cycling england

Valuing increased cycling in the Cycling Demonstration Towns

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Evaluation of the Cycling Demonstration Towns (CDTs) programme[1] [2] has shown that participation in cycling increased in the Cycling Demonstration Towns between 2006 and 2009. This is likely to have led to health benefits in the population of the Cycling Demonstration Towns, through reduced mortality and morbidity. This brief report outlines the methods behind valuing the reduced adult mortality that is likely to arise from this measured increase in cycling.

What data are available to conduct an economic appraisal?

The monitoring and evaluation programmes of the first three years of the Cycling Demonstration Towns have provided a wide range of types of data[3]:

- Automatic counts of cyclists in CDTs; both cordon counts and counts along key cycle routes
- Manual counts (similar locations to automatic counts)
- Local survey data (eg hands up surveys in schools)
- Data from Sport England's active people survey on cycling bouts of 30 minutes or more
- Data from the ICM survey commissioned by Cycling England, on cycling (any duration) in a typical week and in the last week

We set out to find data that would provide input values for the World Health Organization's Health Economic Assessment Tool (HEAT) for cycling[4]. This provides an assessment of the value of decreased mortality due to cycling.

We explored the possibility of using the count data for an economic appraisal. The main advantages of using the count data are that they are objective data from the automatic counters and so, compared to the self-assessed survey data, are not subject to recall error; and they provide direct inputs to the HEAT tool (as the HEAT was designed for two main input values: number of trips and trip length).

However, the main disadvantage of the count data is that they do not capture all cycling in the Cycling Demonstration Towns. The count data were designed to monitor trends in cycling not the prevalence of cycling. Although the counters are placed at key strategic locations agreed with the local authorities, the network of counters can never capture all the cycling in a town. It is likely that the automatic counters in the Cycling Demonstration Towns only count a proportion of all cycle trips.

For this reason we focused on the survey data. The main disadvantage of the survey data is that they rely on self-report, and so (like most physical activity survey data) are prone to recall bias. However, it seems likely that there is less error in recall of cycling than there would be for other types of physical activity, especially walking. It seems likely that people would find it quite easy to assess whether they cycle or not 'in a typical week in the last year' with a reasonable degree of accuracy. We were also able to check the responses from the ICM survey against the data from Sport England's Active People survey, for some degree of validation.

The other disadvantage of the survey data is that they are for adults (aged 16+) only. This would under-estimate the impact of the Cycling Demonstration Towns programme in towns like Derby, where a large part of the programme was aimed at children. However, the mortality rate for children is extremely low and so it is inappropriate to include children in the HEAT mortality model.

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1 Cope A, Muller L, Kennedy A, Parkin J and Page M. *Cycling Demonstration Towns: Monitoring project report 2006 to 2009* London. Cycling England. **www.dft.gov.uk/cyclingengland**
2 Cavill N, Muller L, Mulhall C, Harold K, Kennedy A, Hillsdon M, Bauman A. (2009). *Cycling Demonstration Towns: Surveys of cycling and physical activity 2006 to 2009*. London. Cycling England. **www.dft.gov.uk/cyclingengland**
3 Sloman L, Cavill N, Cope A, Muller L and Kennedy A (2009). *Analysis and synthesis of evidence on the effects of investment in six Cycling Demonstration Towns*. London. Cycling England. **www.dft.gov.uk/cyclingengland**
4 Cavill N, Kahlmeier S, Rutter H, Racioppi F, Oja P. Economic assessment of transport Infrastructure and policies. Methodological guidance on the economic appraisal of health effects related to walking and cycling. Copenhagen. WHO Regional Office for Europe. **http://www.euro.who.int/transport/policy/20070503_1**

What type of economic appraisal can be conducted with these data?

A full appraisal of the benefits of cycling would entail calculation of a wide range of benefits:

- Mortality
- Morbidity
- Absenteeism
- Air quality
- Congestion
- Journey ambience

We do not have the data from the monitoring and evaluation programme to calculate many of these benefits, especially as we have little indication of the proportion of journeys made by bike that might previously have been made by car.

It is hoped that a full economic appraisal of the changes in the Cycling Demonstration Towns will be conducted by DfT in late 2009, using the full WebTag process[5]. In advance of this, we focused on estimating the value of the reduction in adult mortality, using the WHO's HEAT tool, for the following reasons:

- The data are available from the ICM survey
- Adult mortality accounts for a large proportion (> 50%) of the likely benefits
- The impact on mortality can be assessed using fewer assumptions than many of the other impacts
- The HEAT tool has been reviewed thoroughly and is used as part of WebTag

This approach will therefore provide only a partial assessment of the impacts of the programme, but it should provide a useful indication in advance of the full WebTag appraisal.

Use of WHO's Health Economic Assessment Tool (HEAT) for cycling

The published HEAT tool requires input values of trips per day and number of trips. Using a number of assumptions the tool then calculates the number of people affected and the amount of time they spend cycling. However, from the ICM study we have the following data:

- Number of additional people cycling regularly between 2006 and 2009
- Time these people spend cycling per week

We therefore adapted the published HEAT tool to fit the new data. This actually involved a reduction in the number of assumptions in the tool. The published HEAT tool uses the following estimates or assumptions to calculate the risk of death in the study area:

- Average speed (14kph)
- Weeks per year cycled (36)
- Trip length (estimated)
- Proportion of trips undertaken as part of a round trip (0.9)

In the adapted HEAT tool the only assumption needed is weeks per year cycled, as the time per week cycled is now the main input.

5 www.dft.gov.uk/webtag

Estimating the number of additional adult cyclists

The ICM survey asked “In a typical week during the past 12 months, how many hours did you spend on…cycling, including cycling to work and during leisure time” (question 2).

We calculated the % doing ANY cycling in 2006, and subtracted this from the % doing ANY cycling in 2009, for each town. This gave the % change in each town, which was multiplied by the adult population of each town to provide an estimate of total new adult cyclists.

		no cycling (n)	any cycling (n)	total (n)	any cycling (%)	change (%)	total adult population (n)	number of new cyclists (n)
All	2009	6,485	2,486	8,971	27.71%	3.46%	714,907	2,4710.91
	2006	6,939	2,222	9,161	24.25%			
Derby	2009	1,122	375	1,497	25.05%	5.51%	192,600	1,0607.67
	2006	1,231	299	1,530	19.54%			
Darlington	2009	1,158	337	1,495	22.54%	1.26%	81,200	1,021.69
	2006	1,202	325	1,527	21.28%			
Brighton	2009	1,100	394	1,494	26.37%	1.67%	215,600	3,592.48
	2006	1,152	378	1,530	24.71%			
Lancaster	2009	1,043	449	1,492	30.09%	4.20%	76,680	3,220.40
	2006	1,119	391	1,510	25.89%			
Aylesbury	2009	1,057	439	1,496	29.34%	2.57%	43,627	1,119.05
	2006	1,121	410	1,531	26.78%			
Exeter	2009	1,005	492	1,497	32.87%	5.53%	105,200	5,821.46
	2006	1,114	419	1,533	27.33%			
TOTAL NEW CYCLISTS 25,383								

This gives a figure of 25,383 adults in all the towns who are now cycling in a typical week, who did not cycle at all in 2006.

Estimating time spent cycling

Data from Q2 were then analysed to provide an estimate of how long these cyclists were cycling in a typical week. If we looked at the total sample of cyclists, this would skew the mean value as it would include existing cyclists. We therefore looked initially only at data for cyclists who in response to Q9 ("Which of the following statements best describes you?") answered as being 'new to cycling' and 'starting to cycle again'.

As the data showed a range (eg 1-2 hours) we chose the mid-point (eg 90 minutes) and calculated the total amount of minutes cycled by these respondents. This gave a mean time per week cycled by new cyclists as 2.9 hours. This seems far too high for new cyclists, probably due to the lack of sensitivity in the measure.

We therefore looked at Q5 and Q6, which was asked only of people who had cycled in the last week:

Q5: Thinking about the last seven days, on how many days did you cycle?

Q6: And for how long in total did you usually cycle on one of those days?

Data for this question were available in blocks of five minutes so were much more sensitive. We also assumed the mid-point in the range, and found a mean time spent cycling (among those 'new to cycling' or 'starting again') of 22 minutes per cycling day. However, this was based on a very small sample (n=156) which reduces the confidence in the estimate. Therefore we looked at time spent cycling among the whole sample who had cycled in the last week (n=1,206) to find an estimate of 20 minutes per cycling day. This more conservative estimate was used.

The mean time per day of 20 minutes was then combined with frequency of cycling in the last week (mean 2.9 days per person) to give a mean time per cyclist of 60 minutes per week (1.01 hours). This had higher face validity than the above approach so was used in the HEAT.

Applying the HEAT for cycling

The HEAT tool was modified to allow us to enter total number of new cyclists, and time spent cycling, as input values.

A number of assumptions were made (see below). In all cases these tended towards conservative values.

This shows a maximum annual benefit (once the maximum health benefit had been reached after an estimated five years) of £8.9 million.

Taking into account the build up of health benefits in the HEAT tool, the present value of the mean annual benefit of this additional level of cycling is in the region of **£4.52 million per year**.

Over 10 years, assuming the new cyclists remained cycling at the current level, this would result in a saving of **£45 million**. This is based on a number of assumptions (described below).

Comparing benefits and costs

As this is not a full economic analysis, we cannot produce a standard benefit:cost ratio. However, it is still important to compare the cost of the programme with the value of decreased mortality. We have called this the 'mortality benefit:cost ratio.'

The Cycling Demonstration Towns programme cost £2.8m per year of direct Cycling England grant, matched by an additional £3.4m from the local authorities. This totals £18.7m over the three years of the programme.

The net present value of this investment at the start of the project (2005) is £17.45 million (assuming that the first year's investment was paid at the end of year one ie all expenditure was discounted back to the start of the project).

This shows that **for each £1 invested, the value of decreased mortality is £2.59.**

This 'mortality benefit:cost ratio' is for mortality only. Including other benefits would increase the ratio considerably.

Assumptions

- All respondents in the towns who have taken up cycling since 2006 are experiencing health benefits, in proportion to the time they spend cycling. This can be justified as the Copenhagen Heart Study[6] (on which the HEAT is based) found a relative risk of death among regular cyclists of 0.72 compared to non-cyclists *controlled for other types of physical activity*. This means that the study found that it was the level of cycling alone that reduced the risk of death. In addition, the data from the physical activity questions (taken from the European Prospective Investigation into Cancer study[7]) in the ICM survey found a significant reduction in the proportion of people in the towns classed as sedentary between 2006 and 2009 (implying that at least some of the new cyclists were previously sedentary).
- All the increase in cycling observed in the Cycling Demonstration Towns can be attributed to the Cycling Demonstration Towns programme. This is different from the WHO approach where it is recommended that 50% of new users of the infrastructure are assumed to be cycling directly as a result of the infrastructure. However, our approach is different in that we are attempting to put a value on all the new cyclists observed in the Cycling Demonstration Towns, so there is no need to reduce this by half. This is supported by the analysis of data from Sport England's Active People Survey, which showed that cycling levels increased in the Cycling Demonstration Towns but there was not a corresponding increase in local authorities without Cycling Demonstration Towns.
- People who have taken up cycling between 2006 and 2009 do so at a similar level to the mean value for people who cycled in the week before the survey: 20 minutes, three times a week. However, this is a more conservative estimate than that based on those who identify themselves as new to cycling or starting again (22 minutes).
- Cycling levels did not rise immediately but took three years to reach the level measured in 2009. Health benefits did not occur immediately but took five years to reach the maximum level. People will continue cycling at the present rate for the remainder of the 10 years. Benefits (and costs) are averaged over 10 years and discounted at 3.5%.
- The death rate used in the HEAT is the crude death rate for 2007[8] for people aged 16-64. This is applied to population figures for people aged 16+. The death rate for 16+ is not used as it would inflate the figures, and the prevalence of cycling among people aged 65+ is low.

6 Andersen, L. et al. (2000). All-cause mortality associated with physical activity during leisure time, work, sports, and cycling to work. Arch Intern Med 160 (11), pp.1621-1628.
7 Khaw, K. T. et al. (2006). Work and leisure time physical activity assessed using a simple, pragmatic, validated questionnaire and incident cardiovascular disease and all-cause mortality in men and women: The European Prospective Investigation into Cancer in Norfolk prospective population study. Int J Epidemiol 35 (4), pp.1034-1043

8 http://www.nchod.nhs.uk/

Limitations

No value is calculated for those people who cycled in 2006 and may have increased (or decreased) their cycling in 2009, i.e the value is only ascribed to new cyclists.

No value is attached to any health benefits gained by children and young people. This is important in some Cycling Demonstration Towns, such as Derby, where a large part of the Cycling Demonstration Towns programme was aimed at young people.

No value is attributed to other improvements to health; reduced absenteeism; reduced congestion; improved air quality; improved journey ambience; journey time; or any other benefits.

The data from the ICM survey are based on a quota sample.

Sensitivity

We explored the impact of varying some of the assumptions used in the analysis.

- Using the death rate for all ages 15+ (instead of 16-64) increased the 'mortality benefit:cost ratio' to 12.6:1
- Using the higher end of the time range that respondents said they cycled increased the 'mortality benefit:cost ratio' to 2.9:1

Discussion

In this analysis we have tried to be as conservative as possible in order to produce realistic values and provide an authoritative assessment of the emerging value of the Cycling Demonstration Towns programme. The resulting 'mortality benefit:cost ratio' is positive, and is in the sort of range that justifies fully the level of public expenditure on the programme.

Conclusions

The proportion of people cycling in the Cycling Demonstration Towns increased between 2006 and 2009. We estimate the economic value of the reduced mortality associated with this increase to be in the region of £4.5 million per year. Over ten years, if these new cyclists continued to cycle regularly, the value of reduced mortality would amount to £45 million. For each £1 invested, the value of decreased mortality is £2.59.

A benefit:cost ratio of this magnitude is classed as 'high' by DfT. Including other benefits (such as morbidity; absenteeism; congestion; pollution) would be likely to increase this value.

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