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Economic analyses of transport infrastructure and policies including health effects related to cycling and walking: A systematic review ☆

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ABSTRACT

We reviewed published and unpublished studies that presented the findings of an economic valuation of an aspect of transport infrastructure or policy, and included data on walking and/or cycling and health effects in the valuation. We included 16 papers, of which three were classified as 'high; six as 'moderate' and seven as 'low' quality. There is a wide variation in the approaches taken for including the health effects of physical activity in economic analyses of transport projects. This is not helped by a lack of transparency of methods in many studies. A more standardised approach is called for, including a clearer description of the applied methods and assumptions taken.

1. Introduction

Physical activity is a fundamental means of improving physical and mental health. For too many people, however, it has been removed from everyday life, with dramatic effects for health and well-being (Cavill et al., 2006). Walking and cycling represent practical opportunities for people to integrate physical activity into everyday life, and are tangible and achievable alternatives to sport and exercise for which important positive health effects have been demonstrated (Andersen et al., 2000; Matthews et al., 2007; WHO, 2002). The promotion of cycling and walking has become an area of emerging interest and high relevance to the development of comprehensive health and environment policies, in particular those related to the implementation of sustainable transport policies. In recent years, support for policies promoting modal shifts towards cycling and walking has been advocated within a number of strategies for health and sustainable development (WHO Europe, 2005; WHO-UNECE, 2008; European Commission, 1999).

In 2006, the WHO Regional Office for Europe undertook a project on economic valuation of health effects from cycling and walking. This project built on previous initiatives including a workshop of the Nordic Council on "Cost–benefit Analysis of cycling" held in February 2005 in Stockholm[1]; discussions that were held in Switzerland in September 2005 on open questions related to economic valuation of transport-related physical activity; and extensive work by WHO and partners on cost-effectiveness, including the CHOICE project (*Cho*osing *I*nterventions that are *C*ost-*E*ffective)[2] and guidance on cost-effectiveness of environmental health interventions (WHO, 2000). This report pointed out that "there is a serious lack of cost-effectiveness studies for all types of environmental health interventions, and therefore decision makers have limited information on the relative cost-effectiveness of health interventions from which to make evidence-based decisions" (WHO, 2000, p. vi). This also applies to methods for including health impacts in economic assessments of transport projects. Economic assessments are a common part of the professional life of a wide range of professionals including transport planners and environmental managers, who see economic valuation (primarily cost–benefit analysis) as an essential pre-requisite to funding any new scheme, programme or policy. A new road will only be built if its projected benefits outweigh its costs. While the costs are relatively straightforward (tarmac, construction, maintenance, etc.) the benefits are very variable. Many different aspects such as environmental impacts, land use, congestion and time use are already well covered in most cost–benefit analysis studies of transport interventions. Yet too often these do not take account of the wide variety of benefits to health of new schemes, projects or policies.

In recent years, a few countries (e.g. the Nordic Council) have carried out pioneering work in trying to assess the overall costs and benefits of transport infrastructures taking health effects into account, and guidance for carrying out these assessments has

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[1] http://www.norden.org/pub/sk/showpub.asp?pubnr=2005:556.

[2] http://www.who.int/choice/description/en/.

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been developed. However, important questions remain to be addressed regarding the type and extent of health benefits which can be attained through investments in policies and initiatives which promote more cycling and walking.

For example, people have differing views on the value of time, or the importance of issues such as journey ambience. In recent years this approach has begun to be applied to projects concerning cycling and walking, and this opens up many more new issues concerning what should be included in any analysis. If a new bike path is built, what should be counted? All cyclists? New cyclists? New cyclists cycling over a recommended minimum amount? And what health effects should be considered as a result of their cycling? Change in risk of chronic disease such as coronary heart disease or stroke? Improvements to mental health? Or even less tangible outcomes such as quality of life?

This issue is even more important when the results of early cost–benefit analyses of cycling and walking projects are considered. Consideration of the health impacts have, in many cases, resulted in relatively high benefit–cost ratios (BCRs) compared to traditional transport economic appraisals (Nordic Council, 2005). If these cannot be justified with transparent methods, they may arouse suspicion among supporters of motorised transport. This underlines the importance of developing a strong, agreed, evidence-based methodology to help the decision-making process (Grant-Muller et al., 2001).

The overall aim of this project was therefore to review recent approaches to cost–benefit analysis of transport-related physical activity. Based on the approaches developed to date, options for the further development of a more harmonized methodology were to be proposed as guidance for Member States on approaches to the inclusion of health effects through transport-related physical activity in economic analyses of transport infrastructure and policies. This paper reports on the first part of the project.

2. Methods

2.1. Study inclusion criteria

To be included in this review, the study had to:

1. present the findings of an economic valuation of an aspect of transport infrastructure or policy;
2. include data on walking and/or cycling in the valuation (including changes in modal share, distance walked, etc.);
3. include health effects related to physical activity in the economic valuation;
4. be in the public domain. This included government and other reports that were publicly available; reports on websites; as well as papers from peer reviewed journals.

All age groups were considered. Papers from languages other than English were translated and reviewed where necessary.

2.2. Search strategy

A comprehensive literature search was carried out to locate all relevant studies. This was conducted in collaboration with the National Institute for Health and Clinical Excellence (NICE) in the United Kingdom. Economic, health, medical, transport, environmental internet and 'grey' literature databases were searched using search terms tailored for each database. These were drawn primarily from the main components of the study including economic appraisal; walking/cycling; health outcomes. A full description of the search strategy is available in Appendix D. Papers were also sought from experts in the field, including the project advisory group.

The literature search resulted in 4264 titles which were screened for inclusion. Following the application of the inclusion criteria, 57 papers were deemed to be relevant, and were retrieved and read in full. Sixteen papers were included in the final review and subjected to full data extraction and quality appraisal. Included studies are listed in Appendix B. Excluded studies with reasons for exclusion are shown in Appendix C. The main reason for exclusion was that the study was not an economic evaluation, or did not include data on walking or cycling in the valuation.

2.3. Data extraction

The studies were reviewed and core data extracted from each study. These data are presented in Appendix A. Data extraction covered all the main aspects of each study, with a focus on the inclusion of health effects related to physical activity. Results were standardised as far as possible, and values converted into Euros. Data from one Danish study were extracted by a native speaker.

Included studies were rated by two reviewers (NC and SK) to determine the strength of the evidence. Firstly each study was categorised by study type (see below) and each was assessed for methodological rigour and quality against the checklist used by NICE in its appraisal system (NICE, 2006). Each study was assigned a code '++', '+' or '−', based on the extent to which the potential sources of bias had been minimised (see Table 1 below). Appraisals were also compared with those conducted on a similar set of studies by the York Health Economics Consortium for NICE in 2006 (Beale et al., 2007).

A brief overview of the main findings is given in the Results section. As the main focus of this project is to analyse the approaches taken to the inclusion of health effects related to physical activity, this is the main focus of the analysis.

Table 1
Appraisal system used to determine level and quality of evidence (NICE, 2006).

Type and quality of evidence	
1++	High quality meta-analyses, systematic reviews of randomized controlled trials (RCTs), or RCTs (including cluster RCTs) with a very low risk of bias
1+	Well conducted meta-analyses, systematic reviews of RCTs, or RCTs (including cluster RCTs) with a low risk of bias
1−	Meta-analyses, systematic reviews of RCTs, or RCTs (including cluster RCTs) with a high risk of bias
2++	High quality systematic reviews of these types of studies, or individual, non-RCTs, case–control studies, cost–benefit analysis (CBA) studies and correlation studies with a low risk of confounding, bias or chance and a high probability that the relationship is causal
2+	Well conducted non-RCT, case–control studies, cohort studies, cost–benefit analysis (CBA) studies and correlation studies with a low risk of confounding, bias or change and a moderate probability that the relationship is causal
2−	Non-RCTs, case–control studies, cohort studies, CBA studies, ITS and correlation studies with a high risk—or chance—of confounding bias, and a significant risk that the relationship is not causal
3	Non-analytic studies (for example, case reports, case series)
4	Expert opinion, formal consensus
Grading the evidence	
++	All or most of the quality criteria have been fulfilled Where they have been fulfilled the conclusions of the study or the review are thought to be very unlikely to alter
+	Some of the criteria have been fulfilled Where they have been fulfilled the conclusions of the study or the review are thought unlikely to alter
–	Few or no criteria fulfilled The conclusions of the study are thought to be likely or very likely to alter