Corrigendum

Quality of and access to green space in relation to psychological distress: results from a population-based cross-sectional study as part of the EURO-URHIS 2 project
D. Pope, R. Tisdall, J. Middleton, A. Verma, E. van Ameijden, C. Birt, A. Macherianakis, N.G. Bruce.

This is a correction notice for article ckv094 (DOI: https://doi.org/10.1093/eurpub/ckv094), published on 15 July 2015. The authors regret to inform that Alexis Macherianakis was not credited as an author of this article. His name should have been listed after C. Birt and his affiliation should have been given as ''Sandwell Primary Care Trust, Birmingham, UK.'' The funding statement should also have read as follows: ''This research project was co-funded by EU Commission, under the 7th Framework Programme (FP7/2007-2013) as part of the EUROURHIS 2 project (grant agreement no. 223711), Sandwell Primary Care Trust Public Health team and the project beneficiaries.'' These errors have now been corrected online.

Cost-effectiveness of tobacco control policies and programmes targeting adolescents: a systematic review

Teresa Leão[1], Anton E. Kunst[2], Julian Perelman[1,3]

1 Escola Nacional de Saúde Pública, Universidade NOVA de Lisboa, Lisboa, Portugal
2 Department of Public Health, Academic Medical Center, University of Amsterdam, Netherlands
3 Centro de Investigação em Saúde Pública, Portugal

Correspondence: Teresa Leão, Escola Nacional Saúde Pública, Universidade NOVA de Lisboa, Av. Padre Cruz, 1600-560 Lisboa, Portugal, Tel: +351217512100, Fax: +351217582754, e-mail: ti.leao@ensp.unl.pt

Background: Consistent evidence shows the importance of preventing smoking at young ages, when health behaviours are formed, with long-term consequences on health and survival. Although tobacco control policies and programmes targeting adolescents are widely promoted, the cost-effectiveness of such interventions has not been systematically documented. We performed a systematic review on the cost-effectiveness of policies and programmes preventing tobacco consumption targeting adolescents. **Methods**: We systematically reviewed literature on the (i) cost and effectiveness of (ii) prevention policies targeting (iii) smoking by (iv) adolescents. PubMed, Web of Science, Cochrane, CEA-TUFTS, Health Economic Evaluations, Wiley Online Library, Centre for Reviews and Dissemination Database, the National Institute for Health and Care Excellence and Google Scholar databases were used, and Google search engine was used for other grey literature review. **Results**: We obtained 793 full-text papers and 19 grey literature documents, from which 16 studies fulfilled the inclusion criteria. Of these, only one was published in the last 5 years, and 15 were performed in high-income countries. Eight analyzed the cost-effectiveness of school-based programmes, five focused on media campaigns and three on legal bans. Policies and programmes were found to be cost-effective in all studies, and both effective and cost-saving in about half of the studies. **Conclusions**: Evidence is scarce and relatively obsolete, and rarely focused on the evaluation of legal bans. Moreover, no comparisons have been made between different interventions or across different contexts and implementation levels. However, all studies conclude that smoking prevention policies and programmes amongst adolescents are greatly worth their costs.

Introduction

One in every four Europeans is a daily smoker.[1] Tobacco consumption is responsible for about a third of all premature deaths in Europe,[2] being the most important risk factor of premature mortality[2] and the second most important risk factor for disease-adjusted life years in Western Europe.[3]

Tobacco consumption usually starts during adolescence. The Health Behaviour in School-Aged Children 2013/2014 survey stated that 12% of 15-year-old adolescents smoke daily in Europe, Canada and the USA.[4] Because nicotine is one of the most addictive substances,[5] only one in three young smokers will quit smoking and half will die from tobacco-related diseases.[6] This is why preventing tobacco consumption in youth has been considered a priority in the last decade,[7,8] and several tobacco control policies and programmes targeting youths have been suggested.[6–12]

Although recommended by international public health institutions,[6–11] relatively little is known about the cost-effectiveness

of tobacco control policies targeting adolescents. In a context of limited resources and numerous alternative public health priorities, the measurement of costs, besides effectiveness, has therefore become a priority for decision-making. In this paper, we performed a systematic review of studies assessing the cost-effectiveness of policies and programmes aimed at preventing tobacco consumption amongst adolescents.

Methods

We conducted a systematic review on the cost-effectiveness of various tobacco control policies that aimed at reducing adolescents' smoking, such as bans, community interventions or educational programmes, implemented at national, regional, local or school levels.

Search strategy

We searched PubMed, Web of Science, Cochrane Library, CEA-TUFTS Library, Health Economic Evaluations Database, Google Scholar, Centre for Reviews and Dissemination Database, Wiley Online Library and the National Institute for Health and Care Excellence (NICE) databases during the months of October and November of 2015, and, then, updated the search in April 2017. The MESH terms adolescents, students, tobacco smoke, smoking, costs and cost analysis, intervention studies, and policy were used in PubMed searches and equivalent terms were used in other databases search (details in Supplementary table S1).

All the articles identified using these MESH terms were title screened by one reviewer. Duplicates were removed and articles were abstract screened by two reviewers. We only included articles with information about (i) cost and/or effectiveness of preventive (ii) policies or (iii) community interventions on (iv) youth smoking. Articles about tobacco cessation programmes were excluded from this review. Divergences were solved by consensus.

After the first exclusion round, we used the Google search engine to screen for further grey publications not identified in the previous procedures. The first 100 entries were scanned.

The selected papers, including the 'grey' literature, were merged and a final round of selection based on full contents was then performed by two reviewers simultaneously.

Inclusion criteria

Studies were included if they reported on complete economic evaluations, which compare costs and health outcomes of tobacco control policies and programmes targeting adolescents. We did not apply any time period restriction. Though we used English as a search language, all articles written in English, French, Portuguese and Spanish were accepted. All available full-text research articles were considered in the search, excluding study protocols, review articles, opinion articles, editorials, papers that did not present primary cost-effectiveness results or papers that failed to detail the methods used.

Data extraction

We analyzed and extracted data describing the intervention, resources measured, effectiveness indicators, data source, models used to estimate the long-term effectiveness, time horizon, discount rate and total cost-effectiveness results. We also analyzed the selected studies in light of the NICE quality criteria for economic evaluations.[13] High-quality standards included the adequacy (long-term) of time horizons, the inclusion of all relevant costs and outcomes, the use of models that adequately simulate the progression of smoking-related diseases, the accuracy of input sources and the declaration of conflicts of interest.[13]

Results

The results of the search are presented in figure 1. A total 1172 papers were found in the first search through scientific databases, of which 105 were included after title and abstract screening. Nineteen literature publications were selected from the Google search and added to the 105 full-text articles. In a second selection round, we analyzed the remaining 124 documents and excluded 108 articles and/or publications. Absences of complete cost-effectiveness analysis or original results, or evaluation of interventions not focusing on youth, were the main causes for exclusion. Sixteen articles[14–29] met all the inclusion criteria, although two were not peer reviewed.[23,24] Ten presented some methodological limitations such as the absence of clear information on ingredients for costs measurement[23,24] or the use of short time-horizon for cost assessment[16–21,24,28,29] (Supplementary table S2). None of the 16 papers presented 'very serious limitations,' which would be for us criteria for exclusion, so that no study was removed on the basis of insufficient quality. All selected articles are described in Supplementary table S3.

Only 1 out of the 16 articles was published in the last 5 years.[20] Fifteen were related to policies or programmes from high-income countries, namely from the USA, Canada, Australia, the UK, Germany and the Netherlands.[14,15,17–29] The only exception was a study for India.[16] Eight articles analyzed the cost-effectiveness of school-based programmes,[16,19,20,23,26–29] five analyzed the cost-effectiveness of media campaigns[18,21,22,24,25] and the remaining focused on the cost-effectiveness of an increase in the minimum legal age of sales from 18- to 21-years-old, and enforcement of the restriction of sales to minors.[14,15,17]

Effectiveness was assessed in terms of Quality Adjusted Life Years (QALYs) and life years gained in 13 articles.[14–18,21–25,27–29] Eleven papers also included as effectiveness measure the healthcare costs
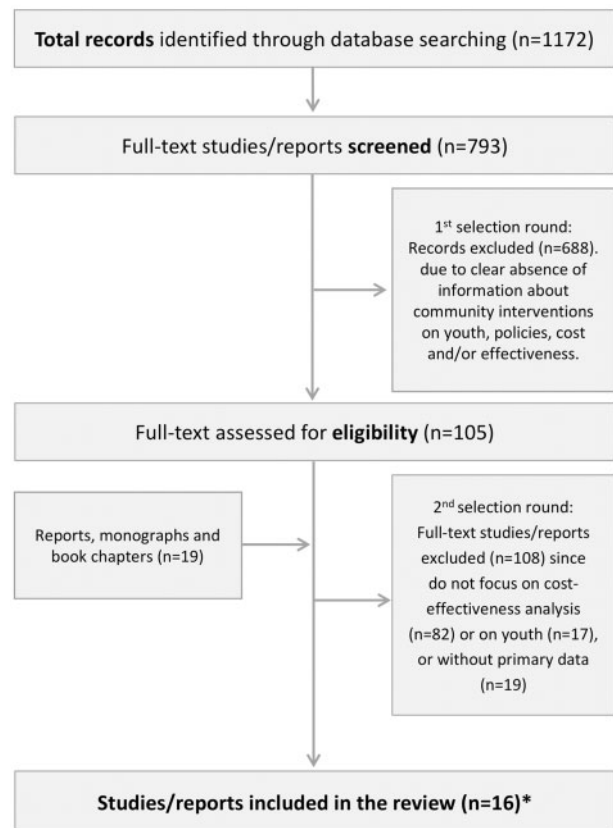

Figure 1 Search strategy and studies analysis followed in this systematic review

avoided because of the diminution in the prevalence of tobacco-related disease,[14,15,18,19,21–23,26–29] and two considered productivity losses averted.[19,26] Vijgen et al.[28] also included the additional healthcare costs due to increased longevity. Number of smokers averted, life years saved and QALYs gained were modelled in a long-term perspective in 15 out of the 16 articles.[14–19,21–29] Most studies mentioned using Markov-type models, but few details were provided on modelling techniques. Estimates of short-term effectiveness of the respective programmes and policies were collected from previous observational studies, and were used to model the long-term effectiveness and monetary gains.

Estimates of the absolute gains showed large variations between studies, mainly related to the size of the population and scale of the intervention (national vs. regional vs. local levels). The implementation of a national-level smoking ban over a 50-year period would save 2.15–12.96 million QALY in the US[15] (in worst and best case scenarios, depending on the estimated prevalence impact of the ban). By contrast, state-level smoking bans would save from 0.26–1.47 million QALY.[14] In Australia, characterized by a smaller population size, a 1-year national-level media campaign would save 407 000 QALY.[22] A 1-year enforcement of a ban on raising the minimum legal age to 21-years-old in the USA was estimated to be similarly effective as a 4-year national-level media campaign: 124 000–620 000 vs. 129 529–630 925 life-years gained, respectively, (pessimist and optimist scenarios). Programmes implemented in small samples of schools estimated a smaller absolute effect: 2-year educational programmes implemented in 8 schools in the US would save 23.3–36.6 QALY[29] and those implemented in 32 schools in India would save 54.42 QALY.[16] Despite the wide variations, all studies estimated an increase in the number of life years and QALY in the intervention groups.

Estimates of the total costs varied substantially between studies, and depended on the intervention characteristics and size of the population studied. Another major difference between studies is that, in contrast to effectiveness measures, intervention costs were calculated for different time horizons, with nine articles presenting only short-term estimates.[16–21,24,28,29] Moreover, there was some variation in the resources included in the cost calculations. From the 14 studies that specified which resources were considered for cost measurement,[14–22,25–29] all considered the expenditures with human and material resources related to the design and implementation of the programme. However, 11 did not consider opportunity costs of teachers and/or students,[14–18,21–27,29] 1 study excluded the salaries of trainers who were already part of health services,[20] 4 excluded transportation costs[18,20,26,28] and 8 excluded infrastructure costs.[18,21,22,25–29] Variations between studies in cost estimates may also be due to variations in the prices of inputs (in particular, salaries), and in the costs attributed to the process of developing and implementing laws and programmes. Finally, some authors[14,15,18,19,21,22,26–29] subtracted from total intervention costs the monetary gains related to averted costs and productivity losses, obtaining cost savings in all cases.

Studies that evaluated the implementation of smoking bans at the USA national level presented annual costs of $27 to $190 million (the variation is due to the wide range of costs from state to state).[17] When subtracting averted healthcare costs, estimated savings amounted from $5335 to $211 653 million.[15] School-based programmes that did not consider the monetary savings estimated the cost at $7261 per school in India[16] and £5662 in the UK,[20] for 2-year programmes. Other authors that subtracted averted healthcare costs obtained $310 737 savings for school-based programmes implemented in 45 classes,[29] and the ones that considered the averted healthcare costs and productivity losses measured €5.59 million savings[19] in Germany and $619 million[26] in Canada. National-level media campaigns, including averted healthcare costs, produced savings of $730.5 million in Australia[22] when costs were projected in a life-long time horizon and $1.9–$5.4 billion in the USA[21] when costs were measured only for the 3-year duration of the programme. In a smaller setting, and not considering healthcare costs

averted, a combined media campaign and school educational programme in four USA communities was estimated to cost $759 436 for a 4-year duration.[25]

These wide variations in costs and effectiveness estimates led to different cost-effectiveness values. Smoking bans at the national level were estimated to be dominant (effective and cost saving), with savings of $34–$212 billion and 2.15–12.96 million QALY,[15] when considering healthcare costs averted. In contrast, a school-based educational programme was not found to be cost saving: the incremental cost-effectiveness ratio was estimated at €19 900 per QALY[28] when considering both healthcare costs averted and future healthcare savings. The benefit-cost ratio of school-based programmes varied from 3.6[19]–15.4[26] (i.e. with benefits 3.6 and 15.4 greater than costs, respectively). These variations related mostly to the time horizon and details of cost estimation. Of all studies, eight concluded that these policies and programmes were not only cost-effective but also dominant, and all of them showed that they were highly cost-effective, taking into account the threshold proposed by the World Health Organization (the annual Gross Domestic Product per capita of the country).[30]

Discussion

Evidence on cost-effectiveness of tobacco control policies and programmes targeting adolescents is scarce. Only 16 articles fulfilled our inclusion criteria and only 2 of them were published after 2010[16,20]. Also, the primary evidence that was used in the effectiveness estimates derived from observational intervention studies or randomized controlled trials that were implemented earlier than 2005. Often, lack of primary evidence led to the use of hypothetical scenarios. Of these 16 studies, only 6 did not present potentially serious methodological limitations[14,15,22,25–27] according to the NICE criteria.[13]

The fragmentary nature of the evidence on the cost-effectiveness of tobacco control interventions in terms of reducing youth smoking may have various causes. First, it may result from the adoption of tobacco control policies amongst youth as a standard recommendation by international organizations:[8,11,31,32] as these policies are implemented in any event, there might be less need to produce economic evaluations to convince decision-makers. Second, the economic evaluation of these policies and programmes is complex. This complexity derives from the need to measure uncertain long-term consequences, and to measure and predict costs that are supported mostly at the system level (vs. the individual level), which is not common practice in economic evaluations. Third, a publishing bias is likely: evaluations that conclude interventions to be cost-effective might be more likely to be reported, especially in peer-reviewed publications. Fourth, as we limited our search on the policies directly targeting adolescents, we may have not included cost-effectiveness studies of strategies that prevent smoking among adults but that may have an indirect effect on the younger groups (but which do not present the terms 'adolescent' or 'youth' on their titles and/or abstracts).

Estimates of the cost-effectiveness of smoking bans, bans on sales to minors or bans on advertizing at points-of-sale were even scarcer than those on school programmes or media campaigns. Legal bans tend to be more difficult to evaluate than other interventions since, commonly, the policy design and implementation involves a rapid and entangled pace, which often limits the access to appropriate data, measures or control groups.[33] As a consequence, there is little evidence on the cost-effectiveness and perhaps cost savings of such bans, especially regarding youth.

The small number of studies and the heterogeneity of methodology used limits both decision-making and scientific knowledge in at least three ways. First, as none of the studies compares multiple policies and programmes, there is little evidence to compare the cost-effectiveness of different interventions to prevent youth

smoking. Such evidence would have been important to set priorities and to use available resources when these are scarce. Second, as no study has evaluated different settings (such as different countries, regions or schools), there is little evidence on how the cost-effectiveness of preventive policies and programmes may vary with the context of the intervention. For example, the costs may vary greatly according to the scale of implementation and to the type and price of each resource needed to be activated in different settings. Similarly, the effectiveness may vary according to the pre-existing support for the policies or depend on the legislative coherence of enacted policies. Evidence on such context dependencies would come from studies that compare different countries, and that analyze interventions with due attention to the wider context. Third, in the same line, the literature does not provide sufficient evidence on the optimal level of action or, even, the type of intervention. Policies and programmes may be implemented differently at different levels, e.g. national, local or school levels, with different costs and consequences. Estimates of the cost-effectiveness by level are fundamental to select the appropriate level of action for each population.

Despite the heterogeneity despite the heterogeneity of evaluations reviewed in this paper, all of these 16 studies concluded that the policies and programmes were always cost-effective and dominant in some cases, if the healthcare costs averted were taken into account. However, the scarcity of economic evaluations of tobacco control interventions, the heterogeneity and limitations of the methods used and the low comparability of the evaluation studies reduces the applicability of the results. For example, they do not allow the preparation of a priority list to support decision-making. Moreover, the available evidence provides little guidance for estimating the cost-effectiveness in different countries or policy levels, or how to improve cost-effectiveness by taking into account local conditions. Therefore, there is a strong need for new evaluations that focus on comparing programmes and policies as implemented in the real world, while taking into account the level and context of implementation. Such contextualized cost-effectiveness estimates are crucial to evidence-based decision making and public health advocacy on tobacco control.

Acknowledgement

Supplementary data

Supplementary data are available at *EURPUB* online.

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Key points

- Tobacco prevention policies and programmes targeting youths may be cost-effective, and a cost-saving option to promote health in many cases.
- Numerous limitations were found in the number and quality of the economic evaluations of tobacco control policies and programmes.

- Further evidence comparing different policies and programmes in different specific contexts and levels is thus required to support decision making.

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Sustainability of outdoor school ground smoking bans at secondary schools: a mixed-method study

A.D. Rozema,[1] J.J.P. Mathijssen,[1] M.W.J. Jansen,[2,3] J.A.M. van Oers[1,4]

1 Department Tranzo, Academic Collaborative Centre for Public Health Brabant, Tilburg University, Tilburg, The Netherlands
2 Academic Collaborative Centre for Public Health Limburg, Public Health Service South Limburg (GGD ZL), Geleen, The Netherlands
3 Department of Health Services Research, School for Public Health and Primary Care CAPHRI, Maastricht University, Maastricht, The Netherlands
4 National Institute for Public Health and the Environment (RIVM), Bilthoven, The Netherlands

Correspondence: A. D. Rozema, Department Tranzo, Tilburg University, P.O. Box 90153, 5000 LE Tilburg, The Netherlands, Tel: +31 (0) 13 4663136, e-mail: a.d.rozema@tilburguniversity.edu

Background: Although increasing numbers of countries are implementing outdoor school ground smoking bans at secondary schools, less attention is paid to the post-implementation period even though sustainability of a policy is essential for long-term effectiveness. Therefore, this study assesses the level of sustainability and examines perceived barriers/facilitators related to the sustainability of an outdoor school ground smoking ban at secondary schools. **Methods:** A mixed-method design was used with a sequential explanatory approach. In phase I, 438 online surveys were conducted and in phase II, 15 semi-structured interviews were obtained from directors of relevant schools. ANOVA (phase I) and a thematic approach (phase II) were used to analyze data. **Results:** Level of sustainability of an outdoor school ground smoking ban was high at the 48% Dutch schools with an outdoor smoking ban. Furthermore, school size was significantly associated with sustainability. The perceived barriers/facilitators fell into three categories: (i) smoking ban implementation factors (side-effects, enforcement, communication, guidelines and collaboration), (ii) school factors (physical environment, school culture, education type and school policy) and (iii) community environment factors (legislation and social environment). **Conclusions:** Internationally, the spread of outdoor school ground smoking bans could be further promoted. Once implemented, the ban has become 'normal' practice and investments tend to endure. Moreover, involvement of all staff is important for sustainability as they function as role models, have an inter-relationship with students, and share responsibility for enforcement. These findings are promising for the sustainability of future tobacco control initiatives to further protect against the morbidity/mortality associated with smoking.