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Promoting sport and physical activity in Italy: a cost-effectiveness analysis of seven innovative public health policies

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Key words: Cost-effectiveness analysis, exercise, physical activity, economics, health expenditure, models
Parole chiave: Efficacia, esercizio fisico, attività fisica, economia, spesa sanitaria, modelli

Abstract

Background. *Inactive lifestyles are a key risk factor underpinning the development of many chronic diseases, yet more than half of the Italian population does not meet WHO thresholds for at least moderate physical activity. This study aims to make the economic case to upscale investments in policy actions to promote exercise and physical activity.*
Study design. *Modelling-based cost-effectiveness analysis in Italy*
Methods. *The study assesses the impact on health and healthcare expenditure of seven public health policies to promote exercise and physical activity against a business as usual scenario. Assessed policies include: promotion of active transport, workplace sedentarily interventions, investments in sports and recreation, mass media campaigns, prescription of physical activity in primary care, school-based interventions and mobile apps.*
Results. *Public policies to promote exercise have the potential to improve population health and produce savings in healthcare expenditure. Assessed policies can avoid hundreds of cases of cardiovascular diseases and diabetes per year and tens of cases of cancer resulting in gains in DALYs in the order of thousands per year. In the medium-term, the vast majority of policies show excellent cost-effectiveness ratio, below internationally recognized thresholds.*
Conclusions. *Investing in policies to promote active lifestyles is a good investment for Italy*

Introduction

In Italy, physical inactivity is widely prevalent, with about 53% of the population not meeting the World Health Organization guidelines for at least moderate physical activity (PA) - well above the OECD average of 43% (1). As such, physical inactivity is becoming an increasingly important issue, and has been dubbed "the biggest public

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health problem of the 21st century" (2-4). Physical inactivity has been linked to such disability-associated conditions (5) as heart diseases, stroke, diabetes, and osteoporosis (6), while sedentary behaviors have been found to increase a risk for all-cause mortality, as well as mortality from and incidence of cardiovascular diseases (CVDs) and cancer (7). Physical inactivity also has a significant economic cost, estimated at USD purchasing power parities (PPP) 53.8 billion worldwide for health systems in 2013, of which 31.2 billion was paid for by the public sector, 12.9 billion by the private sector, and 9.7 billion by households (8).

The reasons underpinning the lack of PA are numerous, many of them related to various influences of the built environment. For example, suboptimal urban design can lead to such causes of inactivity as lack of parks, green spaces and other walkable areas (9); air pollution (10); lack of convenient public transportation options and too much reliance on car use (11); lack of infrastructure to do active travel (12); unsafe neighborhoods (13); as well as lack of access to sports facilities (14). In addition, technological change has contributed to the gradual shift of employment from manual work in agriculture and industry towards office-based jobs in the services industry (15). Finally, economic and social globalization (16) has been associated with various cultural influences and technological developments in transportation, communications and entertainment, predisposing people to more sedentary lifestyles. While the epidemiological and economic burden of physical inactivity is recognized well, the policy response to the challenge has been suboptimal, despite the availability of a number of cost-effective policies (17). One important reason for this is that making the urban environment more PA-friendly requires a multispectral response, which may not be easy to achieve in practice (18), although examples of good practices exist (19). On the other hand, communication-based approaches to encourage PA, for example based on spreading public health messages through mass media campaigns, may be easier to implement. Ultimately, however, there is profound lack of location-specific evidence on the effectiveness and cost-effectiveness of various public health approaches to tackling physical inactivity burden, which in turn hampers efficient resource allocation. This paper presents results from a recently developed microsimulation model at the OECD to estimate the impact of several public health policies in Italy to encourage more PA, both by making improvements to the environment, and by nudging people through communication and education. Findings from this study can be used by policy-makers at the national and local level to make the economic case for stepping up investments to promote sport and PA.

Methods

The OECD SPHeP-NCD (Strategic Public Health Planning for NCDs) model is a tool to forecast future chronic disease burden, longevity and direct economic costs until the year 2050, as well as the extent to which specific policies can modify these outcomes. This model is described in detail elsewhere (20), but in brief, it uses case-based microsimulation to create synthetic life histories in a given country from birth to death, and relies on detailed epidemiological and demographic information from various sources. The model also uses prevalence-based direct cost estimates as an input into the model to forecast incidence-based health expenditures associated with various scenarios/policy interventions, from the health system perspective. In the model, physical activity is assumed to have a direct effect on reducing the incidence of the following diseases, in line with the epidemiological evidence (for more details, see (20): diabetes, myocardial infarction, ischemic stroke, colorectal and breast cancers, depression. In addition, it has indirect effect on a number of diseases through its link with overweight and diabetes, including, among the others, haemorrhagic stroke, several cancers, dementia, back pain, osteoarthritis, gout, atrial fibrillation. Sedentarity is considered a separate risk factor targeted in the intervention to reduce sitting time in the work places (see below). Sedentarity is not necessarily synonymous with being inactive, as a person can both meet conventional PA guidelines, for example by going to the gym regularly, and yet also spend a lot of time being sedentary. The link of both sedentarity and physical inactivity with disease incidence through high blood pressure is not currently implemented, so the results presented in this paper should be viewed as an underestimate of the full potential effect.

To gauge the population-level effectiveness and cost-effectiveness of public health policies designed to promote an active lifestyle, actions are evaluated against a 'business-as-usual' scenario in which no new policy is put in place and provision of preventive and healthcare services is implemented at the current levels, specific to a given country (Italy in this case). The difference between the 'business-as-usual' and the policy scenario corresponds to the impact of a policy. The comparison is carried out by considering all the relevant dimensions including, for instance, differences in health and healthcare costs, which provides all the needed information to carry out a cost-effectiveness analysis.

Taking Italy as a case study, the model was adapted to simulate a set of seven policies promoting PA and active lifestyle: promotion of active transport (AT), workplace sedentarity interventions (WS), investments in sports and recreation (ISR), mass media campaigns (MMC), prescription of PA in primary care (PPA), school-based interventions (SB) and mobile apps (MA).

Whether a particular intervention will work in a given context depends on a number of factors, some of which can be location-specific. For example, policy cost-effectiveness may depend not only on its general efficacy, but also on the local medical costs of treating related diseases and complications; demographic structure of the local population; epidemiological burden and the cost of intervention implementation. Within the SPHeP-NCD model, policies are simulated with respect to the following four key parameters:

1) Effectiveness of interventions at the individual level. This parameter captures how individual behaviour changes, following exposure to the interventions. As much as possible, this evidence is borrowed from peer-reviewed meta-analyses, preferably of randomized control trials. The interventions effectiveness parameters are taken from existing published meta-analyses in three modelled policies (WS, MA, SB), from meta-analyses carried out by the OECD (PPA, MMC, AT) or from individual studies (ISR).

2) Effectiveness of the interventions over time: intervention effect can be time-limited and/or time-dependent, with the relationship generally at first becoming stronger, and then fading out.

3) Intervention coverage, including description of eligible populations, as well as their exposure. For example, some interventions may only affect a subset of a population (e.g., individuals in certain age groups or with particular risk factors). In addition, in some cases, only a proportion of eligible population may be exposed, such as only those who visit primary care and are willing to participate.

4) Implementation cost. The implementation of a public health action may entail a number of costs including, for example, costs related to their planning, administration, monitoring and evaluation

and so on. In addition, interventions may involve providing some form of equipment or material to be delivered to the target population (e.g. brochures, or stand-up desks). The intervention costs are estimated broadly based on the WHO-Choice methodology (21) for one country, and then extrapolated to the other countries using the information on differentials in relative prices (as measured by differences in PPPs and exchange rates). All the costs are expressed in constant Euros (2015).

Interventions are modelled over the period 2019-2050 by considering their effectiveness at the individual level (including its pattern over time), their potential population coverage rates and their costs (also see Table 1):

Communication-based interventions

1. MMC intervention entails the implementation of a public health campaign on traditional media (e.g. radio, television and newspapers/magazines) to promote an active lifestyle in the population. The intervention is run in six segments between 2019 and 2050, with each lasting for 3 years. The evidence on the effectiveness comes from (22).

2. PPA policy involves a brief advice by a primary care specialist to an individual aged 50-75, at high risk for chronic diseases linked to sedentarity and lack of PA, followed by additional formal steps, such as a prescription of a minimum weekly amount of PA, a referral to an exercise referral scheme, or follow-up personalized counselling. In the developed countries, up to 80% of the population visits their GPs at least once a year (23), implying that GPs may be ideally suited to provide advice on adequate PA levels. The evidence on the intervention effectiveness comes from a recent systematic review and meta-analysis (24).

3. MA intervention entails the implementation of a nation-wide roll-out of a smartphone application promoting behaviours leading to weight reduction. 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. It is assumed that the development and release of the application rely on governmental marketing and promotion. The evidence on policy effectiveness comes from a meta-analysis (25).

4. SB policy further upscales and strengthens policies currently in place in many OECD countries mandating the inclusion of PA classes in the school curricula. More specifically, this intervention entails the inclusion of classroom lessons on the benefits of PA led by trained teachers and of moderate-to vigorous PA sessions (including playing sports and aerobic exercise) as part of the school curriculum. In addition, the intervention also entails the distribution of nutritional education materials and the provision of healthful foods in school canteens. The evidence on the policy effectiveness comes from the meta-analysis by (26).

Environmental interventions

5. AT intervention entails the expansion of mass transit options, either publicly or privately provided. The public health rationale for this policy is based on the assumption that public transportation networks may prompt people to be more physically active by encouraging them to get to the transit stations on foot or on bike (27). Specifically, the policy is implemented as expanding access to public transportation to an additional 1% of the Italian population in 2019, with no additional transportation expansion in the following years. The policy effectiveness of this intervention is modelled based on the results of a systematic review and meta-analyzed by (28).

6. WS policy. As adults spend considerable part of their lives in places

where they are employed, workplace-based actions have been increasingly considered a potentially effective tool to influence choices favoring healthier lifestyles. This intervention is modelled as an employer-sponsored programme to discourage sitting in the workplace by providing the sit-stand workstations and treadmill desks to the employees aged 18-65 years, who work in services industry and in medium and large enterprises. The evidence on the policy effectiveness is based on the meta-analysis from the (29) study.

7. ISR policy is modelled as an increase in public spending on recreational and sports services in Italy by about 1%, or by 45 million Euros in 2019, which can be translated into an increase in PA by about 19 MET-minutes a week for the whole population, based on the evidence from (30). Once started, this increase in funding is expected to be maintained at the same level in real terms in all subsequent years until 2050 (Table 1).

Table 1 - Interventions description

Characteristics	Investment in sports and recreation	Prescribing physical activity	Media campaigns	Public transport	Mobile apps	School-based	Workplace sedentarity
Target age	>18	50-75	>18	>5	15-64	8-18	18-65
Target as % of eligible population	100%	26.4% of those with at least 1 risk factor for NCDs	100%	1%	2.21%	90%	5.9% of those employed in 2019; 5.9% of newly employed in subsequent years.
Effectiveness	+18.9 MET-minutes/ week	+168.6 MET-minutes/ week	60% increase* after 1 month; drop to 30% after 1 year, drop to 0 after 2 more years	+105.6 MET-minutes/ week	0.43% drop in BMI	0.3 kg/m^2 drop in BMI	-72.78 min of SB/ 8-h workday
Pattern of exposure	Once started, maintain till death for 50%; for the rest, effect disappears after 2 years	Maximum effect after 6 months; reduced to 0 after 1 year	6 waves of three years each	Once started, maintain till end	Effect lasts for 2 years only	Maximum effect achieved within 1 year and last until graduation. After that, 0.15 drop maintained till the end	Once started, maintain till 65 y.o. for 50% of exposed; for others effect disappears after 1 year
Annual cost per capita, (constant 2015 Euros)	0.88	0.70	1.58	-	0.45	2.27	50**

Note: *Refers to change in the proportion of at least moderately active people. SB: sedentary behaviour; BMI: body mass index; y.o.: years old; MET: metabolic equivalent of task.
**cost is per target person, not per capita.

Results

All seven interventions are predicted to reduce the number of new cases of diabetes, cancer (colorectal and breast) and CVDs [including ischemic heart disease, myocardial infarction, ischemic and haemorrhagic stroke and atrial fibrillation (Figure 1)]. ISR, MMC and PPA have a notably large effect on reducing CVDs and cancer, with, on average, more than 800 new CVD cases avoided annually with ISR, and more than 100 cancer cases avoided in the case of PPA. MMC has the largest effect on the incidence of diabetes, with almost 400 cases avoided annually.

On a more general level, all interventions are found to lead to a cumulative gain in Disability-Adjusted Life Years (DALYs[1]), discounted at 3% annually, starting from 2020 and over the following 30 years (Figure 2 and Figure 3), with the top three interventions being MMC (cumulative gain of 86,000 DALYs), PPA (64,000) and ISR (56,000). Therefore, both environmental (ISR) and communication-based policies (MMC and PPA) are predicted to make a significant impact on related disease burden in Italy.

All modelled interventions are also predicted to lead to a larger gain of DALYs compared to person-years (PYs) – see Figure 2. This suggests that implementing these interventions in Italy is more likely to reduce the morbidity burden, such as by delaying or preventing the onset of chronic diseases, than to reduce the chronic disease-associated mortality rate. The relatively small effect of SB on PYs is mostly due to the insufficient length of span to capture the policy effect on mortality of the younger cohorts, all of whom will be under the age of 50 (when NCDs are still generally too early to develop) by the end of the microsimulation.

All the interventions are also predicted to result in significant decreases in health care expenditures. Thus, up to 25 million Euros can be saved annually in Italy in the case of PPA, followed by slightly less in the case of MMC (Figure 4). In total, starting in 2019 and over the next 31 years, PPA will save 464 million Euros discounted at 3% annually; MMC- 396 million and ISR- 255 million. Nevertheless, in all cases, the annual costs of implementing the interventions will exceed the health expenditure savings (Figure 4).

A fuller picture of the intervention impact is provided by estimating intervention cost-effectiveness over time, because both costs (of interventions themselves, offset by changes in health expenditures) and benefits (expressed in DALYs gained) can be taken into account at the same time. Although no intervention was found to be cost-saving as shown in Figure 4, many of them become cost-effective by conventional thresholds (31), before the end of the modelled period in 2050 (Figure 5). For example, cost-effectiveness ratios for MMC and ISR will be under 30,000 no later than in 2050; WS- in 2034; PPA- 2039 and MA- by 2047. Thus, despite the fact that MA and WS have a relatively modest effect on the disease burden, they are still predicted to be cost-effective by conventional standards. Finally, as the main goal of improving public transportation infrastructure is not to increase PA, but to improve transportation options for people, which is impossible to account for in the context of this analysis, no cost-effectiveness results are presented

1 This indicator is neither DALY nor quality-adjusted life year (QALY) in their traditional sense, although it is closer in substance to the latter. Specifically, it refers to the number of years lived adjusted for the quality of life, where the adjusting factors (or disability weights) where taken from the (3). Thus, this indicator is closer in substance to QALYs than to DALYs, although they are not the same. For consistency (and to account for the fact that we are relying on disability weights from the GBD study), we are referring to this indicator as DALY through the paper.

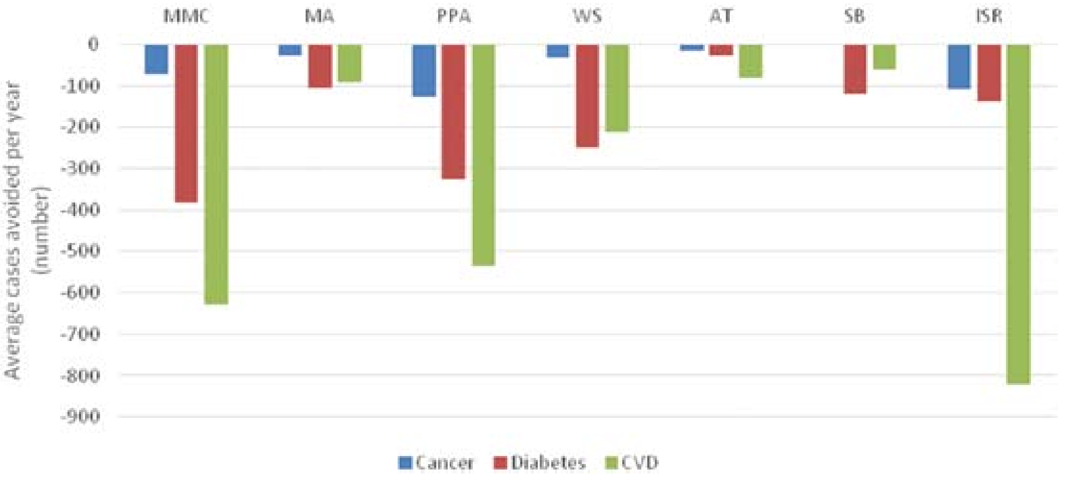

Figure 1 - Average number of avoided cases per year by type of intervention in Italy
Note: Each bar represents the average number of diseases prevented every year by each intervention over the period 2020-2050. These diseases were selected based on their link with the modelled risk factors. CVD refers to ischemic heart disease, atrial fibrillation, myocardial infarction, ischemic and haemorrhagic strokes. Cancers refer to colorectal and breast cancers.
MMC: mass media campaigns; MA: mobile apps; PPA: prescribing PA; WS: workplace sedentarity; AT: active transportation; SB: school-based programs; ISR: investment into sports and recreation

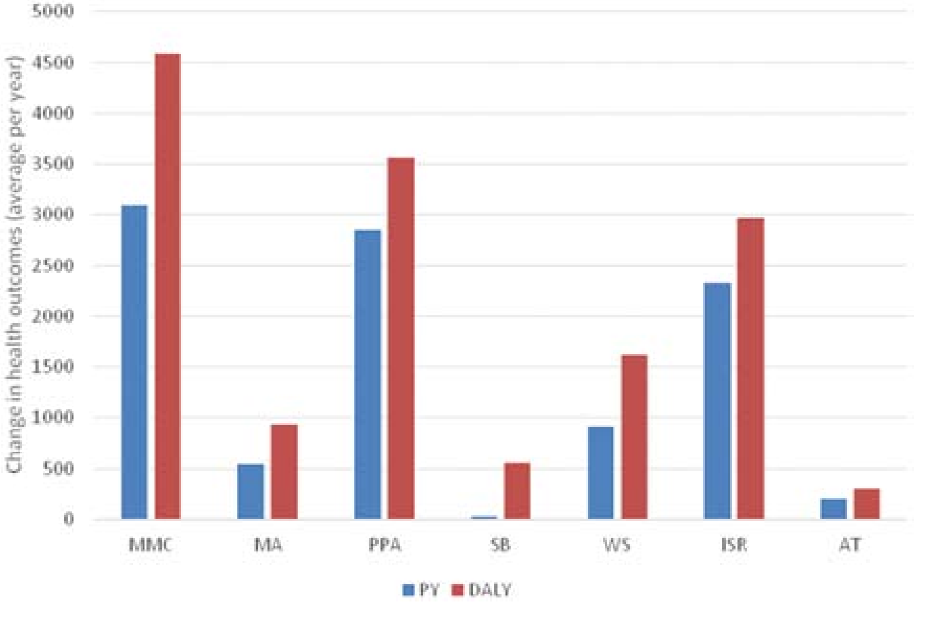

Figure 2 - Average annual change in health outcomes in Italy, 2020-2050
Note: DALYs: disability-adjusted life years. PY: person-years. Each bar shows the cumulative effect of a corresponding intervention on DALYs and PYs gained over 2020-2050. All future DALYs and PYs are discounted at 3% per year.
MMC: mass media campaigns; MA: mobile apps; PPA- prescribing PA; WS- workplace sedentarity; AT- active transportation; SB- school-based programs; ISR- investment into sports and recreation

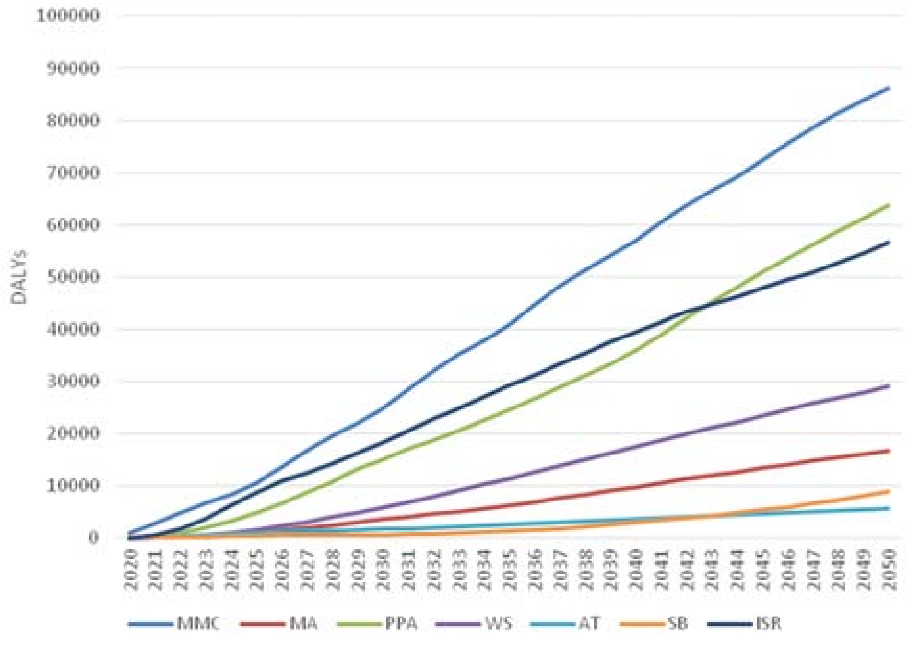

Figure 3 - Cumulative DALYs gained in Italy, 2020-2050
Notes: DALYs: disability-adjusted life years. Each line shows the cumulative effect of a corresponding intervention on DALYs gained over 2020-2050. All future DALYs are discounted at 3% per year. MMC: mass media campaigns; MA: mobile apps; PPA: prescribing PA; WS: workplace sedentarity; AT: active transportation; SB: school-based programs; ISR: investment into sports and recreation

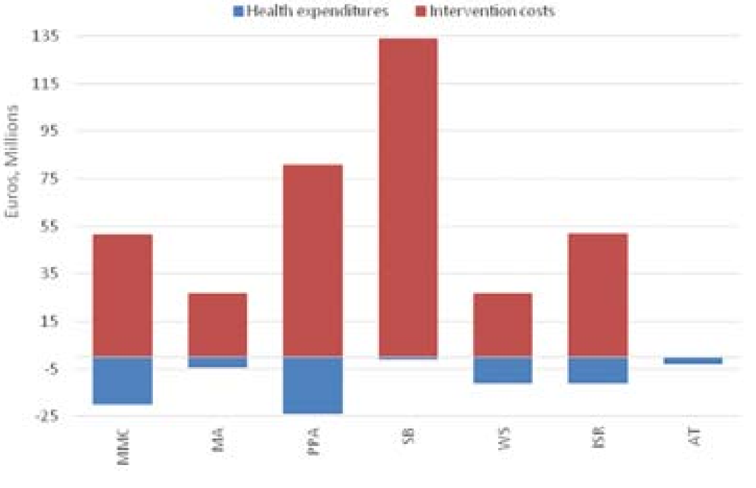

Figure 4 - Average annual cost of implanting interventions vs heath expenditures saved in Italy, 2020-2050
Note: Each column shows the average annual effect on health expenditure (negative) and implementation cost (positive) of a corresponding intervention in million Euros over the period 2020-2050. The expenditures are reported in constant Euros, with 2015 as the base year. MMC: mass media campaigns; MA: mobile apps; PPA: prescribing PA; WS: workplace sedentarity; AT: active transportation; SB: school-based programs; ISR: investment into sports and recreation

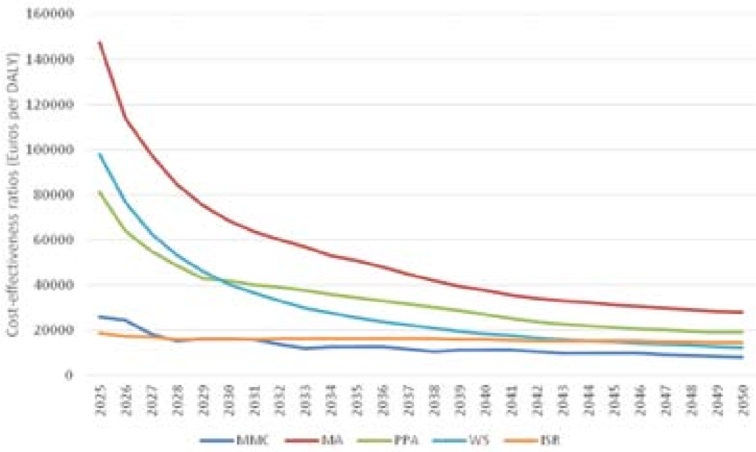

Figure 5 - Cost effectiveness ratios by intervention in Italy over 2025-2050
Note: Each line represents a ratio of cumulative intervention costs (minus health expenditures saved) divided by DALYs gained. All costs are reported in constant Euros, with 2015 as the base year. Both costs and DALYs are discounted at 3% per year. SB cost-effectiveness curve is not shown as it is too high to fit into the figure. AT is not shown as no implementation cost is considered for this intervention. MMC: mass media campaigns; MA: mobile apps; PPA: prescribing PA; WS: workplace sedentarity; AT: active transportation; SB: school-based programs; ISR: investment into sports and recreation

for AT. Finally, SB interventions are not shown to become cost-effectiveness in the considered period.

Discussion and conclusions

Findings from this study suggest that both investments in careful urban design, as well as nudging of people into doing more PA, can have a positive and significant public health impact without the need of mobilizing substantial resources from the healthcare budget in Italy. One environmental intervention - ISR - would have the greatest positive effect on CVD, with more than 800 cases avoided annually. It is also highly cost-effective, as early as 5 years since the beginning of the intervention. Another intervention with the potential to modify the urban environment - AT- is predicted to have smaller impact mainly because it is assumed to apply to a very small proportion of the population, and only once in 2019. This assumption was made based on the fact that public transportation coverage in Italy is already relatively extensive.

In addition, several interventions to nudge people into doing more PA through information and education also performed well, in particular PPA and MMA. Even MA-the intervention providing relatively small population exposure-was found to be cost effective, when both incremental costs and benefits were taken into account. School-based policy was not found to be cost-effective, but the main reason for this is that the simulation period is not long enough to capture the morbidity-reducing effect of this intervention on the cohort of school children, who will still be too young in 2050 when the simulation period ends. However, previous OECD analyses showed that SB interventions may become a cost-effective option when a longer timeframe is adopted (17).

The OECD SPHeP-NCD model presented in this paper addresses an important gap in evidence on the location-specific cost effectiveness of public health interventions promoting PA. Specifically, it is shown that such interventions can be cost-effective in Italy. Moreover, the cost-effectiveness of the assessed interventions compares well with results from other CE analyses on public health intervention, e.g. (32).

Finally, considering only the health-related benefits of the reviewed interventions will give a limited picture, as at least some of them should be placed in the broader context of making improvements to the urban environment. For example, improving public transportation networks is an example of a policy whose benefits may extend well beyond the health-related outcomes. They may include, for example, economic efficiencies gained from better infrastructure; welfare benefits from better transportation options; as well as environmental benefits stemming from reduced pollution. Likewise, spending on sports and recreation will have a number of benefits going beyond health improvements. One should also not forget about the potential productivity benefits resulting from avoiding physical inactivity-related complications, which are not presented in this paper. For this reason, traditional cost-effectiveness analysis of such policies should be considered as a conservative approach, as these broader benefits cannot be taken into account when the health-oriented perspective is chosen.

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Additional documents and the Italian version is available at: www.sitinazionale.it/BDS/muoversi and/or at link www.progettodoping.it

Riassunto

Promozione dello sport e dell'attività fisica in Italia: un'analisi costi-benefici di sette politiche innovative di sanità pubblica

Introduzione. Uno stile di vita inattivo è un fattore di rischio associato allo sviluppo di molte malattie croniche. Tuttavia, oltre la metà della popolazione italiana non raggiunge i livelli minimi di attività fisica raccomandati dall'OMS. Questo documento presenta i risultati di un modello di simulazione per stimare l'impatto di diverse politiche di sanità pubblica in Italia per incoraggiare l'attività fisica.

Disegno dello studio. Analisi costi-benefici di un modello in Italia.

Metodi. Lo studio valuta l'impatto sulla salute e sulla spesa sanitaria di sette politiche di sanità pubblica per promuovere l'esercizio fisico e l'attività fisica. Le politiche valutate comprendono: promozione del trasporto attivo, interventi di sedentarietà sul posto di lavoro, investimenti nello sport e nel tempo libero, campagne sui mass media, prescrizione di attività fisica nell'assistenza primaria, interventi scolastici e un'applicazione per smartphone.

Risultati. Le politiche pubbliche per promuovere l'esercizio hanno il potenziale di migliorare la salute della popolazione e generare risparmi nella spesa sanitaria. Le politiche valutate possono evitare centinaia di casi di malattie cardiovascolari e diabete all'anno e decine di casi di cancro con conseguente guadagno in DALY nell'ordine di migliaia all'anno. A medio termine, la stragrande maggioranza delle politiche mostra un eccellente rapporto costi-benefici, al di sotto delle soglie riconosciute a livello internazionale.

Conclusioni. Investire in politiche per promuovere stili di vita attivi è un buon investimento per l'Italia.

References

1. Organisation for Economic Co-operation and Development (OECD). Health at a Glance. Paris: OECD Publishing, 2017.
2. Blair SN. Physical inactivity: the biggest public health problem of the 21st century. Br J Sports Med 2009; **43**(1): 1-2.
3. Romano-Spica V, Macini P, Fara GM, Giammanco G; GSMS - Working Group on Movement Sciences for Health Italian Society of Hygiene Preventive Medicine and Public Health. Adapted Physical Activity for the Promotion of Health and the Prevention of Multifactorial Chronic Diseases: the Erice Charter. Ann Ig 2015; **27**(2): 406-14.
4. Romano Spica V, Di Rosa E, Savino G, et al. Erice 2018 Charter on the role of the National Health Service in the prevention of doping. Ann Ig 2019; **31**(6): 523-32.
5. Vos T, Abajobir AA, Abate KH, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet 2017; **390**(10100): 1211-59.
6. Kruk J. Health and economic costs of physical inactivity. Asian Pac J Cancer Prev 2014; **15**(18): 7499-503.
7. Biswas A, Oh PI, Faulkner GE, et al. Sedentary time and its association with risk for disease incidence, mortality, and hospitalization in adults: a systematic review and meta-analysis. Ann Intern Med 2015; **162**(2): 123-32.
8. Ding D, Lawson KD, Kolbe-Alexander TL, et al. The economic burden of physical inactivity: a global analysis of major non-communicable diseases. Lancet 2016; **388**(10051): 1311-24.
9. Kaczynski AT, Henderson KA. Environmental correlates of physical activity: a review of evidence about parks and recreation. Leis Sci 2007; **29**(4): 315-54.
10. Roberts JD, Voss JD, Knight B. The association of ambient air pollution and physical inactivity in the United States. PloS One 2014; **9**(3): e90143.
11. Wener RE, Evans GW. A morning stroll: levels of physical activity in car and mass transit commuting. Environ Behav 2007; **39**(1): 62-74.
12. Pazin J, Garcia LMT, Florindo AA, et al. Effects of a new walking and cycling route on leisure-time physical activity of Brazilian adults: A longitudinal quasi-experiment. Health & place. 2016; **39**:18-25.
13. Carver A, Timperio A, Crawford D. Playing it safe: The influence of neighbourhood safety on children's physical activity—A review. Health Place 2008; **14**(2): 217-27.
14. Halonen JI, Stenholm S, Kivimäki M, et al. Is change in availability of sports facilities associated with change in physical activity? A prospective cohort study. Prev Med 2015; **73**: 10-4.
15. Church TS, Thomas DM, Tudor-Locke C, Katzmarzyk PT, Earnest CP, Rodarte RQ, et al. Trends over 5 decades in US occupation-related physical activity and their associations with obesity. PloS One 2011; **6**(5): e19657.
16. Ebrahim S, Garcia J, Sujudi A, Atrash H. Globalization of behavioral risks needs faster diffusion of interventions. Prev Chronic Dis 2007; **4**(2): A32.
17. Cecchini M, Sassi F, Lauer JA, Lee YY, Guajardo-Barron V, Chisholm D. Tackling of unhealthy diets, physical inactivity, and obesity: health effects and cost-effectiveness. Lancet 2010; **376**(9754): 1775-84.
18. Organisation for Economic Co-operation and Development (OECD). Healthy people, healthy planet: The role of health systems in promoting healthier lifestyles and a greener future. OECD, 2017.
19. World Health Organization (WHO). Promoting Health, Preventing Disease the Economic Case: The Economic Case. McGraw Hill Education, 2015 (European Observatory of Health Systems and Policies Series).
20. Devaux M, Lerouge A, Ventelou B, et al. Assessing the potential outcomes of achieving the World Health Organization global non-communicable diseases targets for risk factors by 2025: is there also an economic dividend? Public Health 2019; **169**: 173-9.
21. Johns B, Baltussen R, Hutubessy R. Programme costs in the economic evaluation of health interventions. Cost Eff Resource Alloc 2003; **1**(1): 1.
22. Goryakin Y, Gatta MS, Lerouge A, Pellegrini T, Cecchini M. The case of obesity prevention in Italy. Ministry of Health, Italy, 2017.
23. Sanchez A, Bully P, Martinez C, Grandes G. Effectiveness of physical activity promotion interventions in primary care: A review of reviews. Prev Med 2015; **76**: S56-S67.
24. Goryakin Y, Suhlrie L, Cecchini M. Impact of

primary care-initiated interventions promoting physical activity on body mass index: systematic review and meta-analysis. Obes Rev 2018; **19**(4): 518-28.
25. Mateo GF, Granado-Font E, Ferré-Grau C, Montaña-Carreras X. Mobile phone apps to promote weight loss and increase physical activity: a systematic review and meta-analysis. J Med Internet Res 2015; **17**(11): e253.
26. Wang Y, Cai L, Wu Y, et al. What childhood obesity prevention programmes work? A systematic review and meta-analysis. Obes Rev 2015; **16**(7): 547-65.
27. Chang A, Miranda-Moreno L, Cao J, Welle B. The effect of BRT implementation and streetscape redesign on physical activity: A case study of Mexico City. Transp Res Part A: Policy and Practice 2017; **100**: 337-47.
28. Xiao C, Goryakin Y, Cecchini M. Physical activity levels and new public transit: A systematic review and meta-analysis. Am J Prev Med 2019; **56**(3): 464-73.
29. Chu AHY, Ng SHX, Tan CS, Win AM, Koh D, Müller-Riemenschneider F. A systematic review and meta-analysis of workplace intervention strategies to reduce sedentary time in white-collar workers. Obes Rev 2016; **17**(5): 467-81.
30. Humphreys BR, Ruseski JE. Participation in physical activity and government spending on parks and recreation. Contemp Econ Policy 2007; **25**(4): 538-52.
31. Alageel S, Gulliford MC, McDermott L, Wright AJ. Multiple health behaviour change interventions for primary prevention of cardiovascular disease in primary care: systematic review and meta-analysis. BMJ Open 2017; **7**(6): e015375.
32. Chokshi DA, Farley TA. The cost-effectiveness of environmental approaches to disease prevention. N Engl J Med 2012; **367**(4): 295-7.

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