental determinants. One poorly researched but very obvious set of determinants are the socio-cultural attitudes, beliefs, values and perceptions that may explain the very large differences in obesity prevalence rates seen across different cultures (1–2% in China and Japan to 25–50% in North America and the Pacific).

The strength of the evidence for various determinants of obesity has been used to justify and prioritise action on those factors with the highest levels of evidence. This was the evidence approach used by the World Cancer Research Fund (1997) and World Health Organization (2003) in their reports on the priorities for prevention of cancer and chronic diseases respectively. If the evidence for a particular determinant was rated as "convincing" or "probable" according to a hierarchy (based on internal validity), then it was considered a target for intervention. For example, it was

considered that there was convincing evidence that a high fibre diet was protective and physical inactivity was causative of obesity but only "possible" evidence that low glycemic index diets were protective and "insufficient" evidence that alcohol was causative (Swinburn, Caterson, Seiddell & James, 2004).

Many issues arise in taking the leap from a list of determinants prioritised by strength of evidence to a list of priorities for action. Environmental determinants inevitably have a lower strength of evidence. For example, how strong is the evidence in the reported literature that supportive family environments are protective of obesity? This can never achieve a high level of evidence (randomised controlled trials) and there is no category for the "bleeding obvious" or "jump from a plane with no parachute" type of determinant. The evidence that high protein diets are protective against weight gain is very strong (high internal validity) supported by several randomised controlled trials, (Astrup, 2005) but the generalisability (external validity) is extremely low. The World Health Organization should not be recommending that the global population take up high protein diets, a policy which would be neither achievable nor environmentally sustainable.

The WCRF evidence review (World Cancer Research Fund, 1997) concluded (as will the updated review in progress) that obesity is an important determinant of the cancer burden. This is the equivalent of issue 2 on the IOTF framework (Figure 9.1). Another, totally different view of the evidence is then needed to work out what to do about it. As Robinson and Sirard (2005) eloquently point out, "problem-oriented" evidence (what is to blame?) is often quite different to "solution-oriented" evidence (what to do?). An obverse example is that the absence of dance may never be identified as part of the cause of obesity but dance could readily be part of the solution for teenage girls. Equally, occupational physical inactivity may be an important cause of obesity but it will not be an important solution because society will not revert to life without computers and labour-saving devices.

Opportunities for Action – Who, Where, How?

This is the third issue on the IOTF framework (Figure 9.1). Many countries have now created strategic plans for action on obesity either as an issue by itself or as part of promoting physical activity or health eating or reducing chronic diseases. Classic frameworks for health promotion specify "who" in terms of **target groups** (e.g. children, adolescents, pregnant women, minority ethnic groups, those on low incomes), "where" in terms of **settings or sectors** (e.g. workplace, schools, the commercial sector, the health sector), and "how" **approaches or strategies** (e.g. school education, community development, the use of mass media, environmental change, policy and infrastructure change) and the key issues on each of these will be considered.

Target Groups

Following the model given in the WHO Global Strategy on Diet, Physical Activity and Health (World Health Organization, 2004), target groups can be specified through reference to the life-course: this starts with maternal health and pre-natal nutrition and proceeds through pregnancy outcomes, infant nutrition, pre-school and school-age children, adolescents, adults and elderly people. Cross-cuttings of this sequence are groupings by gender, socio-economic status, ethnicity, and migrant status. The choice of target group will influence the nature of the approach used and the setting where the intervention takes place.

However, a potential limitation of identifying target groups is that they become too much the focus of the action (e.g. by encouraging them to make the healthy choices) rather than the players that influence the environments that determine those behaviours (those who can make the healthy choices easier for the target group). In this respect, the definition of target groups may need to be widened to include the providers of the determinants of health, such as the providers of health information – the health services, schools, the media, commercial producers – and widened still further to include those that set the policies which shape access to healthy lifestyles through, for example, pricing, distribution and marketing. In this sense, target groups may include shareholders in companies, professional groups, policy makers and public opinion leaders, including politicians and celebrities (Box 9.1).

Prevention strategies targeting adults make economic sense because it is the consequences of obesity occurring in middle aged and older adults that generate the economic costs of obesity – especially through type 2 diabetes and cardio-vascular diseases (Seidell, Nooyens & Visscher, 2005). Adults, especially those with other existing risk factors, are at high absolute risk of these diseases; therefore they have the potential for high absolute gains. In addition, there is now very strong efficacy evidence that individual lifestyle interventions in high risk adults prevent diabetes and heart disease (Knowler, Barrett-Connor, Fowler, Hamman, Lachin, Walker, Nathan & The Diabetes Prevention Program Research Group, 2002; Ornish, Brown, Scherwitz, Billings, Armstrong, Ports, McLanahan, Kirkeeide, Brand & Gould, 1990).

Box 9.1. Target groups versus beneficiaries

Jamie Oliver, a celebrity chef, provided an example of the need to widen the definition of target groups for health interventions. His TV series exposed the poor quality of food in English schools and led to a government pledge of money and a programme of raised school food standards. Jamie's intervention (which lacked a control group and was not systematically evaluated) targeted government policy-makers through public opinion, even though the ultimate beneficiaries were school children.

However, children have risen as the priority target group for most action on obesity and this has occurred for a number of reasons – some based on evidence, some based on societal principles, and some based on practicalities. Obesity prevalence among school-age children is rising in virtually all countries for which data are available (Wang & Lobstein, 2006). This is a relatively recent phenomenon, with little evidence of any change in the prevalence of childhood obesity before the 1970s, and signs of an accelerating increase in prevalence since the 1990s. An obese child faces a life-time of increased risk of various diseases, including cardiovascular disease, diabetes, liver disease and certain forms of cancer (World Health Organization, 2000). Even during childhood, obesity increases the risk of these diseases, and is a significant cause of psychological distress.

At present, paediatric services have few treatment options available. Once a child is substantially overweight, successful weight loss is difficult to achieve, as it is for adults, and requires intensive health care resources. However, younger children who are overweight do have a chance to "grow into" their weight. Prevention of obesity is, of course, preferred and as a general principle, it is better to start prevention early (childhood) rather than late (adulthood).

Known environmental risk factors for child obesity have been reviewed by several authors, (Lobstein, Baur, Uauy & The IASO International Obesity TaskForce, 2004; Parsons, Power, Logan & Summerbell, 1999; World Health Organization, 2000) and include parental body size, maternal smoking and diabetes status, infant feeding patterns, dietary energy density and meal patterns, and sedentary behaviour patterns such as TV watching. Children's behaviours are much more environmentally dependent than adults' behaviours and most of the evidence on obesity prevention has been in children (see below). However, far more powerful than the sum of the evidence are two other factors make children a priority target group: societal protection of children and access for interventions – especially through schools. Policy-makers have been especially sensitive to children because society has an obligation to protect them from ill-health. For adults, the societal obligation shifts towards protecting free choice – even if that choice is for unhealthy foods and physical inactivity.

Settings and Sectors

There are many potential settings for interventions (French, 2005; Swinburn & Egger, 2002), although the most powerful setting for influencing children, the home, has received little attention in relation to obesity prevention interventions because of the difficulty in access for interventions. The major options for influencing parents and homes are via mass media (usually very expensive) or via other settings (see below and Box 9.2).

Health care settings are in a key position to influence both their patients and the wider communities. Mother and baby clinics, health promotion programmes and outreach through community health workers (including school and workplace nurses and family health visitors) provide opportunities to monitor the practices of families and individuals, and to provide advice and information. There is a strong

Box 9.2. Policy driving environment and behaviour change

A national parliament may not seem a natural setting for health interventions, but in the broadest sense it is exactly that. In order to reduce the quantity of dairy fats being marketed and consumed, and to increase the amounts of fruits and vegetables available, the government of Finland proposed a new agricultural support policies which assisted farmers in converting from dairy to horticultural production. The parliamentary debate was an opportunity for health promotion through investment which was not entirely welcomed: moves to reduce butter consumption were resisted by commercial interests in the dairy farming sector and the cost of providing farm assistance for horticulture was not politically popular among some parliamentarians. However, the arguments for health eventually prevailed and the proposed polices were enacted, and have come to be recognised as the early drivers of change in the environments and behaviours which led to the reduction of cardiovascular disease in the country.

rationale for major health care organisations such as hospitals to take the lead as health promoting settings in promoting healthy eating.

Schools and other childhood settings such as kindergartens and day nurseries, provide a valuable opportunity to influence the dietary habits of people in a collective setting. Most of the trials of obesity prevention initiatives have been undertaken in schools. Nursery and pre-school settings are valuable opportunities for intervention at an early stage in the child's development, and have the potential to influence both the child and the family by setting an example of good practice.

The workplace has considerable potential to improve the health of the adult population because people spend a large proportion of their time at work and often eat there. It also has a role in supporting breast-feeding women and providing nursery facilities. In the US, workplace interventions are seen as a key strategy for obesity prevention (and weight reduction) and this is made feasible by the high health insurance costs borne by companies and thus the major financial benefits of a healthy workforce. Other countries without these levers will find it more difficult to get effective, sustainable workplace interventions implemented.

Other community settings include supermarkets, community and sports clubs and groups, churches and other religious settings, parks and recreational facilities. Several whole-of-community programs are underway which coordinate action across multiple settings and include local media.

The commercial sector, especially the food industry, has a huge influence on individual behaviours, although researching interventions in this sector is difficult. Proof of principle studies, such as the short-term effects of changes to food services, vending machine contents, labelling, and pricing of foods have shown significant effects on food selection (French, 2005). However, evidence on the wider application of such strategies is limited. Reducing portion sizes and altering food composition in

order to reduce energy density are promising strategies which could have important impacts (Drewnowski & Rolls, 2005; Ledikwe, Ello-Martin & Rolls, 2005).

The built environment holds much promise for interventions, although most of the research to date has been limited to cross-sectional associations between aspects of the built environment and physical activity and obesity (Frank, Andresen & Schmid, 2004). Assessing the impact of cycle routes, walkways, sports and leisure facilities on population's body weight, fitness and cardiovascular health is difficult because these associations are prone to confounding and controlled interventions are difficult to design and implement. The retro-fitting of built environments to make them more conducive to health is likely to be a very long process which relies more on logic and these lower levels of evidence than high level evidence.

Approaches or Strategies

Approaches or strategies address *how* to bring about behavioural change in target groups, directly or indirectly. They can be broadly grouped into communication strategies (e.g. social marketing, education, information), programs (e.g. providing activities, increasing skills), and environmental change. The first two generally promote the healthy choices and the last one makes healthy choices easier – the so-called "upstream" approaches.

The environment, which is external to the individual, can be considered as physical, economic, policy and socio-cultural and these are all are very powerful influences on behaviours (Swinburn & Egger, 2004). For interventions, many environmental changes start at the policy level. For example: making the urban physical environment more walkable has to start with changes to urban planning regulations; exempting fruit and vegetables from a goods and services tax has to start with a policy; even changing the attitudes and perceptions about what is a "normal" school lunch can be accelerated through school food policies. Despite its central role in effecting change, the amount of research on the impact of policies is very limited.

For those who do not have the power to make the policy and environmental changes, advocacy for those changes becomes an important strategy (Box 9.3). Advocacy directed towards politicians on behalf of commercial interests (often referred to as lobbying) is sophisticated and well resourced with money and people. Advocates for public health are less well resourced but are often supported by professional, patient, and consumer groups and other non-governmental organisations. Advocacy organisations acting on behalf of public interests (such as consumer and environmental groups) tend to be trusted by the public at large to a greater extent than are commercial lobbying organisations or political parties (Eurobarometer, 2003). Advocacy no doubt has a major impact on public health but measuring the impact is difficult because it usually happens over long periods of time and in the context of many other changes (Chapman, 2001).

Box 9.3. Advocacy as an effective approach to policy

The protection of traditional, nourishing food sources against competition from less nourishing commercially produced foods can be of significant health benefit, but is likely to be undermined by a lack of market regulation to protect small producers and by economic policies which encourage modernization and a cash-based economy. In this context, advocacy can be one of the few defences of traditional products, and an example of this is given in the protection of breastfeeding undertaken by voluntary groups (involving professionals, parents and concerned individuals). Their advocacy to governments led to the WHO/UNICEF Code of Marketing of Breastmilk Substitutes and the development of some 20,000 Baby Friendly Hospitals in 150 countries, saving countless lives.

Further Caveats

We have described the traditional Targets-Settings-Approaches model for health promotion, but some extensions of this need to be considered.

Inequalities and the Locus of Responsibility

The traditional communications and program strategies (above) are dependent on the uptake of the messages or activities by the individual. Being individual-dependent, they are at risk of increasing health inequalities, because poorer people may not have the financial resources (e.g. to purchase healthier foods or use sports facilities) or the education and skills (e.g. in comprehending food labels and creating healthy recipes) or the "luxury" (e.g. their energy is taken up with coping with rent, jobs, and other problems) to hear the messages and convert them into behaviour changes (Cockerham, Rötten & Abel, 1997). An individual locus of responsibility (e.g. it is up to the parents to control what children eat and to get them involved in sports and other active programs) may pass the responsibility for disease prevention onto those at the most risk with the least capacity to achieve changes. Individualised or family-based health promotion, combined with the emphasis on personal responsibility or "making healthy choices" (Department of Health, 2004) may widen the health divide unless the strategy is supported by public interventions to ensure that healthier choices are fairly and widely available and their selection likely to be made by default.

"Settings Bias" in the Evidence

Although some interventions to prevent weight gain are undertaken within clinical settings (usually targeted at children already overweight or obese) the majority of primary prevention programmes aimed at children use schools. The reason for this is clear enough: that is where children are most accessible and where interventions can be implemented; controlled studies are feasible, usually using classes or

schools as the unit of allocation; measurements are readily done within a school environment.

Care has to be taken with school-based interventions (e.g. contamination between intervention and control groups, effects of clustering, negative reactions to imposed notions of "health", stereotyping of body shapes, resource requirements and sustainability) although these problems are surmountable. However, there is a clear "settings bias" towards schools in the literature on child obesity prevention, leading to concerns that a traditional "evidence-based policy and practice approach" (demonstrated efficacy or effectiveness) will narrow the settings for obesity prevention to schools only and make a comprehensive approach impossible to justify (Swinburn et al., 2005; Lobstein, 2006). A wider view of converting broad evidence into agreed plans of action is outlined in the section on creating a portfolio of interventions.

Community Capacity Building

Community interventions will differ markedly depending on the targeted age group, ethnic mix, socio-economic status, urban/rural status, available settings, champions, existing activities and so on. To account for these contextual differences, one could look at "the intervention" broadly as building community capacity rather specifically as on-the-ground programs (e.g. after school activity program), communications (e.g. messages to parents about TV viewing), or environmental change (e.g. implementing school food policies). The science of measuring community capacity (leadership, resources, skills and knowledge, organisational relationships) is at in its early stages (Laverack, 2006) but since capacity building is an important part of the recipe for sustainability, much more research and better tools are needed in this area.

Effectiveness of Potential Interventions – An Evidence Review

This is the 4th issue in the IOTF framework (Figure 9.1) and asks "what are the potential, specific interventions and what is the evidence for their effectiveness?" In this section we summarise some of the evidence reviews of interventions to prevent overweight and obesity and to promote healthy body weights. We are not considering here the various measures available for obesity treatment or for weight loss in clinical patients.

It should be noted that, for most interventions, long-term follow-up was not undertaken, making it difficult to evaluate the efficacy of these interventions for population wide effects on obesity prevalence. Most of the studies were able to show improvements in eating and/or exercise habits and the large trials used for school-based interventions indicate the feasibility of implementing these sorts of programmes for children on a population basis. We are aware of no systematic reviews of interventions to prevent obesity in commercial settings, although various researchers have looked at the effects of price, labelling and marketing on food choices (French, 2005; Hastings, Stead, McDermott, Forsyth, MacKintosh, Rayner, Godfrey, Caraher & Angus, 2003).

The summary of the conclusions of systematic reviews given here is based on the Cochrane Library review (Summerbell, Waters, Edmunds, Kelly, Brown & Campbell, 2006) and 21 other published reviews (Carrel & Bernhardt, 2004; Casey & Crumley, 2004; Clemmens & Hayman, 2004; Dietz & Gortmaker, 2001; Doak, Visscher, Renders & Seidell, 2006; Flynn, McNeil, Maloff, Mutasingwa, Wu, Ford & Tough, 2006; Goran, Reynolds & Lindquist, 1999; Hardeman, Griffin, Johnston, Kinmonth & Wareham, 2000; Katz, O'Connell, Yeh, Nawaz, Njike, Anderson, Cory & Dietz, 2005; Micucci, Thomas & Vohra, 2002; Muller, Mast, Asbeck, Langnase & Grund, 2003; Mulvihill & Quigley, 2003; NHS Centre for Reviews and Dissemination, 1997; NHS Centre for Reviews and Dissemination, 2002; Reilly & McDowell, 2003; Schmitz & Jeffrey, 2002; Steinbeck, 2001; Story, 1999; Swedish Council on Technology Assessment in Health Care, 2002; Wareham, van Sluijs & Ekelund, 2005).

Breastfeeding Promotion

Four types of interventions have been shown to be useful in promoting breastfeeding:

- Peer-support programmes delivered in the ante- and post-natal periods increase initiation and duration rates among women on low incomes. Peer-support programmes should be targeted at women on low incomes who have expressed a wish to breastfeed.
- Informal, small-group health education sessions delivered during the ante-natal period have been shown to be effective in increasing initiation and duration among women of all income groups and women from minority ethnic groups.
- One-to-one health education can be effective at increasing initiation rates among women on low incomes. It may be more effective than group sessions in increasing initiation among women who have made a decision to bottle-feed.
- Changes in maternity ward practices to promote mother – infant contact and autonomy, such as "rooming in" (keeping the baby beside the mother) and breastfeeding support have been shown to be effective in increasing the initiation and duration of breastfeeding.

A more pronounced effect on both initiation and duration of breastfeeding has been found in studies of the Baby Friendly Hospital initiative promoted by UNICEF, including evidence of significant effects in European settings. In addition, initiation and duration of breastfeeding may be undermined by the physical hospital environment and by hospital routines e.g. feeding at set times, separation of mother and baby, use of infant formula, and by the attitudes and expectations of the health professionals who are involved.

Family-Based and Pre-School Settings

We are aware of no published systematic reviews of family-based interventions to prevent the development of overweight and obesity in pre-school children. A review in preparation suggests that the effectiveness of interventions targeted at

2–5 year olds and their families and carers, in terms of helping children maintain a healthy weight or prevent overweight or obesity, is equivocal (Summerbell, Brown & Ray, 2005). Three studies showed positive significant intervention effects, a further two studies failed to show significant improvements. The review suggests that small changes may be possible, and interventions are more likely to be effective if they are specifically focused on preventing obesity (rather than changing diet and physical activity behaviours), are intensive, costly (primarily a function of the intensity), targeted, and tailored to individual needs.

A review of the effectiveness of interventions to promote healthy eating in pre-school settings for children aged 1 to 5 years found that, while most studies demonstrated some positive effect on nutrition knowledge, the effect on eating behaviour was less frequently assessed and the results were inconsistent (Tedstone, Aviles, Shetty & Daniels, 1998). There were no data to evaluate long term effectiveness on knowledge or behaviour.

In the USA, a focus group involving 19 health care professionals in the Women, Infants and Child programme provided some insight into the barriers health professionals may face when counselling parents of overweight children (St Jeor, Perumean-Chaney, Sigman-Grant, Williams & Foreyt, 2002). They perceive that mothers: (1) were focused on surviving their daily life stresses, (2) used food to cope with these stresses and as a tool in parenting, (3) had difficulty setting limits with their children around food, (4) lacked knowledge about normal child development and eating behaviour, (5) were not committed to sustained behavioural change, and (6) did not believe their overweight children were overweight.

Effectiveness of family interventions targeted at older children, in terms of helping children maintain a healthy weight or prevent overweight or obesity, is also equivocal. Family based interventions may be less effective when trying to prevent obesity in adolescents. Studies of family-based treatment for overweight have indicated the need to consider the role of parents in the treatment process: one study indicated that treating the mother and child separately appeared to be significantly more effective than treating them together, or treating the child alone. In another study (10–11 year old children) there was no significant difference in effect on weight outcomes between treating the parent and child together or separately (McLean, Griffin, Toney & Hardeman, 2003). Interventions that link school and home activities appear to influence knowledge but not necessarily behaviour (Hopper, Gruber, Munoz & MacConnie, 1996). It is noteworthy to point out that family based interventions tend to be more expensive than child-based interventions conducted in schools.

School-Based Settings

Whilst school-based interventions appear able to show gains in children's nutrition understanding, increases in physical activity or improvements in diet, hardly any interventions appear able to demonstrate a significant effect on indicators of adiposity. Very few studies last longer than a year, and in those that follow

children over a longer period find the initial advantages gained by the intervention may be reduced over time (Kafatos, Manios & Moschandreas, 2005).

Nearly all the reviews identify the combination of multiple approaches to obesity prevention – including education, food services and physical activity – as being more successful than single approaches. Increases in school physical activity opportunities and reduced television viewing time appear to be at least as important as classroom health education. Effectiveness may be increased by linking the school-based programme to out-of-school action, through the family and community.

Additional points raised are:

- Different age groups, ethnic groups and genders needed different approaches.
- For increasing physical activity, the most effective initiatives involved children through the whole school day, including lunch and recesses as well as class time and physical education lessons.
- Adults who had participated in school-based physical activities as children were more likely to be active in adulthood than those that had not.
- Breakfast clubs (food provided when children arrive early at school) can have a beneficial effect on behaviour, dietary intake, health, social interaction, concentration and learning, attendance and punctuality. They can reach lower income families and so address inequalities.
- School-based physical activity interventions that appear interesting and innovative to children (such as dance clubs), and interventions that aim to reduce television, videotape and video game use, are most effective.
- The most successful dietary interventions focus on promoting one aspect of a healthy diet, such as fruit and vegetables. Nutrition standards for food served in schools needs to be supported by measures to ensure that healthy options are selected. Restricting the choices of food available to children is associated with healthier eating.
- A comprehensive school food service policy should include snacks brought to school, vending machines, snack bars and access to local shops during breaks.
- Children will choose healthier options from vending machines, such as mineral water, pure fruit juice and skimmed milk: the key to success is pupil involvement, appropriate location of the vending machine close to the dining area, and ensuring continuity of provision (that the machine is full and in working order).
- Walking to school and cycling to school schemes may be effective, and may bring benefits besides preventing weight gain, but there is no good evidence available on which to base a recommendation.

A commentary by Lytle et al (Lytle, Jacobs, Perry & Klepp, 2002) noted the limited effects found in studies, and suggested several factors that may improve success rates, notably ensuring an adequate length of intervention and ensuring the involvement of all participants to prevent drop-out. The authors also note that heterogeneity, i.e. the involvement of participants from diverse cultural backgrounds, is rarely catered for in the experimental designs where "one size fits all", and this may compromise the ability to show significant effects. The authors

recommend programmes which are more flexible and responsive to the social and cultural environments in which they occur, perhaps inviting the active participation of community members during the design of the intervention. They also note Richter et al's evidence that school and community interventions are more likely to be successful if they occur in the context of health-promoting environments (Richter, Harris, Paine-Andrews, Fawcett, Schmid, Lankenau & Johnston, 2000).

Workplace Settings

Strategies that target adults at their place of work include a number of different approaches: nutrition education, aerobic or strength training exercise prescription, training in behavioural techniques, changing workplace food (canteens, vending machines, catered food), and the provision of self-help materials. Evidence of effectiveness of workplace efforts to control overweight and obesity is not strong, but might encourage employers to provide such programmes. The literature supports an emphasis on interventions combining instruction in healthier eating with a structured approach to increasing physical activity in the worksite setting (Katz et al., 2005).

Further observations on the workplace setting include:

- Choose definable and modifiable risk factors which are a priority for the specific worker group.
- Strategies should not isolate health-related knowledge, values and behaviours from the social and material context in which the targeted employees live.
- Program cost-effectiveness data might increase employer interest.
- Given the frequency of weight rebound after short-term weight loss, additional research is needed regarding the most effective means of maintaining initial success.
- Visible and enthusiastic support and involvement from top management.
- Involvement by employees in the planning and implementation stages.

Community Settings

A summary of the evidence found inconclusive evidence regarding the effectiveness of community-based interventions (for example seminars, mailed educational packaged and mass media participation) for the prevention of obesity and overweight in adults (Mulvihill & Quigley, 2003). The review recommended that the effectiveness of community-based education programmes linked with financial incentives should be investigated further.

Examples of more imaginative approaches used in community settings include improved information and access to healthier food choices (for example, improving access to major stores and better provision at local shops, establishment of food co-ops, community cafes, growing clubs); health promotion activities for improving knowledge and skills (for example, through shopping tours, cook and eat classes); improved provision and safety of walking and cycling routes; and local voucher schemes (e.g. for local swimming pools).

Supermarket promotions appear to be effective in improving dietary intakes over the short term, particularly if accompanied by supporting information. Promotions in restaurants and cafes may have a greater impact than those in supermarkets. Using churches as a setting for health education may also have a positive impact on dietary intake (Weightman, Fry, Sander, Kitcher & Jenkins, 2005).

While the general promotion of active transport does not appear to be effective, targeted programmes with tailored advice do appear to change travel behaviour of motivated subgroups. Associated action, such as subsidies for commuters, may also be effective. Promotions which aim to motivate the use of stairs using posters and banners appear to have a positive effect (Kerr, Eves & Carroll, 2001; Marshall, Bauman, Patch, Wilson & Chen, 2002).

Cost Effectiveness

For policy-makers considering strategy options, the distinction between effectiveness and cost-effectiveness is critical. If a policy objective is to be pursued with no limitation on spending, then effectiveness (the beneficial effect of a strategy in practice) is the primary consideration. But when cost limitations apply (as they inevitably do), an evaluation of cost-effectiveness is essential if rational decisions are to be made (Brunner, Cohen & Toon, 2001).

A remarkable feature of the evaluations and systematic reviews of interventions described above is that they rarely mention the costs of the various programmes they examine, and make no estimates of cost-effectiveness. A recent review of workplace and community interventions noted that only two studies which met the criteria for inclusion provided cost-effectiveness analyses of worksite interventions to prevent and control overweight and obesity (Katz et al., 2005).

For child obesity prevention we have identified only one study which explicitly examined the costs of an intervention programme, the US Planet Health Program (Wang, Yang, Lowry & Wechsler, 2003). Planet Health's estimated cost-effectiveness ratio gives a value of $4305 per quality-adjusted life year gained, which compares favourably with interventions such as the treatment of hypertension, low-cholesterol-diet therapies, some diabetes screening programs and treatments, and adult exercise programs (Ganz, 2003).

Creating a Portfolio of Interventions

The evidence for obesity prevention covered thus far has shown: a substantial burden to warrant action; sufficient understanding of the determinants to know *what* to target; a determination of the priority target populations (*who*), the best settings to access (*where*), and the most appropriate strategies to use (*how*), and; a review of the literature about what has been shown to work or not work. The final challenge in the IOTF framework (prior to actually implementing and evaluating

the work) is to create the "portfolio" of interventions to be implemented. This is a considerable challenge in priority setting of, because the aim of intervention selection is:

To agree upon a *balanced portfolio* of *specific, promising* interventions to reduce the *burden of obesity* and *improve health and quality of life* within the *available capacity* to do so

"Agreement" infers a process with decision-makers coming to a joint understanding. "Balanced portfolio" means a balance of content (both nutrition and physical activity), settings (not all school-based), strategies (policies, programs, communications), and target groups (whole population, high risk). Interventions need to be "specific" (not just "promote healthy eating") and can be "promising" rather than proven. The analogy of choosing a balance of products (shares, property, bonds) to create portfolio of financial investments has been used by Hawe and Shiell (1995) to conceptualise appropriate investment in health. The best investments are the safe, high return ones (i.e. high level of evidence, high population impact) but inevitably the choices come down to including some safe, lower return investments and some higher risk (i.e. less certainty), potentially higher return investments while excluding the high risk, low return ones. The IOTF framework (Swinburn et al., 2005) applies this investment concept to obesity prevention and presents a "promise table" which is a grid of certainty (strength of evidence) versus return (population impact) into which interventions can be placed according to their credentials.

The other key concepts in the priority setting aim are that the interventions reduce the "burden of obesity" and "improve health and quality of life". These issues are particularly important for obesity prevention because many of the interventions (healthier eating and physical activity) have their own independent effects on health and some interventions have the potential to do harm (such as increase stigmatisation and teasing) or increase health inequalities. Fitting the plan of action to the available capacity to achieve it is especially a challenge at the community level where the level of health promotion funding is usually very low and the enthusiasm for doing something is usually very high.

Given the challenging aim of intervention selection, how can this be achieved and what role does (or should) evidence play in the process? Certainly, the evidence of effectiveness is not sufficient by itself to guide appropriate decision-making, and, indeed, true evidence-based policy-making is probably quite rare. (Marmot, 2004) Some major policy decisions are made on the basis of extremely little evidence despite high costs (such as military interventions). A helpful concept to apply is that of "practice/policy-based evidence" (Marmot, 2004). Whereas evidence-based practice/policy starts in the library, assesses what has been published and then takes that intelligence to the policy-maker or practitioner to consider for implementation, practice/policy-based evidence starts at the table with the practitioner or policy-maker and assesses what could be implemented with the ideas coming from many sources: what is already happening here, what is happening elsewhere, what the literature shows, what the politicians want to implement and so on. Then some technical estimates are made using the best evidence available and these are brought back to the table to inform the priority setting. Two examples of this are given below.

Evidence and Priority Setting – National/State Level

The ACE-Obesity project (Assessing Cost-Effectiveness of Obesity Interventions) was funded by the Victorian Government in Australia to inform it on the best investments for reducing childhood obesity (Haby, Vos, Carter, Moodie, Markwick, Magnus, Tay-Teo & Swinburn, 2006). The ACE approach included extensive economic analyses around agreed, specified interventions to reduce childhood obesity at a state or national level, plus a process that engaged key stakeholders in first selecting the interventions for analysis and then secondly providing judgments on the modelling assumptions and a number of "second stage filters" (strength of evidence, feasibility, sustainability, acceptability, effects on equity, other positive or negative effects). The definition of evidence was wide and all assumptions in the modelling had to be explicit and have in-built uncertainty estimates. In this way, policies (such as banning food advertisements to children), programs (such as active transport to school) and services (such as gastric banding for very obese teenagers) which lacked trial evidence could still be modelled.

The outputs were estimates of total cost, population health gains (body mass index [BMI] units saved or disability-adjusted life years [DALY] saved), cost-effectiveness ($/BMI saved, $/DALY saved), and the second stage filter judgements. Table 9.2 shows some of these outputs for the 13 interventions modelled (Department of Human Services, 2006; Haby et al., 2006).

From this set of data, there are clear pointers for decision-makers such as the low cost of policies compared to programs and the importance of the reach of an intervention (another advantage of policies over programs). It poses problems

TABLE 9.2. Modelled estimates of costs and impacts of obesity prevention interventions for children and adolescents (ranked by population impact – total DALYs saved)

Intervention	Total DALYs saved	Total BMI units saved	Gross cost (AUD $m)	Net cost (AUD $m)
Bans on TV food advertising to children	37 000	400 000	0.13	−300
Laparoscopic adjustable gastric banding for obese teenagers	12 000	55 000	130	55
School-based programs to reduce TV viewing	8 600	122 000	54.6	−2.1
Multi-faceted school-based including active PE	8 000	124 000	40.4	−28.7
School-based programs to reduce sweet drinks	5 300	69 000	3.3	−5.2
Family-based program for overweight children	2 700	3 400	11	−4.1
Multi-faceted school-based without active PE	1 600	23 000	24.3	11.2
GP delivered program for overweight children	510	2 300	6.3	3.0
Active After School Communities program	450	4 200	40.3	36.6
Orlistat therapy for obese teenagers	450	600	6.4	4.0
Multi-faceted school-based program for overweight children	360	2 000	0.56	−0.1
'TravelSMART' active transport program	50	470	13.1	12.5
Walking School Bus program	30	270	22.8	22.6

DALY = Disability-adjusted life year, BMI = body mass index, AUD = Australian dollars
Adapted from Haby et al (2006) and Department of Human Services (2006).

however when some effective interventions are not very acceptable to stakeholders like governments (such as bans on television advertising to children and gastric banding for teenagers), or when popular programs (such as walking school bus and active after school programs) are not very effective or cost-effective. These and other second stage filters are essentially stakeholder judgements which are either not included or are on the bottom rung of evidence hierarchies as expert opinion, yet they carry such weight in real life policy decisions. The aim here is to make them transparent. It may be perfectly appropriate to fund a Walking School Bus program even though it is costly and ineffective for obesity prevention. It could be justified for other benefits (e.g. reducing congestion and pollution) or as an "icon" program (e.g. as a visible, leader program for active transport in general) but high expectations cannot be placed on the program for contributing to reducing obesity.

Evidence and Priority Setting – Community Level

Well-evaluated community demonstration projects are an excellent strategy to build the evidence for obesity prevention at the community level. However, the same challenges of defining what *could* be done and then undertaking a priority setting process to determine what *should* be done apply at the community level as much as they apply at a state or national level. Similar principles to ACE-Obesity, but a simplified process, were applied in the formative stages of six demonstration projects in Australia, New Zealand and the Pacific (Schultz, Utter, Mathews, Cama, Mavoa & Swinburn, 2007). The central feature is the ANGELO workshop (so-called because it uses an Analysis Grid for Elements Linked to Obesity – see Swinburn, Egger & Raza, 1999) which brings together the literature-based evidence and the local context expertise so that stakeholders can prioritise a number of specified behavioural targets, knowledge and skills gaps and environmental barriers for action. At the end of a 2-day workshop, they have a draft action plan that they own and is truly "practice-based evidence" because the three critical features have been brought together: the evidence (all parts of the IOTF framework), the context (stakeholder judgements) and a transparent process.

Effects of Globalisation

Food supply, food prices, food policies and food marketing at a community and national level are heavily influenced by global forces. It is clear from the recent economically-based analyses for the UK Treasury (Wanless, 2002) that interventions to reduce smoking, obesity and physical inactivity require economic modelling including analyses of the effects of product prices and marketing practices on consumers' purchasing patterns. These approaches have been used by the EU in its agricultural policies for manipulating the production of cereals, meat, milk, butter, sugar, wine, fruit and vegetables by altering subsidy and

tariff levels, controlling minimum prices and shaping markets (e.g. by destroying fish catches and fruit and vegetable crops). Routine economic planning approaches have not often been applied sufficiently to analyses of options for social policy change. The evidence required to show how policy changes in these areas might affect consumption patterns and subsequent chronic disease rates has received too little attention.

In a review of the determinants of dietary trends, Haddad (2003) notes the need to consider several macro-economic factors, including income growth, urbanisation, and the relative prices of foods and their availability which are affected by mass production technology and commodity costs, along with retail distribution chains and catering outlets. One study of US food supply price elasticities showed that an increase in the price of oils would lead to a decrease in fat consumption and total energy intake, and an increase in the consumption of most other nutrients (Huang, 1996).

Prices of foods are in turn affected by the cost of commodities, which are in turn affected by agricultural support policies and trade regulations. Food prices must also absorb marketing and promotion budgets.

Marketing itself interacts with consumer awareness and cultural practices. There is remarkably little publicly available data on the impact of commercial marketing strategies on children's behaviour, including the effects on diet and physical activity and consequential weight gain. It is highly likely that some valuable data is held by the commercial interests themselves. A government initiative to acquire this data on behalf of consumers would be a valuable research resource, on a par with the commercial papers that were released during litigation against the tobacco companies. In respect of marketing, the evidence needed should include not only direct marketing strategies, such as television advertising and promotional internet sites, but also product placement on film and television programmes, cross branding of recognisable elements of food brands on non-food items, the use of colouring and flavour-boosting food additives to promote sales, the use of sponsorship and celebrity endorsement of products, the licensing of children's cartoons for use on food labels and other techniques aimed to influence children's food and leisure choices. Evidence is needed to show how these various promotional methods affect dietary choices and subsequent health.

Similarly, more evidence is needed on the impact of investment strategies, such as foreign direct investment in sectors affecting food supplies – agriculture, food manufacturing, retailing and catering (e.g. fast food catering) – for their potential effects on diet and health, mediated through food prices and availability.

In all the above suggestions, similar analyses could be undertaken relating to the "products" (including buildings, vehicles, parks and streets, television entertainment etc) which affect the physical environment and influence physical activity, or which encourage sedentary behaviour. The marketing of products affecting physical activity are all in need of better research understanding in order to demonstrate to policy-makers that interventions can be a worthwhile investment opportunity.

Evidence Needs

In this chapter we have reflected on the shortcomings of the current evidence base for obesity prevention and the difficulties in obtaining relevant evidence for policy-making. These problems were also considered at the WHO Kobe expert meeting on childhood obesity (World Health Organization, 2005) which made several recommendations, including:

- All interventions should include process evaluation measures, and provide resource and cost estimates. Evaluation can include impact on other parties, such as parents and siblings.
- Interventions using control groups should be explicit about what the control group experiences. Phrases like "normal care" or "normal curriculum" or "standard school PE classes" are not helpful, especially if normal practices have been changing over the years.
- There is a need for more interventions looking into the needs of specific sub-populations, including immigrant groups, low income groups, and specific ethnic and cultural groups.
- There is a shortage of long-term programmes monitoring interventions. Long-term outcomes could include changes in knowledge and attitudes, behaviours (diet and physical activity) and adiposity outcomes.
- New approaches to interventions, including prospective meta-analyses, should be considered.
- Community-based demonstration programmes can be used to generate evidence, gain experience, develop capacity and maintain momentum.
- There is a need for an international agency to encourage networking of community-based interventions, support methods of evaluation and assist in the analysis of the cost-effectiveness of initiatives.

The Kobe meeting also expressed concern at the role of interested parties in the funding and evaluation of research and recommended that research reviews should not be funded by commercial interests. The meeting identified a need to evaluate the impact of programs funded by industry and other sources of potential bias, in order to examine their contribution to the evidence base.

Conclusions

The traditional approach to evidence is based on a medical model but this needs to be adapted to suit obesity prevention, retaining the rigour of evidence assessments and uses while incorporating the flexibility and complexity needed for public health intervention research. The IOTF framework attempts to achieve this by articulating the various questions that the evidence needs to address, by expanding the definitions of evidence, by highlighting the need for modelling where there are gaps in the empirical data, by lifting the value of informed

stakeholder input for those research questions where contextual factors are important, by taking a "solution-oriented" approach to determining interventions, and by defining how a "policy/practice-based evidence" paradigm can better align evidence with the realities of decision-making.

Acknowledgements. We would like to acknowledge the input of Tim Gill and Shiriki Kumanyika in the IOTF evidence framework, the work of Rob Carter, Theo Vos, Michelle Haby, Anne Magnus, Alison Markwick, Marj Moodie, and Mike Ackland on the ACE-Obesity project, and Colin Bell, Andrea Sanigorski, and Anne Simmons on the community-based intervention approaches.

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