The Role of Communication in Public Health Policies

THE CASE OF OBESITY PREVENTION IN ITALY

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BETTER POLICIES FOR BETTER LIVES

Health Division

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EXECUTIVE SUMMARY

This paper evaluates the evidence on the effectiveness of communication-based strategies to prevent obesity, unhealthy diets and physical inactivity. Specifically, the attention is focused on the enforcement of regulation of food advertising to children; on the implementation of food labelling schemes; on the introduction of menu labelling programmes in restaurants; on the introduction of physical activity prescriptions in the primary care sector; on the broader use of public health campaigns; as well as on encouraging healthy behaviours with the help of smartphone applications.

The reviewed evidence suggests that nutrition labels (both for foods sold in shops and in restaurants) are generally perceived as a highly credible source of information, and that they are effective in prompting consumers to make healthier food choices. Almost all OECD countries mandate the use of nutrition labelling on packaged foods, although the content and design of the *mandatory* labels varies between them.

In addition, there is ample evidence that regulation of food advertising is an important driver of food purchasing behaviour. Using information from nine experimental studies on children, the OECD has modelled an impact of a total ban of food advertising targeting children below 18 years of age on television, finding that for every 1% decrease of food commercials, there is a 0.99% reduction in calorie intake. Based on the average exposure to food advertisements by children living in OECD countries, a ban would potentially result in 4.16% reduction in total calorie consumption and about 1.86% reduction in body weight. The review also suggests that there is a positive impact of physical activity (PA) prescriptions on at least physical activity and BMI, although the evidence for other outcomes (e.g. blood pressure, diabetes) is more limited.

There are also numerous public health campaigns to increase public awareness about healthier nutritional choices in OECD countries, for example promoting fruit and vegetable consumption. A qualitative analysis was conducted of the impact of Change4Life (C4L) - an ongoing social marketing campaign established in 2009 in the UK to create awareness about tackling the obesity problem, through the promotion of healthy food choices and physical activity. Preliminary results suggest that the campaign was successful in reaching its target audience; that their logo is well recognized; that there was positive impact on the propensity of participants to switch to healthier foods.

The impact of these interventions on the health of the Italian population was carried out by using a newly built microsimulation model, assuming the start of the interventions in 2018 and their continuation until 2100. Food and restaurant menu labelling interventions were found to be the most cost effective, by having a large impact on the number of years lived without disease, as well as by having positive effect on health expenditures. On the other hand, mass media campaigns, smartphone apps and advertising regulations were less cost effective, although still representing value for money based on the conventional cost effectiveness thresholds.

This paper has demonstrated that several communication interventions can be very cost-effective, in particular in the context of Italy, where people eat out more regularly than in many other countries. In particular, based on the assumption that approximately 50% of people older than 20 respond positively to the intervention, menu labelling intervention was found to be approximately as cost-effective as food labelling; not only generating large gains in years lived without disease, but also potentially leading to big savings in health expenditures over time. Several other interventions, such as restricting food and beverage advertising targeting children on TV; smartphone applications and mass media campaigns promoting physical activity are also potentially very cost-effective.

In all cases, the impact of the interventions will take some time to materialize, which is especially true for the advertising campaign and smartphone apps, which are projected to become cost-effective only a few decades after their implementation. Prescribing physical activity by physicians was the only intervention not found to be cost-effective, which was mainly due to the limited coverage of this intervention, as well as its focus on middle-aged people who already have risk factors predisposing them to ill-health. Nevertheless, this conclusion was based on certain assumptions about the costs of running the intervention (i.e., about 90 Euros per targeted person). The intervention may become cost-effective if it is run more efficiently than assumed in the model.

1. Background

1. Communication-based approaches represent a significant share of disease prevention policies put in place by OECD countries, and may take a number of forms. For example, they can be employed as part of health promotion and social marketing campaigns aimed at changing behaviours adversely affecting health. They can also be used to support other disease prevention policies, such as enforcement of drunk-driving laws, as well aid health education campaigns targeting specific population groups such as school children or vulnerable groups. Communication strategies may also involve policies designed to regulate and restrict exposure of the public to the commercial marketing of potentially harmful products.

2. Although recently there has been a great increase in the use of communication strategies to prevent chronic illnesses, the evidence on their effectiveness and economic value is lacking. In this project, the OECD studies health and economic impact of communication programmes targeting prevention of obesity, unhealthy diets and physical inactivity. The evidence on the policy impact of various communication interventions comes from a variety of sources, some of which provide inputs to the newly built population-level microsimulation model. Although the project focuses on Italy, the analyses rely on evidence collected for other OECD countries as well.

3. This paper starts with a review of the effectiveness of various communication policies to prevent chronic diseases. The quantitative evidence collected was used to feed the microsimulation model, which in turn generated estimates of (cost)-effectiveness impact of these policies in preventing various adverse health events. A qualitative analysis of case studies of policies implemented in several high-income countries, with the objective of identifying key factors underpinning the success of the selected policies, was conducted.

4. The remainder of this report is structured as follows. Section 2 discusses existing options for communication-based public health interventions. Section 3 summarizes evidence on their effectiveness and cost-effectiveness. Section 4 describes three cases studies to analyse drivers of success in the implementation of best practices. Section 5 discusses policy implications of this analysis, and outlines the next steps.

2. Communication policies: what are the options?

5. Information and communication policies can potentially play an important role in affecting health outcomes. For example, there is widespread consumer interest in EU countries concerning the nutrition information on food packages (Grunert and Wills, 2007). There is also evidence that consumers adjust their behaviour when given relevant health-related information. For example, in Spain, high correlation was found between nutritional label use and healthier food purchases (Barreiro-Hurlé et al., 2010). In China, people diagnosed with hypertension reduced their fat intake per day by 7.7g upon receiving relevant health advice (Zhao et al., 2013, Hollands and Marteau, 2015). Children and adolescents are particularly vulnerable to the influence of unhealthy foods advertising, which is why it is often subject to additional restrictions (Lau et al., 2011).

6. Table 1 presents a summary of the main communication policies that have been identified in this paper, which can be divided into the following 6 broad categories: i) food labelling; ii) media restrictions; iii) public health campaigns; iv) nutritional advice and counselling; v) parental education and school curriculum; vi) advising in the workplace.

Table 1. Overview of communication policies to reduce obesity

Food labelling	
Nutrition label standards and regulations on the use of health claims and implied claims on foods	Nutrient lists on food packages
	Clearly visible 'interpretive' and calorie labels
	Menu labelling
	Shelf labels
	Rules on nutrient & health claims
Media restrictions	
Restrict food advertising and other forms of commercial promotion	Restrict advertising to children that promotes unhealthy diets in all forms of media
	Sales promotions
	Packaging
	Product placement
	Sponsorship
Public-health campaigns	
Inform people about food and nutrition through public awareness	Mass media
	Social marketing
	New technology (mobile app)
	Education about food-based dietary guidelines
	Community and public information campaigns
Clinic-based counselling	
Nutrition advice and counselling in health care settings	Nutrition advice for at-risk individuals
	Prescribing exercise as preventive therapy
	Telephone advice and support
	Clinical guidelines for health professionals on effective interventions for nutrition
Parental education and school curriculum	
Give nutrition education and skills	Nutrition education programme (parents and children)
	Food production skills
	Cooking classes (parents and children)
Advising in the workplace	
Set standards in specific settings	Workplace health schemes with physical activity

Source: OECD analysis, 2016

7. The main messages for each of these categories are as follows:

- Food-labels can be an effective, cost-effective and highly credible source of information for shoppers (Sacks et al., 2011, Campos et al., 2011). For example, a review of 58 studies conducted in 2003–2006 in the EU-15 countries found that there was widespread consumer interest in nutritional information on food packages (Grunert and Wills, 2008). Another review concluded that food labelling was associated with an approximately 18% increase in the number of people selecting healthier food products (Cecchini and Warin, 2016). Some evidence also demonstrates the positive impact of menu labelling in restaurants on healthier food choices (Pulos and Leng, 2010, Morley et al., 2013) as well as public support for such policies (Mah et al., 2013).

- Food advertising is an important driver of food purchasing behaviour and dietary intake, and therefore it is often subject to regulatory interventions. At present, almost all restrictions on the nutrition-related advertising apply to the marketing of foods and beverages for children and young adults, with a number of OECD countries tightening their regulation since 2011 (OECD, 2015). Studies suggest that statutory restrictions on commercial food advertising and promotion can have a significant effect on dietary intake, as in Quebec, where implementation of this policy was followed by a reduction in calorie consumption at fast-food restaurants of between 5.6 billion and 7.8 billion per year (Dhar and Baylis, 2011). Another study in Australia concluded that banning TV advertising for energy-dense foods during children's peak viewing times was highly cost-effective (Magnus et al., 2009). On the other hand, a recent systematic review concluded that voluntary pledges to restrict high-calorie advertising may not be as effective in reducing exposure of children to advertisements, which may be due to the lack of enforceability or penalties for non-compliance (Galbraith-Emami and Lobstein, 2013).

- A number of public health mass media campaigns to increase public awareness about healthier nutritional choices have recently been launched in OECD countries. For example, there is almost universal governmental promotion of fruit and vegetable consumption, not only of the well-known "5 a day" target (e.g. Chile, Germany, Italy, Mexico, New Zealand, Spain) but also of "6 a day" (Denmark), " 2+5 a day" (Western Australia), "Fruits & Veggies – More Matters" (United States) or "5-10" (France) (World Cancer Research Fund International, 2016). In France, the public health campaign "Eat Move" has been implemented since 2001 and is part of the National Nutrition and Health Programme (PNNS), spreading messages through mass media, informational videos, home advertising and a website (Manger Bouger, 2016). Still, empirical evidence on the effectiveness of these campaigns is limited. One recent example includes the Australian "LiveLighter" campaign, which has been encouraging healthy eating and being physically active with the help of free resources such as healthy recipes, meal and activity planner since 2012. The evaluation of the programme found increased and sustained levels of population-level awareness, compared to other obesity campaigns. The campaign was also found to be well-targeted (Morley et al., 2016).

- In recent years, public health promotion campaigns have increasingly been delivered through innovative communication channels, such as online marketing, social networks (e.g. Facebook or Twitter), or mobile applications. As this is only a recent development, rigorous long-term evaluations of these campaigns is still lacking. However, some evidence indicates that they can be effective. For example, about 58% of individuals targeted by the "Change4Life" (a health promotion campaign carried out in the UK) switched to lower fat dairy products, compared to 26% in the comparison group. In addition, a recent systematic review and meta-analysis concluded that the use of a mobile phone applications was related to a significant decrease in body weight of about 1 kg, corresponding to a drop in body mass index (BMI) of about 0.43 kg/m^2 (Mateo et al., 2015).

- Other communication-based interventions include nutrition counselling; education on the benefits of healthier lifestyle; as well as prescriptions of sessions of physical activity by healthcare workers. A recent meta-analysis found that school-based lifestyle interventions can lead to reduction of BMI of 0.054 kg/m^2 (Oosterhoff et al., 2016). Worksite interventions can aim to achieve nutrition improvements through changes in the selection of daily menus and snacks, integrated with a promotion of physical activity through discounts or reimbursement of health club annual fees. Thus, a two year Seattle-based multicomponent worksite program was found to increase consumption of fruit and vegetables by 0.3 servings a day (Afshin et al., 2015).

3. A quantification of the effectiveness of interventions

8. Based on the results of the review presented in section 2 of this report (Table 1), our focus is on selected number of policies, including i) enforcement of regulation of food advertising to children; ii) implementation of food labelling schemes; iii) introduction of menu labelling programmes in restaurants and cafeterias; iv) introduction of physical activity prescriptions in the primary care sector; v) broader use of public health campaigns; and vi) use of mobile apps. The reminder of this section describes, for each of the policies mentioned above, the characteristics of the modelled intervention, the process to collect and evaluate its effectiveness and the key drivers underlying the implementation costs.

i) Food labelling

a) General introduction

9. Almost all OECD countries mandate the use of nutrition labelling on packaged foods. The exceptions are South Korea, where the lists have to be provided for selected food categories only; Switzerland, where labelling is mandatory only for food sold in the EU; and Turkey, where labelling is mandatory only where a health claim is made. In the EU, Regulation 1169/2011 on the "Provision of Food Information to Consumers" has required that the following nutrients be listed at the back of the pack of most pre-packaged foods from 2016: energy value; the amounts of fat, saturates, carbohydrates, sugars, protein and salt. However, the content and design of the mandatory labels varies between countries, whereby some require information on added sugars or trans fats at the back of the panels, and others mandate special front package labelling of high salt content foods.

10. In addition to mandatory schemes, some voluntary initiatives have also been adopted recently. For example, in 2013 "Health Star Rating" front of pack (FoP) labelling initiative was approved in Australia, which requires participating businesses to disclose several macronutrients on packaging, both potentially harmful to health (energy, saturated fat, sodium and total sugars), and beneficial (fruit and vegetable content, dietary fibre and proteins). On the basis of this information, stars are assigned, ranging from 1 (least healthy) to 5 (most healthy). In Denmark, Norway and Sweden, the "Keyhole Labelling System" was launched in 2009, with stricter criteria coming into force in 2015. When a product has less fat, less sugar, less salt, more dietary fibre and whole grain, compared to other foods of the same type, the companies are allowed to put a keyhole logo on the front of the pack, assuming one or more of these criteria are met. One study found that about 95% of consumers were aware of the Keyhole Logo in Sweden, and that its purpose was also broadly understood, and could be used correctly to identify healthier food options within the same product category (Grunert and Wills, 2008).

b) Selection of the evidence

11. Selection of evidence to model the effectiveness of food labelling interventions is based on a recent systematic review by Cecchini and Warin (2016), who measured the effect of food labelling on the selection of healthier products, and on calorie consumption, by meta-analysing data from nine randomized trials. They also studied the effect of traffic-light schemes, a particularly easy-to-interpret food labelling system based on three colours to identify the amounts of unhealthy nutrients in the product, on food choices made.

c) Characteristics of the intervention;

12. The modelled intervention consists of statutory policy changes, requiring all manufacturers/retailers to provide information on the nutritional composition of foods sold in stores/supermarkets. Such information should either include nutrient lists, for example "informative" calorie labels, or clearly visible "interpretive" labels. This type of labelling aims to inform consumers

about the nutritional value of food products, and may either warn about potentially negative issues (e.g. on salt, sugar, saturated fats content), as well as highlight positive aspects (such as about dietary fibre and protein content). As a rule, it is applied to pre-packaged products, and may be attached to the front [i.e. front-of-pack (FOP)] or to the back [i.e. back-of-pack (BOP)].

d) Effects of the interventions

13. In a recent meta-analysis of randomized studies conducted by OECD (Cecchini and Warin, 2016), food labelling, relative to no intervention, was estimated to increase the average number of people making a healthier food choice by about 18% (CI: +11.24% to +24.66%). In addition, it was found that traffic lights were more effective [an increase of 29% (CI: 19.73% to 39.00%)] than other food labels [an increase of 15% (CI: 3.56% to 25.82%)] and Guideline Daily Amount (GDA) schemes (an increase of 12%; CI: 5.43% to 18.28%). Food labelling interventions were also found to lead to a reduction in average calorie intake by 3.59% (Cecchini and Warin, 2016), although the effect was not statistically significant (CI -8.9% ; + 1.2%).

14. Based on this information, food labelling was modelled to lead to a decrease in the average calorie intake by about 3.59%. However, the confidence intervals on this estimate are wide (between -8.9%; to +1.2%). In addition, this evidence only applies to shopping in supermarkets, and excludes calories consumed while eating out (in Italy, 80% of people are assumed to eat out at least once a week), as well as food purchased in smaller shops/farmer's markets. Therefore, we have made a simplifying assumption that this reduction will apply to 50% of calories consumed, i.e. the intervention will reduce calorie intake by 1.8%.

15. As our model relies on the impact of interventions on BMI (rather than calories consumed), we have used the following tool to convert energy intake changes into changes in BMI, by implementing methodology described in the Lancet article "Quantification of the effect of energy imbalance on bodyweight" (Hall et al., 2011): https://www.supertracker.usda.gov/bwp/index.html.

- Based on the average adult characteristics for Italy, a 1.8% reduction in energy intake over 100 days was estimated to lead to about 0.88% lower BMI. An important point is that this reduction is not absolute, but relative to the counterfactual of no intervention.

- After 100 days, the participants' new BMI is modelled to continue in parallel to the counterfactual old trend, but on a lower level, until the end of life. In other words, we assume that people will not only get used to processing the food labelling information during the introductory period of 100 days, but also will maintain this habit until the end of their life.

- The eligible population are everyone older than 20, but only two thirds of the population are assumed to be affected by the intervention (i.e. to read and act upon the information that will be on the food label).

- The cost is assumed to be 0.92 Euros per capita (constant 2017 Euros). It includes expenses on policy administration, planning and enforcement in the form of food inspections, but does not account for the additional costs associated with designing and printing nutrition labels and for the potential cost associated with the reformulation of certain foods, likely to be borne by the private sector.

- The intervention is modelled to last from the beginning of 2018 until the end of 2099.

ii) Regulation of advertising of unhealthy products to children

a) General introduction

16. Consumption of unhealthy foods may contribute to the development of overweight and obesity, and food marketing represents a key factor that incentivises the consumption of high-calorie and nutrient-poor foods through persuasive messages (Adams et al., 2012b). As children are usually not fully aware of marketing intent, and are incapable of critically interpreting marketing messages, regulating food advertising for them is often of particular importance. More persuasive techniques of marketing for children are developed through product placement in TV programmes, movies or in toys. There exist numerous examples of character licensing, celebrity endorsements or cellular-telephone text messages to influence children audience's choices (Nestle, 2006).

17. Food advertisements can be streamed through a variety of media, both traditional (e.g. television or radio) and modern (e.g. social network and mobile apps) (Chambers et al., 2015). However, despite the public health guidance put in place by the World Health Organization (2010b), only relatively few countries have implemented advertising restrictions to preserve healthy diet for children (Boyland et al., 2016). In the OECD, seven countries have tightened such restrictions since 2011, focussing mostly on marketing of potentially unhealthy foods and sweetened beverages directed to children and young adults (OECD, 2017). Some food manufacturers have adopted self-regulation, but it has been argued that it is not always sufficiently effective (Galbraith-Emami and Lobstein, 2013).

b) Selection of the evidence;

18. Several systematic reviews, summaries of evidence and meta-analyses (Boyland et al., 2016, Sadeghirad et al., 2016, Chambers et al., 2015, Cairns et al., 2013, Jenkin et al., 2014, Sonntag et al., 2015) have been selected as evidence to analyse the impact of food advertising bans. Sadeghirad et al's (2016) meta-analysis of randomized control trials (RCTs) indicates that exposure to unhealthy food marketing is related to an increase of dietary intake by about 30.4 kcal. Boyland's (2016) systematic review and meta-analysis likewise suggests that unhealthy food advertising increases food intake by the standardized mean difference of 0.37. Chambers (2015) concluded that statutory regulations of advertising can reduce the children's exposure to advertising for unhealthy foods, while the evidence on the impact of self-regulatory approaches is more varied. Cairns (2013) presented a retrospective summary of evidence, concluding that "there is a convergence of evidence […] indicating marketing is modifiable risk factor for children's health".

19. Other literature reviews and qualitative reports have also been analysed, e.g. (Kelly and King, 2014, Cairns et al., 2009, Hastings et al., 2003, Hastings et al., 2006, Livingstone, 2006, Dalmeny et al., 2003, Escalante de Cruz et al., 2004, McGinnis et al., 2006). Their analysis broadly supports the above-mentioned conclusions.

c) Characteristics of the intervention;

20. The intervention being modelled was defined as a total statutory ban of food advertisement on television, targeting children below 18 years of age, with the intent of limiting their consumption of unhealthy food. The intervention is assumed to be initiated by a government, and may include both regulatory and enforcement components, to support maintenance of healthier dietary patterns among children.

21. Similar interventions are already in place in Iceland, Sweden and Norway, through policies focussing on children under 12 years of age (World Health Organization, 2013). Chile, with a law fully implemented in 2016, combines advertising and food labelling restrictions at a school level, more recently

extending the advertising restriction to other media (e.g. cinemas, radio and on the internet). Countries such as Ireland and Mexico have implemented a ban on unhealthy food advertising in TV programs for children. France has established that any potentially unhealthy food and beverage advertising must be accompanied by a message emphasizing principles of dietary education (World Cancer Research Fund International, 2016).

d) Effects of the interventions;

22. Boyland's systematic review and meta-analysis (2016) of nine laboratory or school-based experiments represents the best evidence to translate food advertising bans into children's calorie intake change. Girls and boys were randomly selected at school and in summer camps: one group was exposed to unhealthy food or non-alcoholic beverage advertising on television, and another to non-food advertisement or a no-advertisement control. The maximum exposure time could vary between 10 and 40 minutes, with food commercials not to exceed 5 minutes. This is consistent with analysis by Kelly (2010), who found that, on average, there were maximum five food commercials per hour, totalling 2.5 minutes per hour.

23. We assume that a ban of advertising would produce, over a one year period, a reduction of calorie intake in children equal to a situation with non-exposure to advertisement on TV. Based on the evidence identified in the paper by Boyland (2016), an advertising scenario ban would result in a decrease of children's calorie intake of 26.9% in a random effects model (95% confidence interval [CI] 9.6 to 44.2). However, such a decrease is based on an average exposure to food advertising corresponding to about 27% of total screen time, which is significantly higher than the average exposure in the real world. For this reason, we modelled a meta-regression (Figure 1) where the percentage of unhealthy TV announcements on total stream time was added as an explanatory variable. The rate outcome of 0.99 [95% CI: 0.17 to 1.80] explains that for every 1% increase of food commercials as screen time, there is a 0.99% rise of calorie intake.

24. Kelly et al (2010) found that on average, across 11 (mostly OECD) countries, there were five food advertisements per hour per channel. Assuming each advert takes about 30 seconds, the advertising exposure corresponds to approximately (5*30)/3,600= 4.2% of total streamed viewing time. Next, according to our meta-regression, reducing this exposure to zero would result in 4.2%*0.99= 4.16% reduction in total calorie consumption, or in 1.86% reduction[1] in body weight[2] (Swinburn et al., 2006). Finally, given the distribution of height and weight among children in the UK[3], this reduction would correspond to about 0.31 kg/m^2 lower average BMI among this group. This is also consistent with a previous OECD study (Sassi, 2010a), where a reduction of BMI of between 0.13 to 0.34 kg/m^2 among children was estimated.

25. Results in other studies mostly agree with this analysis. Andreyeva (2011) estimated that TV advertising increases children's soft drink consumption by 9.4%, with a confidence interval that is close to the one analysed (CI 4.3 to 14.5)[4]. Magnus (2009) demonstrated how removing television advertising of high-fat and/or high-sugar food and beverages to children reduces the probability of consuming energy-dense and nutrient-poor food by 13% (CI 3 to 25), and decreases the likelihood of sweetened beverage consumption by 4% (CI 1 to 8). Furthermore, Magnus (2009) estimated that the modelled intervention would produce a reduction of 3% in the total daily energy intake[5], in line with Veerman (2009) study

1 According to Swinburn et al (2010), a 10% reduction in energy balance among children would lead to 4.5% reduction in body weight.

2 Given that the height is fixed, this also corresponds to 1.86% reduction in BMI.

3 http://www.rcpch.ac.uk/improving-child-health/public-health/uk-who-growth-charts/uk-who-growth-charts-0-18-years

4 Remember that our estimates predict that a ban on advertising would result in 4.16% drop in total calorie consumption- close to the lower bound of the above confidence interval.

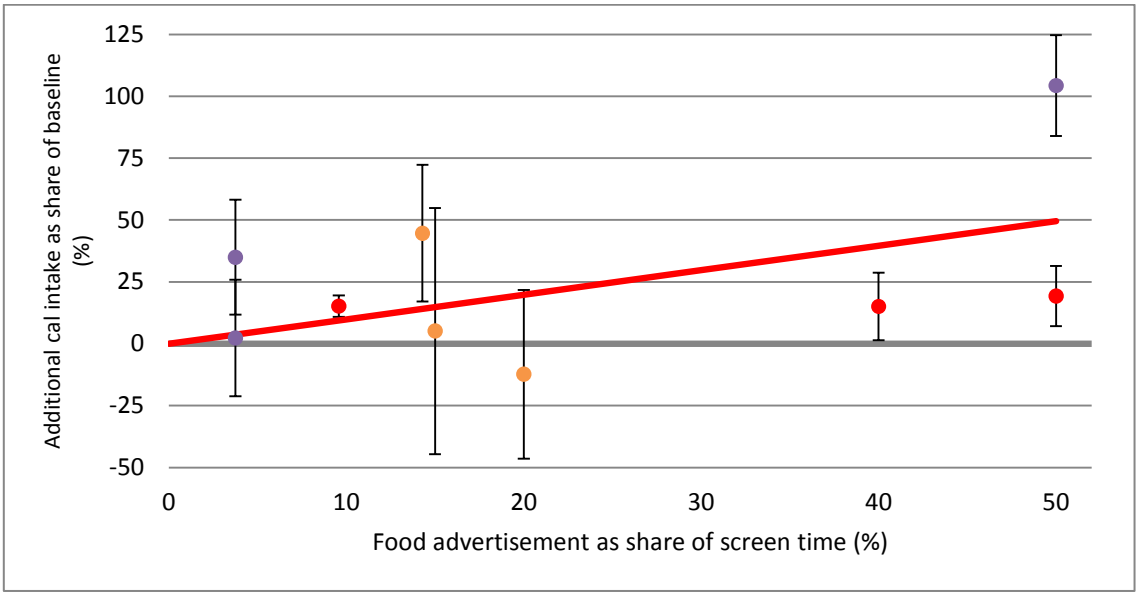
5 Again, this value is close to our estimated value of 4.16% drop in total calorie consumption which would result from the total advertising food ban for children.

where a total ban "would decrease total consumption by 4.5%". It's also notable that despite being estimated with different methodologies, the implied elasticities of BMI with respect to changes in energy are very close under food labelling and advertising restriction scenarios: in the former, it is 0.47, and in the latter it is 0.45.

26. Based on our meta-regression study, restricting food advertising to children aged between 5 and 18 is expected to result in the decrease of average BMI by 0.31 kg/m^2. The following time pattern is assumed in the microsimulation model:

- Gradual change in BMI with full effect reached after 1 year: -0.12 for children between 5 and 12 years (reached at 6 for most, then constant until 12), -0.31 between 12 and 18 years (reached at 13 for most then constant until 18).
- The new BMI is parallel to the upward trend that would have happened without the intervention.
- When children (previously exposed) reach the age of 18, they have linear decrease of effectiveness until reduction of BMI to 0.155 compared to counterfactual of no intervention, over 1 year, which then stay for the rest of life
- It is expected that the intervention will last from the beginning of 2018 till the end of 2099.
- The cost of the intervention is assumed to be 0.41 Euros per capita, i.e. it will apply to everyone in the population in the intervention scenario, and not just to children. This cost will include expenses on administration and planning 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.

Figure 1. Meta-regression for the impact of regulation of advertising



Note: the colour of the dots provides information about the contribution of each study in determining the meta-regression coefficient. The value of each study is weighted according to the number of participants. Studies with a higher number of participants have a higher weight compared to studies with a smaller sampling size. Red dots represent the three studies with the highest weight; violet dots represent the three studies with intermediate weight; while yellow dots represent the three studies with the lowest weight. Studies have similar weights: average weight 11.1% (min 6.5% and max 13.9%).

Source: Authors' analysis on Boyland (2016)

iii) Restaurant menu labelling

a) General introduction

27. Nutritional labelling of restaurant menus can be another instrument to empower health-conscious consumers[6]. In the UK, as of 2016, 45 businesses voluntarily committed, as part of the Government's Responsibility Deal, to providing nutritional information on their menus (World Cancer Research Fund International, 2016). In USA, all chain restaurants[7] will be required to clearly show calorie information on their menus in 2017 (World Cancer Research Fund International, 2016). Several municipalities and states in the US are already implementing related legislation. For example, in New York, chain restaurants are required to put a warning label for dishes that exceed 2,300 mg of sodium. In addition, from mid-2018, these regulations will also cover vending operators of at least 20 machines (World Cancer Research Fund International, 2016). In Australia, several states introduced legislation in 2016 requiring fast food outlets of certain size to display the energy content of their menu items (World Cancer Research Fund International, 2016). In Ontario, Canada, restaurants and other venues selling hot foods, with at least 20 locations, have been required to list calorie counts on their menus since January 2017[8].

28. After the introduction of labelling in six full-service restaurants in the Washington State, USA, there was a small drop of about 15 calories and 1.5 grams of fat per entrée sold (Pulos and Leng, 2010). This was also true for the chain restaurants there, as the introduction of labelling on the menus was found to lead to a significant decrease in the average amount of calories per purchase both in food and coffee chains, especially among women (Krieger et al., 2013). In Victoria, Australia, consumers who were exposed to menu labelling information selected meals with about 120 kcal lower energy content compared to the reference unexposed group (Morley et al., 2013). On the other hand, there was little evidence that the introduction of menu calorie labelling in New York City affected the amount of calorie purchased, although one study found that almost 28% of those who saw calorie labelling reported that this information affected their purchasing decisions (Elbel et al., 2009). Besides influencing consumer behavior, there is emerging evidence that mandatory menu labelling may encourage restaurants to reformulate their menus by offering lower calorie content (Block and Roberto, 2014, Bleich et al., 2015). The differences in results between some studies may be due to the type of labelling used, e.g. purely informative vs interpretive.

29. Indeed, the ideal format, placement and contents of menu labels still have to be determined. For example, several studies suggest that "informative" menu labelling with calorie content alone has no or little effect. However, when contextual (e.g. on the recommended daily calorie intake for an adult) or interpretive (e.g., traffic lights systems) information is given, menu-labelling appears to be more effective (Pang and Hammond, 2013, Ellison et al., 2013, Swartz et al., 2011).

30. Menu labelling may impact some subgroups differently. Thus, women seem to be more receptive to menu labels than men (Nikolaou et al., 2014, Swartz et al., 2011, Sinclair et al., 2014, Afshin et al., 2015). In Nikolaou's study (2014), more females (63%) than males (40%) reported being influenced by calorie-labels when choosing foods. Detailed research into specific socio-economic and demographic segments, e.g. the elderly (Feldman et al., 2011) is still missing. Furthermore, health and nutrition literacy, education (Fernandes et al., 2016) and preference for healthy eating (Vyth et al., 2011) may also impact the effectiveness of the labels.

6 Menu labelling involves listing information on the calorie content of items on the menu, as well as on the content of other nutrients, such as salt and sugar, at points-of-purchase of restaurants and cafeterias. This can be done with or without contextual information like recommended daily calorie intake, or interpretive information such as a traffic light system or PACEs (physical activity calorie equivalent) labels that indicate the number of minutes of exercise needed to burn off the calories consumed.

7 Defined as having 20 or more outlets.

8 https://www.ontario.ca/page/calories-menus

b) Selection of evidence

31. The evidence on this intervention was selected by reviewing papers referenced in 2 systematic reviews (Swartz et al., 2011, Sinclair et al., 2014), one meta-review (Afshin et al., 2015) and some more recent articles found through PubMed. Mainly two kinds of studies exist: those testing the effect of menu labelling on restaurant's *proposed* food items, and those testing the effect on customers' food *choices*. Available research would benefit from relying more on pre-post designs with control groups (Krieger et al., 2013, Thunström and Nordström, 2011). There are also not enough studies measuring long-term effect, or taking into account factors such as hunger, time pressure, costs and marketing practices, which may likely influence real-world behavior. Most studies included in this review have been conducted in the United States, and only few elsewhere (in the UK, the Netherlands, Australia, and Sweden).

c) Characteristics of the intervention

32. A statutory menu labelling intervention is comprehensively implemented in restaurants and other foodservice establishments (e.g., fast food places). The labelling has to be provided on the menus, and may include information on the calorie content of foods, as well as on other nutrients (e.g., sodium, fats, sugar). In addition to simply informing (e.g. on the total amount of calories per portion), such menu labels may provide some contextual information (e.g., on the recommended daily caloric intake for an average adult), and/or have an interpretive dimension (e.g. with the help of a traffic lights system; or with a warning sign).

d) Effects of the intervention

33. Of greatest relevance to us is the recent systematic review and meta-analysis by Sinclair et al (2014). The authors found that for all the studies combined, participants in the menu label group selected 43 fewer calories (P=0.03) and consumed 41 fewer calories (P=0.03) compared to the control group. However, when restricted to interventions where contextual (e.g. on the recommended daily caloric intake for an average adult) or interpretive (e.g. traffic lights) information was added, the effect on calorie consumption was a larger reduction of 81 kcal (P=0.007). On the other hand, labelling containing information only on total calories had no effect on calorie purchase/consumption. Finally, the authors concluded that the labelling interventions had stronger effect on women, although it was not clear what the magnitude of this effect modification was.

34. In a recent systematic review, Fernandes et al (2016) considered broad definition of menu labelling, going beyond total calories. Similar to (Sinclair et al., 2014), they concluded that qualitative information, such as health-food symbols and traffic-light labeling, was more effective in promoting healthy eating, than information labelling alone.

35. Based on Sinclair et al (2014), menu labelling with contextual or interpretive information is expected to lead to the reduction in the calories consumed (per purchase) of about 81 kcal.

- We calculated that, in Italy, people will eat out about every 3rd day(Censis, 2010), which suggests that they will be exposed to this intervention about 100 days a year.

- Given the same input parameters for the converting tool mentioned above[9], this will translate into 1.09% decrease of average BMI after 1 year of intervention (or 100 days of cumulative exposure a year). Again, this decrease in BMI will be relative to the counterfactual "business as usual" BMI.

9 https://www.supertracker.usda.gov/bwp/index.html

- Once their BMI drops by 1.09%, it will continue on the new, lower trajectory.

- We assume that the eligible population is all adults older than 20 years, and that 53% will be actually exposed to the intervention[10].

- The cost is assumed to be 0.92 Euros per capita. It includes expenses on policy administration, planning and enforcement in the form of food inspections, but does not account for the additional costs associated with designing and printing menu labels and for the potential costs associated with the reformulation of certain foods, likely to be borne by the private sector.

- The intervention is modelled to last from the beginning of 2018 until the end of 2099.

iv) Prescription of physical activity by primary care physicians

a) General introduction

36. The importance of physical activity (PA) policies was underlined in the "Global Recommendations on Physical Activity for Health" report, published by WHO in 2010 (World Health Organization, 2010a). Amongst other priorities, it proposed the implementation of PA-promoting policies in the primary care (PC) sector.

37. In the developed countries, up to 80% of the population visits their GPs at least once a year (Sanchez et al., 2015), implying that GPs may be ideally suited to provide advice on adequate PA levels. There is general consensus that PA interventions in the PC settings may increase PA levels of sedentary patients, at least in the short-term (Campbell et al., 2015, Orrow et al., 2012, Lin et al., 2010, Sanchez et al., 2015). At the same time, there are still significant gaps in the evidence base. For example, existing meta-analyses of the intervention do not take into account intensity of exercise, nor are such interventions always specific to the PC settings (Foster et al., 2005, Conn et al., 2011).

b) Selection of evidence

38. 15 systematic reviews were identified, of which 10 were found through one literature review of reviews published in 2015 (Sanchez et al., 2015). All references of the systematic reviews had been screened and, if considered relevant, extracted and categorized by intervention type. The evidence on the intervention effectiveness was collected from peer-reviewed articles with a randomized control trial (RCT) design. As the focus of this review is on patients with an increased risk of NCDs, only studies with populations having an elevated risk of NCDs were considered. This means, for instance, that the examined group would be overweight or obese, sedentary, hypertensive and/or with a family history of chronic disease. We did not exclude any age groups or geographical areas from the literature search. However, no study for children or adolescents was found.

c) Characteristics of the intervention

39. The modelled intervention had to be more than just a simple brief advice, and thus could include exercise on referral (ERS)[11] or exercise on prescription (EoP) schemes,[12] or another form of personalized counselling. Some parts of the intervention could take place outside the primary care sector, for example

10 This proportion consists of two parts: 80% of the population in Italy are assumed to be eating out regularly, and of this group, about 66% (two thirds) are assumed, in line with the food labelling intervention assumption, to care to read and act upon the menu labelling information.

11 Under ERS, patients are referred to a third provider (e.g. leisure centre), and subsequently can enrol in a PA program.

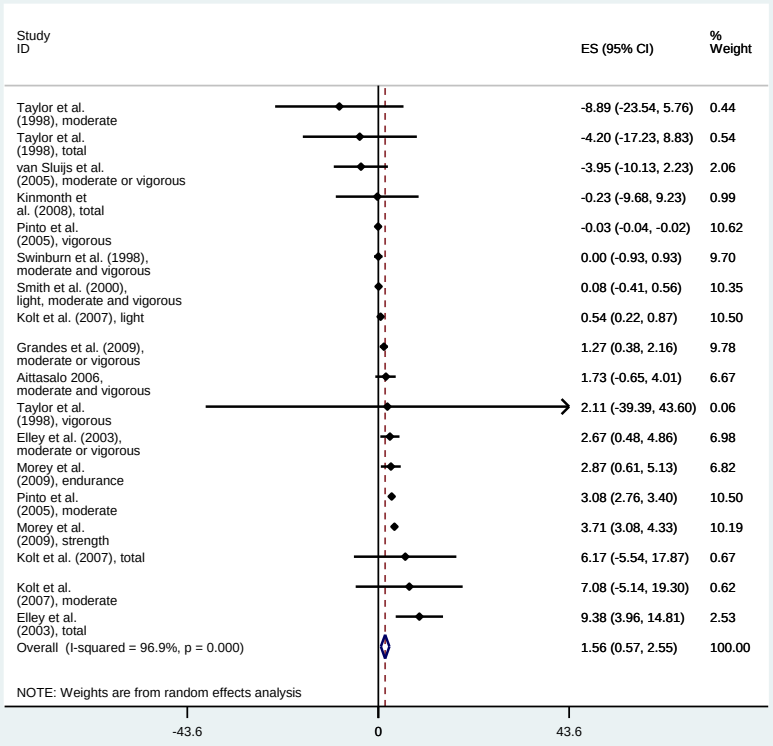
12 Under EoP, patients receive a prescription of PA by the GP. It includes an individualized exercise plan and can in some cases be linked to a third provider.

with the exercise program being run by a wellness provider. However, eligible studies had to be linked to the PC sector in a meaningful way (such as, for example, through being initiated there, or through at least one interaction between healthcare workers and the patients). The control group received either usual care or brief advice on the benefits of PA.

d) Effects of the intervention

40. Our main interest was in the effect of PA interventions on the amount of energy expenditure, expressed as METS*h/week. In 11 out 18 studies, interventions had a positive effect. Figure 2 below demonstrates that this translates into about 1.56 greater METS*h/week on average, with the effect being statistically significant.

Figure 2. Pooled estimation of METS*h/week



41. When the analysis was restricted to studies in which health professionals were actively engaged with the participants since the start of the intervention, the pooled effect was yet stronger, at 2.24 METS*h/week, or about 134.1 extra MET*minutes per week. Assuming the lower bound of 3 METs for moderate activity, this implies about 45 extra minutes of moderate-level exercise per week due to PA-promoting interventions. Such an increase would account for about a third of the 150 minutes per week of moderate exercise recommended by the WHO, which is certainly not a trivial amount. This was not the case when the studies were restricted to those where there was only some initial interaction between patients and healthcare workerless.

42. The intervention is modelled to have maximum effect (134.1 extra MET*minutes per week) after half a year, which then gradually wears off to zero by the end of the year. The eligible population includes, in line with the studies reviewed, population aged 40-70 years with at least one chronic condition/risk factor: overweight/obese; physically inactive; with diabetes (other conditions not supported yet by the

microsimulation model: hypertension; smoking; high cholesterol; high salt consumption). After the effect of the intervention wears off, still eligible individuals can again be randomly picked up for participation.

43. The participation is modelled to be 26.4% among the eligible pool, which is due to the three components gathered from the literature:

- primary care visiting in a year is assumed to be 80%;
- 60% of GP/practitioners are likely to participate in the PA-prescribing intervention;
- 55% of patients will respond positively to the prescription.

The cost of prescription has two components: 1) 0.68 euros per capita; and 2) 81.7 euros per target person. The per capita cost will come from expenses on program administration and on recruitment of doctors; while the target costs- from doctor-provided consultations; maintaining contacts with the participating patients; as well as, in some cases, expenses on health membership fees through third providers.

v) Mass media campaigns

a. General introduction

44. Various mass media (or social marketing) campaigns can be implemented to raise public awareness about the benefits of healthy diet and physical activity (Mozaffarian et al., 2012, Bauman et al., 2001). Health promotion through traditional (television, radio, newspaper) or new media (internet, social networks, mobile apps) is frequently introduced at a national level.

45. These campaigns are often implemented as part of a policy package, which may make evaluation of their effectiveness complicated (Afshin et al., 2015). Still, such studies do exist. For example, in Australia, LiveLigher campaign, which has been encouraging healthy eating and being physically active with the help of free resources such as healthy recipes, meal and activity planner, was found to increase population-level awareness, compared to other obesity campaigns (Morley et al., 2016). The evaluation of the 2+5 mass marketing campaign in Western Australia concluded that the program was successful in reaching the target audience and in increasing awareness about the importance of adequate fruit and vegetable consumption, and that it contributed to the population-wide increase in the mean intake of fruit and vegetable servings by about 0.2 over 3 years ($P<0.05$) (Pollard et al., 2008). In the UK, Change4Life social marketing campaign was found to be successful in reaching target audience, as evidenced by 58% people switching to lower fat dairy products compared to 26% in the comparison group.

b) Selection of evidence

46. A review of the literature identified a number of systematic reviews assessing the effectiveness of mass media campaigns. However, some of the existing reviews don't report effectiveness results (Lehnert et al., 2012, Beauchamp et al., 2014), while others don't share comparable outcomes (Camacho-Miñano et al., 2011, Metcalf et al., 2012). In a number of cases, mass media campaigns are assessed as part of more comprehensive interventions including other components. Finally, studies tend to report studies in heterogenous units of measures that do not allow a synthesis of the results.

47. Therefore, the effectiveness of this intervention is based on a new review of reviews of the literature. The first step was to identify a number of documents reviewing the effectiveness of mass media campaigns. In addition to the documents mentioned above, documents by McDaid et al (2015), Leavy et al (2011), Cavill and Bauman (2004), Kahn et al (2002), and Ezzati and Riboli (2013) were also considered.

Articles cited in each of these publications were retrieved and assessed with the objective to categorize their results according to the following dimensions: name of the campaign, type of media, target population, duration of the campaign, sample size, changes in awareness and in behavioural outcomes. Relevant information on level of PA and dietary improvements were also collected.

48. The selection process identified a number of papers that reported homogenous evidence that was used to assess the effectiveness of mass media campaigns (Bauman et al., 2001, Reger et al., 2002, Miles et al., 2001, Booth et al., 1992, Hillsdon et al., 2001, Reger-Nash et al., 2006, Reger-Nash et al., 2005, Reger-Nash et al., 2008, Brown et al., 2006, John-Leader et al., 2008, Craig et al., 2006, Craig et al., 2009, Matsudo et al., 2010, De Cocker et al., 2007, Sharpe et al., 2010, Berkowitz et al., 2008, Huhman et al., 2010, Stern et al., 1976, Foerster et al., 1998, Dixon et al., 1998, Stables et al., 2002, Reger et al., 1999, Jason et al., 1991)

c) Characteristics of the intervention

49. Our focus is on the effect of traditional media campaigns (radio, television, newspapers/magazines) on physical activity levels, and does not cover the impact of campaigns aired through the social media. We assume that the modelled intervention will include two 15-second television paid commercials, as in the mass-media campaign to promote physical activity in the state of New South Wales, Australia, in 1998 (Bauman et al., 2001). In addition, the TV commercials will be combined with some other resources, such as adverts in printed media, posters, leaflets, postcards, web sites and public relations events, as in the Active For Life campaign in the UK (Hillsdon et al., 2001). We assume that the mass media campaign intervention will cover all adults aged 18 years or older.

d) Effects of the intervention

50. In evaluating and summarizing studies, this report exploits Kahn (2002) method which relies on a "standardized abstraction form" to evaluate the intervention effectiveness. With this approach, different measurements for the same outcome variables can be used (e.g., number of times per week spent doing at least moderate exercise; self-reported physical activity scores; MET*hours per week exercising). The effect sizes were estimated as a net percent change from the baseline, according to one of the following three approaches, depending on the data availability:

a) The first, and the most desirable approach, is used when the study includes both intervention and control groups, and the measurement is performed both before and after the intervention. In this case, the measured effect is calculated according to the following formula:

$$\frac{I_{post} - I_{pre}}{I_{pre}} - \frac{C_{post} - C_{pre}}{C_{pre}}$$

b) The second approach is used if the study does not have a control group, and relies on pre and post measurements in the intervention group only:

$$\frac{I_{post} - I_{pre}}{I_{pre}}$$

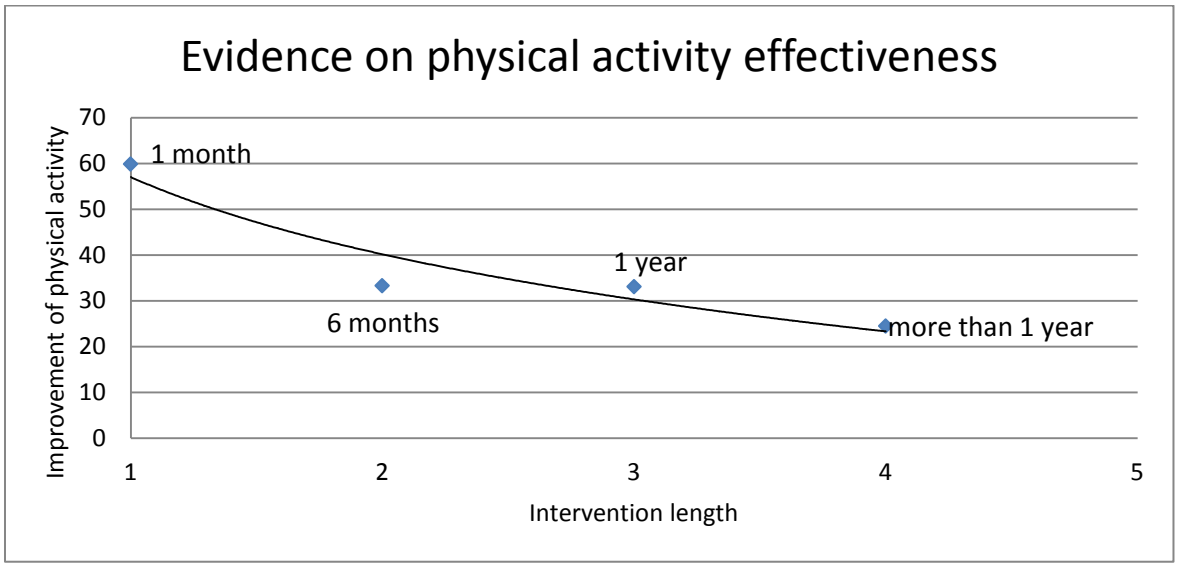
c) The third one is implemented if the study has both intervention and control groups, but no baseline measurements:

$$\frac{I_{post} - C_{post}}{C_{post}}$$

51. When we consider the evidence from all included studies, mass media interventions are found to increase physical activity levels by a median of 19%. However, when focusing on papers where outcomes include a defined threshold (Bauman et al., 2001, Reger-Nash et al., 2005, Reger-Nash et al., 2008, Reger-Nash et al., 2006, Reger et al., 2002, Miles et al., 2001, Hillsdon et al., 2001, Brown et al., 2006, Craig et al., 2006, Matsudo et al., 2010, De Cocker et al., 2007, Sharpe et al., 2010), mass media campaigns are found to increase physical activity by a median of 35.55%. In other words, after the mass media campaign, there will be about 35.55% more people who are considered "active", compared to the absence of the program.

52. Figure 3 below shows this evidence, adjusted for the duration of the campaign. The graph indicates a diminishing trend, with a high impact of health campaign in the first month (around 60% increase of physical activity compared to the baseline level); but after one year, the effectiveness falls to less than 25%.

Figure 3. Effectiveness of health campaign on physical activity



Source: OECD, Role of Communication in Public Health Policies, 2017

53. Finally, we only found two articles reporting separate results for men and women, with some evidence that mass media campaigns may more favourably affect physical activity of women than men (no gender differences in the effectiveness were found for the diet-related studies).

54. We also found that communication interventions are expected to increase consumption of fruit and vegetables by a median of about 13.8%. In addition, median consumption of at least five portions of fruit and vegetables a day is expected to increase by about 3.7%. We have also estimated that the mass media campaigns are expected to reduce the kcal intake by a median of about 6.9%. As this analysis is based on papers dated between 1976 and 2000, these results should be treated with caution.

55. Based on this analysis, mass media campaigns were expect to lead to an increase of 35.55% in the proportion of people who are at least moderately active, compared to the absence of the program. This increase is not in absolute percentage points, but in relation to the proportion of people who were at least moderately active at the beginning of the intervention.

- A linearly diminishing trend in the intervention effectiveness is assumed, with the maximum level achieved during the first month of the campaign (about 60% increase compared to baseline), which then diminishes to about 30% after 1 year, and then goes to zero after 2 more years.

- The campaign is modelled to cover all adults aged 18 years or older.

- The intervention is expected to run in 7 segments: between 2018 and 2020; between 2023 and 2025; between 2028 and 2030; between 2033 and 2035; between 2038 and 2040; between 2043 and 2045; between 2048 and 2050. Once a person has had an intervention, they will be eligible to participate again as soon as the effect of the previous wave is over.

56. As far as the costs are concerned, previous analysis done by the OECD has found that "estimated cost of per capita of a mass media campaign ranges between USD PPPs 0.5 and 2" (Sassi, 2010b), while Peterson (2008) found that they could reach $4.01 per person. Hillsdon et al (2001) reported that the whole expenditure for a six weeks campaign in the UK in 1996 was £2 million (or 2.81 $ US billion, using PPP conversion rates). The cost of the intervention in the model is 1.54 euros per capita. Almost two-thirds of this cost will be spent on broadcasting advertisements on national and local radio and television channels and on producing and distributing flyers and leaflets. The remaining resources are mainly devoted to hiring personnel to design, run and supervise the programme. We assume that public health specialists are involved in designing the prevention programme. Planning and administration costs are spread over a large target population.

vi) Smartphone Apps

a) General introduction

57. In the last five years, there has been a large increase in health-related applications (apps) available for smartphone devices, and it was argued that the development of the new generation of mobiles may represent a new frontier for obesity prevention and management (Wolfenden et al., 2010). The health-improving potential of these apps is still constrained by the low frequency of their usage: one study found, for example, that individuals use the applications only 2 or 3 days in a week, and that the time spent with health and fitness apps is only 3%; significantly lower than time spent by playing games (39%) or on social networks (24%) (Yoganathan and Kajanan, 2013). The uptake of mobile apps may depend on various factors, such as the spread and intensity of the marketing campaigns promoting their use, as well as any concerns about the privacy.

b) Selection of evidence

58. The review of the literature identified two meta-analyses on the effectiveness of mobile applications on weight reduction: by Flores Mateo et al (2015), and by Liu et al (2015). In addition, several systematic reviews on the effectiveness of mobile apps in terms of promoting obesity reduction were analysed (Aguilar-Martínez et al., 2014, Bacigalupo et al., 2013, BinDhim et al., 2015, Lau et al., 2011, Knight et al., 2015, Bardus et al., 2016, Siopis et al., 2015)

c) Characteristics of the intervention

59. The effect of a nation-wide introduction of a smartphone application promoting behaviours leading to weight reduction was modelled. For example, such applications can help individuals count the numbers of steps they walk in a day, or estimate calories consumed by providing nutritional information for various foods and beverages. Such applications can take advantage of various technological options, for example by linking calorie information to product barcodes that can be scanned by phones; by generating charts on trends in calorie consumption and physical activity levels; by providing information on the nearby health and wellness events/facilities; by promoting health behaviours through various rewards programmes. It is assumed that such interventions will rely on governmental marketing and promotion.

d) Evidence on effectiveness of mobile apps

60. A review of the literature identified two meta-analyses on the effectiveness of mobile applications on weight reduction. Flores Mateo (2015) demonstrated, in a meta-analysis of 12 articles, that the use of mobile phone apps was associated with significant changes in body mass index of -0.43 kg/m^2 (95% CI -0.74 to -0.13). Liu (2015) found that mobile phone intervention led to a significant reduction of BMI equal to 0.24 units (95% CI: −0.40, −0.08).

61. In addition, several systematic reviews on the effectiveness of mobile apps in terms of promoting obesity reduction were analysed. A wider review presented by Aguilar-Martínez (2014) showed that within 43 studies identified on the use of mobile app, SMS messages and web-based programs, there appears to be a correlation between weight loss and programme use. Bacigalupo (2013) concluded that there was good evidence on the efficacy of mobile interventions in encouraging weight loss, at least in the short run. On the other hand, BinDhim (2015) noted that 60% of studies they reviewed did not provide full information on the evaluated mobile apps. Some other authors, e.g. (Knight et al., 2015, Bardus et al., 2016, Lau et al., 2011) also noted lack of studies of sufficiently good quality.

62. As for the effectiveness of SMS text messaging, Bardus (2016) found that they can lead to a significant, moderate-sized pooled weight loss of 1.09-2.17kg. This was also supported by finding from another systematic review (Siopis et al., 2015), which concluded that "the weighted mean change in body weight in intervention participants was 2.56 kg (95% confidence interval = 3.46 to 1.65) and in controls 0.37 kg (95% confidence interval = 1.22 to 0.48)".

63. The intervention is modelled to affect individuals aged 15-64. We assume that the population coverage is 2.16%, which is based on the case study of Singapore (discussed in the following section). Specifically, the population of Singapore is 5.67 million. Of them, 73% (or 4.16 million) are aged 15-64. 156,000 signed up to the smartphone application provided by the government, which represents approximately 3.75% of 15-64 age group there[13]. Given that smartphone penetration rate in Italy relative to Singapore is about 0.576, the sign-up rate in Italy is assumed to be 3.75%*0.576= 2.16%.

64. Based on meta-analysis by (Flores Mateo, 2015), mobile apps use was associated with the drop of BMI by 0.43, or about 1.67% relative to average BMI in the Italy population. We also know from the Singapore case study that approximately 60% of those who signed up were active after 4 months; 20% active after 1 year, and 0% after 2 years. Based on this, we assume 1.67% drop in BMI for 20% of participants (achieved after 1 year). For the rest, we make a simplifying assumption that there will be drop of BMI half this size (0.84%), and that it will take place gradually in the year of the intervention. After the end of participation in the intervention, people will gradually revert to their older BMI (within 1 year)

13 We assume here that the absolute majority of those who signed up for this application were aged 15-64.

65. The intervention is assumed to cost 0.44 Euros per capita, which should cover the cost of developing/updating the application, marketing it nationwide, as well as storing/processing the data generated by the application use.

66. Table 2 summarizes the main characteristics and the effectiveness of the interventions included in this analysis. The majority of these interventions, with the exception of regulation of advertising, target the adult population. This is a direct consequence of the focus of this document which looks at communication policies, rather than education policies. The interventions vary quite widely also in terms of the behavioural change they want to trigger, the type of behaviour they target (e.g. purchase of pre-packaged food, purchase of food consumed in restaurants, support of an active lifestyle, etc.) and the media that is used to deliver the intervention. More specifically, this analysis tried to comprehensively assess communication campaigns delivered through traditional media (e.g. radio, TV), printed material, food products and new media (i.e. mobile apps).

67. In addition, Box 1 provides a brief summary of the main details of the microsimulation model used to quantify the impact of these policy interventions.

Table 2. Summary of coverage and the main effect of selected communication interventions

	Food labelling	**Regulation of advertising**	**Menu labelling**	**Prescription of PA**	**Mass media campaigns**	**Mobile apps**
Target age	>20 y.o.	Between 5 and 18 y.o.	> 20 y.o.	40-70 y.o., with at least 1 chronic condition/risk factor	>18 y.o.	15-64 y.o.
Target % coverage	66%	100% of children	53%	26.4%	Everyone who is not at least moderately active	2.16%
Effectiveness	0.88% lower BMI	-0.12 BMI (between 5 and 12 y.o.) -0.31 BMI (between 12 and 18 y.o) -after 18: -0.155 BMI	1.09% decrease of BMI after 1 year of intervention	134.1 extra MET*minutes per week, lasting 1 year	60% increase in at least moderate activity after 1 month; 30% after 1 year, 0 after 2 years.	0.43% (1.72%) will experience reduction of BMI of 1.67% (0.84%) after 1 year, then the effect goes to zero after 1 more year.
Cost per capita	0.92 Euros	0.41 Euros	0.92 Euros	0.68 Euros	1.54 Eros	0.44 Euros
Cost per targeted person	n/a	n/a	n/a	81.7 Euros	n/a	n/a

Box 1. The modelling platform

The effect of the interventions was modelled using a stochastic Monte Carlo discrete-event microsimulation model. The modelling platform is developed in C++. The model projects individual life histories starting from 2014, with each person potentially living up to a maximum of 100 years (although most will die much sooner than this). One can select both the size of the population to be modelled, as well as the projection timeframe. All state transitions occur in yearly cycles.

The model requires a number of age and gender-specific parameters. One set of parameters (e.g., birth rates and general mortality rates; population size) allows projection of general population changes over time. The second set relates to incidence, prevalence, relative risks for diseases for a set of risk factors such as high BMI and lack of physical activity. The third set reflects a disease burden (e.g., incidence, prevalence, case fatality; remission rates; disability weights) of several conditions, such as diabetes, myocardial infarction; ischemic stroke; haemorrhagic stroke; colorectal cancer; breast cancer; back pain. Most of epidemiological evidence for the model has come from the Global Burden of Disease project, implemented by the Institute for Health Metrics and Evaluation.

In the model, risk factors such as high body mass index and inadequate physical activity have a direct influence on the probability of developing chronic diseases through known pathophysiological mechanisms. Individuals are initially randomly assigned a risk factor status, and their waiting times for disease and mortality events are a function of their age, gender as well as risk factor profile. For the years in which epidemiological data is available, the model also makes sure that the modelled epidemiological profile of the population is as close to the actual one as possible. The model accounts for mortality from all causes of death, and assumes that mortality associated with diseases that are not explicitly modelled remains stable at the rates currently observed in the relevant populations.

In the business as usual scenario, the model projects country-specific population, risk factor and disease trends into the future under the assumption that no new policy is implemented beyond the policies that are already in place. Under intervention scenario, relevant risk factors are amended based on the available epidemiological evidence pertaining to the efficacy of specific interventions.

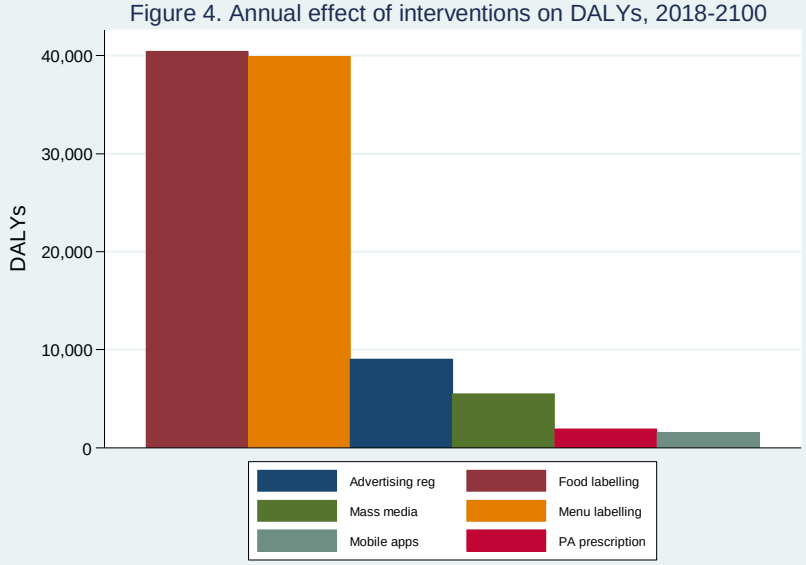
Effectiveness of interventions is modelled on three dimensions: efficacy in changing behaviours and risk factors, coverage (i.e. share of the population covered by the intervention) and time to steady state. Food and menu labelling, advertising restrictions and mobile apps were modelled to affect changes in the body mass index. Mass media campaigns and prescribing physical activity interventions were modelled to affect changes in the physical activity levels. In turn, these risk factors affected the changes in the burden of diabetes, myocardial infarction; ischemic stroke; haemorrhagic stroke; colorectal cancer; breast cancer; back pain. Finally, each policy scenario is compared with the baseline scenario to estimate the net effects produced by the policy changes. Costs are reported in constant Euros, with 2015 as the base year. Where appropriate, future costs and benefits are discounted using a 3% discount rate.

4. Main results

68. In this section, we compare the effect of the modelled interventions on several outcomes of interest. In Figure 4, we show the effect of the intervention (relative to the baseline "things as usual" scenarios) on the number of disability-adjusted life years (DALYs) gained.[14] We find that menu and food labelling interventions are in their own league, each contributing to many more DALYs gained than the other interventions. This is mostly due to our assumption that they will affect very large proportion of adult population, and that the effect will last a lifetime. On the other hand, small effect of PA prescriptions and mobile apps is down to the fact that only relatively small parts of the population are exposed in the model, and that the effect will be limited to a short period of time.

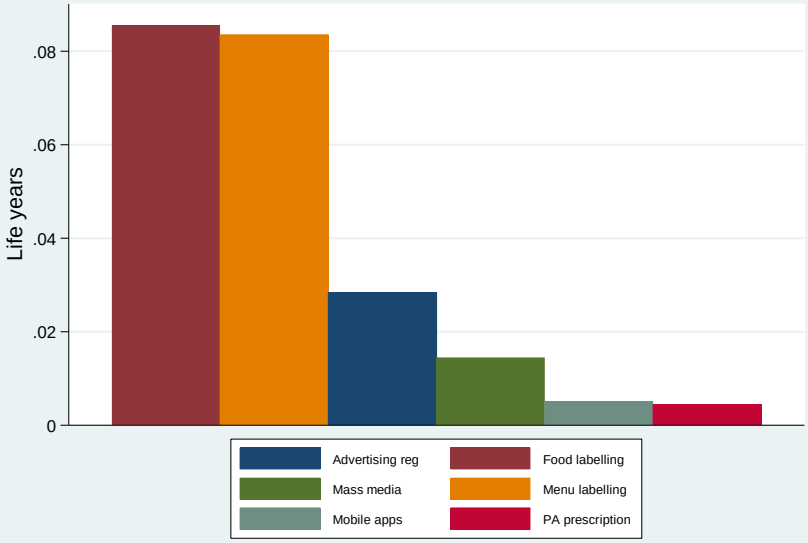
14 Note that our focus in this paper is in on the DALY *gain* resulting from the implementation of interventions, rather than on *loss*, which is traditionally a measure of the disease burden.

Figure 4. Annual effect of interventions on DALYs, 2018-2100



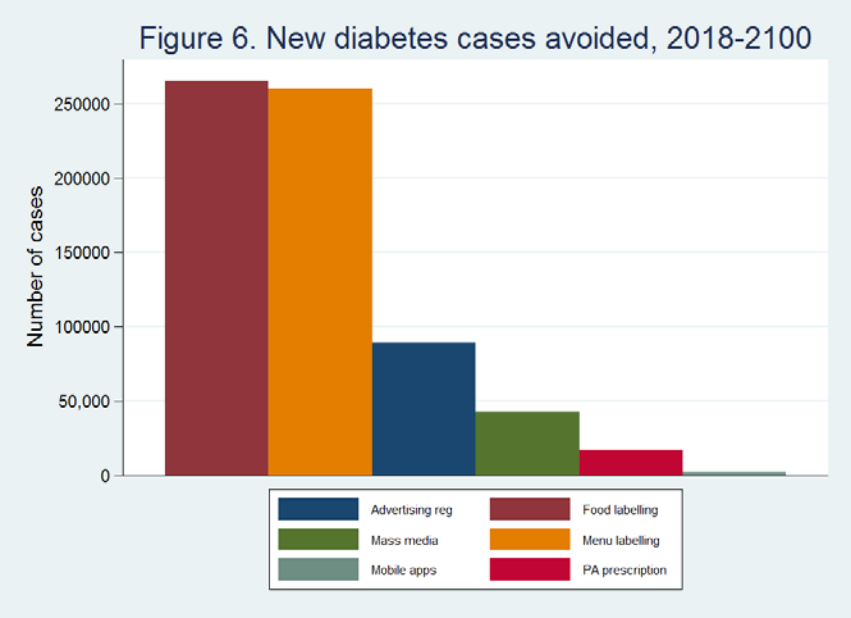
Source: OECD analysis on the microsimulation model relying on input data from multiple sources. Each bar shows the effect of a corresponding intervention on DALYs gained per year, undiscounted.

Figure 5. Annual effect of interventions on life years gained, 2018-2100

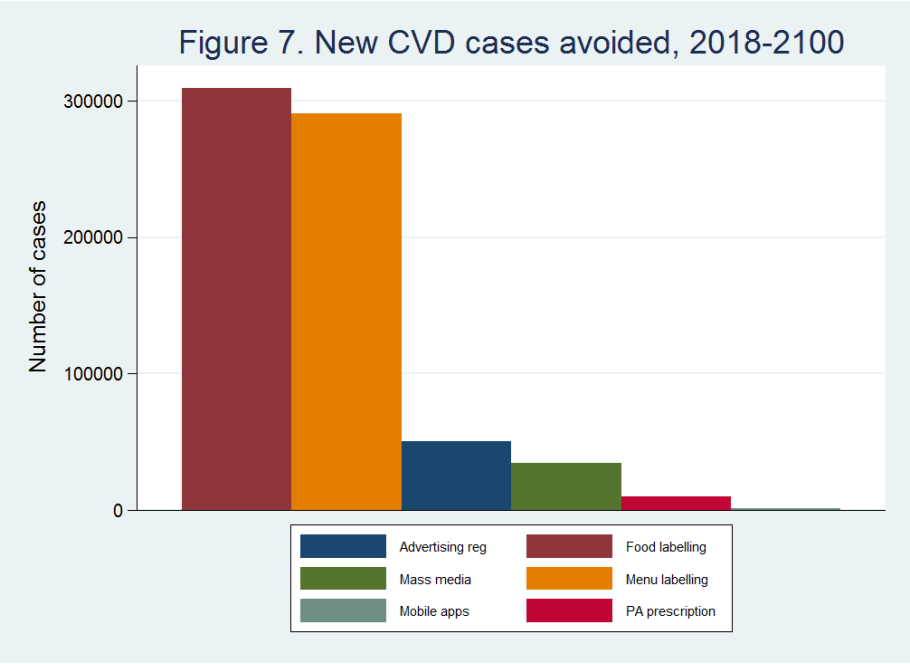


Source: OECD analysis on the microsimulation model relying on input data from multiple sources. Each bar shows the effect of a corresponding intervention on life years gained per year, undiscounted.

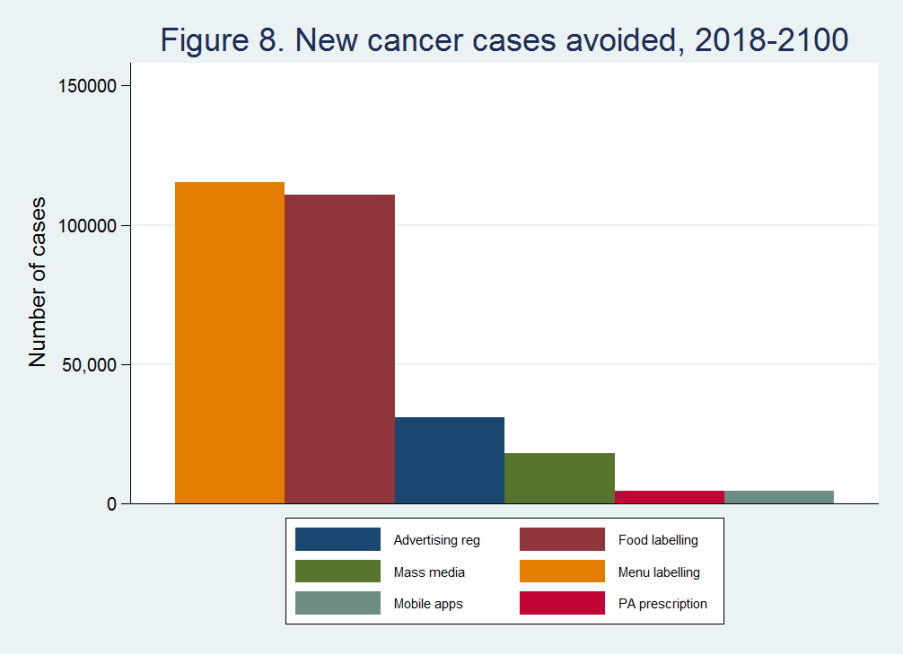
69. Next, in Figure 6-9, the modelled effect on several other outcomes is shown. Specifically, menu and food labelling interventions are predicted to be the most successful in reducing the number of new CVD (i.e., myocardial infarctions and strokes), cancer (breast and colorectal cancer); diabetes as well as back pain cases. Advertising restrictions are also predicted to be successful in helping avoid a relatively large number of back pain, CVD and cancer cases.



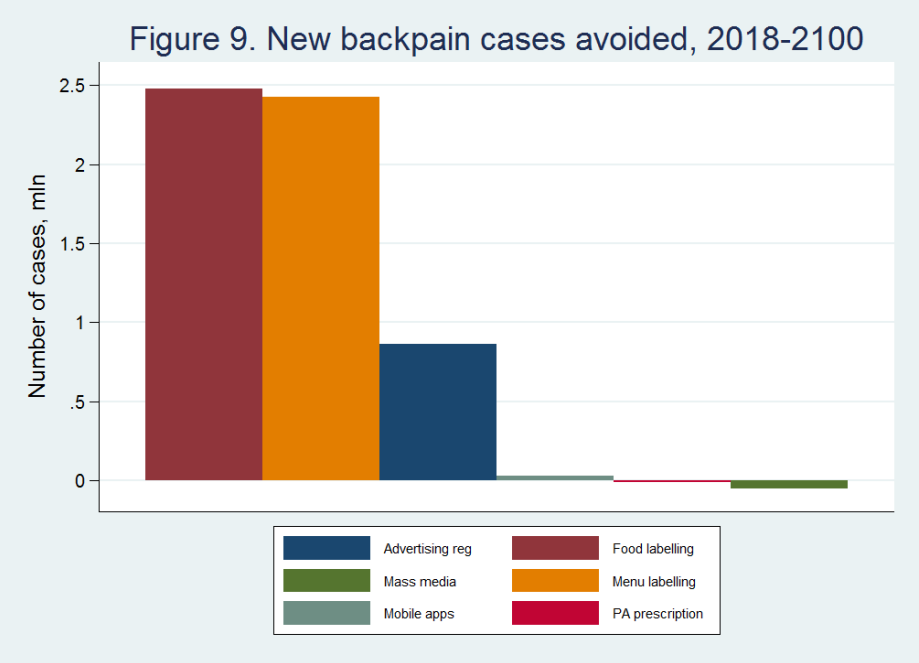
Source: OECD analysis on the microsimulation model relying on input data from multiple sources. Each bar shows the effect of a corresponding intervention on diabetes cases prevented, undiscounted.



Source: OECD analysis on the microsimulation model relying on input data from multiple sources. Each bar shows the effect of a corresponding intervention on CVD cases prevented, undiscounted.



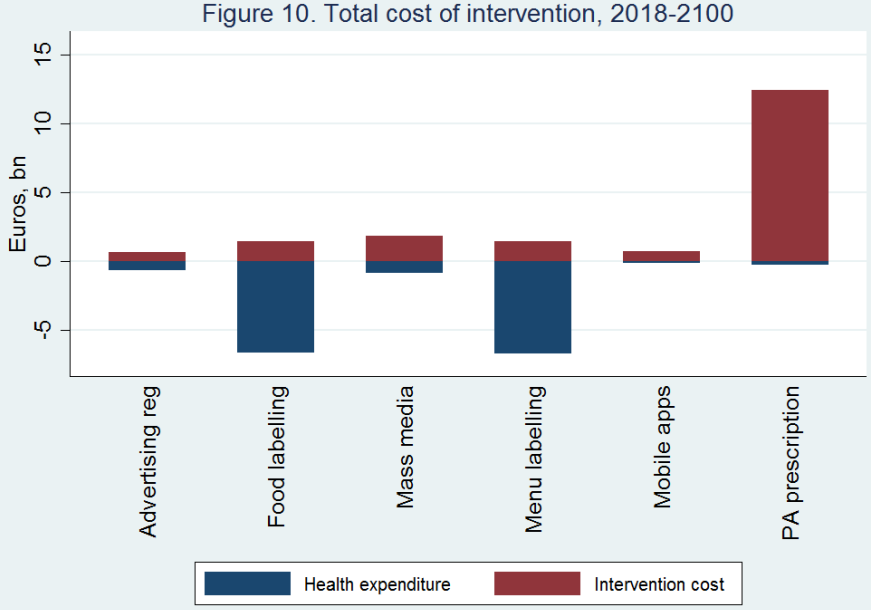
Source: OECD analysis on the microsimulation model relying on input data from multiple sources. Each bar shows the effect of a corresponding intervention on cancer (breast, colorectal) cases prevented, undiscounted.



Source: OECD analysis on the microsimulation model relying on input data from multiple sources. Each bar shows the effect of a corresponding intervention on back pain cases prevented, undiscounted.

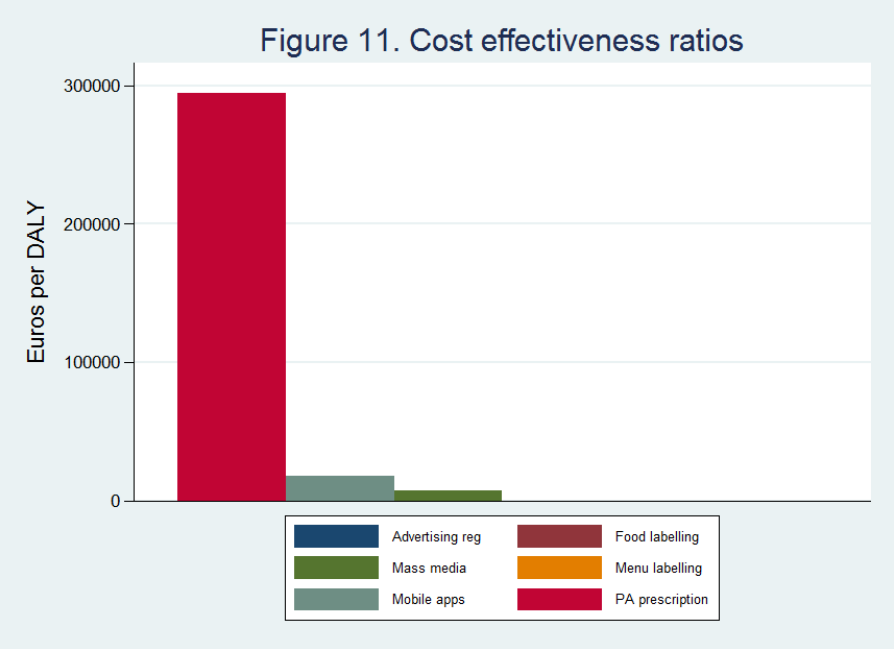
70. In Figures 10-11, the evidence on the economic value of the modelled interventions is shown. PA prescriptions are predicted to be the most expensive, while restrictions on advertising and mobile apps- the least. Food and menu labelling are again in their own league, as the amount of savings to the healthcare system from their implementation is predicted to significantly exceed the cost of running them. As they were also shown to generate a large increase in DALYs gained, they are therefore predicted to be dominant in terms of their impact on cost effectiveness (Figure 11). On the other hand, while advertising, mass media and mobile apps are also predicted to be cost-effective, this is not the case for PA prescriptions, which have an incremental cost-effectiveness ratio (ICER) significantly above the commonly accepted thresholds[15]. Figure 14 shows that interventions in general become more cost effective as time passes since the beginning of the intervention implementation. This makes sense, as the mostly unchanging costs of running the interventions are more than outweighed by the increasing benefits accrued over time.

Figure 10. Total cost of intervention, 2018-2100



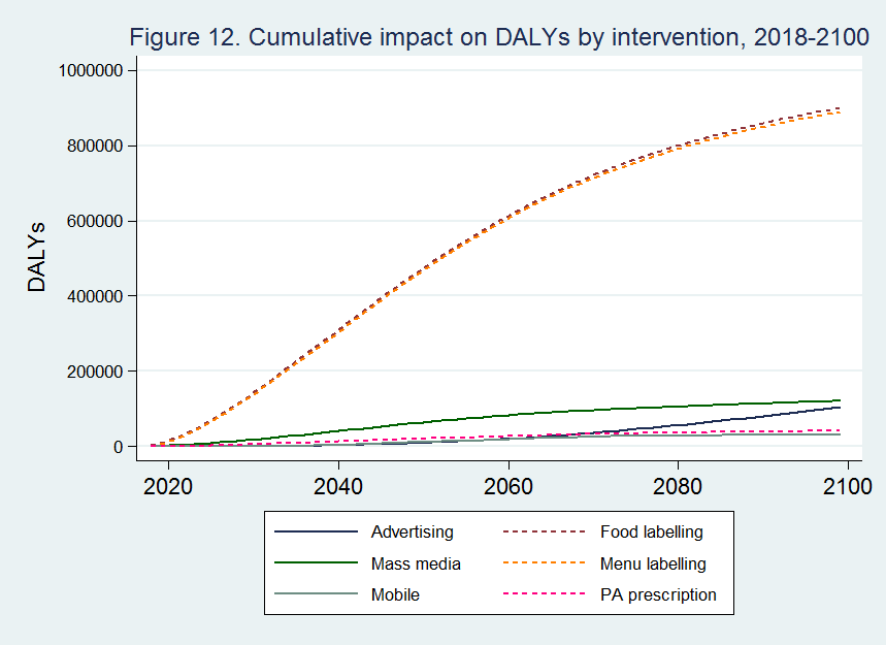
Source: OECD analysis on the microsimulation model relying on input data from multiple sources. Each bar shows the effect of a corresponding intervention on two types of costs: on health expenditures and costs of intervention. All costs are summed up over 2018-2100, and discounted at 3% per year.

15 For example, in the UK, the threshold for approving medical technologies for reimbursement is around 30,000 British pounds per QALY gained.

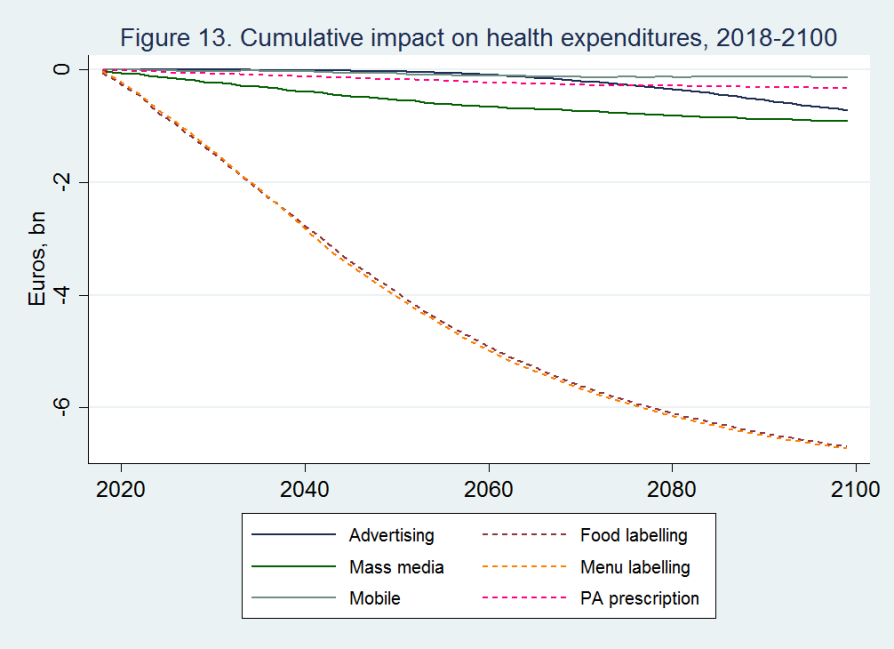


Source: OECD analysis on the microsimulation model relying on input data from multiple sources. Each bar shows the cost-effectiveness of a corresponding intervention in terms of total cost of an intervention divided by the total DALYs gained, over 2018-2100. All future costs and DALYs are discounted at 3% per year.

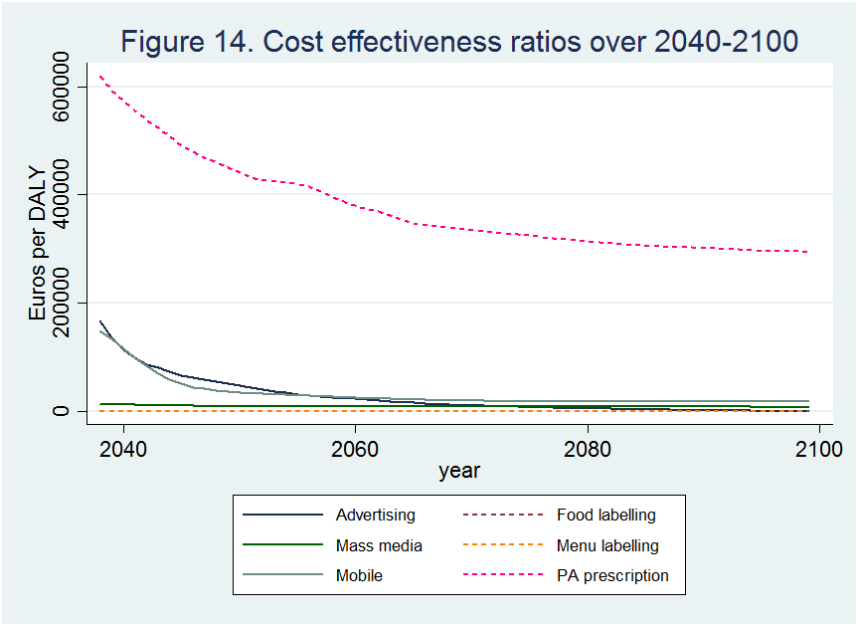
71. Finally, in Figures 12-13, cumulative impact of the interventions on the two outcomes of interests- DALYs gained and healthcare expenditures – is shown. The gap between food and menu labelling and the other interventions in terms of their effect on this outcome grows over time, although at a declining rate.



Source: OECD analysis on the microsimulation model relying on input data from multiple sources. Each line shows the cumulative effect of a corresponding intervention on DALYs gained over 2018-2100. All future DALYs are discounted at 3% per year.



Source: OECD analysis on the microsimulation model relying on input data from multiple sources. Each line shows the cumulative effect of a corresponding intervention on health expenditures (excluding intervention costs) over 2018-2100. All future costs are discounted at 3% per year.



Source: OECD analysis on the microsimulation model relying on input data from multiple sources. Each line shows the cumulative effect of a corresponding intervention on health expenditures (excluding intervention costs) over 2018-2100. All future costs are discounted at 3% per year.

5. Case studies in communicating healthy lifestyles in OECD and beyond

72. The focus of this paper so far has been on the quantitative evaluation of the effectiveness and cost-effectiveness of several communication policies. In this section, this analysis is complemented by qualitative assessment of three related cases studies: the Change4Life mass media campaign in the UK; the Interactive Diet and Activity Tracker in Singapore; and Guadagnare salute 'Gaining in health' (GiH) campaign in Italy. The main objective is to identify key successful factors underpinning the success of selected policies, as well as to provide examples of how the interventions can be implemented in the real-world setting.

i) The Change4Life mass media campaign: a case study from the United Kingdom

a) General introduction

73. Change4Life (C4L) is an ongoing social marketing campaign established in 2009 to tackle the obesity problem, through the promotion of healthy food choices and physical activity (Levy, 2013). C4L is a preventative, not curative policy, designed to provide healthy-eating advice, with tips for reducing alcohol intake and helping families to find local activities. Both children and adults are targeted through press, radio advertisement campaigning and a website.

b) Design

74. Change4Life promotes more healthy weight through a programme of eight behavioural changes:

a) reducing their intake of fat, particularly saturated fat (Cut Back Fat)

b) reducing their intake of added sugar (Sugar Swaps)

c) controlling portion size (Me Size Meals)

d) eating at least five portions of fruit and vegetables per day (5 a Day)

e) establishing three regular mealtimes each day (Meal Time)

f) reducing the number of snacks they eat (Snack Check)

g) doing at least 60 minutes of moderate-intensity activity per day (60 Active Minutes)

h) reducing time spent in sedentary activity (Up and About).

75. For example, parents can fill in a voluntary questionnaire about a typical day of their children ('How are the Kids?'), which lets them receive tailored suggestions. When results indicate unhealthy behaviours, parents are invited to encourage children to take action based on the above components.

76. Eight steps have been defined in consultation with experts, medical officers, phycologists and public authorities like Food Standards Agency. The Government decided to avoid a visible involvement in the campaign, to guarantee the idea of a bottom-down movement where the main actors are children and their families. To promote a positive and proactive message to the audience, the word "obesity" was taken out from the brand name.

77. When a customer decides to sign up to the C4L website, a free package is delivered containing various materials, including meal plans and recipes to increase consumption of fruit and vegetables, fridge magnets, a smart swapper and money off vouchers, helping them to take simple steps to swap the unhealthy behaviours for more healthy ones. Printed flyers and online C4L resources have been produced, and all materials are available with guidance on healthy eating and physical activity behaviours. In addition, several different programmes have been implemented, including actions to combine the increase of physical activity and fun (Let's Dance with Change4Life, Bike4Life, Walk4Life), to involve pregnant mothers (Start4Life), ethnic minority communities and at-risk families, to promote healthy diets (Be Food Smart) and to make small changes in food purchases (Smart Swaps).

78. In addition, the C4L website provides suggestions on healthy eating and practising physical activity more regularly, with campaigns like Start4Life; Get going every day; Active travel; among others. C4L also takes advantage of modern technology through the use of smartphone applications that promote physical exercise or diet monitoring, through a number of applications that have been developed over the last 6 years.

- For example, during the "Smart Swaps" campaign, mobile applications were collecting data on daily consumption of sugar-containing foods to give a clear snapshot or reminders;

- To help everybody from beginners to experts, to encourage running as a physical activity, a free application "Couch to 5k" was developed, helping to prepare to a 5K run.

- "Easy Meals" and "Meal Mixer" applications helping and encouraging people to eat healthier foods, by suggesting meal plans, were developed.

c) Implementation and impact

79. DH Communications Directorate has reported that the campaign reached families as planned. 87% of mothers with children under 11 years of age knew about the Change4life campaign and 88% of the interviewed mothers were aware of the campaign logo. Also, success of national television advertisements was testified by their reaching more than 90% of lower socioeconomic mothers in England. "Meal mixer" and "Recipe Finder" have been viewed by hundreds of thousands families (Levy, 2013). This progress in awareness and coverage was reported to continue in the following years, with a large number of primary schools, hospitals, general practices, town and village halls, children's centres, pharmacies, nurseries, libraries and leisure centres displaying Change4Life materials.

d) Effectiveness

80. Several studies evaluated the effectiveness of various components of the campaign. Wrieden and Levy (2016) published a paper to evaluate "Smart Swaps" campaign results. After three weeks since the beginning of the action, 58 % of participants had swapped to a lower-fat dairy product compared with 26% of the comparison group ($P<0{\cdot}001$), 32% of the intervention group had purchased a lower-sugar drink compared with 19% of the comparison group ($P=0{\cdot}01$); and 24% had made a change to a lower-sugar cereal compared with 12% of the comparison group ($P = 0{\cdot}009$). In addition, families' response demonstrated improvements in healthier eating habits, at least in the short run.

81. On the other hand, Adams et al (2012a) found that customers who lived in socioeconomically disadvantaged areas did not have improved access to fruit and vegetables, and that long-term effect on customers' consumption of fruit and vegetables was not significant (Adams et al., 2012a). Another study concluded that although the C4L campaign materials achieved increases in awareness of the campaign, the behavioural impact was small, mainly due to a low engagement with the intervention (Croker et al., 2012).

ii) Smartphone Apps to tackle obesity: a case study from Singapore

a) General introduction

82. In this part, a case study from Singapore is analysed. In 2012, Singapore was the world's leader in smartphone usage or penetration, with a percentage of apps usage around 75% in 2013 (Anjum, 2013). Given that Singapore's obesity prevalence of people aged 18–69 reached 10.8% in 2010, with about 40% of the population not being physically active, and about 60% consuming excess energy (Foo et al., 2013), mobile apps may potentially play a useful role in affecting health behaviours.

83. The Health Promotion Board (HPB) is a governmental organisation which implements health promotion campaigns and disease prevention programmes in Singapore. During the last few years, HPB has launched an ambitious plan to implement a strategic shift, by supplementing public education campaigns aimed at individual behaviours with additional actions to create a ground-up social movement to enable and empower individuals to live out a healthy lifestyle (Foo et al., 2013). HPB launched a mobile app called Diet and Activity Tracker (*iDAT*) in 2011, which helps individuals count their calorie intake by recognizing components of over 1,000 dishes and beverages, and also helps them track their physical activity levels[16]. In 2016 iDAT was replaced by *Healthy 365*, a platform complemented with the extension to *National Steps Challenge* programs to encourage individuals to be more active and attain more steps every day[17].

b) Design

Mobile App

84. Healthy 365 is a mobile application that can help people to:

- Monitor weight and calories intake through access to over 1,000 local food and beverage options (highlighting top 3 daily nutrients high in calories);
- adjust daily calorie intake based on individual body mass index and age, also providing some food suggestions;
- count daily step and relative calories burned, generating history charts to keep records;
- encourage participation in nearby events, workshops and programmes on healthy living;
- help locate nearby healthy eating establishments;
- join nearby physical activity events and facilities such as Sundays at the park, fitness corners, and walking trails;
- participate in health challenges and rewards programmes (described below).

National Steps Challenge

85. *Health Challenges* are initiatives to encourage healthy lifestyle by providing incentives such as bonus points and redeemable rewards. One example of this is the National Steps Challenge (NSC), which leverages the use of empowering technologies such as a steps tracker and HPB's Healthy 365 mobile app, to nudge participants towards a more active lifestyle by walking more[18]. For example, anyone who

16 https://www.hpb.gov.sg

17 https://www.tech.gov.sg/TechNews/DigitalGov/2016/06/Stepping-Up-to-the-Healthy-Challenge

18 https://www.tech.gov.sg/TechNews/DigitalGov/2016/06/Stepping-Up-to-the-Healthy-Challenge

downloads Healthy 365 *and* chooses to participate in the National Steps Challenge (NSC) can share data, and be ranked, on their physical activity performance, through a mobile tracking mode system (HealthKit). Participants can also earn various rewards, thanks to commercial agreements with partners as sport centres, wellness companies, or food and beverage industry. With the concept of "the more steps you take, the more points you earn", participants can earn bigger prizes.

Other Mobile Apps

86. HPB also offers other health-related mobile apps, although they tend to be more focussed on monitoring specific health conditions and body functions (for instance related to knees, eyes, hands) or focusing on illness (asthma, anxiety), or selected populations (pregnant women)[19].

c) Uptake

87. Foo (2013) reported that "since its launch in November 2011, iDAT has garnered 50,000 downloads, with 20,000 active users tracking their workouts online". In March 2016, 156,000 sign-ups for the National Steps Challenge were recorded through Healthy 365. It was also found that 58% of participants were still active over a four-month period, with results more encouraging in comparison to similar community based interventions in US or Australia (Government Technology Agency, 2016). Some users have voiced concern about the privacy of the collected data, which may be a barrier to its wider uptake, although many may be reassured by the fact that the data collection is managed by the government. In addition, Direito (2014) concluded that "behaviour change techniques associated with increased intervention effectiveness were in general more common in paid apps". This should be kept in mind as the government of Singapore has made this application available free of charge.

iii) A comprehensive multi-stakeholder mass media campaign: a case study from Italy

88. Guadagnare salute 'Gaining in health' (GiH) is a comprehensive multi-component intervention aiming to 'make healthy choices easy'. The main objective of this intervention is to 'nudge' people towards healthier behaviours which would decrease the likelihood of developing chronic diseases. The programme was launched in 2007, as a direct consequence of the National Plan on Prevention (approved in 2005) and the signing of the WHO plan to contrast obesity in the European Region in 2006.

89. The programme was initially designed to address obesity; however, Italy ended up using the 'gaining in health' approach as a broader tool to address all the major behavioural risk factors causing chronic diseases. Currently, the programme targets four key lifestyle behaviours: unhealthy diet, particularly for what concerns low consumption of fruit and vegetables, tobacco smoking, physical inactivity and harmful alcohol drinking. Giving the focus of this publication, the remainder of the section will focus on diet and physical inactivity.

90. GiH is designed as a multi-stakeholders intervention led by the Italian Ministry of Health with the participation of other governmental institutions and the civil society. Ministries that are involved in delivering GiH initiatives include, for example, the Ministry of Education and the Ministry of Agriculture. Given the structure of the Italian National Healthcare System and the important role of local communities in providing healthcare services, local authorities (i.e. Regions and city councils), together with schools play also a key role in organizing activities at the sub-national level. Non-governmental stakeholders including, for example, industry and civil society are also involved in delivering actions, both at the national and local level.

19 https://www.healthhub.sg/apps/listing

91. The programme includes a number of different components. Generally speaking, all the action parts of the GiH programme fall into one of the three following categories: i) educational and informational activities to increase the awareness about healthy behaviours in the general population; ii) regulatory actions, including intersectoral strategies to modify the environment; and iii) allocation of dedicated resources to support the implementation of specific activities at the local level.

92. Particular emphasis is given to communication policies, i.e. actions falling in the first of the three categories mentioned above. More specifically, the communication and education campaign part of GiH is based on the following actions:

- Leaflets and booklets have been distributed to the Italian population through major newspapers. The material aimed to increase awareness about four unhealthy behaviours and to provide advice on simple changes that, if implemented, would help the individual achieve a healthier lifestyle. A particular focus is on presenting enjoyable activities and on giving inspiration in daily life (e.g. taking the stairs rather than the lift). Specific examples are given for people in particular age-groups (e.g. children and the elderly). The leaflets include a final summary with a section titled 'ten top tips to…' which report, for each risk factor, a list of action that would improve the lifestyle.

- A number of mass media campaigns have been launched, on a regular basis, to promote a specific healthy behaviour. For example, in 2013, the objective of the campaign was to promote physical activity. In one typical advertisement, the coach of the Italian National Football team invited a group of people sitting in a bar to warm up and start moving. This scene was followed by a brief explanation of the positive effects of an active lifestyle. The advertisement ended with what looked like a grandfather and his grandson doing jogging while the grandson was telling him: "when the coach of the National Team calls you, you cannot refuse!" The campaign was launched on TV, radio and press.

- School-based programme. A specific partnership with schools is part of the GiH programme. The school programmes are mainly designed and managed at the local level and are usually arranged as partnerships between schools and Local Health authorities to adapt the message and the activities to the specific local context. A review of a few examples suggests that, independently of the regions, programmes give children the critical tools to understand and elaborate messages from advertisements to develop critical thinking about what they find on media and to develop skills helping them resist peer pressure toward unhealthy behaviours. At the same time, actions use the positive multiplicative effect of peer-education to favour healthy behaviours. In a number of cases, the programmes are also designed to actively involve parents.

93. As part of the regulatory actions to modify the environment, in 2015 the Ministry of Health agreed with the food industry a code of self-regulation called "Commercial Communications Guidelines relating to food products and beverages, for the protection of children and their proper nutrition". The agreement concerns communication about food products for children or for foodstuff that is likely to be consumed by children. According to this agreement, advertisements should be honest and accurate and should not be designed to mislead children. The advertisements should also avoid communicating that the non-possession of the product implies parental failure or inferiority for the child. In addition, the advertisements should promote a balanced consumption of the product and, more broadly, it should also support a healthy diet and an active lifestyle. Being a self-regulatory agreement, there is no programme of governmental enforcement. However, any interested party (e.g. civil society organizations, individual citizens, etc.) can report the violation of any of the rules set in the self-regulatory agreement to the Institute for Self-Regulation in Advertising (IAP), a private body self-regulating advertisement standards.

6. Conclusions and key policy implications.

94. This paper provides an overview of a range of communication policies to increase population awareness about the consequences of obesity, as well as the benefits associated with healthy diets and active lifestyles. Preliminary findings of this work support the following policy implications:

- Governments can put in place a broad range of communication policies. Our review identifies a full range of actions including: i) health promotion policies; ii) provision of information and education in various setting (e.g. media, workplace, schools, etc.); and iii) regulation of messages promoting unhealthy lifestyles.

- Retrieved evidence generally suggests that communication policies may play a significant role in promoting healthy behaviours. Our quantitative estimates consolidate previous findings suggesting that communication policies have a statistically significant effect in increasing the probability of a healthy diet and an active lifestyle.

- Using a newly built microsimulation model, we have quantified the impact of several communication interventions on the health of the Italian population. Our findings suggest that food and restaurant menu labelling are very cost effective interventions, both increasing the number of life years lived without disease, as well as having positive effect on health expenditures. On the other hand, mass media campaigns and advertising regulations have a more substantial negative impact on the health budgets, although still potentially representing value for money based on the conventional cost effectiveness thresholds.

- The study of the C4L campaign suggests that social marketing campaign success may depend on: i) a comprehensive set of messages on different dimensions rather than a specific focus on a single dimension (e.g. messages focus on portions sizes, limiting snacking, increasing fruit and vegetable consumption, etc. rather than any of them on their own); ii) targeting population groups at a particular risk (e.g. minorities or low socio-economic status families) or on 'trendsetters'(e.g. mothers-to-be to produce positive spill-over effects on new generations); iii) use of engaging messages (e.g. by using popular cartoons) and a focus on actions easy to be achieved; iv) an increasing use of new media and apps for mobile phones.

- This paper has demonstrated that several communication interventions can be very cost-effective, in particular in the context of Italy, where people eat out more regularly than in many other countries. In particular, menu labelling intervention was found to be approximately as cost-effective as food labelling; not only generating large gains in years lived without disease, but also potentially leading to big savings in health expenditures over time. Several other interventions, such as restricting food and beverage advertising targeting children on TV; smartphone applications and mass media campaigns promoting physical activity are also potentially very cost-effective.

- In all cases, the impact of the interventions will take some time to materialize, which is especially true for the advertising campaign and smartphone apps, which will become cost-effective only by about 2055. Prescribing physical activity by physicians was the only intervention not found to be cost effective, which was mainly due to the limited targeting of this intervention, as well as its focus on middle-aged people who already have risk factors predisposing them to ill health. Nevertheless, this conclusion was based on certain assumptions about the costs of running intervention, and it is possible that it will be much more cost-effective if it is run more efficiently than assumed in the model.

ANNEX 1

Comparison between main results, OECD and CDP models

95. We can also compare our results with an earlier work on three similar interventions conducted at OECD (Sassi, 2012). Specifically, we can compare some results for advertising regulation interventions, mass media campaigns and food labelling (Table 3 below). We are restricting our comparison until 2050, as extending it until 2100 may be too long as other external factors are likely to play a significant role.

Table A1. Comparison between main results for 3 interventions, OECD and CDP models

Intervention	OECD	CDP
Cumulative DALYs gained, 2050		
Advertising reg	9,200	5,600
Mass media	64,000	26,000
Food labelling	475,000	30,000
Intervention cost/year, 2050		
Advertising reg	11	21
Mass media	30	77
Food labelling	23	46
Health expenditure/year, Eur mln 2050		
Advertising reg	-12	1.2
Mass media	-15	-9.4
Food labelling	-112	-20
ICER, 2050		
Advertising reg	46,000	41,000
Mass media	8,900	19,600
Food labelling	dominant	4,500

Note: results for interventions running until 2050 shown.

96. OECD and CDP cost-effectiveness estimates for 2050 are very similar for advertising regulation intervention. On the other hand, mass media campaigns and food labelling are estimated to be more cost-effective than previously thought. This is especially true for food labelling intervention, for which the predicted effect on DALYs gained is about 15 times larger in the new OECD model.

97. The ranking of interventions in terms of their cost-effectiveness is similar: the most cost-effective in this group is food labelling, and the least- advertising regulations.

98. The big difference in food labelling efficacy is probably due to much smaller effect that was assumed previously. Specifically, in Fit for Fat, the assumed effect on BMI (based on the impact of the intervention on fruit and vegetable consumption, as well as total fat intake) was small: a reduction of only 0.02 points. On the other hand, our assumed effect on BMI was based on a more recent systematic review, and was considerably larger in magnitude: 0.88% reduction in BMI.

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