Active Transportation and Obesity in Europe, North America, and Australia

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INTRODUCTION

Walking and bicycling account for a much higher share of daily trips in Europe than in North America and Australia.[1] Similarly, Europeans are far more likely to use public transport, which normally requires walking or cycling to reach the rail station or bus stop.[2,3] Travel-related walking, bicycling, and public transport are collectively referred to as "active transportation" and are more common in Europe for several reasons: [1,3,4]

- Compact, dense cities with mixed land uses that generate short trips;
- Restrictions on car use such as car-free zones, low speed limits, and prohibitions of through traffic;
- Extensive, safe, and convenient facilities for walking and cycling;
- Traffic calming of residential neighborhoods;
- Coordination of public transit with walking and cycling to transit stations and stops, including bike parking, as well as safe sidewalks and bikeways;
- Traffic regulations and enforcement policies that favor pedestrians and cyclists over motorists; and
- High cost of owning and operating a car due to expensive driver licensing, high gasoline prices, and high taxes on car purchases.

Some researchers have suggested that active transportation is helpful in weight control.[5,6] Walking and bicycle commuting usually fall into the moderate-intensity range, and if performed regularly, can result in substantial energy expenditure.[7] In addition, the use of public transit (trains, subways, and buses) usually involves walking or cycling to and from transit stops and hence would also be expected to promote weight control, as well as a host of other physical and mental health benefits.[8,9]

The purpose of this study was to determine whether variations in active transportation (defined here as the percentage of trips taken by walking, bicycling, and public transit) are related to international differences in obesity prevalence. It was hypothesized that developed nations where active transportation is common would have lower obesity rates than those with high automobile dependency. We limited our comparison to Europe, North America, and Australia, since industrialized countries on those continents have similar, high levels of income and standards of living.[10,11]

METHODS

To be able to draw valid conclusions, representative data on active transportation and obesity prevalence in different nations were needed. The approach we used was to assemble data from various sources. This included both raw data from national surveys of travel behavior and health indicators obtained from government agencies, as well as summary data obtained from published reports.

Transportation Data

At present, there are no standardized travel surveys that gather data for the purpose of allowing international comparisons.[12] However, in many countries, national travel surveys are conducted by, or under the direction of, national or federal authorities. An article by Pucher,[4] cited by the Transportation Research Board of the National Academy of Sciences,[3] compiled data on the percentage of trips in the mid-1990s taken by various transportation modes in 10 countries of Europe and North America. We expanded this dataset by including more countries and updated travel data for most of the 10 previously included countries by using national transportation studies conducted between 1994 and 2006. We consulted a review of short distance travel patterns in

Europe[12] and gathered additional data from ministries of transportation in various countries. By using this combination of all available data sources, we produced a synthesis of the best and most recent information on the percentage of trips taken in each country by walking, cycling, public transit, and automobiles. All of these studies attempted to obtain a representative sample of the residents of that country. The data in these travel surveys did not include long-distance trips but were restricted mostly to daily travel.[4]

Most travel surveys use an additional diary in which the respondent records each place visited during the course of a day, the starting and ending time of each trip, transportation mode, and trip distance.[13] In some countries, the travel diary is supplemented by a computer-assisted telephone interview (CATI) to enable interviewers to verify and edit the individual's responses. This combined method (diary plus CATI) has been reported to increase the numbers of respondents who made trips by 7 percent.[14] Germany, the Netherlands, Norway, Switzerland, and the United States are examples of countries that use this technique.[14] Other factors limiting comparability between surveys are the response rate, method of survey administration, and the inclusion/exclusion of weekend travel.[14,15] Despite some inconsistencies, it is still possible to obtain a rough estimate of active transportation in different countries by using data from national surveys.

Further information on the specific design characteristics of various national transportation surveys is available in several reviews. For instance, Schafer[14] reported on the comparability of travel surveys from 11 industrialized countries between 1981 and 1995. More recently, Kunert et al.[13] published an international comparison of travel surveys from 10 countries in Europe and North America, conducted between 1988 and 2000.

Obesity Prevalence Data

We examined obesity rates in selected European nations, the United States, Canada, and Australia for the period of 1995 to 2005. We included studies on obesity prevalence if they (a) defined obesity as a body mass index (BMI) ≥ 30 kg·m^{-2}, (b) computed BMI from self-reported height and weight, (c) included nationally representative data, and (d) had fieldwork periods ending between 1995 and 2005.

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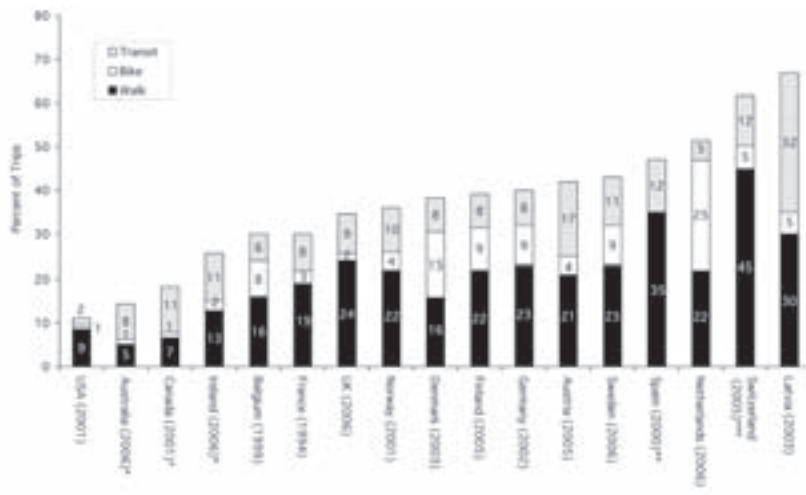
RESULTS

Data on travel behavior and health indicators were used to construct a figure showing the modal shares of walking, bicycling, and public transit, as a percentage of the total number of trips, for 17 countries (see Figure 1). The lowest rate of active transportation was seen in the United States (only 11percent of trips by walking plus cycling plus public transit), whereas the highest rate was seen in Latvia (67 percent of trips by walking plus cycling plus public transit). Detailed information on the national travel surveys of these countries can be found in the longer version of this article.[16]

The obesity rates in different countries, based on self-reported height and weight, were compiled. These national health interview surveys tend to yield lower obesity prevalence values than those based on clinical measures, but it was necessary to rely on them since not all countries had health examination surveys that measured height and weight. The Pearson correlation coefficient between active transportation and obesity rates was $r = -0.86$ ($P<0.001$). The characteristics of these health interview surveys have been presented elsewhere.[16]

There are large differences between nations in their use of active transportation, and obesity rates (see Figure 2). European countries that rely heavily on walking and cycling have lower rates of obesity. In contrast, the United States, Australia, and Canada demonstrate extreme automobile dependence and have the highest rates of obesity.



* Work trips only, ** Walk and bike trips combined for Spain, *** special focus on short trips (any trip of 25 m or more is included)

Figure 1. Percentage of trips taken by walking, bicycling, and public transit, in Europe, North America, and Australia. For data sources, see Table 1.

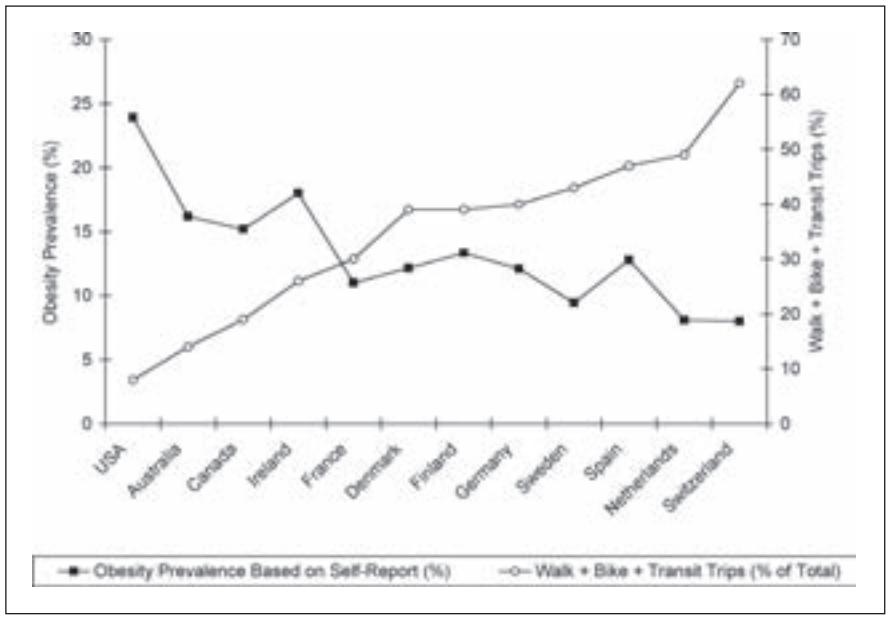


Figure 2. Obesity (BMI ≥ 30 kg·m^{-2}) prevalence and rates of active transportation (defined as the combined percentage of trips taken by walking, bicycling, and public transit) in Europe, North America, and Australia. BMI was computed from self-reported height and weight. Data were obtained from national surveys of travel behavior and health indicators conducted between 1994 and 2006 (see text for details).

DISCUSSION

The main finding of this study is that countries in Europe, North America, and Australia where active travel is most common have the lowest obesity rates, while those countries with the highest rates of car use for travel have the highest obesity rates. The data are cross-sectional and we did not adjust for possible confounders such as energy intake. Thus, our analysis cannot prove causality, but there are reasons to expect such a causal relationship.

A possible explanation for these findings is that the increased energy expenditure required by walking, cycling, and public transit contributes to lower rates of obesity. Supporting evidence for this view comes from China, where the use of automobiles is rapidly increasing. In the 1980s, few households in China owned motor vehicles, but 14 percent of Chinese households acquired a motor vehicle between 1989 and 1997. Bell et al.[5] conducted a longitudinal study of 2,485 adults (aged 20 to 45 years) during this time period. They found that Chinese men who acquired a car averaged a 1.8 kg greater weight gain and were twice as likely to become obese, compared to men whose vehicle ownership remained unchanged. These findings held even after adjusting for diet.

In both the United States and Europe, walking is the most common leisure-time physical activity (LTPA).[17,18] On both continents, a high percentage of adults report having walked for exercise in the past one to two weeks, and walking participation is high for all age groups. Although walking for health and fitness is popular in both Europe and North America, Europeans are far more likely to walk for utilitarian purposes such as shopping, commuting to work, and school trips.[3,4] Short trips in Europe are often taken by walking or cycling,[19] but in the United States they are usually taken by automobile.[14]

Even within the United States, there are variations in the use of active transportation. Active transportation tends to be more prevalent in older cities with mixed land use (having residential, commercial, and civic buildings interspersed), sidewalks, and well-developed public transit systems.[20–22] Frank et al.[6] studied 10,878 people in the Atlanta area and showed that land-use mix had a strong association with obesity, with each quartile increase in land-use mix yielding a 12.2 percent reduction in the likelihood of obesity. They concluded that each hour spent driving was associated with a 6 percent increase in the likelihood of being obese and that each additional kilometer walked per day was associated with a 4.8 percent reduction in the likelihood of obesity. The use of public transit has been shown to help Americans achieve recommended levels of physical activity. For example, Greenberg et al.[2] found that 78 percent of New Jersey train commuters met the national recommendation for physical activity, compared to 45 percent of all U.S. adults. Having a good transit system encourages more walking through access trips to bus stops and rail stations.

Another measure of active transportation is the number of kilometers walked and cycled per person per year. The European Commission's Directorate-General for Energy and Transport[23] has compiled summary data on walking and bicycling, and we obtained comparable data from the U.S. Department of Transportation.[24] In 2000, Europeans walked an average of 382 km (237 miles) per year, almost three times as much as the U.S. average of 140 km (87 miles) per year. The average distance cycled each year in Europe is about 187 km (117 miles) per year, compared to 40 km (87 miles) per year in the United States (see Figure 3). We estimated the calories burned per day by active transportation, using published values for the energy expenditure of bicycling at 8–10 miles per hour (mph) and walking at 3 mph.[7] In 2000, Europeans expended between 48 and 83 calories per person per day in active transportation, compared to 20 calories per person per day in the United States (see Figure 4).

The metabolic energy requirements for active transportation in Europe are roughly equivalent to oxidation of 5–9 pounds of fat per person per year, compared to only 2 pounds in the United States. Considering the substantial effects of daily travel mode choice, and the fact that adequate levels of physical activity are helpful in weight control,[25] it is reasonable to conclude that active transportation contributes to the lower rates of obesity seen in Europe.

In 2010, our analysis was updated and expanded to include health and travel data for 14 countries, 50 U.S. states, and 47 of the 50 largest U.S. cities.[26] Country-, state-, and city-level data showed statistically significant inverse relationships between active transportation and obesity prevalence. At the state and city levels,

there were statistically significant inverse relationships between active travel and diabetes. A forthcoming article compares the role of walking and cycling in the United States and Germany in achieving recommended levels of physical activity. The results show that in 2008–2009, Germans were more than three times as likely as Americans to achieve at least 30 minutes of daily physical activity by walking and/or cycling (28.4 percent versus 8.6 percent).[27]

CONCLUSIONS

Walking and bicycling are much more common in European nations than in the United States, Canada, and Australia. The present study shows that there is an inverse association between active transportation and obesity rates in these countries. Walking and cycling are important sources of physical activity, and previous research has shown that they are important in prevention of obesity.[28] The infrastructure, programs, and policies needed to increase walking and cycling are well known, with decades of successful experience in many European cities as well as some American and Canadian cities.[1,3,29–32] Thus, the challenge is to encourage more widespread use of these measures to promote active travel. ■

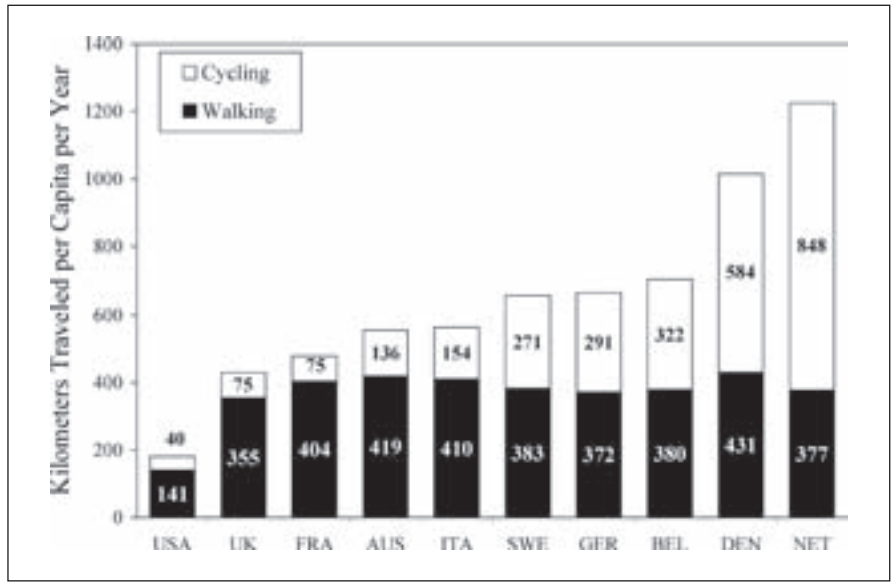


Figure 3. Walking and cycling distances in selected European countries and the United States, expressed in kilometers traveled per person per year in 2000. *Source: European Commission's Directorate-General for Energy and Transport,[23] the Danish Ministry of Transport, and United States Department of Transportation.[24]*

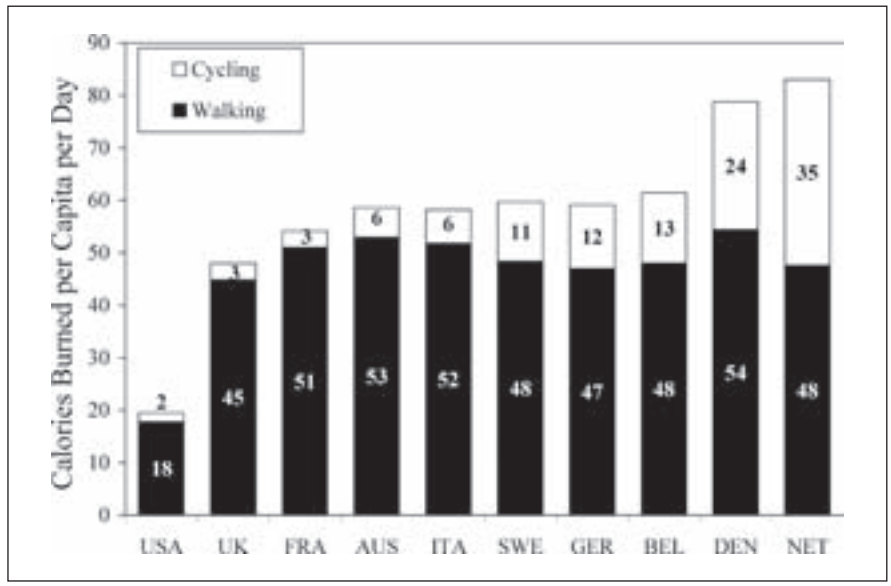


Figure 4. Estimated energy expenditure by transportation-related walking and cycling in selected European countries and the United States in 2000, expressed as calories burned per person per day.

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