The Economics of Prevention

Summary of findings and policy implications concerning the prevention of chronic diseases linked to unhealthy diets and sedentary lifestyles

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NOTE FROM THE SECRETARIAT

1. The Health Committee’s Programme of Work and Budget for 2007-08 included a mandate to undertake a project on the Economics of Prevention (Output Result 2.4.2.4). The project was undertaken on the basis of a work plan presented to the Group on Health in a preliminary form in its November 2006 meeting, involving a focus on the prevention of chronic diseases arising from unhealthy diets, sedentary lifestyles and obesity [DELSA/HEA(2006)9]. The work plan was then revised in the light of discussion at an Expert Group meeting in April 2007 and endorsed by the Health Committee at its May 2007 meeting.

2. The project involved several streams of work and output. The first output, OECD Health Working Paper 32 entitled “The prevention of lifestyle-related chronic diseases: an economic framework”, was published in March 2008 [DELSA/HEA/WD/HWP(2008)2]. This proposed a conceptual framework on the prevention of lifestyle-related chronic diseases. Work on other components of the project is reported in the following papers, available as annexes to the attached overview paper. Draft versions of the first two papers in the list below were presented and discussed at an Expert Group meeting held in April 2008, therefore further comments are not specifically invited on those. Conversely, the last two papers in the list were not previously released in a complete draft form, therefore written comments are invited on them:

- A paper entitled “Analysis of past and projected future trends in obesity in the OECD area”, reporting the results of analyses of health survey data from a range of OECD countries (including analyses of past trends and future projections of overweight and obesity, age-period-cohort analyses, analyses of inequalities in obesity and of the main individual and social characteristics associated with obesity) [DELSA/HEA(2008)13/ANNEX 1];

- A paper entitled “Analysis of policies and initiatives to improve diets and physical activity in OECD and other EU countries”, reporting the results of a policy survey, and private sector initiatives discussed in meetings with representatives from the food and leisure industries [DELSA/HEA(2008)13/ANNEX 2];

- A paper entitled “Efficiency and distributional impact of interventions to prevent chronic diseases linked to unhealthy diets and sedentary lifestyles”, reporting the results of an economic analysis jointly undertaken with WHO, based on a micro-simulation model linking different levels of risk factors with a range of chronic diseases [DELSA/HEA(2008)13/ANNEX 3];

- A paper entitled “Education and obesity in four OECD countries”, reporting the results of work jointly undertaken with the OECD Centre for Education Research and Innovation (CERI) on the relationship between education and obesity, focusing on Australia, Canada, England and Korea [DELSA/HEA(2008)13/ANNEX 4].

3. The four papers above will be published after revision in the light of member countries’ comments as Health Working Papers. The paper “Education and obesity in four OECD countries” will be published jointly with CERI, and the paper “Efficiency and distributional impact of interventions to prevent chronic diseases linked to unhealthy diets and sedentary lifestyles” will be published as a joint OECD/WHO working paper. Both of these papers will be subject to a dual review process. In addition, the Secretariat plans to bring together all the outputs generated by the Economics of Prevention project into an
overall final publication, to be published under the authority of the Secretary-General, which will present the findings of the various streams of work in a cohesive form for an audience of policy makers, health professionals and health policy scholars. Health Committee delegates will be given an opportunity to comment on a draft version of the final publication, which the Secretariat intends to circulate before Summer 2009.

4. The Committee is invited to:

   **NOTE**, and **COMMENT** on, the main findings of the Economics of Prevention project and their suggested policy implications, as set out in the attached overview paper.

   **NOTE** the proposal for the eventual publication of the main findings from the project, duly revised in the light of delegates’ comments, under the responsibility of the Secretary-General.
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EXECUTIVE SUMMARY

5. The economics of prevention project largely focused on the prevention of chronic diseases that are linked to unhealthy diets, sedentary lifestyles and obesity. A conceptual framework developed during the first part of the project was applied to this area in the following ways: (a) by exploring the trends, determinants and outcomes of the obesity epidemic that developed over the last 20-30 years in virtually all OECD countries; (b) by assessing the response given by governments and other subjects to such epidemic, and further measures that could potentially be taken to counter recent lifestyle trends; and (c) by evaluating the efficiency and distributional impact of a range of possible interventions to improve patterns of diet and physical activity at the population level.

6. Overweight and obesity rates have been increasing relentlessly over recent decades in all industrialised countries, as well as in many lower income countries. Our analyses of trends over time support the grim picture drawn in the international literature and so do our projections of overweight and obesity rates over the next ten years. The circumstances in which people have been leading their lives over the past 20-30 years, including physical, social and economic environments, have exerted powerful influences on their overall calorie intake, on the composition of their diets and on the frequency and intensity of physical activity at work, at home and during leisure time. On the other hand, changing individual attitudes, reflecting the long-term influences of improved education and socio-economic conditions have countered to some extent environmental influences. In a policy perspective, countries wishing to implement interventions aimed at curtailing the growth of overweight and obesity should take account of both of these major forces.

7. Project findings confirm the existence of what has been described elsewhere as a “social multiplier” effect, corresponding to the clustering of overweight and obesity within households, social networks, and possibly other levels of aggregation. This is very likely to have contributed to the rapid spread of overweight and obesity throughout the OECD area, reflecting externalities of lifestyles, particularly within households. The impact on other individuals’ health may be less direct in this case than, for instance, in the case of passive smoking, but it is no less important. In a policy perspective, such externalities are likely to be more relevant than those associated with health expenditures, which remain somewhat controversial. The role played by education, health literacy and information as determinants of obesity suggests that lifestyle choices could be improved by changing individual endowments and the availability of information. There is also some evidence of rationality failures in choices concerning diet and physical activity, but these are unlikely to have had an important role in the recent obesity epidemic.

8. Many OECD countries have been concerned not only about the pace of the increase in overweight and obesity, but also about inequalities in their distribution across social groups, particularly by socio-economic status and by ethnic background. Large inequalities across social groups are observed in women, while substantially milder inequalities, or none at all, are observed in men. Acting on the mechanisms that make women in poor socio-economic circumstances so vulnerable to obesity, and women at the other end of the socio-economic spectrum much more able to handle obesogenic environments, is of great importance not just as a way of redressing existing inequalities, but also because of its potential effect on overall social welfare. The current distribution of obesity appears particularly undesirable, as it is likely to perpetuate the vicious circle linking obesity and disadvantage by intergenerational transmission.
9. OECD and other EU governments have implemented a wide range of interventions at the national and local levels, particularly during the past 5 years. Governments have been taking action in response to calls by international organisations and pressure by the media and the public health community, but without a strong body of evidence of the effectiveness of interventions, and virtually no evidence of their efficiency and distributional impact. The opportunity cost of resources used by governments to promote healthy diets and physical activity may be high, and most governments have not yet engaged in open discussions of possible rationales for intervention. A potentially important contribution to tackling unhealthy diets and sedentary lifestyles has also been made by the private sector, including employers, the food and beverage industry, the pharmaceutical industry, the sports industry and others, often in co-operation with individual governments and international organisations. Evidence of the effectiveness of such interventions is still insufficient, but an active role of the private sector has the potential to enhance the impact of any prevention strategies and to reduce some of the costs involved.

10. Most of the preventive interventions evaluated as part of the project appear to have favourable cost-effectiveness ratios, relative to a scenario in which no systematic prevention is undertaken and chronic diseases are treated once they emerge. However, none of the interventions assessed in the analysis may provide the means for a significant reduction of the scale of the obesity problem, if implemented in isolation. Although the most efficient interventions appear to be outside the health sector, health care systems can make the largest impact on obesity and related chronic conditions by focusing on individuals at high risk. Interventions targeting younger age groups are unlikely to have any significant health effects at the population level for many years. The cost-effectiveness profiles of such interventions may be favourable in the long-term, but may remain very unfavourable for several decades at the start of the interventions. Preventive interventions do not always generate reductions in health expenditure, even when the analysis is limited to a set of diseases that are more directly affected by diet, physical activity and obesity. Governments should determine what level of resources (budgets) they are willing and able to convey to prevention, and they may use the findings of our economic analysis to assess what portfolio of interventions would make the best use of such budgets.

11. Tackling major risk factors for health, or chronic diseases linked to behaviours that are highly prevalent in a population, requires more than a single preventive intervention, however effective and broadly based it may be. Turning the tide of diseases that have assumed epidemic proportions during the course of the 20th century requires fundamental changes in the social norms that regulate individual and collective behaviours. Such changes can only be triggered by wide ranging prevention strategies addressing multiple determinants of health. A prevention strategy can be devised by selecting an appropriate mix of interventions, which may provide an adequate balance between available resources, timing of expenditures and health effects, distribution of costs and health effects across population groups, and interference with individual choice, dimensions among which tradeoffs must be expected.

12. The adoption of a “multi-stakeholder” approach is increasingly invoked by many parts as the most sensible way forward in the prevention of chronic diseases linked to unhealthy diets and sedentary lifestyles. While it must be recognised that the interests at stake are sometimes in conflict with each other, at least to a certain degree, it must also be acknowledged that no party is in a position to meaningfully reduce the size of the obesity problem and associated chronic diseases without full co-operation with other stakeholders.
INTRODUCTION

13. The overarching aim of the Economics of Prevention project was to “propose a conceptual and analytical framework forming a basis for developing and evaluating policies to maintain and improve population health by reducing the occurrence and the impact of non-communicable diseases”. The project was also meant to provide an application of such a framework to the prevention of the disease consequences of unhealthy diets and sedentary lifestyles, in order to assist the design and evaluation of government policies.

14. The economic framework proposed as part of the project is centred on the hypothesis that the prevention of chronic diseases may provide the means for increasing social welfare, enhancing health equity, or both, relative to a situation in which chronic diseases are simply treated once they emerge. The framework outlines a process for testing whether such a hypothesis holds in relation to the prevention of specific risk factors and chronic diseases. This process entails an assessment of the pathways through which chronic diseases are generated and an exploration of whether such pathways are simply the outcome of efficient market dynamics, or the effect of market and rationality failures preventing individuals from achieving more desirable outcomes. Where failures exist, there may be scope for adopting preventive interventions, if such interventions are shown to have the potential to increase social welfare or improve its distribution. The expected impact of preventive interventions on individual choices should be commensurate to the extent of the above failures and to the severity of the outcomes arising from them.

15. The application of the project’s conceptual framework to the prevention of diseases linked to unhealthy diets and sedentary lifestyles involved three main areas of work, reflecting key steps of the process described above. The first area was the synthesis of existing evidence, and the production of new evidence, on the scale and characteristics of the obesity epidemic, which is the most immediate and visible reflection of changing patterns of diet and physical activity. This was aimed at assessing the ways in which obesity has spread in recent decades and some of the impacts of such growth on social welfare and its distribution across population groups. Section I of this paper reports the findings of such work, mainly based on analyses of health survey data from 11 OECD countries, reported in full detail in DELSA/HEA(2008)13/ANNEX 1 and DELSA/HEA(2008)13/ANNEX 4. This work has generated a body of evidence that governments may wish to take into consideration in determining the extent to which action should be taken to address increasing trends in overweight and obesity, and in determining what types of actions may be appropriate in pursuing such a goal.

16. A second area of work was the review and analysis of actual and potential interventions to improve diet and physical activity. This was aimed at reviewing the actions taken by governments and private sector organizations in response to the growing epidemic of overweight and obesity, and other possible actions discussed in the literature, sometimes because of their proven effectiveness in other areas of chronic disease prevention, but not fully implemented as measures aimed at tackling obesity. The purpose of this work was also to assess the characteristics of interventions on the basis of a typology proposed in HWP 32, which focused on the degree of interference with individual choice and on the health determinants targeted by the interventions. Section II of this paper reports the findings of such work, mainly based on a survey of recent government policies aimed at improving diet and physical activity, on exchanges with private industry representatives, and on reviews of the existing literature. These findings are reported in detail in DELSA/HEA(2008)13/ANNEX 2. This work aims to provide governments with a broad international perspective on actions taken at various levels and by various subjects to counter
lifestyle changes that have led to a growing obesity problem, and on actions that could potentially be taken in the pursuit of such goal. It also enables governments to make a preliminary assessment of important characteristics of those actions, before they may be considered for a more detailed assessment involving a thorough economic analysis.

17. A third and final area of work was the economic analysis of a range of interventions to improve diet and physical activity, selected on the basis of their prominence in the current policy debate, and of the availability of sufficient evidence of their effectiveness. This work was aimed at assessing the efficiency and distributional impact of such interventions, thus contributing to bridging an important gap in the existing evidence base concerning the impact of preventive interventions. Section III of this paper reports the findings of the economic analysis undertaken as part of the project, mainly based on a micro-simulation model designed in collaboration with the WHO to assess the impact of changes in risk factors on chronic diseases, quality of life, longevity and expenditure. The findings summarized in section III are reported in detail in DELSA/HEA(2008)13/ANNEX 3. This work provides governments with evidence of the expected impacts of the implementation of large-scale interventions aimed at improving diet and physical activity, in terms of likely changes in life expectancy and disability-adjusted life expectancy, health expenditure and other forms of government and non-government expenditure, timing of health and expenditure effects over a period of 100 years, and the likely distributional consequences of such changes disaggregated by age, gender and socio-economic status.

18. Finally, section IV illustrates a number of considerations based on the findings of the various streams of the project, concerning the relevance of those findings for government policy aimed at tackling the growing epidemic of overweight and obesity.
SECTION I
CHANGING LIFESTYLES AND THE GROWING OBESITY PROBLEM: DIMENSIONS, DETERMINANTS AND IMPLICATIONS

1.1. The obesity epidemic: historical and projected future trends in BMI and obesity.

19. A detailed analysis of individual-level national health examination and health interview survey data was undertaken, using surveys from the following 11 OECD countries: Australia, Austria, Canada, England, France, Hungary, Italy, Korea, Spain, Sweden, and the US. All of the available waves of these health surveys were used in the analyses, providing a temporal coverage that varies from 4 (Hungary) to 31 years (US). The surveys used provide the most accurate and detailed information currently available on overweight and obesity, assessed with reference to the body mass index (BMI)\(^1\), which is directly measured in three of the 11 countries (England, Korea, and US) and based on self-reported height and weight in the remaining eight.

20. Rates of overweight and obesity vary considerably across OECD countries (Figure 1), even after accounting for differences in the age structures of national populations. However, such rates have been increasing consistently over the past three decades in all OECD countries. Obesity has been increasing at a faster pace in countries with historically higher rates, leading to a widening gap among countries over time (Figure 2). Conversely, pre-obesity appears to have been growing faster in countries with historically lower rates. This picture is consistent with a progressive shift of relatively large groups within national populations from normal weight to pre-obesity first, and subsequently from pre-obesity to obesity. In fact, in certain countries with historically high rates of overweight and obesity (e.g., US, England), rates of pre-obesity stabilised or even began to shrink in recent years, while obesity rates continued to rise.

21. Projected trends in adult overweight and obesity (age 15-74) over the next 10 years, based on the assumption that the entire distribution of BMI in national populations would continue to evolve following the patterns observed in the past, predict a progressive stabilisation or slight shrinkage of pre-obesity rates in many countries (e.g., Australia, England, US), with a continued increase in obesity rates. Increases in overweight and obesity are expected to happen at a progressively faster pace in countries (e.g., Korea, France) where rates of obesity were historically lower. Obesity is more common in older age groups, within the age-range examined, and appears to be growing at slightly faster rates than in younger age groups in several countries. However, changes in the age structures of national populations in the OECD area are unlikely to have contributed in a major way to past increases in overweight and obesity, or to contribute to expected future increases.

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\(^1\) The terms “overweight”, “pre-obesity” and “obesity” will be used in this paper with reference to specific levels of the body mass index. In particular, an overweight individual is an individual with a BMI of 25 or above. The overweight class is in turn split into two sub-classes as follows: individuals with a BMI of 25 or above, but less than 30, are classified as pre-obese, while individuals with a BMI of 30 or above are classified as obese.
Figure 1. Overweight (left) and obesity rates in OECD countries (OECD Health Data 2008).

Note: For Australia, the Czech Republic, England, Luxembourg, New Zealand and the United States, rates are based on measured, rather than self-reported, BMI.

Figure 2. Past trends in obesity, age-standardised rates.

1.2. The driving forces behind the epidemic: individual attitudes and environmental influences.

22. Previous research has provided substantial evidence of the role of individual characteristics and of environmental influences in the development of overweight and obesity (a comprehensive summary is available in Branca et al., 2007), but less is known on the way these factors have acted over time, and on the relative contribution they made to the recent obesity epidemic. We used individual-level data from repeated cross-sectional surveys to assess the relative contribution of different time-related factors to the obesity epidemic: age (reflecting biological as well as age-specific lifestyle factors); birth cohort (reflecting time-varying characteristics that are common to individuals in a given generation, because of exposure to similar influences at key stages in the life-course); and period of observation (reflecting environmental factors affecting every individual in a population at the times when surveys were undertaken). The data provided information on the BMI of large numbers of individuals born in different years and observed at different points in time and at different ages.

23. The resulting age-period-cohort (APC) analysis, based on a statistical approach recently developed to overcome some of the problems generally encountered in separating these three effects, consistently showed that individuals who belong to the oldest birth cohorts observed in existing health surveys are substantially more likely to be overweight or obese than those who belong to more recent birth cohorts, after accounting for differences in age and period of observation. Such declining cohort effects were observed in all the countries (6) for which appropriate data were available (Figure 3). Cohort effects for obesity were only mildly declining in Korea and Canada (but they were more steeply declining for overweight at least in Korea), and there appeared to be a reversal of trends in France and the US since the 1970s, leading to increasing cohort effects for obesity (but, again, this was not observed for overweight, where cohort effects were more consistently declining). Age effects followed a bell-shaped pattern, similar to that identified using simpler descriptive statistical models, but overweight and obesity rates appeared to start declining at older ages when cohort and period effects were properly accounted for. Period effects were steeply increasing, more so than in models which do not account for cohort effects. This is because in the latter models, commonly used to illustrate trends in obesity over time, period effects are partly offset by cohort effects, which carry a negative sign.

24. At least three factors may contribute to explaining declining cohort effects. First, education and socio-economic status have changed substantially over time since the Second World War. Individuals who were born and who have grown up in more recent periods benefited from greater opportunities to pursue
formal education, and generally lived in more educated family and social environments. In addition, the availability of information on the health risks and benefits associated with diet and physical activity and the awareness of such risks at critical times in the development of individual habits and personality have been increasing over time, possibly contributing to declining cohort effects. Finally, there is evidence in the literature that material deprivation, especially food deprivation, during infancy and childhood increases the likelihood of obesity later in life. These conditions were particularly widespread during and after World War II, and declined thereafter.

25. The above findings suggest that diverging forces are at play, which have been pushing overweight and obesity rates in opposite directions. On one hand, the powerful influences of obesogenic environments (aspects of physical, social and economic environments that favour obesity) have been consolidating over the course of the past 20-30 years, reflected in the period effects resulting from the APC analysis. On the other, the long-term influences of changing education and socio-economic conditions have made successive generations increasingly aware of the health risks associated with lifestyle choices, and sometimes more able to handle environmental pressures, reflected in the cohort effects shown in Figure 3.

1.3. Unequal lifestyles, unequal health: disparities in obesity across social groups

26. After exploring trends over time and across countries in rates of overweight and obesity, we turned to the distribution of the latter across social groups within national populations. A range of analyses were conducted to assess the extent to which socio-economic groups differ from one another in terms of body mass, after controlling for a number of individual characteristics. Inequality indexes were used to make comparisons of disparities over time and across countries.

27. Significant disparities exist among social groups in OECD countries, both in relation to lifestyle choices and health outcomes. This is true along several dimensions, including age, gender, social class, level of education, and ethnicity. Overweight and obesity are at the same time markers reflecting aspects of individual lifestyles and important risk factors for health and longevity. Disparities across social groups in overweight and obesity matter not just because of their impact on the distribution of income and health, but also because of their potential impact on overall social welfare.

28. The distribution of overweight and obesity among the population in OECD countries consistently shows pronounced disparities by education and socio-economic status among women (with more educated and higher socio-economic status women displaying substantially lower rates), while mixed patterns are observed among men. In some countries, men display a similar but markedly less pronounced gradient than women, in others no clear gradient is detectable, and in at least one country (Korea) a reverse gradient is observed among men, both by education and socio-economic status.

29. A comparison of disparities in overweight and obesity in the last 10 years across OECD countries shows that countries where the largest (relative) disparities exist are not necessarily those where overweight and obesity rates are highest. Least educated women are at greatest disadvantage in Korea, Spain, Italy and France, where their chances of being overweight or obese are many times higher than those of their most educated counterparts. Conversely, disparities are least in England and Australia, where women at the two extremes of the education spectrum differ in their overweight and obesity rates by a factor of less than two. Disparities in obesity by education among men are largest in France, Austria, Spain and Italy, but still substantially smaller than among women, and are relatively minor in other countries. Disparities in obesity by socio-economic status follow a similar pattern, and are largest in France, Spain and Korea for both men and women.

30. In most countries, disparities have not significantly changed over the period of time for which data are available, although widening disparities were observed at least in Spain, Australia (by education
level), England and Italy (by socio-economic status). In those countries, more disadvantaged population
groups have been increasing their rates of obesity at a faster pace than their better-off counterparts, over the
last 15 years.

1.4. The spread of obesity within families and social networks.

31. Overweight and obesity are social phenomena. The lifestyle choices leading to overweight and
obesity, typically those concerning nutrition and physical activity, as well as the outcomes of those choices
in terms of body weight, tend to be shared among members of the same families, social networks and peer
groups. Research has shown that similarities within such groups exist when measured at a given point in
time, but also when changes in individual behaviours are observed over time.

32. Data from countries which provided full information on all members of each surveyed household
(England, France, Korea and Italy), show that one sixth to one fourth of the overall variation in the
probability of being obese is determined by differences among households, rather than differences among
individuals. The proportion was higher, up to 50% (similar to what is observed in smoking), for health-
related behaviours such as consumption of fruit and vegetables and physical activity, and was about one
third for fat consumption. When selecting pairs of spouses within households (i.e. individuals not sharing
the same genetic background), the correlation of BMI levels in each couple was above 20% in all countries
except Korea, where it was substantially smaller. The correlation was stronger in older age couples,
suggesting that the effect is at least in part due to the adoption of common lifestyles, and not merely to
partner selection.

33. Genetic factors may also play a part in determining a convergence of BMI levels within
households. Studies comparing natural and adopted children with two, one or no obese parents showed that
natural children are substantially more likely than adopted ones to resemble their parents in terms of body
weight. However, when selecting only mothers and their children within households (i.e. members who
share the same genetic background) in the above health survey data, the correlation was stronger than
between spouses in all countries, but not so much stronger to suggest that similarities in BMI among
household members may be mostly explained by genetic factors. Genetics alone cannot account for the rise
in overweight and obesity experienced over the past 20-30 years by all OECD countries. Rather,
obesogenic environments appear to have encouraged individuals, especially when culturally and socially
vulnerable, to make less healthy lifestyle choices, and those genetically predisposed have tended to become
overweight or obese as a result. This interaction between genetic factors and environment appears to be
strongly supported by the findings of the analyses undertaken as part of this project.

1.5. The role of education, information and risk perception in shaping lifestyles.

34. As previously indicated, better education is associated with significantly reduced overweight and
obesity rates in women, and to a lesser extent in men. Given the likely importance of education in
determining declining cohort effects, and the emphasis many OECD governments are placing on education
as a means of tackling the growth in overweight and obesity, a further detailed analysis of data on
education and obesity from four countries (Australia, Canada, England, and Korea) was conducted in
collaboration with the OECD’s Centre for Educational Research and Innovation (CERI). The aims,
methods and findings of this analysis are set out in detail in DELSA/HEA(2008)13/ANNEX 4.

35. There is a broadly linear relationship between the number of years spent in full-time education
and the probability of obesity, with most educated individuals displaying lower rates of the condition (the
only exception being men in Korea). This suggests that marginal returns to education, in terms of reduction
in the obesity rates, are approximately constant throughout the education spectrum. As previously
indicated, the education gradient in obesity is stronger in women than in men. Differences between genders
are minor in Australia and Canada, more pronounced in England and major in Korea. The causal nature of the link between education and obesity has not yet been proven with certainty; however, using data from France we were able to ascertain that the direction of causality appears to run mostly from education to obesity, as the strength of the association is only minimally affected when accounting for reduced educational opportunities for those who are obese in young age.

36. Most of the effect of education on obesity is direct. Small components of the overall effect of education on obesity are mediated by an improved socio-economic status linked to higher levels of education, and by a higher level of education of other family members, associated with an individual’s own level of education. The positive effect of education on obesity is likely to be determined by at least three factors: (a) greater access to health-related information and improved ability to handle such information; (b) clearer perception of the risks associated with lifestyle choices; and, (c) improved self-control and consistency of preferences over time. However, it is not just the absolute level of education achieved by an individual that matters, but also how such level of education compares with that of the individual’s peers. The higher the individual’s education relative to his or her peers’, the lower is the probability of the individual being obese.
SECTION II
THE RESPONSE TO THE OBESITY EPIDEMIC

2.1. The development of government policies on diet and physical activity in the OECD area.

37. Governments in the OECD area have taken a broad range of actions in recent years to improve nutrition and physical activity, reacting to a growing concern about increasing obesity rates, particularly in vulnerable population groups. A survey of national policies was undertaken as part of this project. The survey was designed to compile an inventory and develop a taxonomy of policies and initiatives aimed at tackling unhealthy diets and sedentary lifestyles. Further objectives of the survey were to identify similarities and differences between country approaches and factors that may explain them, and to gather any evaluations of the effectiveness and costs of existing policies, which may not be in the public domain.

38. The survey covered all OECD and other EU countries and we were able to examine responses from the vast majority of those countries. The primary focus of the survey was central government initiatives, although governments were also invited to report on activities at the regional or local levels, and provide examples of the latter, when relevant. Health ministries were mainly targeted by the survey, but they were invited to share the questionnaire with other relevant ministries, as appropriate. The survey involved the collection of major policy statements on diet and physical activity in each country, as well as information on up to 10 most impactful preventive interventions adopted during the past 10 years in the countries concerned. In particular, information was sought on whether important interventions had been monitored or evaluated and, if so, whether there was any evidence on the effects of the interventions on behaviour or health status.

39. The survey was also aimed at gathering information on joint initiatives and partnerships between governments and private sector organisations. In addition, the OECD held consultations with representatives of the food and beverage industry and of the sports industry, as well as with representatives of advocacy groups concerned with lifestyles and obesity, in order to gauge their views and obtain information on initiatives promoted by the private sector.

2.1.1. Policy objectives and rationales for government intervention

40. A large number of OECD governments view the rise of overweight and obesity as a major public health concern. Governments are concerned about the health, social and economic consequences of obesity and about their projected future increases, which are deemed to justify at least certain forms of government intervention. Most governments see as their own responsibility to ensure that the conditions in which individuals lead their lives are conducive to good health and recognise that living and working conditions have changed substantially in recent decades, leading to changes in individual lifestyles and population health. However, in most cases the magnitude of the problem is assessed in fairly general terms. Only in a few instances have governments engaged in detailed evaluations of the health and economic consequences of obesity in the respective countries.

41. There is a widespread recognition in the government documents examined as part of the survey that individuals need improved knowledge and understanding of the health effects of lifestyle choices in
order to be able to handle the environmental influences that have been associated with a growing obesity problem. Governments acknowledge that individuals are often exposed to large amounts of potentially confusing information on health and lifestyles from a variety of sources, and assert that it is primarily their responsibility to act as a balanced and authoritative source of information, thus providing clear guidance to individuals who struggle to cope with increasingly powerful environmental influences. Many governments began to develop nutritional standards and guidelines well before obesity had risen to the top of the health policy agenda, and they are now intensifying their efforts to promote a culture of healthy eating and active living.

42. A further rationale for intervention which appears from a number of government documents is the higher prevalence of obesity in certain vulnerable groups. It is of particular concern to some governments that disadvantaged socio-economic groups and ethnic minorities appear to take up less healthy lifestyles in increasing proportions, and they appear to be less responsive than other groups to interventions aimed at improving lifestyles. There appears to be a strong and established link between obesity and various dimensions of disadvantage, from unemployment to low income, from poor education to social isolation, and a number of governments appear to view interventions to tackle obesity as part of their efforts to protect the health of vulnerable groups and prevent the widening of health gaps between population groups positioned at the opposite ends of the social scale.

43. Virtually all OECD governments have set themselves objectives and targets in tackling overweight and obesity. In some cases, including countries that have developed and implemented comprehensive and detailed programmes, such objectives remain very general and do not commit governments to achieving specific results. In other cases, governments have chosen to identify measurable objectives in terms of nutrition (e.g. fat, carbohydrate, sugar, salt, dietary fibre, fruit and vegetable intake, mostly with reference to WHO recommendations); physical activity (e.g. proportion of adults engaging in at least 30 minutes of vigorous physical activity per day); or obesity (e.g. halting the progression of obesity rates or reversing it by a certain proportion within a given time frame).

2.1.2. Types of interventions

44. A large majority of the initiatives reported by OECD countries are aimed at improving diets, rather than increasing physical activity. The latter objective is more typically pursued at the local level, particularly through community-based initiatives, although several countries have adopted comprehensive health promotion strategies at the national level that do include actions to increase physical activity. In most cases, interventions are led, or coordinated, by health ministries, although they often involve several government departments (education, agriculture, industry, transport, sport) and are often implemented outside the conventional boundaries of the health sector. These initiatives often involve the development, diffusion and promotion of nutrition guidelines. The most common target group is children and a large number of interventions are school-based, aiming at encouraging healthy lifestyles from early ages.

45. Four main groups of preventive interventions can be distinguished, based on the degree to which such interventions may interfere with individual lifestyle choices. The four groups are as follows, in order of increasing interference: (a) interventions aimed at expanding individual choice by making available new options or lowering the price of existing options; (b) interventions aimed at influencing individual preferences through means other than prices; (c) interventions which restrict choice by increasing the price of certain options; and (d) interventions which restrict choice by banning or mandating certain options. In relation to this classification, the policy survey revealed that governments tend to view initiatives in the first two groups, which involve the mildest degrees of interference, as their most “impactful” actions (effective on a large scale). No governments reported initiatives in the third group among those they believed had the largest impact, although many OECD governments have been making use of taxes and tax
exemptions, particularly in food markets, for some time\(^2\). No interventions were mentioned in the fourth group either, probably reflecting the fact that outright bans of specific forms of consumption are unlikely to be appropriate in relation to diet and physical activity.

46. A large majority of OECD countries have adopted initiatives aimed at school-age children. These entail a variety of measures, often combined for greater impact. Measures include changes in the school environment, sometimes limited to improving school canteen menus, often through re-negotiation of contracts with external caterers. But in many cases they extend to improvements in facilities for physical activity and to changes in the types of food and beverages sold by vending machines and other outlets within schools. Interventions generally involve an educational component as well, entailing the inclusion in the school curriculum of health and lifestyle education aimed at improving children’s health literacy. It is not uncommon for such initiatives to involve the children’s families. Additionally, they can be supported by the distribution of discount vouchers or even free food, such as items of fruit. On the other hand, they rarely entail individualised health checks.

47. The second most common group of interventions adopted by OECD governments is typically set within the public health function of health systems. These interventions are primarily based on the development and dissemination of nutrition guidelines to a wide variety of population groups, although in some cases they also involve promotion of active transport and active leisure. Accordingly, interventions often make use of a variety of channels to convey health promotion messages, including the mass media, schools, employers, job centres, shops, pharmacies, general practices and other health care facilities, recreation facilities and others.

48. Regulatory initiatives concerning the market for food products are common in the OECD area, although these have been reported only in a few instances in the policy survey. These include food safety standards, which may be seen as having a relatively limited impact on obesity, but also food labelling schemes and the regulation of nutrition and health claims, which are likely to have a bigger and more direct impact on nutrition choices and obesity. Workplace interventions were also reported in very few instances, probably reflecting the view that employers are primarily responsible for implementing such programmes. Finally, a few governments reported interventions on the physical environment (e.g. extension of bicycle lanes and green spaces), on the transport system, or partnership with the private sector to improve access to sport and leisure facilities.

49. In addition to fiscal measures in use in OECD countries (generally omitted from survey responses), at least one country and a sub-national jurisdiction appear to have adopted schemes based on financial (dis)incentives after the conclusion of the policy survey. The latter are not designed as taxes on certain forms of consumption. Rather, they involve financial penalties for individuals (Alabama, US) or their health insurers (Japan) when certain physical standards (e.g. waist size below a given threshold) are not achieved and commitment to improvement is not shown. Incentives of this type have been advocated as a more equitable, and possibly more effective, alternative to taxes on certain forms of food and beverage consumption, although existing empirical evidence does not appear to support the claim that such incentives may contribute to weight loss.

\(^2\) It should be noted, however, that health ministries were primarily responsible for responding to the survey. It is possible that they did not view fiscal measures as mainstream health promotion tools to be reported in such survey. It is also possible that fiscal measures were not reported because originally implemented before the period of interest to this survey.
2.1.3. Monitoring and evaluation of effects

50. Most countries have planned some form of monitoring and evaluation for at least some of their initiatives to improve nutrition and increase physical activity. However, out of all the interventions reported as part of the survey, only about half were being actively evaluated, and results from such evaluations were available for even fewer. The latter, of course, is partly a reflection of the recent implementation of the interventions reported, most of which were adopted during the course of the past five years.

51. Where evaluations were undertaken, or planned, these tend to be in the form of questionnaire surveys of individuals who were targeted by the interventions. Such surveys are generally aimed at eliciting the views of respondents on the intervention and their awareness of it, although in some cases surveys attempt to measure self-reported changes in health-related behaviours and other relevant outcomes. Only in a few instances do the evaluations entail rigorous comparative assessments of the outcomes achieved by the intervention, relative to control groups. Several evaluations are merely based on the assessment of participation rates as a proxy for impact. Where results are available from ongoing evaluations, these indicate that, on average, 3 out of 4 individuals in target populations were aware of the relevant public health campaigns and appeared to have learnt the key messages from such campaigns. There also appeared to be increases over time in declared intentions to adopt healthier behaviours and in participation rates in public health initiatives. Unfortunately, actual changes in patterns of food consumption or physical activity were measured in very few instances and these do not yet appear to provide a sufficiently robust and generalisable evidence-base. It seems that government policy makers will not be able to rely on the findings of evaluations of ongoing national programmes, at least for some time. The existing evidence of the effectiveness of interventions to prevent obesity and related chronic conditions remains confined to a relatively small body of experimental and observational studies published in the international literature, most of which focus on small-scale interventions, have limited duration, and are based in one of a small number of countries. Such evidence was reviewed as part of the project and the findings concerning specific interventions are briefly discussed in section III below.

2.2. The private sector response: are markets adjusting to the new challenges?

52. As individuals need to balance energy intake and expenditure in various aspects of their own lives and consumption, the industries in which they are employed and those which supply the commodities they consume may play an important role in helping to prevent overweight and obesity. Industries in which technological innovation and automation of production have more dramatically reduced work-related physical activity may offer incentives and programmes to help employees improve their lifestyles. The sports and exercise industry may provide further opportunities for physical activity during leisure time. The real estate industry may contribute to urban design solutions that facilitate active transport and active leisure opportunities. The food and beverage industry may help consumers maintain a balanced nutrition and an adequate energy supply. The health care industry may provide medical solutions to the problems of overweight and obesity for those cases in which behavioural approaches prove insufficient.

53. The government documents and statements gathered as part of the policy survey indicate that all governments emphasise the importance of co-operation and partnership with the private sector. A range of actors, or stakeholders, are mentioned in such documents as natural partners in the development of strategies to improve nutrition and physical activity. However, the precise terms in which such co-operation should take place and the respective roles of the different stakeholders often remain vague.

54. Business organisations often engage in health promoting production, marketing, and human resource management policies to fulfil the expectations and demands of consumers, government, and society at large. A health and wellbeing industry has been developing at a very fast pace in recent years,
driven by a growing consumer demand. This has provided, for instance, greater opportunities for leisure-
time physical activity and healthy nutrition, which may have an impact on obesity. An increased
availability and awareness of health-related information, and an increased attention to obesity and its
consequences by the mass media, have contributed to changing consumer preferences, to which business
organisations have often responded promptly. However, this phenomenon appears to be mostly confined to
certain population groups, particularly those with higher levels of education and better socio-economic
status. More disadvantaged groups continue to display lower levels of leisure-time physical activity (not
compensated by work-related physical activity) and less healthy nutrition patterns (Arnade and Gopinath,
2006; Cerin and Leslie, 2008).

55. A second major force that may lead business organisations to adopt health promoting initiatives
and policies is government action, or simply the expectation of government action. Government regulation
may produce both direct and indirect effects on markets for health-related commodities, but governments
are often reluctant to use regulation because of the complexity of the regulatory process, the enforcement
costs involved, and the likelihood to spark a confrontation with the industry. In situations in which an
expectation exists that governments will consider regulatory actions, business organisations may seek to
anticipate such actions through self-regulation and co-operation with governments, which confer them
some control over the regulatory process. This has recently been the case, for instance, in the regulation of
food advertising to children and in food labelling. In these areas, business organisations have taken
initiatives before most governments could implement formal regulatory measures. Industry self-regulation,
when pursued within a broader regulatory and monitoring framework set out by, or agreed with
governments, presents a number of advantages over government regulation alone, as it may substantially
reduce enforcement costs and may avoid conflict with the industry. However, the effectiveness of self-
regulation may be hindered when only selected business organisations sign up to the relevant voluntary
agreements.

56. An area of special complexity is product reformulation, especially in the food and beverage
industry. In this case, business organisations have to balance consumer demands for taste and convenience
with the threats and opportunities involved in different types of government regulation. Demands for taste
and convenience may lead to a larger-than-desirable use of certain ingredients which may have negative
health consequences, especially if consumed in large quantities, such as salt and sugar for taste, or transfats
for convenience (extended shelf-life). Governments may ban or strictly limit the use of such ingredients, or
simply threaten to do this in order to elicit an appropriate response from the industry. However, this form
of regulation is not widely applicable in food manufacturing, and governments often prefer to use
incentives to encourage business organisations to reformulate less healthy products. Common incentives
include those involved in the regulation of nutritional or health claims.

57. Finally, business organisations may engage in health promoting initiatives to fulfil broader
societal expectations, as a form of corporate social responsibility. Societal concerns have increasingly been
voiced in recent years by consumer organisations and advocacy groups battling against obesity and
unhealthy individual lifestyles. Business organisations, both as employers and as producers and marketers
of products and services that have a potential impact on health, have a strong interest in retaining a positive
and credible image, particularly when their market success depends crucially on advertising. A number of
large employers have therefore taken initiatives to promote healthy lifestyles among their employees,
despite limited evidence that such initiatives generate positive returns in terms of reduction of sick leave
and higher productivity. Major players in the food and beverage industry have contributed, for instance, to
health education initiatives or programmes to promote physical activity among children.

58. The extent to which some of the above initiatives may have an impact on lifestyles and chronic
diseases may partly be gauged from the findings of a micro-simulation modelling exercise presented later
in this document. However, there is at present very limited empirical evidence that market-based solutions
can contribute significantly to containing overweight and obesity. Much of the existing evidence relates to industry compliance with self-regulatory initiatives, consumer awareness and consumer perceptions. It is in the interest of all stakeholders to expand and strengthen the existing evidence-base through new and improved research on how market-based initiatives may reduce exposure to potentially harmful environmental influences and change individual behavioural and consumption patterns in ways that promote healthy lifestyles.
SECTION III
IS PREVENTION COST-EFFECTIVE?

3.1. Assessing the efficiency and distributional implications of prevention policies.

59. Action on diet and physical activity may both contribute to the prevention of further increases in overweight, obesity and chronic diseases, and help to reduce the magnitude of the existing problem. However, such efforts are hindered by the scarcity of sound evidence on the effectiveness of interventions aimed at improving health habits, and by the virtual lack of evidence of their efficiency and distributional impacts. A large part, although not all, of the evaluations undertaken in recent years to assess the effectiveness of preventive interventions have been based on qualitative research, or have measured short-term intermediate outcomes unlikely to reflect the extent to which interventions may reduce the incidence of chronic diseases or lower mortality in the long run. Evaluations of the efficiency (e.g. cost-effectiveness) and distributional impacts of interventions are even fewer, and narrower in terms of numbers of options considered. No comprehensive assessment of large-scale interventions has ever been carried out.

60. An economic analysis was developed as part of this project, with the aim of contributing to strengthen the existing evidence-base on the efficiency of interventions to tackle unhealthy diets and sedentary lifestyles. The analysis was undertaken in close collaboration with the WHO, broadly based on the WHO-CHOICE (CHOosing Intervention that are Cost-Effective) approach. The aim of the analysis was to assess the efficiency of a range of policy options to tackle unhealthy lifestyle and related chronic diseases. Additionally, compared to the traditional CHOICE framework, the analysis involved an assessment of the distributional impact of preventive strategies on costs and health outcomes.

61. The core component of the analysis is a micro-simulation model designed to reproduce the epidemiological dynamics of a population. A diagrammatic representation of the structure of the model is shown in Annex 1. The assumption underlying this model is that diseases originate from a complex chain of interacting behaviours and events over the life-course of an individual, as illustrated in Box 1 (below). Despite its overall complexity, the model remains a somewhat simplified representation of real disease and life events. For instance, it was not possible, at least in the current version, to model carbohydrate intake, or to distinguish between different types of fats (e.g. saturated vs. unsaturated). This was partly due to the technical difficulties involved in modelling too wide a range of parameters, but also to the scarcity of reliable information on the incidence and prevalence of risk factors and on their effects on other risk factors, diseases and longevity.
Box 1. The underlying epidemiological model

The epidemiological model (called "LifeStyle") used in the economic analysis implements a "causal web" of lifestyle-oriented risk factors for selected adult chronic diseases. The concept of a causal web includes the idea that risk factors range in the immediacy of their effect on disease events 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"), which are more immediately connected to disease events. The causal web concept also typically includes the possibility, as also implemented here, that risk factors can influence other risk factors. Thus, in a causal web, disease events are influenced by risk factors both directly and indirectly. The definition of the risk factors, as well as the thresholds used to identify individuals at risk, is largely based on data provided by the WHO publication "Comparative quantification of health risks" (Ezzati et al., 2004).

The model explicitly accounts for three groups of chronic diseases: stroke, ischemic heart diseases and cancer (including lung, colorectal and 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 such chronic diseases, usually through altered physiological 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, generally mediated by BMI, which acts as an intermediate risk factor, as well as on proximal risk factors. The model accounts for mortality from all possible causes of death, assuming that mortality associated with diseases that are not explicitly modelled will remain stable at the rates currently observed in the relevant populations.

The LifeStyle model is a stochastic microsimulation model. The term "microsimulation" refers to the fact that the model separately represents the lifetimes of many different individuals; emergent properties about the population are then obtained by "adding up" across individual histories. The term "stochastic" refers to the fact that the model employs random variation, for example, individuals are randomly assigned risk factor status and are randomly assigned waiting times for disease and mortality events; the program ensures that, on average, the number of individuals with, for example, a given risk factor status matches the observed risk factor prevalence in the population being modelled, and that the annual disease rates of simulated individuals in the model matches, on average, the disease rates in the population being modelled.

The model is dynamic in the sense that effects are measured with reference to individual life histories that have unique beginning and end points in the model's representation of calendar time. The initial population in the model moreover reproduces the demographic features of the population being modelled in cross section at an arbitrary point in time, for example "current time". The model thus contains a full age, period and cohort representation of the simulated population. Typical lifetable variables, such as residence time in particular states, are collected and reported for the purpose of measuring health effects and reporting other epidemiological features of interest.

The LifeStyle model is based on an earlier prototype ChildHealth model orginally created by Statistics Canada based on a design provided by the World Health Organization. As the ChildHealth model also implemented a version of a causal web, it provided a useful starting point for the development of the LifeStyle model.

62. The economic analysis was undertaken for three geographical macro-regions, broadly reflecting WHO regions within the OECD area (Europe, America, Asia-Pacific region). The best available sources of information on the epidemiology of risk factors and chronic diseases were used to provide the basic data for the micro-simulation model. A baseline scenario was developed involving treatment (acute and chronic) of diseases as they emerge, and an absence of systematic and large-scale prevention strategies. Further scenarios were developed to assess the impacts of a range of preventive interventions, based on a comprehensive synthesis of the best existing evidence of the effectiveness of such interventions, and on a costing exercise mostly based on the CHOICE costing approach. The interventions evaluated include the following: counselling of at-risk individuals in primary care; community-based education and counselling; mass media campaigns; school-based interventions; worksite interventions; fiscal measures (combination of taxes and subsidies); regulation of food advertising to children (either through government regulation or industry self-regulation); and compulsory food labelling regulation.
3.2. Expected impact of selected interventions.

63. Expectations about the potential impact of preventive interventions are often inaccurate, because such interventions produce multiple and sometimes interacting effects, which are difficult to predict. A common misconception, for instance, is that prevention will reduce future health care costs. In fact, this may or may not be the case. Prevention may reduce fatality rates associated with certain chronic diseases and extend life with those diseases, which may increase overall health care costs in the long run. Individuals who live longer as a result of prevention will also develop diseases other than those targeted by prevention, which may require treatment and increase health expenditure. The analysis focused on a set of diseases that are affected by changes in diet, physical activity and BMI. Estimates of the impact of preventive interventions on health expenditure therefore concentrate on the costs associated with the treatment of those diseases. On the other hand, life expectancy is estimated in relation to mortality from all causes, and what is labelled here as “disability-adjusted life expectancy” refers to life expectancy adjusted for the levels of disability associated with the diseases that are explicitly modelled in the analysis.

64. 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 (e.g. health care costs), others arise within other sectors of government intervention (e.g. most of the costs associated with school-based interventions). In principle, the costs associated with preventive interventions and with the treatment of risk factors and chronic diseases could be calculated at the national level, and the economic analysis could be set in the context of individual countries. However, for practical reasons we aggregated OECD countries into the three macro-regions mentioned previously, and the costs calculated for each region reflect average conditions across the countries that make up that region. Cost differences between countries undoubtedly exist, although international comparisons found similar cost-of-illness patterns in several OECD countries (Heijink et al., 2004). The costing methodology used in the joint OECD-WHO analysis involves an assessment of cost differences across countries based on a regression analysis approach, mainly accounting for country GDP and characteristics of the supply of health care. The resulting cost variation across countries is illustrated in Annex 2 with reference to selected countries in the European region and for selected interventions.

65. The effectiveness of individual preventive interventions was assessed on the basis of targeted reviews of existing studies. Since the micro-simulation model developed for the analysis is capable of estimating the impact of changes in risk factors such as diet, physical activity and BMI on chronic diseases, the reviews included also short-term studies measuring only intermediate outcomes (e.g. dietary changes). Studies were generally very heterogeneous, even when focusing on the same type of intervention. For certain interventions, it was possible to select one study that was superior to all others because of its large sample size, rigorous design, length of follow-up or detailed measurement of outcomes. In other cases, a small subset of relatively homogeneous studies was selected, and average effects were calculated and used as inputs in the analysis. Assumptions were made on the long-term sustainability of the changes brought about by preventive interventions, using longer-term studies (e.g. Franz et al., 2007). In general, the impact on individual behaviours was assumed to halve after the completion of the intervention.

66. The main characteristics of some of the interventions evaluated in the analysis are summarised below. A synoptic table of the most important effects of such interventions (costs and impacts on risk factors) is shown in Annex 3. Model estimates of the impacts of selected interventions in different age groups in the European region are shown in Figures 6 to 13. The charts on the left-hand side of these figures show changes in life years and disability-adjusted life years lived with preventive interventions, relative to the baseline scenario, while those on the right-hand side show changes in health care costs. Intervention costs were calculated separately. In order to gauge the scale of the health gains generated by
the interventions examined, one should consider that the top of the scale of the vertical axis in Figures 6 to 13 corresponds to an order of magnitude of 2 years of life gained per 10,000 life years lived by the reference population, roughly equivalent to one year of life gained for every 60 individuals.

The analysis was undertaken as a simulation of health outcomes and costs over a period of 100 years, assuming no underlying trends in risk factor or disease incidence, or mortality. Over this time horizon, the initial population is almost completely replaced by new individuals “born” during the course of the simulation, who are exposed to preventive interventions at certain stages in the course of their lives. A 100-year time perspective covers the effects of all possible interventions, including those whose effects are significantly delayed (e.g. school-based interventions). Most interventions appeared to have a favourable efficiency profile, as illustrated in Figure 4 by broad cost-effectiveness categories, with fiscal measures leading to overall cost savings. However, it was also apparent from the results of the analysis that all interventions had a limited impact on the overall scale of the obesity problem (model estimates indicate that interventions would reduce the obese population by a percentage comprised between 0.1% and 7.4% at age 60), although they all increased life expectancy and disability-adjusted life expectancy. This is particularly evident in interventions aimed at children (e.g. school-based interventions, regulation of food advertising) which take several decades to produce visible health effects. Although the cost-effectiveness of the latter interventions seems very favourable in the long-term (100 years), in the first 20-30 years of their implementation cost-effectiveness ratios are extremely high. In general, the scale of the impact of individual interventions is limited by the difficulties involved in reaching a large proportion of the national 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 compliance rates are low, as is typically the case for several of the interventions examined, based on existing evidence.

**Figure 4. Cost-effectiveness of selected preventive interventions.**

Note: a threshold of $50,000 per disability-adjusted life year is used to separate groups of interventions in this figure, because an incremental cost-effectiveness ratio of that magnitude is often viewed as an upper limit to identify unequivocally efficient interventions within the health care domain. The classification of each intervention into a particular cost-effectiveness category is subject to a degree of uncertainty in relation to a range of assumptions and parameter estimates used in model design and calculations.

### 3.2.1. Counselling of at-risk individuals 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 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

69. 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/m2 or above, high cholesterol (75th percentile or above), high systolic blood pressure (>140 mmHg), and type II diabetes. Based on a selection of three studies which provide detailed accounts of controlled experiments of similar counselling interventions in primary care (Ockene et al. 1996; Herbert et al. 1999; Pritchard et al. 1999), it was assumed that 80% of primary care physicians join the programme and that 90% of eligible individuals choose to participate in the programme. Of the latter, 75% successfully complete the programme.

70. Candidates are either recruited opportunistically, by screening patients waiting for a consultation (Pritchard et al. 1999), or identified using the information contained in practice records and invited for a consultation through a telephone call (Ockene et al. 1996; Herbert et al. 1999). Individuals are asked to complete a health and lifestyle questionnaire while they wait for their consultation, which will be used to tailor physician advice. Physicians spend roughly 8-10 minutes providing information and advice on lifestyle, and particularly on diet. The same information is repeated in follow-up consultations.

71. 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 5 group sessions of 15 minutes and by a final 45-minute individual session.

Effects

72. The intervention will modify risk factors at all the three levels modelled in the analysis. It will decrease fat consumption, body mass index, systolic blood pressure and total cholesterol. Effects are assumed to persist in a reduced form after the completion of the intervention.

2.1 The estimated cost of the intervention is about $100 per target individual ($210 in the more intensive version). A large share of this covers the cost of extra working hours of physicians and other health professionals, including dieticians and office support staff. Costs for the training of health professionals and basic organization costs account for less than $10.

3.2.2 Mass media campaigns.

73. 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 intervention

74. 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 6 months of intensive broadcasting with 3 months of less intensive broadcasting. During the more intensive phases television and radio channels broadcast 30-second advertisements 6 times a day, 7 days a week. In the less intensive phases they broadcast 15-second advertisements 3 times a day, 7 days a week. Advertisements contain messages both on diet and physical activity. Broadcast messages are associated with the distribution of printed material, which is assumed to reach 10% of households.
Effects

75. Based on the evidence provided in three studies selected from a broader literature review (Dixon et al. 1998; Foerster et al. 1995; Craig et al. 2006), the intervention will increase consumption of fruit and vegetables, as well as the proportion of the population undertaking adequate levels of physical activity.

76. The estimated cost of the intervention is $2.27 per target individual, most of which is spent in broadcasting advertisements on national and local radio and television channels. Planning and administration costs are spread over a large target population.

3.2.3. School-based interventions.

77. 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

78. 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.

79. 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 1 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.

Effects

80. A range of studies (Gortmaker et al. 1999; Luepker et al., 1998; Perry et al., 1998; Reynolds et al., 2000) indicate that school-based interventions of the kind described above modify distal risk factors, particularly by increasing the intake of fruit and vegetables and decreasing energy from fat. The analysis was 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.

81. The estimated cost per target individual is $113, divided in the following way: 60% is spent in organization costs and training of teachers and food service staff; 25% on hours of extra teaching for additional curricular activities; and the remainder on brochures, books, posters and equipment in general. Costs do not include changes in food service contracts, vouchers/coupons from sponsors and school nurse time.

3.2.4. Worksite interventions.

82. 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

83. The intervention targets individuals between the ages of 18 and 65 working for companies with at least 50 employees, which was deemed to be the smallest scale that would make the intervention viable. It is assumed that 50% of employers, and 45% of their employees, will participate in the programme.

84. 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 twenty months. Messages are reinforced by the distribution of information materials and posters in common areas and cafeterias. Other activities are coordinated by volunteers who also act as peer educators and organize “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.

Effects

85. Based on evidence provided in a range of studies (Sorensen et al. 1996; 1998; 1999; Emmons et al. 1999; Buller et al. 1999), the intervention increases the consumption of fruit and vegetables and physical activity, and decreases fat intake. After retirement, those exposed to the intervention retain some of the benefits accrued.

86. The estimated cost per target individual is $77. Organization and training of peer-educators and food service staff account for less than 9%, while the largest component of the cost of the intervention (about 80%) is represented by seminar organisation and nutritionist fees. Other costs include information materials and a guest speaker. The costs involved in re-negotiating food service contracts or accessory measures (e.g. installation of bicycle racks) were not included in the analysis.

3.2.5. Fiscal measures to promote consumption of fruit and vegetables and reduce consumption of fats.

87. 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. 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. Fiscal measures also have potentially large re-distributive effects which should be accounted for in any economic evaluation.

The intervention

88. 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.

Effects

89. 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 those discussed in a recent report issued by the French
Government (Hespel and Berthod-Wurmser, 2008), it was estimated that a 10% change in price will produce, on average, a 2% change in consumption in the opposite direction. The health outcomes presented in this paper are based on the assumption that the price elasticity is the same 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. However, the health effects of the intervention appear to favour those in poorer socio-economic circumstances more than their better-off counterparts. This is illustrated in Figure 5, showing that in all age groups, the less well-off gain proportionally larger numbers of life-years than their better-off counterparts, following the fiscal interventions described. And the gains are proportionally larger for all socio-economic groups in older ages. The financial burden of the tax, however, will also be significantly greater for poorer households.

90. The costs of the intervention 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. Potential efficiency losses for the economy as a whole resulting from fiscal measures (deadweight losses) are also not accounted for at the current stage of the analysis.

![Figure 5. Life-year gain through fiscal measures for different socio-economic groups.](image)

3.2.6. Restrictions on food advertising.

91. 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. On the other hand, 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

92. The intervention is targeted to children between the ages of 2 and 16. 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. The best evidence currently available on the impact of restrictions on food advertising concerns the advertising of fast food (Chou et al., 2008), therefore the intervention designed for the analysis focused on this type of advertising. 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.

Effects

93. The intervention will reduce children’s BMI through changes in dietary habits. Chou et al. (2008) suggest that in the absence of fast-food advertising to children, the number of overweight children would be reduced by 12%. It was assumed in the analysis that the effect of advertising restrictions will be only 50% of the above, because children will remain exposed to a certain amount of advertising, either because they watch television programmes outside the hours in which restrictions are enforced, or because the industry may substitute television advertising with 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 the voluntary nature of the intervention and possibly slightly looser limitations self-imposed on advertising.

94. 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.

**Box 2. How to read Figures 6 to 13**

The left-hand side of each figure shows the health gains generated by preventive interventions, relative to a baseline scenario in which chronic diseases are treated once they are diagnosed. The bars illustrate the numbers of life years and disability-adjusted life years gained in each age-group. Gains tend to be largest in the age-groups comprised in the range 60-90. As previously indicated, the top mark on the left-hand scale corresponds to a gain of approximately one year of life for every 60 individuals with an average life expectancy.

The right-hand side of each figure displays the effects of preventive interventions on the health care costs associated with the treatment of the chronic diseases explicitly addressed in the model (stroke, ischaemic heart disease and some cancers) by age-group. Negative bars indicate cost-savings. As preventive interventions tend to delay mortality, cost savings tend to be reduced, or even reversed, in the oldest age groups.
Figure 6. Mass media campaign, costs and health outcomes by age group (European region).

Figure 7. School-based intervention, costs and health outcomes by age group (European region).

Figure 8. Worksite intervention, costs and health outcomes by age group (European region).
Figure 9. Fiscal intervention, costs and health outcomes by age group (European region).

Figure 10. Primary care counselling, costs and health outcomes by age group (European region).

Figure 11. Primary care counselling (intensive), costs and health outcomes by age group (European region).
Figure 12. Enforced food advertising restrictions, costs and health outcomes by age group (European region).

Figure 13. Self-regulation of food advertising, costs and health outcomes by age group (European region).
SECTION IV
CONCLUSIONS AND POLICY RELEVANCE OF THE FINDINGS OF THE PROJECT

95. Virtually all OECD governments have expressed serious concerns in recent years about unhealthy diets and sedentary lifestyles, which are seen as the immediate causes of a rising epidemic of overweight and obesity. There is little doubt that such concerns are legitimate. A large body of empirical evidence shows that overweight and obesity rates have been increasing relentlessly over recent decades in all industrialised countries, as well as in many lower income countries. Our analyses of trends over time support the grim picture drawn in the international literature and so do our projections of overweight and obesity rates over the next ten years. Our analyses of changes in the distribution of BMI over time and across countries show that patterns observed today in countries with relatively low rates of overweight and obesity are strikingly similar to those observed in the past in countries that have now reached substantially higher rates. It may not take a long time before the former countries catch up with the latter. In the absence of effective interventions, countries with historically low rates of overweight and obesity, such as Korea, may expect within the next 10 years to reach the same proportions of pre-obese population (BMI between 25 and 30) as countries that currently rank near the top of the BMI league table, such as England.

96. While weight gain is fundamentally determined by an energy imbalance (energy intake greater than energy expenditure), the relative roles played by changing diets (intake) and sedentary lifestyles (expenditure) on the recent spread of overweight and obesity remain somewhat uncertain. However, it seems clear that the circumstances in which people have been leading their lives over the past 20-30 years, including physical, social and economic environments, have exerted powerful influences on their overall calorie intake, on the composition of their diets and on the frequency and intensity of physical activity at work, at home and during leisure time. The environmental influences described here were shown to have been even stronger than suggested by many existing empirical analyses. Indeed, they are so strong that they have more than offset a declining underlying trend in the likelihood of overweight and obesity for successive birth cohorts.

Addressing both individual attitudes and environmental influences

97. Policy makers appear to face a conflict between contrasting forces affecting overweight and obesity rates. On one hand, the powerful influences of obesogenic environments (physical, social and economic environments) have been consolidating over the course of the past 20-30 years. On the other, changing individual attitudes, reflecting the long-term influences of improved education and socio-economic conditions have countered to some extent environmental influences. In a policy perspective, countries wishing to implement interventions aimed at curtailing the growth of overweight and obesity should take account of both of these major forces. If interventions are deemed to be justified, these should counter the influences of obesogenic environments on individual lifestyle choices, and should aim at modifying such environments in ways that would make healthy choices easier. At the same time, interventions should promote a further decline in the underlying probability of overweight and obesity for new generations. However, our analysis of policies and interventions adopted by OECD and other EU countries seems to indicate that governments have been making great efforts in the latter direction, but have shown a lesser propensity to tackle aspects of the obesogenic environments in which people have been leading their lives in recent years. For instance, there appears to be a limited awareness of, or
willingness to intervene on, features of the political and economic environments which have contributed to
the growth in overweight and obesity. Limited attention has been paid to dynamics in price and availability
of different types of foods. Changes in physical environments and transport systems are contemplated only
in relatively few instances. There might be good reasons for not intervening in these areas. In some cases,
potential interventions may be ineffective, or they may eventually lead to welfare losses. It should not be
forgotten that obesogenic environments have often developed through changes that were perceived to
enhance individual or social welfare. However, any reasons for and against intervention should be made
explicit and open to challenge.

The role for governments, the private sector, and individuals

98. The findings of the policy survey showed that OECD governments have been very active,
particularly during the past 5 years, and have implemented a wide range of interventions at the national and
local levels. Governments have been taking action in response to calls by international organisations and
pressure by the media and the public health community, but without a strong body of evidence on the
effectiveness of different interventions, and virtually no evidence on their efficiency and distributional
impacts. The opportunity cost of resources used by governments to promote healthy diets and physical
activity may be high, and most governments have not yet engaged in open discussions of possible
rationales for intervention.

99. A potentially important contribution to tackling unhealthy diets and sedentary lifestyles has also
been made by the private sector, including employers, the food and beverage industry, the pharmaceutical
industry, the sports industry and others, often in co-operation with individual governments and
international organisations. However, robust evidence of the impact of private sector initiatives has not yet
been produced, and the modelling work undertaken as part of the project on interventions for which some
evidence of effectiveness is available suggests that individual interventions are unlikely to alter
significantly the scale of the obesity problem. This should not lead to the conclusion that the private sector
has only a limited role to play in the prevention of chronic diseases. On the contrary, combining
government and private sector initiatives is likely to enhance the impact of any prevention strategies.

Exploiting the “social multiplier” effect

100. The clustering of overweight and obesity within households, social networks, and possibly other
levels of aggregation, provides important insights on the trends observed in recent years and on possible
ways of tackling them. Project findings confirm the existence of what has been described elsewhere as a
“social multiplier” effect, which is very likely to have contributed to the rapid spread of overweight and
obesity throughout the OECD area. It has been calculated that a large proportion of the increase observed
in child obesity in recent years is a direct effect of increases observed in adult obesity. In economic terms,
this effect may be described as an externality, indicating that individual lifestyle choices are likely to have
an influence on other individuals’ lifestyles. The impact on other individuals’ health may be less direct in
this case than, for instance, in the case of passive smoking, but it is no less important. A strong indication
emerges that actions targeting individuals outside the social context in which they lead their lives are
unlikely to be very effective. A number of countries are increasingly promoting interventions involving
peer groups (e.g. school-based, or workplace interventions) or family members (e.g. children and parents).
These interventions may better exploit the “social multiplier” effect, turning it into a positive externality
which generates favourable influences on health behaviours among members of families and social
networks. In addition to providing better chances of interventions being effective in changing behaviours,
exploiting the “social multiplier” effect in the way just described may produce faster reductions in
overweight and obesity rates than interventions targeting individuals out of their social context.
Concerns for disparities in obesity

101. Many OECD countries have been concerned not only about the pace of the increase in overweight and obesity, but also about inequalities in their distribution across social groups, particularly by socio-economic status and by ethnic background. Our findings so far confirm the existence of important socio-economic gradients, which appear to have become wider over time. However, our findings also emphasise important gender differences in both socio-economic and ethnic inequalities in overweight and obesity. In particular, large inequalities across social groups are observed in women, while substantially milder inequalities, or none at all, are observed in men. Part of the difference between genders may be explained by a reverse causal link (obesity generates unemployment and low socio-economic status) which has been shown elsewhere to be significantly stronger in women than in men. Differences in lifestyles are also likely to contribute to explaining gender differences in socio-economic and ethnic inequalities. Acting on the mechanisms that make women in poor socio-economic circumstances so vulnerable to obesity, and women at the other end of the socio-economic spectrum much more able to handle obesogenic environments, is of great importance not just as a way of redressing existing inequalities, but also because of its potential effect on overall social welfare. The current distribution of obesity appears particularly undesirable, as it is likely to perpetuate the vicious circle linking obesity and disadvantage by intergenerational transmission.

The efficiency of preventive interventions

102. The findings of the economic analysis provide a number of important indications for policies aimed at preventing chronic diseases linked to unhealthy diets and sedentary lifestyles:

- Most of the preventive interventions evaluated as part of the project appear to have favourable cost-effectiveness ratios. Therefore, those interventions may be regarded as efficient uses of resources when their benefits are measured in terms of life years, or disability-adjusted life years gained, relative to a scenario in which no systematic prevention is undertaken and chronic diseases are treated once they emerge.

- However, cost-effectiveness ratios do not provide information on the scale of the overall effects and costs associated with preventive interventions. When such effects are considered, it is clear that none of the interventions assessed in the analysis may provide the means for a significant reduction of the scale of the obesity problem, if implemented in isolation.

- Although the most efficient interventions appear to be outside the health sector, health care systems can make the largest impact on obesity and related chronic conditions by selecting individuals at high risk and by using existing facilities, particularly in primary care, to deliver effective counselling. However, it is also possible that the outcomes of primary-care-based interventions appear superior to those of other interventions because a more detailed assessment of their impact on risk factors could be made in a clinical setting.

- Among the most important reasons for the limited overall impact of individual interventions are the difficulties involved in reaching large sectors of national populations through preventive interventions, and those involved in securing their active participation in such programmes. In fact, the interventions that are capable of reaching the largest numbers of individuals (e.g. mass media campaigns, or fiscal measures), are among those that appear to have the largest impacts, even if the effects of the latter interventions are smaller at the individual level.

- Interventions that target younger age groups are unlikely to have any significant health effects at the population level for many years. The cost-effectiveness profiles of such interventions may be
favourable in the long-term, but may remain very unfavourable for several decades at the start of the interventions.

- Preventive interventions do not always generate reductions in health expenditure, even when the analysis is limited to a set of diseases that are more directly affected by diet, physical activity and obesity. Individuals may live longer with chronic diseases, as a result of prevention, and may survive long enough to experience unrelated diseases which they would not have experienced otherwise.

- With the exception of fiscal measures, all of the interventions assessed in the economic analysis generate a requirement for additional resources to be made available within the health sector, in other areas of government intervention, or within the private sector. Most interventions appear to be efficient uses of such resources; however, a large part of those resources would need to be made available upfront, while health returns are often delayed. Governments should determine what level of resources (budgets) they are willing and able to assign to prevention, and they may use the findings of our economic analysis to assess what portfolio of interventions would make the best use of such budgets.

103. The cost-effectiveness ratios resulting from the economic analysis are generally favourable, but subject to a certain degree of uncertainty because of the heterogeneity and relatively wide confidence intervals of the estimates of effectiveness used as inputs in the modelling work. Although a range of sensitivity analyses confirmed that model estimates are relatively robust, the range of variation in potential inputs suggests that interventions need to be very carefully designed in order to achieve at least the same levels of effectiveness recorded in the studies referred to in the economic analysis, at no greater cost. Given the degree of heterogeneity observed among interventions documented in the existing literature aimed at tackling the same health-related behaviours in the same settings, and the variation in the outcomes observed, it is likely that the ways in which interventions are designed and implemented may significantly affect their results.

104. The findings of the economic evaluation strongly support one of the preliminary policy implications set out in OECD Health Working Paper 32, which indicated that tackling major risk factors for health, or chronic diseases linked to behaviours that are highly prevalent in a population, requires more than a single preventive intervention, however effective and broadly based it may be. Turning the tide of diseases that have assumed epidemic proportions during the course of the 20th century requires fundamental changes in the social norms that regulate individual and collective behaviours. Such changes can only be triggered by wide-ranging prevention strategies addressing multiple determinants of health. A prevention strategy can be devised by selecting an appropriate mix of interventions, which may provide an adequate balance between available resources, timing of expenditures and health effects, distribution of costs and health effects across population groups, and interference with individual choice, dimensions among which tradeoffs must be expected.

105. Although the contribution and cooperation of many agents is needed for the success of a prevention strategy, none of the agents potentially involved, at any point in time, is in possession of all the information, the tools and the power required for the planning of comprehensive chronic disease prevention strategies, and none of the agents is able to take a sufficiently long time perspective in its action to make such planning possible. The adoption of a “multi-stakeholder” approach is increasingly invoked by many parts as the most sensible way forward in the prevention of chronic diseases. While it must be recognised that the interests at stake are sometimes in conflict with each other, at least to a certain degree, it must also be acknowledged that no party is in a position to meaningfully reduce the size of the obesity problem and associated chronic diseases without full co-operation with other stakeholders.
The economic analysis contrasts the costs involved in implementing preventive interventions with the expected health outcomes of those interventions, without distinction as to the subjects who might bear the costs. The conclusion that many such interventions are efficient is based on the assumption that the health outcomes generated by the interventions are of value to those who bear the relevant costs, as it would be the case for governments that view the enhancement of individual and population health as one of the goals of their action. However, at least some of the costs of preventive interventions might be shifted onto the private sector, as long as those interventions generate outcomes that may be of value to potential payers. Initiatives taken by the food industry, for instance, in relation to self-regulation of advertising or nutrition labelling, have the effect of charging the industry with a significant portion of the cost of those actions (which may eventually be transferred onto consumers). Similarly, parents might be willing to pay for school-based initiatives from which their children could benefit. In summary, when government finances are too tight to permit long-term investments in preventive interventions, governments may seek co-operation with potential private payers, provided the appropriate incentives are in place for their participation.
REFERENCES


ANNEX 1: STRUCTURE OF THE MICRO-SIMULATION MODEL FOR THE ECONOMIC ANALYSIS

- **Distal risk factors**
  - **Physical activity**
    - $P_0$: adequate physical act
    - $P_1$: insufficient physical act
  - **Body mass index**
    - $N$: normal weight
    - $U$: pre-obesity
    - $V$: obesity
  - **Fat**
    - $F_0$: low fat intake
    - $F_1$: medium fat intake
    - $F_2$: high fat intake
  - **Fibre**
    - $Y_0$: adequate fibre intake
    - $Y_1$: low fibre intake
  - **Socio-economic status**
    - $I_0$: upper
    - $I_1$: lower

- **Intermediate risk factor**
  - **Blood pressure**
    - $Z_0$: normal
    - $Z_1$: hypertension
  - **Cholesterol**
    - $A_0$: normal
    - $A_1$: hypercholesterolemia

- **Proximal risk factors**
  - **Glycaemia**
    - $B_0$: normal
    - $B_1$: diabetes

- **Diseases**
  - **Cancers**
  - **Stroke**
  - **Ischemic heart disease**
ANNEX 2:
EXAMPLES OF VARIATION IN THE ESTIMATED COSTS OF PREVENTIVE INTERVENTIONS IN THE EUROPEAN REGION

Regulation of food advertising to children

Physician counselling in primary care

Fiscal measures
## ANNEX 3:
SUMMARY OF COVERAGE AND MAIN EFFECTS OF SELECTED PREVENTIVE INTERVENTIONS

<table>
<thead>
<tr>
<th>Target</th>
<th>School-based Intervention</th>
<th>Worksite intervention</th>
<th>Mass media Campaign</th>
<th>Fiscal measures</th>
<th>Physician counselling</th>
<th>Physician/dietician counselling</th>
<th>Food advertising regulation</th>
<th>Self-reg. food advertising</th>
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<tbody>
<tr>
<td>Age range</td>
<td>8-9</td>
<td>18-65</td>
<td>18+</td>
<td>0+</td>
<td>22-65</td>
<td>22-65</td>
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<tr>
<td>Restrictions</td>
<td>only schoolchildren</td>
<td>large employers</td>
<td>none</td>
<td>none</td>
<td>BMI ≥ 25 or high chol/blood pressure or diabetes</td>
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<td>Target as % of the population</td>
<td>2.3%</td>
<td>5.8%</td>
<td>79.4%</td>
<td>100%</td>
<td>7.22%</td>
<td>19.7%</td>
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<tr>
<td>% Pop. affected at steady-state</td>
<td>91.3%</td>
<td>7.2%</td>
<td>79.4%</td>
<td>100%</td>
<td>9.71%</td>
<td>97.9%</td>
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<td>Effectiveness</td>
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<td></td>
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<td>Fruit/vegetables (g/day)</td>
<td>+ 37.6</td>
<td>+ 45.6</td>
<td>+ 18.4</td>
<td>+ 8.6</td>
<td>-</td>
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<td>Fat (% of total energy from fat)</td>
<td>- 1.64</td>
<td>- 2.2</td>
<td>-</td>
<td>- 0.77</td>
<td>- 1.6</td>
<td>-9.8</td>
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<td>Physical activity (% of active)</td>
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<td>+ 11.9</td>
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<td>BMI (kg/m²)</td>
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<td>-</td>
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<td>0.83</td>
<td>2.32</td>
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<td>Systolic blood press. (mmHg)</td>
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<td>-</td>
<td>-2.3</td>
<td>-12</td>
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<td>Costs ($PPP)</td>
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<td>Per target individual</td>
<td>$112.95</td>
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<td>$210.82</td>
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<td>Per capita (whole population)</td>
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