Dutch Cycling: Quantifying the Health and Related Economic Benefits

The Netherlands is well known for their high bicycle use. We used the Health Economic Assessment Tool and life table calculations to quantify the population-level health benefits from Dutch cycling levels. Cycling prevents about 6500 deaths each year, and Dutch people have half-a-year-longer life expectancy because of cycling. These health benefits correspond to more than 3% of the Dutch gross domestic product. Our study confirmed that investments in bicycle-promoting policies (e.g., improved bicycle infrastructure and facilities) will likely yield a high cost–benefit ratio in the long term. (*Am J Public Health.* 2015;105:e13–e15. doi: 10.2105/AJPH.2015.302724)

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THE NETHERLANDS IS WELL known for their high cycling levels.[1,2] Currently, about 27% of all trips in the Netherlands are made by bicycle.[3] Investments in bicycle paths, bicycle parking, traffic calming, and other policies contribute to these high cycling levels; therefore, the Dutch approach is internationally recognized as an example for other countries.[1,2] Although the health benefits of cycling as a means to reduce the risk of sedentary lifestyle diseases and all-cause mortality are well known,[4–6] no previous study has actually quantified the health benefits and related economic benefits at a population level in the Netherlands, which has the highest level of bicycle use in the world.[1] Quantifying and monetizing these benefits are important to inform policymakers in the field of transport.[7] Therefore, we examined the health benefits and health-related economic benefits of population cycling levels in the Netherlands.

METHODS

Data on age group–specific cycling levels (i.e., average time spent cycling weekly per person), population counts, and mortality rates in the Netherlands in 2010 to 2013 were retrieved from Statistics Netherlands.[3] Data about cycling levels had been collected by a travel diary survey (National Travel Survey or "Onderzoek Verplaatsingsgedrag in Nederland") among a nationally representative random sample of about 50 000 persons each year. All types of travelers and households and all days of the year are proportionately represented.

We used the Health Economic Assessment Tool (HEAT) developed by the World Health Organization[8] to estimate the mortality rate reduction and number of deaths prevented each year by cycling. The tool estimates the value of reduced mortality that results from specified amounts of cycling (or walking). On the basis of a recent meta-analysis of studies about the effect of cycling on all-cause mortality,[4] HEAT assumes a reduction in mortality risk of 10% (95% confidence interval = 6%, 13%) for an exposure to cycling of 100 minutes per week. This risk reduction is controlled for by other forms of physical activity, such as leisure time or occupational physical activity, and other health behaviors such as smoking.[4] Negative side effects as a result of increased exposure to road safety and air pollution risks were controlled for because the meta-analysis was about all-cause mortality. HEAT considers only ages 20 to 65 years. Younger people are excluded because the evidence base for the health effects of physical activity on young people is not as large as that for adults. Older age groups are excluded because countries often lack mobility data for older age groups.[8] However, because the underlying meta-analysis did provide information for ages 65 years and older,[4] the annual number of deaths prevented per age group was calculated by the product of the mortality rate reduction and the mortality rate (annual number of deaths per 100 000) for age groups between 20 and 90 years.

To calculate the economic health benefits of cycling, HEAT uses a standard value of a statistical life to monetize the number of deaths per year prevented by cycling participation. Certain costs such as expenditures related to medical treatment are not reflected in the value of a statistical life estimates, but these are relatively small. HEAT applies a value of a statistical life of $3.6 million for the European Union's 27 countries but advises a locally agreed value of a statistical life where available.[8] The Dutch value of a statistical life is €2.8 million per death at the 2013 price level.[3,9]

We entered Dutch hazard rates in the open-access life-table calculations, IOMLIFET, to estimate the life expectancy increases by age group in response to the reduced risk of mortality as calculated by the HEAT approach.[10]

RESULTS

The time spent cycling was about 74 minutes per week for Dutch adults aged 20 to 90 years (Table 1). This level of cycling was fairly stable over adulthood and reached its peak around 65 to 70 years, in early days of retirement, and strongly declined after age 80 years. The mortality rate reduction, which was a direct result of the average time spent cycling for a certain age group, was therefore also highest between 65 and 70

TABLE 1—Health Economic Assessment Based on Time Spent Cycling and Mortality Rates of the Dutch Population Between 20 and 90 Years: 2010–2013

	Input Data			Outcome HEAT Approach			Life-Table Calculation Results
Age Group, Years	Average Weekly Minutes of Cycling per Person	Population (x 1000)	Average Annual Mortality Rate per 100 000 Population	Mortality Rate Reduction, %[a]	No. of Deaths Prevented per Year[b]	Annual Benefit of Current Dutch Cycling, Billon €[c]	Increase in Average Life Expectancy[d]
20–29	73	2 058	31	7.3	47	0.1	0.01
30–39	69	2 087	53	6.9	77	0.2	0.02
40–49	69	2 573	135	6.9	241	0.7	0.03
50–59	79	2 320	390	7.9	715	2.0	0.08
60–64	89	1 071	757	8.9	719	2.0	0.07
65–69	94	872	1 232	9.4	1 009	2.8	0.09
70–74	88	652	1 963	8.8	1 127	3.2	0.10
75–79	73	507	3 422	7.3	1 274	3.6	0.09
80–84	36	369	6 328	3.6	842	2.4	0.05
85–90	24	216	11 663	2.4	606	1.7	0.03
Total or average	74	12 725	878	7.4	6 657	18.6	0.57

Note. HEAT = Health Economic Assessment Tool.
[a]Based on an estimated mortality rate reduction of 10% per 100 min of cycling per week according to the meta-analysis.[5,8] For instance, for the age group of 20–30 years: 73/100 = 7.3%.
[b]The product of the mortality rate reduction, population, and mortality rate (per 100 000 population)/100 000.
[c]The product of the number of deaths multiplied by the standard value of a statistical life year of €2.8 million.
[d]Based on life-table calculations using IOMLIFET with Dutch mortality rates between 2010 and 2013.[3]

years. As a result of the mortality reduction of all age groups together, about 6500 deaths per year were prevented as a result of cycling in the Netherlands. With a value of a statistical life of €2.8 million per prevented death, the total economic health benefits of cycling were estimated at €19 billion per year.

Life-table calculations suggested that people in the Netherlands would die about half a year earlier without cycling. More than half of this total life expectancy increase was achieved by cycling among adults aged 65 years and older.

DISCUSSION

Cycling levels in the Netherlands have substantial population-level health benefits: about 6500 deaths are prevented annually, and Dutch people have half-a-year-longer life expectancy. These large population-level health benefits translate into economic benefits of €19 billion per year, which represents more than 3% of the Dutch gross domestic product between 2010 and 2013.[3]

The 6500 deaths that are prevented annually as a result of cycling becomes even more impressive when compared with the population health effects of other preventive measures. In an overview, Mackenbach et al.[11] showed that the 22 new preventive interventions that have been introduced in the Netherlands between 1970 and 2010 (e.g., tobacco control, population-based screening for cancer, and road safety measures) altogether prevent about 16 000 deaths per year.

Still, our results are likely to be an underestimation of the true total health and economic benefits. The benefits calculated are for health only (excluding, for instance, reduced traffic congestion) and within the health category, only for mortality and not for prevented morbidity. There is considerable uncertainty regarding the monetization of morbidity,[5] which is why it is not included in the World Health Organization's HEAT model.[8]

Compared with the capital investments by all levels of Dutch government in road and parking infrastructure for cycling of almost €0.5 billion per year over the last decades,[12] the annual benefits of €19 billion are much higher than the annual costs. We acknowledge that this comparison excludes private spending on bicycles and savings on fuel costs if the same trips were made by car. Moreover, next to safe and efficient cycling infrastructure and facilities, geographic factors, such as the Dutch flat terrain and mild climate, and cultural factors likely contribute to high volumes of cycling.[13] These are unrelated to capital investment by governments. However, infrastructure and safety measures are important to facilitate cycling.[13] For instance, elderly, the group among whom the largest health and economic benefits can be achieved, indicated a preference for separate bicycle paths.[14] The Dutch case shows that investments in bicycle-promoting policies (e.g., improved bicycle infrastructure and facilities) would likely yield a high cost–benefit ratio in the long term. We therefore recommend investments in bicycle policies as suggested earlier by Pucher and Buehler[1] and Pucher and Dijkstra.[2] ■

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Contributors

E. Fishman contributed to the conceptualization and design of the study. P. Schepers acquired the data and conducted the analyses. All authors were involved in the interpretation of the data and results and drafting of the brief and approved the final version. All authors, especially C. B. M. Kamphuis, contributed to the literature search for the introduction and Discussion section.

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Human Participant Protection

Institutional review board approval was not needed for this brief because no human participants were involved.

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