The challenges of evaluating environmental interventions to increase population levels of physical activity: the case of the UK National Cycle Network

D A Lawlor, A R Ness, A M Cope, A Davis, P Insall, C Riddoch

PHYSICAL ACTIVITY AND PUBLIC HEALTH
Regular, physical activity is associated with increased life expectancy and reduced risk of coronary heart disease, stroke, diabetes, hypertension, obesity, and osteoporosis. It has been suggested that promoting physical activity is “public health’s best buy.” However, most people are not regularly active and the challenge remains as to how “more people” can be encouraged to be “more active, more often.” To date, most public health interventions to increase levels of physical activity, such as media campaigns or primary care based “exercise on prescription schemes”, have focused on individual behaviour change. At worst these have no overall effect and at best they result in increased levels of activity in only a small proportion of the population and that are seldom maintained long term. This may not be surprising as these interventions are in effect trying to persuade individuals to participate in activities in environments that are (or are perceived to be) hostile to the very activities they promote. Indeed such interventions may be necessary before individual lifestyle approaches can be effective.

In this paper we will discuss the potential role of environmental strategies to increase population levels of cycling and walking; describe one such UK intervention—the UK National Cycle Network; discuss the challenges of evaluating this project and suggest appropriate ways of assessing its effect on population levels of physical activity.

THE POTENTIAL PUBLIC HEALTH IMPORTANCE OF CYCLING AND WALKING
Regular participation in moderately intense activity, such as brisk walking and cycling, is associated with health benefits. Activities that can become part of every day life, such as walking or cycling to work or school, are more likely to be sustained than activities that require attendance at specific venues. Therefore, walking and cycling offer an effective means of increasing population levels of physical activity and improving health.

Cycle ownership in the UK has increased from 14% in 1975/76 to 32% in 1995/97. This suggests that many people wish to cycle but something prevents the transition from intention to actual participation. In the past many more journeys were made by bicycle (fig 1). Furthermore, the number of short journeys (of less than half a mile) undertaken by car has increased from under 4% of all car journeys in the early 1980s to about 25% by the late 1990s. These short trips often take as long, or longer, by car than they would on foot or by cycle, suggesting that people do not necessarily choose the car because they have further to travel now than in the past or because the car is faster.

ENVIRONMENTAL BARRIERS TO INCREASING CYCLING AND WALKING
Various lines of evidence suggest that the environment has an important impact on levels of regular activity. In ecological studies the number of safe and convenient walkways is positively associated with higher levels of regular walking. In one study, after adjustment for potential confounding factors, residents who lived in coastal areas were 23% less likely to be sedentary and 27% more likely to participate in levels of activity that were adequate for health improvement, than residents in similar, but inland, areas. In a US study residents in areas of Los Angeles that were laid out in a “traditional grid system” were up to 25% more likely to regularly walk to work compared with residents in socioeconomically similar areas that were laid out specifically for cars. A survey among adults from six European countries suggested that both moderate and vigorous levels of activity were influenced by perceived environmental factors that encouraged activity. In an in depth interview study low income mothers of young children expressed the view that walking through the depressed and neglected areas in which they lived would be more likely to have a negative rather than positive impact on their own health and that of their children.

THE UK NATIONAL CYCLE NETWORK
Development of the UK National Cycle Network has been initiated and coordinated by the charity Sustrans (Sustrans is a registered charity (number 326550) dedicated to practical measures for the promotion of non-motorised transport. Sustrans stands for Sustainable Transport.”

* Sustrans is a registered charity (number 326550) dedicated to practical measures for the promotion of non-motorised transport. Sustrans stands for Sustainable Transport.

Figure 1 Secular trends in cycling and car use on public roads in Great Britain, 1952–1999; mean billion vehicle kilometres per year, plotted on a log scale to emphasise rate of change over time. Source: Department of Environment and Transport and the Regions.
stands for sustainable transport). Sustrans was established in 1978 as a community group in Bristol, south west England, to design and create traffic free paths for cyclists and pedestrians; over the next few years it expanded to work on a national scale. Sustrans objective was to promote non-motorised forms of transport as more environmentally responsible alternatives to the private car. This objective was later widened to include other potential benefits, including the promotion of healthy physical activity.

In 1995 Sustrans proposed a structured programme to use new and existing traffic free paths to link quiet and traffic calmed roads into a UK national cycle network (fig 2). The purpose was to tackle the overall objectives of Sustrans and also to increase cycling levels in the UK to levels similar to other European countries with more cycle friendly transport systems (18% of routine journeys in Denmark are made by bicycle, comparable figures for Switzerland, Germany, and Sweden are 15%, 11%, and 10% but for the UK this figure is only 2%). The proposal requested 500 partner bodies to collaborate on the development of an 8000 km first phase network, for completion by June 2000. This first phase was successfully completed, and work is now in progress to extend the Network to 16000 km by summer 2005.

The partners include local (government) authorities, national groups active in environmental, transport, recreation, health and social welfare, local organisations and community groups active in these fields, and major landowners such as British Waterways, the National Trust, and the Forest Enterprise. The project also has the support of thousands of individuals, as planning, construction and maintenance volunteers and as financial donors. Other project funds have been assembled from the Millennium Commission of the UK.
national lottery, national transport funds, local authority funds for transport, recreation and environmental improvement, commercial sponsorship, donations from charitable foundations, works carried out by private developers, European funds, and a range of smaller sources. The total cost to June 2000 was about £210 million.

The network is made up of more than 1000 individual projects, which range from bridges to new road crossings, signage of existing quiet minor roads to construction of new traffic free paths up to 10 km in length, and incorporation of cycle access into new developments. Most require planning permission and many include on road sections, which must be implemented by the highway authority. This multi-stage process, over so many individual projects, requires a major coordination effort which is undertaken by Sustrans. One of the most important aspects of the project is to stimulate local authorities to contribute to the Network in all local areas across the country.

By June 2000, the routes of the Network were already highly accessible—11.3 million people in England, Scotland, and Wales (of a total population of about 53 million) lived within 1 km of a national route (data for Northern Ireland not currently available). It is a key criterion of national route planning that the routes should run through population centres and where possible connect them to schools, shopping areas, and work places. The network therefore has the potential to facilitate short (less than 0.5 mile) commuter journeys by bicycle or on foot that can be incorporated into everyday activity, as well as providing for recreational cycling and walking.

The Network aims to provide safer environments not only for cyclists but also walkers, joggers, wheelchair users, and other non-motorised forms of transport over much of its length (figs 3–5). It has been constructed with an emphasis on aesthetics and has become the UK’s largest outdoor art gallery (fig 5). The Network could be potentially an important contributor to improvements in the public health by supporting regular moderate physical activity in pleasant environments.

WHY EVALUATE THE UK NATIONAL CYCLE NETWORK?

It could be argued that the Network is a “societal public good” with broad aims and as the continuation of this programme is in no way dependent upon demonstrating an effect on population levels of physical activity evaluation is not necessary. We believe, however, that there are several reasons why the effect of the Network on levels of regular physical activity should be evaluated. Firstly, such an evaluation would add to the body of evidence on the effect of environmental change on population levels of physical activity. Secondly, evaluation may be valuable in shaping the way in which the network develops. For example, process evaluation could seek to identify groups who do not use the Network and reasons for this. Thirdly, the evaluation itself may provide additional impetus for building of further cycle paths in local areas.

DIFFICULTIES OF EVALUATING THE UK NATIONAL CYCLE NETWORK

Evaluating the effect of the Network on levels of activity is not straightforward. The evaluation must not be too expensive as it makes little sense to set up an elaborate evaluation that is unlikely to provide a definitive answer and costs more than the intervention itself. Although important in evaluating the clinical effectiveness of therapeutic interventions the randomised controlled trial is seldom an appropriate tool for assessing the health impact of an intervention with a population level outcome. More specifically, randomised comparisons might not be meaningful as the differences between comparison areas may take some years to emerge (by which time the control area has been enrolled in the programme). They may also be diluted by building of local cycle paths in the control areas, or they may be dependent on the establishment of an interlinking and extensive network. A way around these problems is to use evidence from a variety of sources to evaluate both the process and outcomes of the Network: “if the resulting data all point in the same direction, it is reasonable to assume that a programme has been successful.” Various sources of information are available or could be collected that could be used together to assess the effect of the Network. These are summarised in table 1.
Sustrans has already worked with a number of local authorities to undertake surveys of users of the Network showing that such surveys are feasible. The sites were chosen by local authorities and are therefore not representative of the whole network. Also though the data were collected using the same questionnaire and with standardised protocols: each survey was conducted over four 12 hour periods (a weekday during school term and school holidays) the data were collected by different interviewers and no attempts were made to monitor or assess interviewer bias, preliminary analyses of these data provide some useful insights into current use of the network. Fifty one per cent indicated that they were using the network for a specific purpose (for example, barriers to use for groups not represented in user surveys) limited use for outcomes because no comparison group.

Electronic counters are placed at most survey sites and can be used to validate the manual counts of the interviewers. Extensive use of electronic monitors across the network could be used to monitor changes in use over time. One limitation is that these monitors only detect cycle use and provide no information on pedestrian use or other users of the paths.

The user survey does not include a comparison group so it is impossible to make definite statements regarding the effect of the network on levels of walking and cycling.

### Table 1

<table>
<thead>
<tr>
<th>Approach</th>
<th>Data sources</th>
<th>Potential outcomes</th>
<th>Developments required to existing data to improve value for evaluating cycle network</th>
<th>Limitations / potential problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>User surveys</td>
<td>Local authority user surveys</td>
<td>Process measures:</td>
<td>Random selection of survey sites from across network</td>
<td>No information on non-users interviewing (for example, barriers to use for groups not represented in user surveys)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Who is using network and for what purpose</td>
<td>Standardisation of data collection at each site</td>
<td>Limited use for outcomes because no comparison group</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To inform future developments of network</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>To determine whether users feel network has increased their likelihood of being</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>regularly active</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>To identify groups who do not appear to use the network</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Routine data</td>
<td>National road traffic survey</td>
<td>Process measures (users and non-users):</td>
<td>Include details of trips undertaken on traffic free routes in surveys</td>
<td>May not be possible to include additional questions into routine survey</td>
</tr>
<tr>
<td></td>
<td>National travel survey</td>
<td>Awareness of network</td>
<td>Inclusion of questions relating to national cycle network into next round of survey</td>
<td>Time-trend analysis—difficult to be certain the intervention has definitely cause any change, latency period unknown</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Barriers to use</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outcome measures:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time-trend analyses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comparisons</td>
<td>Linking routine data from National Travel Survey and National Travel Survey</td>
<td>Outcome measures:</td>
<td>Linking of routine data to postcodes and from this to areas of completed network paths</td>
<td>May not be possible to obtain routine survey data linking of</td>
</tr>
<tr>
<td>between areas close to</td>
<td>and more distant from network</td>
<td>Differences between areas in amount of walking and cycling</td>
<td></td>
<td>adequately adjust for potential sociodemographic confounding factors</td>
</tr>
<tr>
<td>and from network</td>
<td></td>
<td>Differences between areas in self-reported levels of physical activity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**The Role of UK National Cycle Network User Surveys**

Sustrans has already worked with a number of local authorities to undertake surveys of users of the Network showing that such surveys are feasible. The sites were chosen by local authorities and are therefore not representative of the whole network. Also though the data were collected using the same questionnaire and with standardised protocols: each survey was conducted over four 12 hour periods (a weekday during school term and school holidays) the data were collected by different interviewers and no attempts were made to monitor or assess interviewer bias, preliminary analyses of these data provide some useful insights into current use of the network. Fifty one per cent indicated that they were using the network for a specific purpose (for example, barriers to use for groups not represented in user surveys) limited use for outcomes because no comparison group.

Electronic counters are placed at most survey sites and can be used to validate the manual counts of the interviewers. Extensive use of electronic monitors across the network could be used to monitor changes in use over time. One limitation is that these monitors only detect cycle use and provide no information on pedestrian use or other users of the paths.

The user survey does not include a comparison group so it is impossible to make definite statements regarding the effect of the network on levels of walking and cycling.

### The Role of Routine Transport Data

There are several sources of routine transport data in the UK. These include the UK National Road Traffic Survey and the UK National Travel Survey. The UK National Road Traffic Survey has been used to describe traffic profiles on the public road network since the 1950s. Data are derived from manual roadside traffic counts and automatic traffic counters at a large number of sites. Figure 1 shows secular trends in mean yearly distances travelled by car and bicycle, over the past 50 years using data from Road Traffic Surveys. From the early 1950s to 1970 there was a steep increase in the distance travelled per year on public roads by car and an equally steep decline in distances travelled per year by bicycle. Since 1970 car use has continued to increase whereas cycling on public roads has exhibited an irregular pattern. Rates of cycling remained stable and at an all time low (4 km per person per year) in the early to mid-1970s. Between the mid-1970s and the mid-1990s rates have changed erratically but have tended to be higher (6–7 km per person per year) than in the early 1970s. From the mid-1990s to 1999 cycling rates have returned to the mid-1970s rate of 4 km per person per year. The changes in cycling over the past 30 years are difficult to explain by any single factor (though the increase in rates in the mid-1970s may have been in response to the oil crisis and petrol price increases). What they tend to suggest, however, is that cycling rates on public roads can change over comparatively short periods of time and may therefore be modifiable. The use of
Key points

- Increasing population levels of physical activity will result in improvements in population health.
- Strategies that seek to change the environment to one that is supportive of regular commuting by bicycle or on foot have an important part to play in increasing population activity levels.
- The National Cycle Network is the UK’s largest environmental intervention to support such activities.
- Evaluating the effect of the Network on population levels of physical activity would be valuable but is not straightforward.
- We suggest that evaluation should be undertaken combining evidence from network user surveys, routine transport surveys and linking details of development of the network with routine surveys to compare modes of transport and levels of activity between areas close to the network and those more distant from a network path.

The role of comparisons between areas close to a network path and those more distant

As the network is still in a process of development and in particular local authority extensions to it will be ongoing for some time it may be possible to link data from routine surveys, via postcodes of respondents and detailed knowledge of the network development, to knowledge of whether respondents were close to or distant from a network route. Data from the UK National Travel Survey could be used to compare levels of regular cycling and walking between people living in areas close to and more distant from network routes and data from the Health Survey for England could be used to compare overall levels of physical activity between individuals from each area. It would be necessary to be able to make adequate adjustment for a number of potential confounding factors, such as socioeconomic circumstances and other sociodemographic factors for this approach to be valid. As such data are collected in both the UK National Travel Survey and the Health Survey for England this should be possible. Access to the data by postcodes may not be feasible and may raise issues relating to data protection, but this approach is worth further investigation. In addition before and after studies of specific projects within the overall Network development programme could be undertaken. For example, a well conducted survey of a community before and after removal of a physical barrier (such as building a bridge across a busy road) between the community and main areas of work and shopping could be undertaken. This would provide information on the effect of a specific activity in a particular context and several such projects may provide information that could be generalised to the whole Network and its future development.

Conclusions

Environmental interventions that support regular physical activity are likely to contribute to improving public health. The UK National Cycle Network represents the UK’s largest such environmental intervention. Assessing its effect on levels of physical activity is important but is not straightforward. We suggest that rather than set up controlled trials, evaluation could best be undertaken combining evidence from network user surveys, routine transport surveys, and linking details of development of the network with routine surveys to compare modes of transport and levels of activity between areas close to and those more distant from a network path.

Authors’ affiliations

**D A Lawlor, A R Ness**, Department of Social Medicine, University of Bristol, Bristol, UK

**A M Cope**, Sustrans North, Newcastle, UK

**A Davis, P Insall**, Sustrans, Bristol, UK

**C Riddoch**, Department of Exercise and Health Sciences, University of Bristol

Funding: The National Cycle Network is a Millennium project supported by funds from the National Lottery. The local authority surveys of National Cycle Network users were supported by a grant from the Sainsbury Trust and funds from Sustrans*. DAL is funded by the Medical Research Council. The views expressed in this publication are those of the authors and not necessarily those of any of the funding bodies.

Competing interests: AC and PI work for Sustrans; AD is a health adviser to Sustrans. All authors walk or cycle regularly.

Correspondence to: Dr D Lawlor, Department of Social Medicine, University of Bristol, Canynge Hall, Whiteladies Road, Bristol BS8 2PR, UK; D.A.lawlor@bristol.ac.uk

Accepted for publication 7 May 2002

**References**

Physical activity and population health


The writing group for the Activity Counseling Trial Research Group. Effects of physical activity counseling in primary care: the Activity Counseling Trial: a randomized controlled trial. JAMA 2001;286:677-87.


