Chapter 6

The Impact of Interventions

Governments in OECD countries have intervened in a variety of ways to improve diets, increase physical activity and tackle obesity in recent years. The preventive interventions assessed in this analysis are drawn from the most commonly used approaches, including: health education and health promotion (mass media campaigns, school-based interventions, worksite interventions); regulation and fiscal measures (fiscal measures altering the prices of healthy and unhealthy foods, regulation of food advertising to children and mandatory nutrition labelling); and, counselling of individuals at risk in primary care. This chapter examines the characteristics, the costs and the relative success of each approach in improving health outcomes and social disparities in health, with a focus on five OECD countries: Canada, England, Italy, Japan and Mexico.

What interventions really work?

Governments in OECD countries have considered or implemented numerous interventions to improve diets, increase physical activity and tackle obesity in recent years (see Chapter 5 for a full discussion). Building on reviews[1] by WHO and OECD, it has been possible to identify a relatively small but important evidence base on the impact of nine different health interventions on individual health-related behaviours, obesity and other risk factors for chronic diseases. The nine interventions, listed below within three main groups, formed the object of an economic analysis undertaken by the OECD to assess the cost-effectiveness and the distributional impacts of different means of preventing chronic diseases, based on a mathematical model jointly developed with the WHO (Sassi *et al.*, 2009).

Health education and health promotion interventions	Regulation and fiscal measures	Primary-care based interventions
Mass media campaigns	Fiscal measures altering the prices of fruit and vegetables and foods high in fat	Physician counselling of individuals at risk
School-based interventions	Government regulation or industry self-regulation of food advertising to children	Intensive physician and dietician counselling of individuals at risk
Worksite interventions	Compulsory food labelling	

The quality and quantity of the evidence available for different interventions vary widely,[2] but mathematical models like the OECD/WHO one can be used to combine multiple sources of evidence to make up for the limitations of individual sources.

The OECD/WHO analysis relies on the existing effectiveness evidence to identify possible key characteristics of the nine interventions. Therefore, the interventions considered here reflect the characteristics of those assessed in existing experimental and observational studies, and not necessarily those of interventions which specific countries may have adopted or which countries may be considering to adopt. Interventions may be designed and implemented in a variety of ways, and the evidence presented in this chapter should serve as a guide to policy makers as to what impact may be expected.

The preventive interventions assessed in the analysis reflect a wide variety of approaches and are based in diverse settings. The costs associated with those interventions may arise in different jurisdictions. Some of the costs are typically paid through public expenditure (*e.g.* the costs associated with regulatory measures), others typically not (*e.g.* most of the costs associated with worksite interventions). Some of the costs arise within the health sector, others arise within other sectors of government intervention (*e.g.* most of the costs associated with school-based interventions). Only public sector costs are accounted for in the analysis, while costs borne by the private sector are excluded. All costs are reported in US dollar Purchasing Power Parities (USD PPPs), with 2005 the chosen base year, a unit that is commonly used to account for differences in purchasing power across countries.

The analysis focuses on five OECD countries: Canada, England, Italy, Japan and Mexico. These reflect a wide geographical spread, as well as markedly different epidemiological characteristics in terms of risk factors and chronic diseases. This group includes countries with some of the highest rates of obesity in the OECD area, such as Mexico and England, as well as the country with the lowest rate, Japan, with Italy and Canada faring, respectively, in the lower and upper sections of the ranking (as shown in Chapter 2, Figure 2.1).

Health education and health promotion interventions

We consider three types of health education and health promotion interventions, targeting different populations. The first is a campaign run through the mass media, designed to deliver health promotion messages to the adult population. The second intervention targets children within schools, while the third targets working age adults who are employed by large firms through a series on initiatives run at the workplace.

Exploiting the power of the media

The mass media can reach vast audiences rapidly and directly. Health promotion campaigns broadcast by radio and television may raise awareness of health issues and increase health information and knowledge in a large part of the population.

The campaign is assumed to be broadcast on television and radio channels at the national and local levels, and to follow a two year pattern alternating six months of intensive broadcasting with three months of less intensive broadcasting. During the more intensive phases television and radio channels broadcast 30 second advertisements six times a day, seven days a week. In the less intensive phases they broadcast 15 second advertisements three times a day, seven days a week. Advertisements contain messages both on diet and

physical activity. Broadcast messages are associated with the distribution of printed material, both of which are assumed to reach 10% of households.

Targeting children

School enrolment is nearly universal in the OECD area at younger ages; therefore, schools provide the means for reaching a large audience of children from all backgrounds. Additionally, food preferences are formed during childhood and helping children to develop a taste for healthier foods may have an effect on their diets persisting into their adult life.

The intervention targets all children attending school in the age group 8-9, but it is assumed that just above 60% of children will fully participate in the activities which form part of the intervention.

The intervention entails the integration of health education into the existing school curriculum with support from indirect education and minor environmental changes such as healthier food choices in cafeterias. The main component is represented by an additional 30 hours per school year (about one hour per week) of health education focused on the benefits of a healthy diet and an active lifestyle. This is associated with an opening lecture held by a guest speaker, and further activities during ordinary teaching hours (*e.g.* science) with the support of school nurses. Indirect education consists of the distribution of brochures or posters, while environmental changes are pursued by re-negotiating food service contracts and re-training of staff.

Healthy workplaces

Working adults spend a large part of their time at the workplace, where they are exposed to a number of factors that may influence their lifestyles and health habits. Existing evidence suggests that health education, peer pressure, and changes in the work environment contribute to changing lifestyles and preventing certain chronic diseases.

The intervention targets individuals between the ages of 18 and 65 working for companies with at least 50 employees. It is assumed that 50% of employers, and 45% of their employees, will participate in the programme.

The intervention involves an introductory lecture by a guest speaker and a series of 20 minute group sessions with a nutritionist every two weeks for 20 months. Messages are reinforced by the distribution of information materials and posters in common areas and cafeterias. Other activities are co-ordinated by volunteers who also act as peer educators and organise "walk-clubs" or similar initiatives. As part of the intervention, catering staff are re-trained to prepare healthy dishes and food service contracts are re-negotiated.

Box 6.1. **Health education and health promotion**

Mass media campaigns

Main sources of evidence. Intervention characteristics and effectiveness are modelled on the basis of a selection of studies selected from a broader literature (Dixon *et al.*, 1998; Foerster *et al.*, 1995; Craig *et al.*, 2007).

Effects of the intervention. The intervention will increase consumption of fruit and vegetables by an average of slightly more than 18 grams per day, and it will increase the proportion of the population undertaking adequate levels of physical activity by approximately 2.35%.

Intervention costs. The estimated cost of per capita of a mass media campaign ranges between USD PPPs 0.5 and 2 in the five countries examined. Almost two-thirds of this cost is spent in broadcasting advertisements on national and local radio and television channels and on producing and distributing flyers and leaflets. The remaining resources are mainly devoted to hiring personnel to design, run and supervise the programme. We assume that public health specialists are involved in designing the prevention programme. Planning and administration costs are spread over a large target population.

School-based interventions

Main sources of evidence. Intervention characteristics and effectiveness are modelled on the basis of a selection of studies selected from a broader literature (Gortmaker *et al.*, 1999; Luepker *et al.*, 1998; Perry *et al.*, 1998; Reynolds *et al.*, 2000).

Effects of the intervention. The intervention will modify distal risk factors, particularly by increasing the intake of fruit and vegetables by almost 38 grams per day during the course of the intervention and by decreasing the proportion of energy intake from fats of nearly 2%. The BMI of children exposed to the intervention will be reduced by 0.2 points. The analysis is based on the assumption that children will enjoy the benefits of the intervention throughout the course of their lives, although dietary changes will be reduced after exposure to the programme ceases.

Intervention costs. The estimated cost per capita of a school-based intervention ranges between one and two USD PPPs in the five countries examined. About half of this is spent in programme organisation costs, while the remaining half is split between training of teachers and food service staff, extra teaching and additional curricular activities, *e.g.* guest speakers, brochures, books, posters and equipment. The single most expensive item is extra teaching hours. Costs do not include changes in food service contracts, vouchers/coupons from sponsors and school nurse time.

Box 6.1. **Health education and health promotion** *(cont.)*

Worksite interventions

Main sources of evidence. Intervention characteristics and effectiveness are based on evidence provided in Sorensen *et al*. (1996; 1998; 1999), Emmons *et al*. (1999) and Buller *et al*. (1999).

Effects of the intervention. The intervention will increase the consumption of fruit and vegetables by an average of almost 46 grams per day and the proportion of physically active employees by 12%. It will also decrease the proportion of total energy intake from fats by over 2%. Employees exposed to the intervention will have their BMI reduced by, on average, half a point.

Intervention costs. The estimated cost of per capita of a national worksite intervention ranges between USD PPPs 2.5 and 5.5 in the five countries examined. Organisation and training of peer-educators and food service staff account for less than one-tenth of these costs, while the largest component is represented by seminar organisation and nutritionist fees. Other costs include information materials and a guest speaker. Although the intervention is delivered by employers, its costs are assumed to be fully subsidised by the public sector. The costs involved in re-negotiating food service contracts or accessory measures (*e.g*. installation of bicycle racks) were not included in the analysis.

Regulation and fiscal measures

Governments may pull different regulatory and fiscal levers in their fight against obesity. We consider three types of interventions in this category. The first is a broadly defined set of fiscal measures combining initiatives to alter the relative prices of different types of foods. The second intervention involves the regulation of food advertising to children, which may also be designed as a self-regulation intervention driven by the food and beverage industry. Finally, we consider the introduction of compulsory nutritional labelling of foods.

Using fiscal levers to change people's diets

Fiscal incentives can directly affect consumption behaviours, and therefore influence lifestyle choices. Taxes, tax exemptions and subsidies are widely used in agriculture and food markets in the OECD area. Differential taxation of food products is relatively common. Sales taxes, or value added taxes, are often applied at different rates to different types of food. In many countries most foods are exempt, or subject to a reduced rate taxation, but certain foods are often subject to higher rates, particularly manufactured foods, or foods containing larger amounts of certain ingredients, such as sugar. Food taxes are often viewed as not particularly effective in changing

patterns of food consumption, but several studies suggest that they can have an impact on both consumption of unhealthy foods and people's weight, although evidence of the latter is weaker (Powell and Chaloupka, 2009). Fiscal measures may be complex to design and enforce, and their impacts may be somewhat unpredictable as the price elasticity of lifestyle commodities varies across individuals and population groups, and substitution effects are not always obvious. However, the demand for foods which might be subjected to taxation in the pursuit of health objectives is generally inelastic. As discussed in Sassi and Hurst (2008), this is associated with more limited substitution. Rather, individuals end up consuming less of the taxed commodity while at the same time spending more of their income on that same commodity, which may also displace other forms of consumption to a certain degree. The combined use of taxes and subsidies on different types of foods whose demand is similarly inelastic may neutralise such displacement effect, although empirical evidence of the effects of similar combined measures is lacking at present. Fiscal measures also have potentially large re-distributive effects, which are mostly dependent upon existing differences in price elasticities between socio-economic groups, overall consumption of the foods targeted by fiscal measures, and cross-elasticities between the demand for these and for other foods. Income distribution effects are not explicitly addressed in the analyses reported in this chapter.

Taxes and subsidies typically affect all consumers. The intervention assessed in the analysis involves fiscal measures that will both increase the price of foods with a high fat content (*e.g.* many dairy products) by 10% and will decrease the price of fruit and vegetables in the same proportion. No assumptions are made as to what specific measures should be taken to achieve those price changes.

In modelling our "fiscal measures" intervention, we deliberately avoided to specify the detailed nature of the measures that governments may wish to use to cause a rise in the prices of foods high in fat and a fall in the prices of fruit and vegetables. Therefore, we only expect our estimates of the costs associated with the intervention to reflect a realistic average across a range of possible options.

Interventions to influence food prices might rely on the infrastructure of existing agricultural policies. The overall cost of agricultural policies may be high, but the additional administrative cost of incremental measures to influence the prices of selected foods is likely to be substantially lower. Alternatively, the prices of foods high in fat may be raised by imposing indirect taxes. If our modelling assumptions were applied to household expenditure data from the United Kingdom (Expenditure and Food Survey, 2007) it could be roughly estimated that a tax on foods high in fat leading to a 10% price increase and eliciting a 2% reduction in consumption would yield revenues in

the region of USD PPPs 1 billion in the United Kingdom, while the estimated administrative cost of the tax, based on our modelling assumptions, would be up to USD PPPs 16.8 million, or 1.6% of the total revenue yield of the tax.

Protecting children from food advertising

Heavy marketing of fast food and energy-dense food is regarded as a potential causal factor in weight gain and obesity, particularly because of its impact on dietary habits in children and teenagers. Most advertising explicitly directed to children is broadcast on television. Some countries have already taken formal regulatory steps to limit food advertising to children. Furthermore, major international players in the food industry are adopting forms of self-regulation, which may be viewed as an alternative, or a complement, to government regulation.

The intervention is targeted to children between the ages of 2 and 18. The intervention is intended to limit children's exposure to food advertising on television, particularly in programmes primarily aimed at children and during times of the day when a large proportion of the audience is made up by children in the above age group. Two versions of the intervention were assessed in the analysis: the first involving formal government regulation introduced by law and enforced by communication authorities; the second involving self-regulation by the food industry and broadcasters, with the government acting only in a monitoring and supervisory role.

Informing consumers on food nutritional contents

Disclosure of the nutritional characteristics of food sold in stores through labels reporting easy-to-read "nutrition facts" helps consumers choose healthier diets and may provide strong incentives for food manufacturers to decrease serving size and reformulate packaged food with healthier nutrients.

Although the intervention is intended to affect all consumers, empirical evidence suggests that only about two-thirds of store customers actively read labels. The intervention entails the adoption of a mandatory food labelling scheme for food sold in stores. Labels will deliver information about nutrient contents and serving size. Retailers will post information about how to read labels and about the benefits of a healthy diet. The intervention does not involve other forms of communication. The accuracy of the information reported on labels is verified through an extensive programme of food inspection.

Counselling individuals at-risk in primary care

In many OECD countries most citizens have a primary care physician who acts as their first point of contact with the health service and as a usual source of primary health care. Primary care physicians are also an important source

Box 6.2. **Regulation and fiscal measures**

Fiscal measures

Main sources of evidence. We modelled the effects of fiscal interventions only through changes in consumption of fat and fruit and vegetables, based on some of the most conservative estimates of the price elasticity of demand for foods high in fat and for fruit and vegetables, among the nine studies reviewed in a recent French Government report (Hespel and Berthod-Wurmser, 2008).

Effects of the intervention. A 10% change in price will produce, on average, a 2% change in consumption in the opposite direction. Depending on the baseline levels of consumption in the countries concerned, the above price change will generate increases of between 4 and 11 grams of fruit and vegetable consumption per day, on average, and reductions in the proportion of total energy intake from fats between 0.58% and 0.76%. Price elasticity is assumed equal across population groups, which may slightly overestimate the responsiveness of low income groups to changes in the prices of fruit and vegetables, and correspondingly underestimate the responsiveness of high-income groups.

Intervention costs. The estimated cost of per capita of fiscal measures ranges between USD PPPs 0.03 and 0.13 in the five countries examined. We modelled the costs of fiscal measures to include basic administration, planning, monitoring and enforcement at the national level. The latter, in particular, accounts for most of the cost. Potential revenues from the tax, as well as expenditures originating from the subsidy, are not accounted for in the analysis, as they represent transfers rather than costs. Tax operating costs, also not included in the analysis, may be driven by a broad range of factors (associated with the nature of the tax base or with characteristics of the tax) which makes it difficult to generalise existing estimates to new taxes or settings. A review of studies up to 2003 concluded that "studies that do address administrative costs suggest that they rarely exceed 1% of the revenue yield, and more usually come in well below 1%" (Evans, 2003).

Regulation of food advertising to children

Main sources of evidence. The effects of children's exposure to (fast) food advertising on BMI was estimated on the basis of the findings reported by Chou *et al.* (2008). The impact of government regulation on children's exposure to food advertising was based on an evaluation of the impact of Ofcom's regulatory measures in the United Kingdom (Ofcom, 2008).

Effects of the intervention. As a result of restrictions in advertising, children aged 4-9 will see 39% less advertising of foods high in fat, salt, or sugar, while children aged 10-15 will see 28% less. Depending on the overall amount of

Box 6.2. **Regulation and fiscal measures** *(cont.)*

television viewing by children in different countries, and on the amount of food advertising broadcast, children's BMI in the above age groups will be reduced by 0.13 to 0.34 points. This effect takes into account children's residual exposure to a certain amount of advertising, either because they watch television programmes outside the hours in which restrictions are enforced, or because advertisers may switch from television to other forms of advertising to which children remain exposed. The effects of the intervention were assumed to persist into adult life in a reduced form. In the case of self-regulation, the effects of the intervention were assumed to be half of those produced by formal regulatory measures, because of possibly looser limitations self-imposed on advertising and a less than universal compliance to the voluntary arrangements.

Intervention costs. The estimated cost of per capita of government regulation of food advertising to children ranges between USD PPPs 0.14 and 0.55 in the five countries examined, while the industry self-regulation option would cost between USD PPPs 0.01 and 0.04 per capita. The intervention involves basic administration and planning costs at the national and local levels, as well as monitoring and enforcement costs. In addition, minor training may be required for communication authority staff charged with the task of overseeing the implementation of the scheme. In the case of self-regulation, basic administration, facilitation and supervision costs will arise at the national level. Enforcement costs will be largely reduced, but there will remain a need for monitoring of compliance and effects.

Compulsory food labelling

Main sources of evidence. Intervention characteristics and effectiveness are based on evidence provided in Variyam and Cawley (2006) and Variyam (2008).

Effects of the intervention. Food labelling helps conscious consumers follow a healthy diet. Evidence suggests that this will increase the consumption of fruit and vegetables by an average of 10 grams per day, and reduce the proportion of total energy intake from fats by 0.42%. The average BMI reduction that will be achieved in the population exposed to the intervention is 0.02 points.

Intervention costs. The estimated cost of per capita of introducing compulsory food labeling regulation ranges between USD PPPs 0.33 and 1.1 in the five countries examined. The costs of the intervention include basic administration, planning, enforcement, preparation and distribution of posters and, finally, resources needed to manage the programme of food inspection. The programme does not account for the additional packaging costs associated with designing and printing nutrition labels and for the potential cost associated with the reformulation of certain foods, likely to be borne by the private sector.

of information and advice on lifestyles and the prevention of chronic diseases. However, such advice is not offered systematically, and is generally provided in response to specific individual demands.

The intervention targets individuals between the ages of 25 and 65 who present at least one of the following risk factors: a BMI of 25 kg/m^2 or above, high cholesterol (75th percentile or above), high systolic blood pressure (> 140 mmHg), and type 2 diabetes. It is assumed that 80% of primary care physicians will join the programme and that 90% of eligible individuals will choose to participate in the programme. Of the latter, 75% will complete the programme successfully.

Candidates are either recruited opportunistically, by screening patients waiting for a consultation, or identified using the information contained in practice records and invited for a consultation through a telephone call. Individuals are asked to complete a health and lifestyle questionnaire while they wait for their consultation, which will be used to tailor physician advice.

Box 6.3. **Counselling of individuals at risk in primary care**

Main sources of evidence. Intervention characteristics and effectiveness are modelled on the basis of a selection of studies which provide accounts of controlled experiments of counselling interventions in primary case (Ockene *et al.*, 1996; Herbert *et al.*, 1999; Pritchard *et al.,* 1999).

Effects of the intervention. The intervention will modify risk factors at all the three levels modelled in the analysis. In its more intensive form (physician and dietician counseling), the intervention will decrease the proportion of total energy intake from fats by almost 10%, on average (1.6% in the less intensive version, in which counseling is only provided by physicians), it will reduce BMI by 2.32 points (0.83 in the less intensive version), it will reduce blood cholesterol by 0.55 mmol/l (0.12), and systolic blood pressure and by 12 mmHg (2.30).

Intervention costs. The estimated cost of per capita of a counseling intervention run by physicians and dieticians in primary care ranges between USD PPPs 9 and 20 in the five countries examined, while the cost of the less intensive version of the programme ranges between USD PPPs 4.5 and 9.5. A large part of these costs (up to three-quarters in the intensive intervention) covers the cost of extra working hours of physicians and other health professionals, including dieticians and office support staff. In particular, we assume that target individuals spend on average 25 minutes over 2.6 sessions with their physician. The intervention also includes laboratory costs, training of health professionals and basic organisation costs.

Physicians spend roughly 8-10 minutes providing information and advice on lifestyle, and particularly on diet. The same information is repeated in following consultations.

A second, more intensive, version of the intervention involves additional counselling provided by a dietician upon referral. This consists of a first 45 minute individual session, followed by five group sessions of 15 minutes and by a final 45 minute individual session.

Cost-effectiveness analysis: A generalised approach

Cost-effectiveness analysis (CEA) is concerned with how to make the best use of scarce health resources. The large and growing literature on the topic is dominated by comparisons of interventions aimed at a particular disease, risk factor or health problem, which provides relevant information to programme managers or practitioners with this specific disease mandate. In practice, however, different types of policy makers and practitioners have different demands. Managers of hospital drug formularies must decide which of a vast array of pharmaceuticals they should stock, taking into account the available budget. Countries where health is funded predominantly from the public purse make decisions on what type of pharmaceuticals or technologies can be publicly funded or subsidised, while all types of health insurance – social, community or private – must select a package of services that will be provided. These types of decisions require a broader set of information, involving comparisons of different types of interventions across the entire health sector – whether they are aimed at treating diabetes, reducing the risk of stroke, or providing kidney transplants. This type of analysis can be referred to as "sectoral cost-effectiveness analysis".

Although the number of published cost-effectiveness studies is now very large, there are a series of practical problems in using them for sectoral decision making (Hutubessy *et al.*, 2003). The first is that most published studies take an incremental approach, addressing questions such as how best should small changes (almost always increases) in resources be allocated, or whether a new technology is cost-effective relative to the existing one it would replace. Traditional analysis has not been used to address whether existing health resources are allocated efficiently, despite evidence that in many settings current resources do not in fact achieve as much as they could (Tengs *et al.*, 1995). A second problem is that most studies are very context specific. The efficiency of additional investment in an intervention aimed at a given disease depends partially on the level and quality of the existing health infrastructure (including human resources). This varies substantially across settings and is related to a third problem – individual interventions are almost always evaluated in isolation despite the fact that the effectiveness and costs

of most will vary according to whether other related interventions are currently undertaken or are likely to be introduced in the future.

In response to these concerns, a more generalised approach to CEA has been developed by WHO in order to allow policy makers to evaluate the efficiency of the mix of health interventions currently available and to maximise the generalisability of results across settings. Generalised cost-effectiveness analysis (GCEA) and its implementation *via* the CHOICE (CHOosing Interventions that are Cost Effective) project allows for an assessment of the efficiency of the current mix of interventions by analysing all interventions and combinations incremental on doing nothing (Murray *et al.*, 2000; Tan Torres *et al.*, 2003; *www.who.int/choice*). The approach adopted by the OECD and the WHO in their joint analysis of the impact of strategies to improve diets and increase physical activity is a modified version of the generalised CEA approach used in previous CHOICE analyses. The main difference between the two is that while the counterfactual adopted in applied CHOICE studies is defined in terms of what would happen to population health if all interventions being provided now were stopped, in the OECD/WHO analysis the counterfactual is a situation in which no prevention were systematically delivered but chronic diseases were treated as they emerged with the conventional medical means available in the health services of OECD countries. A further difference relative to the traditional CHOICE approach is that the OECD/WHO model was specifically designed to assess the impacts of interventions on health inequalities, in addition to their health impacts and cost-effectiveness.

Many interventions interact in terms of either costs or effects at the population level and interacting interventions are undertaken in different combinations in different settings. Neither the health impact of undertaking two interventions together nor the costs of their joint production are necessarily additive. To understand whether they are efficient uses of resources independently or in combination requires assessing their costs and health effects independently and in combination.

GCEA has now been applied to a wide range of specific diseases (including malaria, tuberculosis, cancers and mental disorders) as well as risk factors (for example, child under-nutrition, unsafe sex, unsafe water, hygiene and sanitation, hypertension and smoking) (see, for example, Chisholm *et al.*, 2004a; Chisholm *et al.*, 2004b; Groot *et al.*, 2006; Murray *et al.*, 2003; Shibuya *et al.*, 2003; WHO, 2002).

Effects of the interventions on obesity, health and life expectancy

Interventions to improve diets and increase physical activity have the potential to reduce obesity rates, decrease the incidence of ischaemic heart

Box 6.4. **The Chronic Disease Prevention model**

The OECD and the WHO jointly developed a micro-simulation model called Chronic Disease Prevention (CDP) which implements a "causal web" of lifestyle risk factors for selected chronic diseases. This model was initially used to estimate the impact of interventions (the same examined here) in the EUR-A WHO region (Sassi *et al.*, 2009). Risk factors range from more distant exposures ("distal risk factors"), which are several steps away from disease events in the chain of causation, to more proximate exposures ("proximal risk factors"), more immediately connected to disease events. The causal web concept involves mutual influences among risk factors, which therefore have both direct and indirect impacts on chronic diseases. The model explicitly accounts for three groups of chronic diseases: stroke, ischemic heart disease and cancer (including lung, colorectal and female breast cancer). Proximal risk factors, such as high blood pressure, high cholesterol and high blood glucose, have a direct influence on the probability of developing the above chronic diseases, based on established pathophysiological mechanisms. Conversely, distal risk factors such as low intake of fruit and vegetables, high fat intake and insufficient physical activity have an indirect influence on chronic diseases. The indirect effect is mediated in part by the body mass index (BMI), which acts on proximal risk factors as well as directly on disease events. The model accounts for mortality from all causes of death and assumes that mortality associated with diseases that are not explicitly modelled remains stable at the rates currently observed in the relevant populations. The model simulates the dynamics of a given country or regional population over a lifetime period (set at 100 years in order to capture the full effectiveness of all interventions, including those targeting young children), although impacts can be assessed at any point in time. Births, deaths and the incidence and prevalence of risk factors and chronic diseases are modelled accordingly, based on the best existing epidemiological evidence for the relevant countries from a range of sources, including WHO, FAO and IARC datasets, national health surveys and published studies. A diagrammatic representation of the model is shown in the figure below. Future costs, as well as future health effects, were discounted at a 3% rate. The model was programmed using a software called ModGen (*www.statcan.gc.ca/spsd/Modgen.htm*), which is a generic "Model Generator" language created by Statistics Canada for developing and working with micro-simulation models.

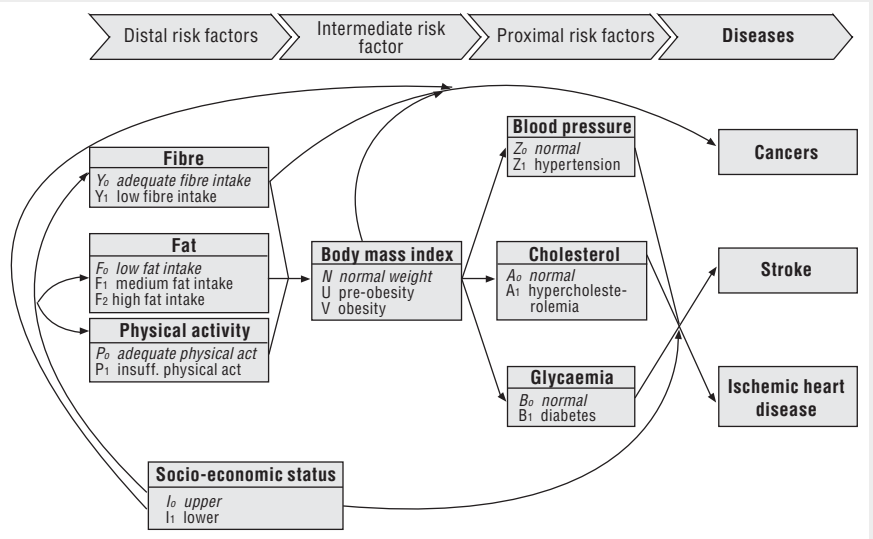
The CDP model requires a series of epidemiological input data by gender, class of age (0 to 100) and socio-economic status. A first group of parameters allows the software to model population changes over time. This includes global mortality, fertility and the demographic structure of the population. A second group of parameters relates to the three levels of risk factors (*i.e.* distal, intermediate and proximal). This group includes the following epidemiological parameters: prevalence, incidence of new cases, remission rates, and relative risks (RRs) for higher level risk factors. A third and last group of parameters is used to model

Box 6.4. **The Chronic Disease Prevention model** *(cont.)*

diseases. This includes prevalence, incidence rates, remission rates, relative rates (RRas) of disease for different risk factors, and case-fatality hazards (risk of dying of a disease for individuals who have that chronic disease).

We used the best available sources of information on the epidemiology of risk factors and chronic diseases to populate the micro-simulation model. When it was not possible to find input parameters from existing sources, these were calculated based on other parameters using the WHO software DisMod II, or through the analysis of data from national health surveys.

Figure Box 6.4. **The Chronic Disease Prevention model**



disease, stroke and, to a lesser extent, the incidence of at least three forms of cancer. The impact of interventions on the morbidity associated with these chronic diseases is generally larger than their impact on mortality. Prevention in many cases delays the onset of chronic diseases, rather than preventing them altogether.

If they were to be implemented in isolation, interventions would generate a reduction in the number of people who are obese in the order of four to five percent, at best, in most OECD countries, although the majority of interventions would have substantially smaller impacts. This may seem a modest achievement, but in fact measuring changes in obesity rates is a rather inadequate way of assessing the value of such interventions. Many more people

benefit from prevention than those who actually make it across the line that formally separates obesity from non-obesity thanks to those interventions. Improving one's own lifestyle and loosing weight will generate beneficial effects on health regardless of the BMI category in which someone is classified.

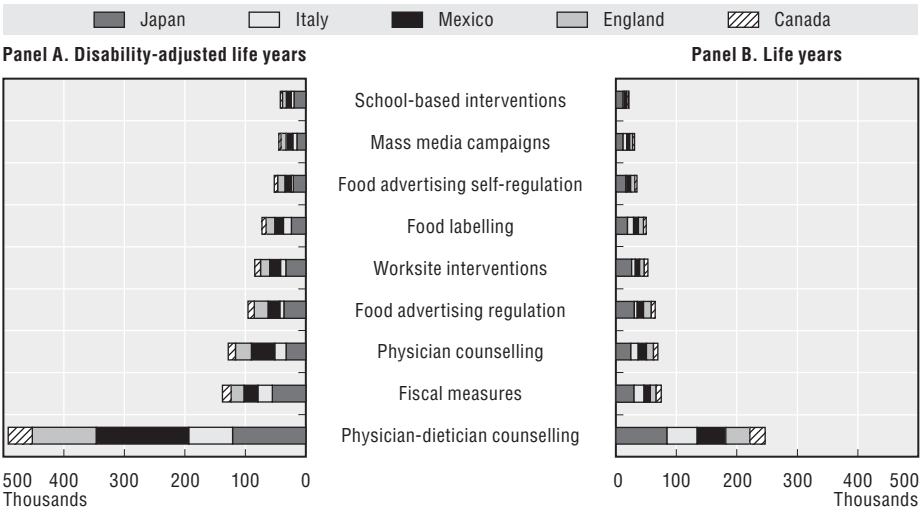
The outcomes that matter the most when assessing the impacts of prevention are mortality and the occurrence of chronic diseases, or morbidity. Accordingly, health outcomes are measured in this analysis in terms of life years (LYs) gained through prevention (reflecting improvements in mortality) and disability-adjusted life years (DALYs) averted (reflecting the combined effect of prevention on mortality and morbidity). These outcomes capture comprehensively the ultimate impacts of prevention on health and longevity, although they fall short of reflecting some of the more subtle effects of improved lifestyles on quality of life, particularly in terms of psychological well-being and social functioning. Life years and DALYs are also widely used as outcome measures in economic evaluations of health interventions in areas other than prevention, which facilitates comparisons across a broad spectrum of options in setting priorities for health expenditures.

All but one of the interventions examined by the OECD have the potential to save, every year, a total of between 25 and 75 000 life years in the five countries, relative to a situation in which no prevention were offered and chronic diseases were treated when they emerged. An intervention based on the intensive counselling of individuals at risk in primary care, however, was found to have a substantially larger impact, with over 240 000 life years gained in the five countries. This is shown in the right-hand panel of Figure 6.1.

When the reduction in morbidity from chronic diseases is taken into account (left-hand panel of Figure 6.1) the annual benefits of prevention increase to 40-140 000 disability-adjusted life years (DALYs) saved, and those obtainable though an intensive counselling of individuals at risk in primary care rise to almost half a million DALYs saved.

As indicated, Figure 6.1 shows the average annual gain in life years and DALYs generated by each intervention over the entire simulation (100 years). However, the distribution of gains over time is particularly uneven for interventions targeting children, with most gains concentrated in the final part of the period and little or no gains during the first several decades. When the value of health gains is appropriately discounted, based on the time at which gains occur, it is precisely interventions aimed at children, whose benefits are farthest away, which are penalised the most. So, even regulation of food advertising to children, which ranks fourth in terms of average annual gains in Figure 6.1, in fact has a lower overall effectiveness than most interventions, similar to mass media campaigns at the end of the simulation, but lower than the latter throughout the first 85 years. This is illustrated in

Figure 6.1. **Health outcomes at the population level (average effects per year)**

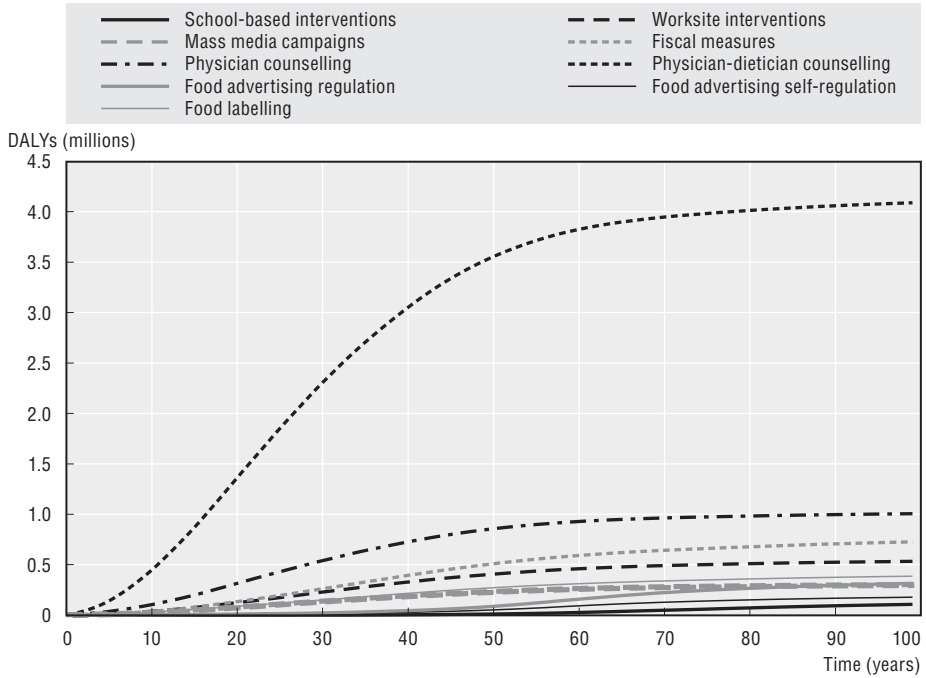


Source: CDP model-based analysis relying on input data from multiple sources, listed in Table A.2 in Annex A.
StatLink http://dx.doi.org/10.1787/888932316077

Figure 6.2, which shows the value of cumulative gains in DALYs associated with each intervention, after those gains have been discounted at an annual rate of three percent. Consistently with 6.1, Figure 6.2 shows that counselling individuals at risk in primary care is the intervention associated with the largest numbers of DALYs saved, with the intensive counselling option outperforming all other interventions by a large margin, followed by fiscal measures and worksite interventions. At the other end of the spectrum we find interventions aimed at children, whose benefits are more heavily penalised by discounting, due to their later occurrence. Interventions targeting adults have health impacts which are more evenly distributed over time, because they start to generate benefits shortly after their implementation, and impacts are even faster when interventions narrowly target higher-risk individuals and age groups, as in the case of primary-care based counselling.

The health impacts of interventions vary in different age groups. Health gains below age 40 are barely noticeable, while the largest benefits tend to be realised from the age of 40 up to the eighth or ninth decade of life. In the latter group, interventions tend to delay the onset of chronic diseases more than they reduce mortality from those diseases. This pattern is reflected in larger numbers of DALYs averted than LYs gained in the same age group. For instance, physician counselling in primary care can generate twice as large gains in DALYs than in LYs in Canada, and proportionally even larger are the DALYs averted by school-based interventions in Italy, relative to LYs gained

Figure 6.2. **Cumulative DALYs saved over time**

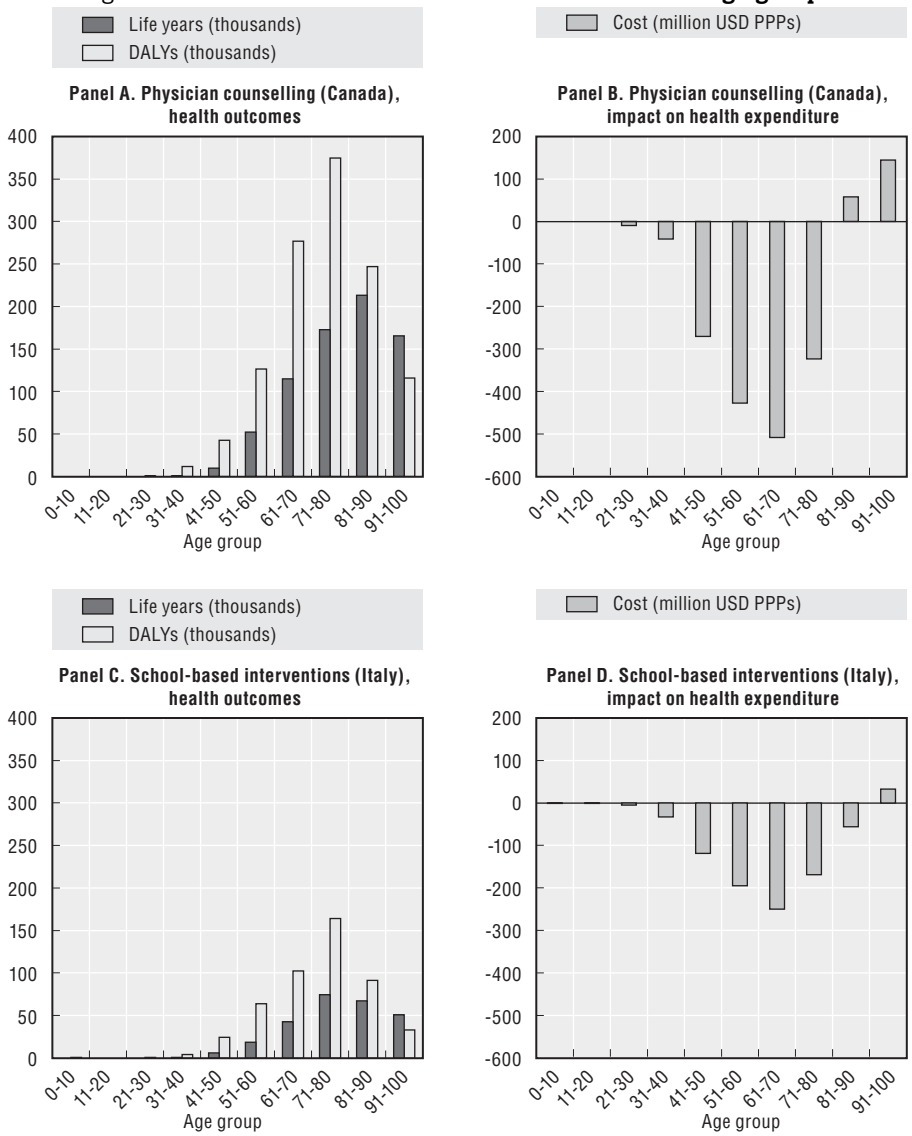


Source: CDP model-based analysis relying on input data from multiple sources, listed in Table A.2 in Annex A.
StatLink http://dx.doi.org/10.1787/888932316096

(see Panels A and C in Figure 6.3). Among the longest survivors, many will be enjoying the benefits of prevention in terms of a delayed onset of chronic diseases or will be spared altogether. In this age group, the balance between DALYs averted and LYs gained is reversed, with twice as many LYs gained as DALYs saved through intensive counselling in primary care in Canada, and 50% more LYs than DALYs through school-based interventions in Italy.

The impacts of interventions on health care expenditure reflect a mirror image of the patterns of effectiveness described above, as shown in the right-hand panels in Figure 6.3. Interventions have virtually no effects on expenditure up to age 40; they reduce health expenditure for several decades thereafter, consistently with a greater reduction in morbidity than in mortality; and, they increase expenditure in later years of life because of increased survival and need for medical care. The increase in health expenditure in the oldest age groups tends to be directly proportional to the decrease in expenditure realised at earlier ages, *i.e.* the largest the benefits of prevention in terms of reduced morbidity from chronic diseases, the more substantial the upturn in health expenditure among those surviving the

Figure 6.3. **Effects of selected interventions in different age groups**



Source: CDP model-based analysis relying on input data from multiple sources, listed in Table A.2 in Annex A.

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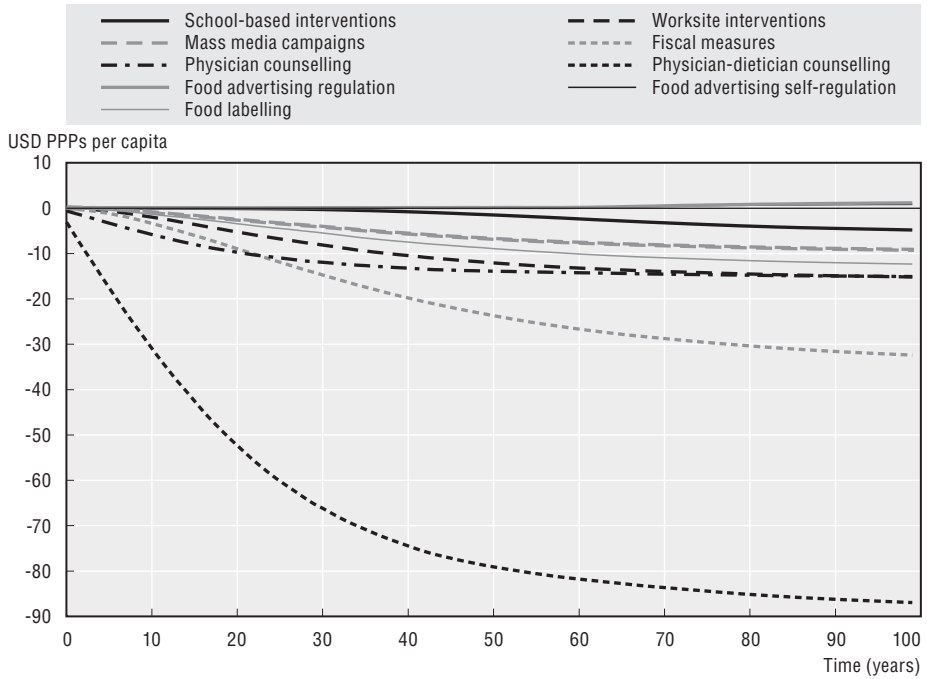
longest. Over the entire period covered by the simulation, all interventions except the two forms of regulation of food advertising to children (government regulation and industry self-regulation) generate net savings in health expenditure, as shown in Figure 6.4. The largest savings are associated with the most effective intervention, intensive counselling of individuals at risk in

primary care, which generates savings three times as large as those of fiscal measures, the next most effective intervention. In the case of food advertising regulation, the savings in health expenditure obtained in the middle decades of life are more than offset (although by a thin margin) by increases in health expenditure in older age groups, with a slight increase in health expenditure as the overall net effect.

Figure 6.4. **Cumulative impact on health expenditure over time**

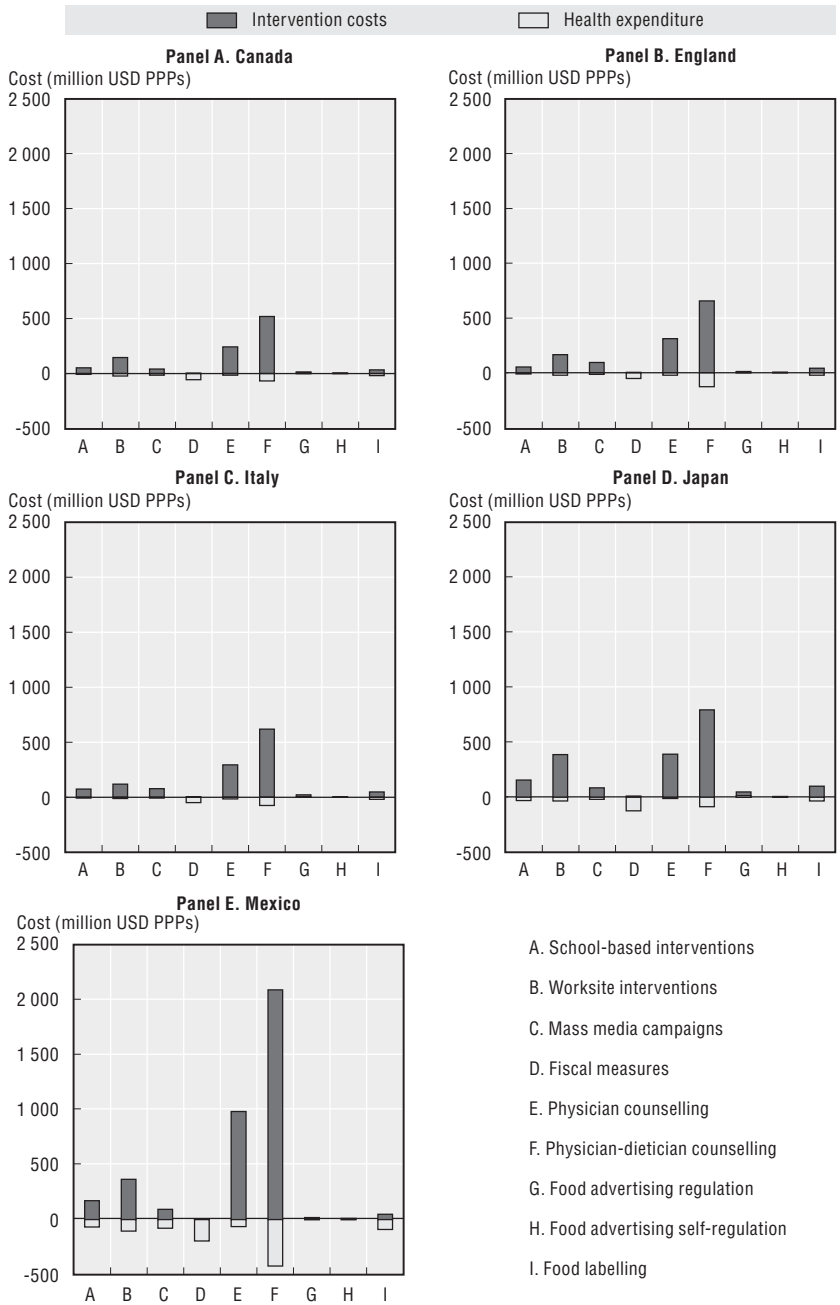


Source: CDP model-based analysis relying on input data from multiple sources, listed in Table A.2 in Annex A.
StatLink http://dx.doi.org/10.1787/888932316134

The costs and cost-effectiveness of interventions

The costs of delivering the interventions in the countries examined are often several times larger than the interventions' impacts on health expenditure. Therefore, even accounting for the reduced health expenditure, governments wishing to implement the interventions assessed here will bear extra costs, which will be higher at the start and will be progressively attenuated once interventions start to generate their health benefits. While investments in prevention need to be made available upfront, potential savings are usually deferred.

Figure 6.5. **Economic impact at the population level (average effects per year)**



Source: CDP model-based analysis relying on input data from multiple sources, listed in Table A.2 in Annex A.

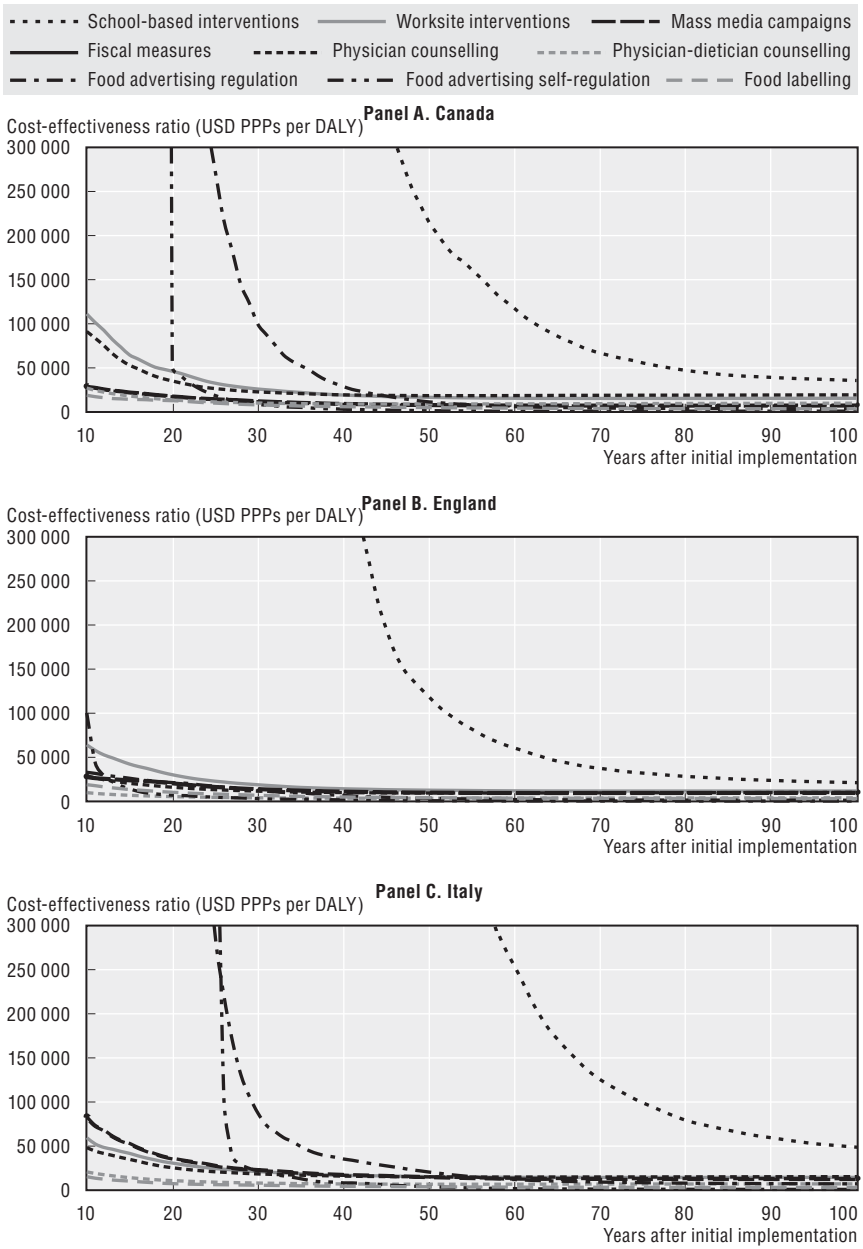
StatLink http://dx.doi.org/10.1787/888932316153

The average annual costs of delivering individual interventions, as well as the average annual savings in health expenditure associated with each intervention, are illustrated in Figure 6.5. Once differences in purchasing power among countries are accounted for, the results are remarkably consistent, with primary care counselling interventions displaying not only the largest savings in health expenditure but also the largest costs of delivery. Health promotion interventions are the next most expensive to deliver. The most expensive in this group are worksite interventions, generally followed by school-based interventions and mass media campaigns. Regulatory and fiscal interventions, on the other hand, are the least expensive interventions among those examined by the OECD. In particular, the relatively small cost of implementation and the relatively large effectiveness of fiscal measures make these the only intervention likely to pay for itself, *i.e.* the only one which generates larger savings in health expenditure than costs of delivery.

Combining the health and economic outcomes of interventions into incremental cost-effectiveness ratios shows patterns of cost-effectiveness declining over time, reflecting an increasing efficiency of the interventions in question as their health benefits build up over time. The one exception is fiscal measures, which are consistently cost saving throughout the period covered by the simulation in all of the five countries examined.

In the first 20-30 years from the initial implementation of interventions, cost-effectiveness ratios tend to be very high. In general, the scale of the impact of individual interventions is limited by the difficulties involved in reaching a large proportion of the population, either because only certain age groups are targeted by the intervention, in which case it may take many years before a large share of the population receives some exposure to the intervention, or because response rates are relatively low, as is typically the case for some of the interventions examined (*e.g.* worksite interventions), based on existing evidence. While cost-effectiveness ratios tend to be favourable for all interventions by the end of the simulation, the patterns of decline over time vary across interventions. Interventions that target children tend to have incommensurable cost-effectiveness ratios during the first several decades, while the measurable health benefits of those interventions are close to zero. However, when health benefits do begin to materialise, the cost-effectiveness of interventions such as school-based health education and health promotion or regulation of food advertising to children has a very steep drop, gradually approaching levels that are commonly regarded as favourable. This is shown clearly in Figure 6.6, in which we may consider the USD PPPs 50 000 per DALY line to broadly reflect an acceptable level of cost-effectiveness in OECD countries.

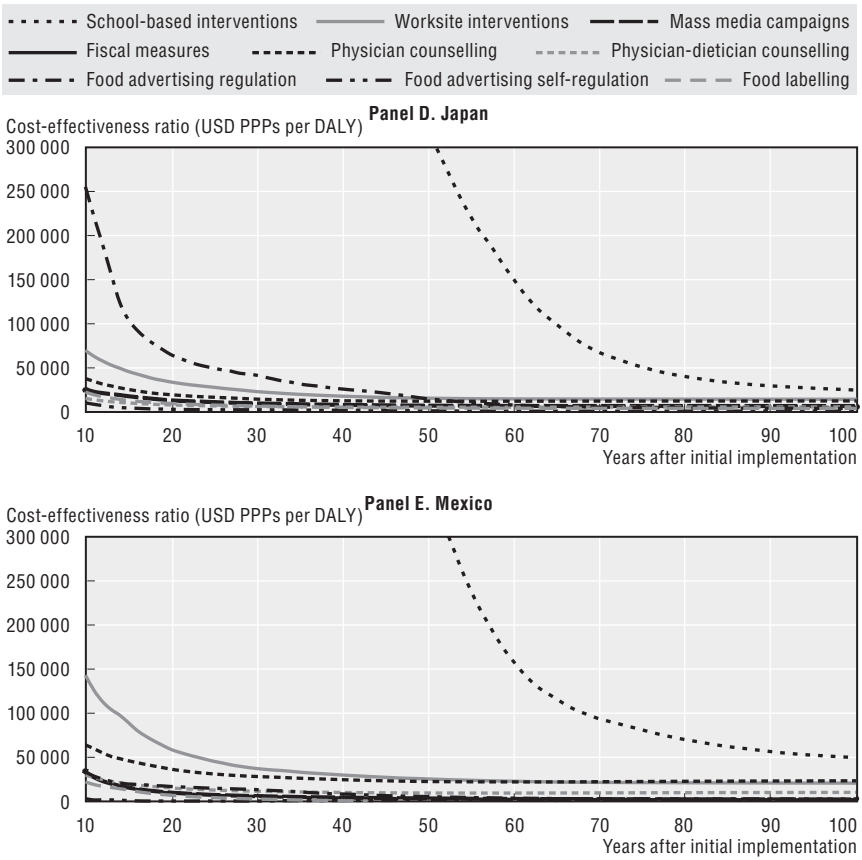
Figure 6.6. **Cost-effectiveness of interventions over time**



Source: CDP model-based analysis relying on input data from multiple sources, listed in Table A.2 in Annex A.

StatLink http://dx.doi.org/10.1787/888932316172

Figure 6.6. **Cost-effectiveness of interventions over time** *(cont.)*



Source: CDP model-based analysis relying on input data from multiple sources, listed in Table A.2 in Annex A.
StatLink http://dx.doi.org/10.1787/888932316172

A fuller set of graphs and tables illustrating in further detail the results of the analyses described in this chapter for individual countries is available in Annex A, along with a set of figures illustrating the results of a range of sensitivity analyses aimed at assessing the robustness of the findings relative to the uncertainty surrounding cost and effectiveness estimates.

Strategies involving multiple interventions

If evidence of the effectiveness of individual interventions is not abundant, evidence of the combined effectiveness of multiple interventions implemented simultaneously is virtually nonexistent. It is difficult to predict whether combinations of interventions would create synergies which would translate into an overall effect larger than the sum of individual intervention

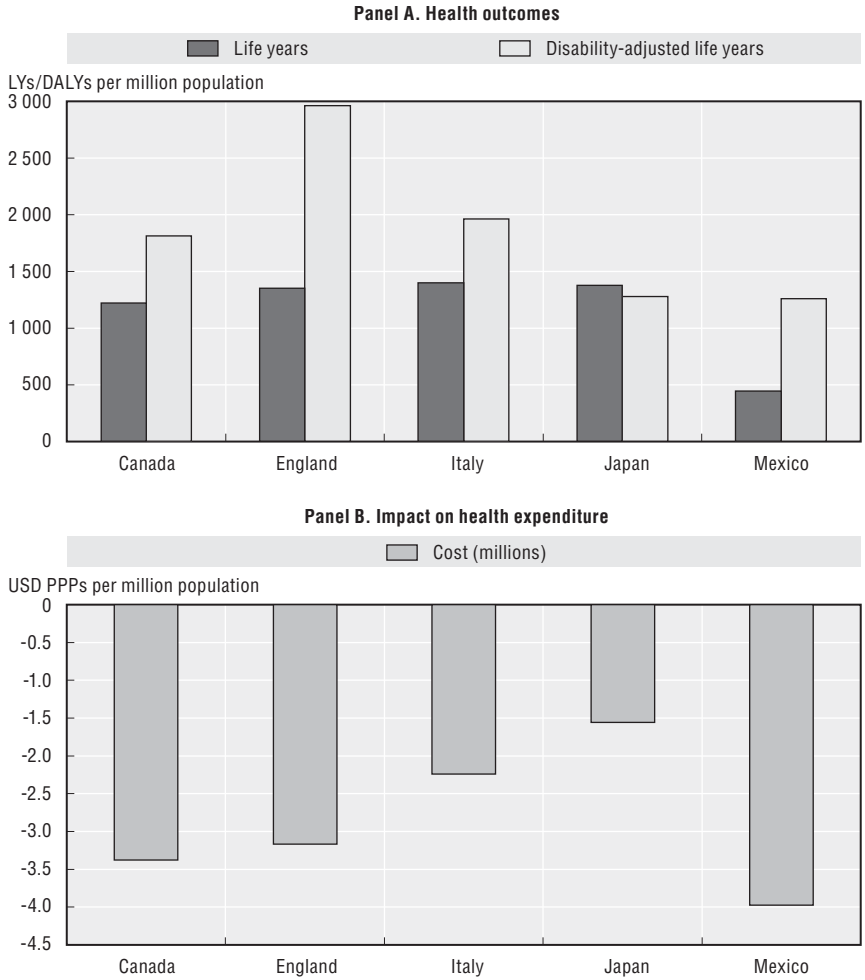
effects, or whether the opposite would be true and adding interventions to a prevention strategy would have decreasing incremental returns. However, a micro-simulation model like CDP can be used to assess at least some of the effects to be expected from combining multiple interventions into a prevention strategy which targets different population groups. Only for the groups exposed to more than one intervention at the same time, an assumption is required as to what the combined effect of the interventions will be. The assumption made in this analysis is a conservative one, estimating that the overall effect of interventions is less than additive, relative to the effects of individual interventions.

The potential impact of a combination of five interventions was explored, including regulatory interventions such as compulsory food labelling and industry self-regulation of food advertising to children, worksite and school-based health promotion programmes, and intensive counselling of individuals at risk in primary care. This combination of interventions provides a balanced coverage of different age groups (children and adults) using both regulation and health promotion approaches. In addition, it targets high-risk individuals with a more focused intervention which has been shown to be particularly effective in previous analyses.

The estimated impacts of the combined intervention on population health and health expenditure are illustrated in Figure 6.7 for the five countries concerned. Health impacts are up to twice as large as those attributable to the single most effective intervention (intensive counselling in primary care), while the cost-effectiveness profile of the multiple-intervention strategy is very similar to that of the former. Once differences in population size among the five countries are accounted for, England would appear to have the largest health returns from a combination of the five strategies listed above, while Mexico would enjoy the largest reduction in health expenditure.

The reason why some countries benefit more from the prevention package in terms of health gains while others benefit more in terms of reduction in health expenditure is that these two outcomes are driven by partly different effects. In particular, the incidence and prevalence of the risk factors considered in the CDP model have a much greater influence on health expenditure than on health gains measured in terms of life years and DALYs, because risk factors may be expensive to treat but have a less direct impact on health outcomes. Accordingly, the health gains generated by the interventions discussed in this chapter are less affected by changes in risk factors produced by the same interventions than are health expenditure. The result is that reductions in health expenditure in the five countries, as illustrated in the Panel B of Figure 6.7, reflect more closely than health gains the prevalence of risk factors in the same countries. Mexico would enjoy the largest reduction in health expenditure from a multiple-intervention strategy, in line with a very

Figure 6.7. **Estimated impacts of a multiple-intervention strategy (average effects per year)**



Source: CDP model-based analysis relying on input data from multiple sources, listed in Table A.2 in Annex A.
StatLink http://dx.doi.org/10.1787/888932316191

high prevalence of obesity and proximal risk factors such as diabetes, and therefore with a greater scope for improvement through the interventions in question. On the other hand, Japan and Italy, with a more favourable risk profile, would enjoy lesser, but still significant, reductions in health expenditure. Differences in health gains among the five countries, as illustrated in the Panel A of Figure 6.7, are mostly driven by different factors, including the incidence and prevalence of chronic diseases and the proportion of the population covered by the interventions in question.

The cost of delivering the package of interventions varies between USD PPPs 12 per capita in Japan to USD PPPs 24 in Canada, a tiny fraction of health expenditure in those countries, and also a small proportion of what is currently spent on prevention in the same countries. Moreover, part of the above costs would be offset by the savings in health expenditure generated by the interventions, as shown in the Panel B of Figure 6.7.

Distributional impacts of preventive interventions

The issue of the impact of prevention on equity and health inequalities is widely debated in academic and policy circles, although arguments often rest on speculation and anecdotal evidence, rather than sound empirical data. The CDP model was explicitly designed to assess, among other things, the distributional impact of prevention strategies. The model accounts for one dimension of socio-economic status along which two main groups are identified with different risk factor profiles and consequent chronic disease morbidity and mortality rates. In the analysis reported here, the two groups correspond to occupation-based social classes and broadly reflect the distribution of the five countries' populations into blue and white collar workers, or manual and non-manual occupations.

There are two main ways in which the impacts of prevention may vary across different socio-economic groups. First, different groups are characterised by different levels of morbidity and mortality from the risk factors and chronic diseases to be prevented. Which group will benefit the most from preventive interventions is mainly determined by the relative sizes of incidence, prevalence and mortality rates in the different groups. As a general rule of thumb, socio-economic groups that have a less favourable risk profile and bear a higher burden of chronic diseases are likely to benefit more from prevention. But in practice the distributional effect of prevention depends on a very large number of factors, including, for instance, the age-distribution of risk factors and intervention effects.

On the other hand, a second mechanism may be at play in chronic disease prevention. Different socio-economic groups may be more or less likely to respond favourably to prevention programmes, *e.g.* to comply with health promotion messages, use the information delivered through programmes, or change their consumption in response to price changes. There is at least some evidence that individuals in higher socio-economic groups, who tend to have higher levels of education, are more likely than others to respond favourably to prevention programmes that involve the delivery of health promotion or health education messages. But there is also some evidence that more cogent interventions, such as fiscal measures altering the prices of lifestyle commodities, elicit a greater response from individuals in lower socio-economic groups. Therefore, whether differences in

response and intervention effectiveness across socio-economic groups are likely to reduce or increase health disparities depends largely on the nature of the interventions in question.

In the analysis presented here, we were able to account for the different incidence and prevalence rates of risk factors and chronic diseases in the two socio-economic groups (the first effect), but we could account only to a very limited extent for differences in response to interventions by different groups, because of the paucity, or even absence, of reliable quantitative evidence that could be used as an input into the CDP model-based analysis. In practice, we could only account for different responses to fiscal measures, which generate price incentives, based on existing estimates of price elasticity of the demand for different foods in different socio-economic groups, ranging from a greater response in the less well-off (the vast majority of estimates) to a greater response in the better-off.

When only the effect of differences in morbidity and mortality between socio-economic groups are accounted for, the analysis shows mixed results. England is the only country in which interventions generate consistently larger health gains in the lower socio-economic group (up to 50% larger, in proportion, than in the higher socio-economic group for school-based interventions and fiscal measures). In the other four countries, fiscal measures have consistently more favourable effects in the lower socio-economic group but other interventions have different distributional effects in different countries, depending on the epidemiological characteristics of those countries. Canada has the largest variability in distributional effects across interventions, with counselling in primary care, worksite interventions and food labelling displaying more favourable effects in the better-off, while interventions aimed at children (school-based and food advertising regulation) and fiscal measures display more favourable effects in the less well-off.

Given that fiscal measures generate consistently larger health gains in the lower socio-economic group, accounting for a different response to food price incentives in different groups further increases the advantage for the lower socio-economic group, however, the size of the change is minor. Starting from price elasticities of 2% for both socio-economic groups in the main analysis, elasticities were changed to 1.56% and 2.38%, respectively, for the higher and lower groups, in line with Mytton *et al.* (2007). Despite the relatively large change in elasticities, health gains were only slightly more favourable in the less well-off, relative to the better-off, than in the initial analysis, suggesting that differences in morbidity and mortality between the two groups are more important than differences in the response elicited by the intervention in explaining the health gains generated by the same intervention. Similarly, when alternative elasticities were used in the model to test for the effects of a possibly larger response in the higher socio-economic

group (not widely supported by the existing evidence), in line with Allais *et al.* (2008), the advantage in health gains for the lower socio-economic group was only marginally decreased.

From modelling to policy: Key drivers of success

The findings presented in this chapter are the result of a major analytical effort, aimed at bringing together the best existing evidence on the epidemiology of risk factors and chronic diseases in the five countries concerned and the best evidence of the effectiveness of preventive interventions. However, the analysis remains a simulation and the results obtained may or may not reflect accurately the outcomes to be expected from the implementation of the interventions discussed here in real world settings. In general, the model was designed, and the input parameters were selected, with a view to minimising the risk of overestimating the impacts of interventions. So, the findings reported in this chapter may be regarded as conservative estimates of those impacts in real world settings.

The most conservative of all the assumptions made is that the only effects to be accounted for in the analysis, among those potentially generated by prevention, are the ones for which there is clear and direct evidence from existing studies. Effects for which only indirect or anecdotal evidence is available were ignored in the analysis. One example is social multiplier effects, discussed in Chapter 4, which are very likely to be triggered by at least some of the interventions discussed here. The benefits of school-based or worksite health promotion interventions, for instance, are likely to spread into the families of those who are exposed to the interventions, although the lack of quantifiable evidence of how social multiplier effects may develop prevented their formal inclusion into the analysis.

Following a similar logic, the CDP model only accounts for a set of relationships among factors, and between these and chronic diseases, which are supported by existing epidemiological evidence. In the real world, further and more complex relationships may exist that could not be reflected in the structure of the model.

Another instance in which a conservative attitude was adopted in modelling interventions is the assumption made about the long-term sustainability of the effects of interventions. With the exception of interventions such as food labelling, or fiscal measures, which essentially target the entire population, most interventions target specific age groups (*e.g.* children, working-age adults, adults at risk, etc.). As individuals targeted by interventions grow older and cease to be part of the relevant target groups, they may or may not retain some of the behaviour changes generated by the interventions while they were exposed to them. The conservative assumption

made in this analysis is that they would not retain any of the effectiveness of the interventions to which they were previously exposed, and their behaviours would essentially become the same as those of individuals of the same age who had never been exposed to the interventions in question. The only exception to this rule was made for interventions aimed at children (school-based interventions and food advertising regulation) which would be of very little value if they were assumed to have no long-term effects on behaviours. Children exposed to the latter interventions were assumed to retain some of the behaviour changes associated with those interventions (half of the original effects).

Limitations in the existing epidemiological evidence-base is a further possible cause of divergence between model estimates and real world impacts. Despite major efforts made by OECD countries to collect detailed and representative information about health and lifestyles at the population level, the availability and quality of some of that information remain unsatisfactory. The greatest limitations affect behavioural risk factor data. In particular, information on aspects of diet and physical activity is derived either from surveys, which tend to be affected by various forms of bias associated with the framing of questions and with poor recollection and self-reporting, or from national sources such as food balance sheets for food consumption, which are affected by similarly important limitations (*e.g.* they do not account for waste) and only provide average consumption estimates. A further critical input parameter in the CDP model is incidence rates for chronic diseases. While reliable incidence data tend to be available for cancer, thanks to existing disease registries, information on IHD and stroke incidence is much more difficult to compile, and it is not unconceivable that some of the parameter estimates used in the analysis do not reflect the true incidence of chronic diseases in the countries concerned, leading to an underestimation of the overall effect of preventive interventions, despite adjustments made in the analysis to account for the variable quality of different input parameters.

Aside from assumptions and potential data limitations, the analysis provides some clear indications as to what the key success factors are in the prevention of chronic diseases linked to obesity.

One clear driver of success for prevention programmes is high participation rates. The numbers of people who actually benefit from some of the interventions assessed in the analysis is dramatically low. For instance, less than 10% of the population in the countries concerned is expected to benefit from worksite interventions and from counselling in primary care. This is partly the result of supply-side constraints, including the choice of target group and decisions made by employers and primary care practices as to whether they should offer the interventions, but it is also the result of individual choices to participate in the programmes by those who are offered

to do so. The overall impacts of the interventions in question would be greatly enhanced if participation rates were increased. One possible strategy for increasing participation rates is generally to make adherence to interventions less dependent on an active choice to participate (both in terms of supply of interventions and uptake by individuals). As discussed in Chapter 5 in relation to the principles of libertarian paternalism, making participation in a prevention programme the default option might significantly increase uptake. For instance, employees could be automatically enrolled in health education classes, and attendance at those classes could be monitored. Employees would have to explicitly opt out if they did not wish to participate. Concerning the supply-side of preventive interventions, appropriate financial and non financial incentives may be used, particularly at the primary care level, to increase the number of professionals and practices willing to engage in counselling programmes.

Interventions will also be more effective if they produce long-lasting changes in people's behaviours. This should be an important consideration in the design of any prevention programmes. Booster interventions may have to be associated with the main interventions described in this chapter. In principle, social multiplier effects may also make behaviour changes last longer, through a mutual reinforcement of healthy habits within families and peer groups. However, at present there is no clear evidence of any effective ways of enhancing the sustainability of behaviour changes in the long term.

Finally, the time-frame within which interventions produce their effects has an important bearing on the interventions' overall impacts. As discussed above, interventions targeting adults produce their effects earlier than those targeting children, and interventions on high-risk individuals produce their effects earlier than those targeting the general population. This should not lead to the conclusion that forward looking interventions which aim at giving a healthier adult life to the youngest generations should be assigned a lower priority than interventions targeting adults at high risk. There are good reasons for attaching a high priority to the former regardless of their overall effectiveness and cost-effectiveness, but policy makers may want to consider combining interventions that produce their effects over different time horizons in order to minimise delays in returns from prevention strategies and increase their overall impacts.

Key messages

- Interventions aimed at tackling obesity by improving diets and increasing physical activity in at least three areas, including health education and promotion, regulation and fiscal measures, and counselling in primary care, have favourable cost-effectiveness ratios.

- The health impacts of individual interventions are small, when interventions are assessed in isolation, but the use of multiple-intervention strategies may significantly enhance overall impacts while retaining a favourable cost-effectiveness profile.
- Interventions, especially those aimed at children, may take a long time to make an impact and reach favourable cost-effectiveness ratios.
- Impacts on health expenditure are relatively small (in the order of 1% of original expenditures for the relevant diseases), intervention costs exceed health care cost savings for most interventions.
- Interventions with the most favourable cost-effectiveness profiles are outside the health care sector. Counselling of individuals at risk in primary care has the largest health impact, but is also the most expensive intervention of those assessed in the analysis.
- The distributional impacts of interventions are mostly determined by differences in morbidity and mortality among socio-economic groups. Fiscal measures are the only intervention producing consistently larger health gains in the less well-off. The distributional impacts of other interventions vary in different countries.
- The impacts of interventions reported in this chapter are likely to be conservative estimates of the impacts to be expected in real world settings.
- Key drivers of success for preventive interventions include high participation (on both supply and demand sides), long-term sustainability of effects, ability to generate social multiplier effects, and combination of multiple interventions producing their effects over different time horizons.

Notes

1. A WHO review of the effectiveness of interventions to improve diets and increase physical activity found that school-based interventions are those most often assessed, while fewer studies focused on other public health interventions (WHO, 2009). The OECD collated the existing evidence concerning the impacts of interventions on diet and physical activity, of which the above WHO review includes a large part. The OECD retrieved a number of studies which were not covered in the WHO review because published after June 2006, not indexed in the literature databases used in the review, or because the relevant interventions were out of the scope of the review.
2. Rigorous prospective controlled studies have only been used in a few instances to assess the effectiveness of interventions (*e.g.* primary-care based interventions). In some cases (*e.g.* fiscal measures), the only evidence available is from regression modelling studies based on retrospective data. The impacts of interventions are generally measured in terms of behaviour change, while longer-term outcomes are seldom assessed.

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