

# Promoting Safe Walking and Cycling to Improve Public Health: Lessons From The Netherlands and Germany

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**Objectives.** We examined the public health consequences of unsafe and inconvenient walking and bicycling conditions in American cities to suggest improvements based on successful policies in The Netherlands and Germany.

**Methods.** Secondary data from national travel and crash surveys were used to compute fatality trends from 1975 to 2001 and fatality and injury rates for pedestrians and cyclists in The Netherlands, Germany, and the United States in 2000.

**Results.** American pedestrians and cyclists were much more likely to be killed or injured than were Dutch and German pedestrians and cyclists, both on a per-trip and on a per-kilometer basis.

**Conclusions.** A wide range of measures are available to improve the safety of walking and cycling in American cities, both to reduce fatalities and injuries and to encourage walking and cycling. (*Am J Public Health.* 2003;93:1509–1516)

Improving conditions for walking and bicycling in our cities is vital for America's public health. The measures described in this article would not only reduce pedestrian and cycling fatalities and injuries but also allow millions of people, many of them dangerously overweight, to bike or walk for some of their short trips and thus obtain healthful exercise in the course of daily life. More walking and cycling would yield further public health benefits by reducing the use of automobiles, thus diminishing air and noise pollution and the overall level of traffic danger.

The United States is gripped by a worsening epidemic of obesity. Nationwide surveys based on self-reported weight and height indicate an increase in obesity from 12% of adults in 1991 to 20% in 2000.<sup>1</sup> Estimates of obesity based on clinical measurements of weight and height are considerably higher, indicating that in 2000, 31% of the adult population was obese (body mass index [BMI]  $\geq$  30) and 64% was overweight (BMI  $\geq$  25).<sup>2</sup> Many studies suggest that lack of physical exercise is one important reason for the alarming trend toward increased obesity. Several articles and editorials in the leading medical and public health journals have explicitly advocated more walking and cycling for daily travel as the most affordable, feasible, and dependable way for people to get the additional

exercise they need.<sup>3–7</sup> Similarly, the US surgeon general specifically recommends more walking and cycling for practical, daily travel as an ideal approach to raising physical activity levels.<sup>8</sup>

Even in the sprawling metropolitan areas of the United States, 41% of all trips in 2001 were shorter than 2 miles, and 28% were shorter than 1 mile.<sup>9</sup> Bicycling can easily cover distances of up to 2 miles, and most people can walk at least a mile.<sup>10</sup> Yet Americans use their cars for 66% of all trips up to a mile long and for 89% of all trips between 1 and 2 miles long.<sup>9</sup> Clearly, there is enormous potential for increased walking and cycling over these shorter trip distances.

There are 2 problems with proposals to increase walking and cycling: their current danger and inconvenience in most American cities. As documented in this article, walking and cycling in the United States are much more dangerous than car travel, both on a per-trip and per-mile basis. Moreover, the lack of proper pedestrian and bicycling facilities makes walking and cycling not only unsafe but also inconvenient, slow, unpleasant, and unfeasible in most places.

The good news presented in this article is that it is indeed possible to achieve safe and convenient walking and cycling conditions, as demonstrated by the experience of Germany and The Netherlands. Those 2 countries have

implemented a wide range of policies over the past 2 decades that have simultaneously encouraged walking and cycling while dramatically lowering pedestrian and bicyclist fatalities and injuries and keeping auto use at only half the American level. The Netherlands and Germany provide valuable lessons for integrating more physical exercise into the lives of Americans.

This article first examines variations in walking and cycling levels among North American and Western European countries and then focuses on The Netherlands, Germany, and the United States in particular. We examine differences in travel behavior, fatality and injury rates, and trends over time. Most importantly, we describe the 6 categories of policies in The Netherlands and Germany that have made walking and cycling such safe and attractive alternatives to driving: better facilities for walking and cycling, urban design sensitive to the needs of nonmotorists, the traffic calming of residential neighborhoods, restrictions on motor vehicle use in cities, rigorous traffic education of both motorists and nonmotorists, and strict enforcement of traffic regulations protecting pedestrians and bicyclists.

## DATA AND METHODS

We relied on secondary sources for all the data series discussed in this article. They are the official national sources of statistics on travel behavior and traffic accidents in each country. For the United States, the data for travel behavior came from the 1995 Nationwide Personal Transportation Survey and the 2001 National Household Travel Survey, both conducted by the US Department of Transportation (Federal Highway Administration).<sup>11</sup> The data on traffic fatalities also came from the US Department of Transportation (National Highway Traffic Safety Administration),<sup>12</sup> while the injury data came

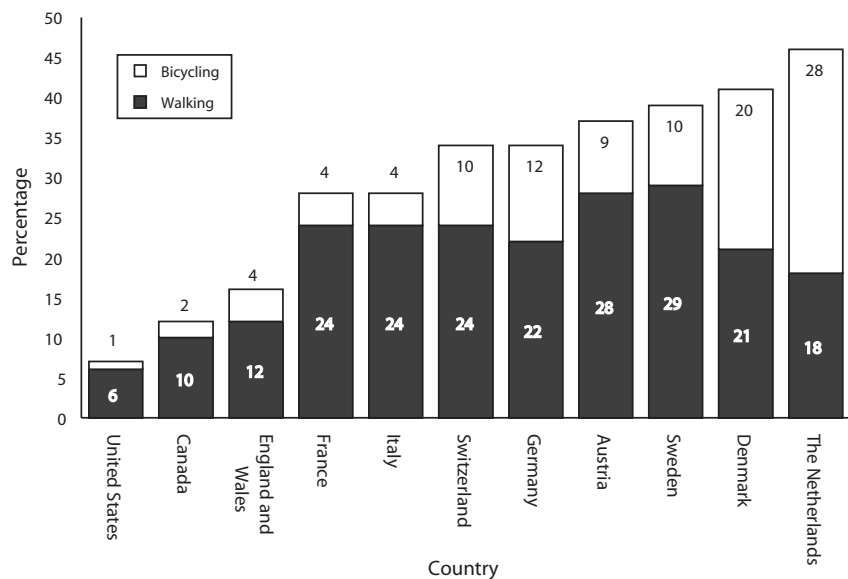
from the Centers for Disease Control and Prevention (CDC).<sup>13</sup>

For Germany, the data on travel behavior came from the German Ministry of Transport<sup>14,15</sup> and the German Institute of Economic Research.<sup>16</sup> The German fatality and injury data came from the Federal Statistical Office<sup>17</sup> and the Federal Traffic Institute.<sup>18</sup>

The data for The Netherlands came from Statistics Netherlands<sup>19</sup> and the Dutch Ministry of Transport.<sup>20</sup> Each of these surveys and other data collection procedures relied on extensive underlying methodologies that cannot be discussed here. Interested readers can consult any of the individual sources for detailed information. We note in the text and figures the specific sources and any important differences among the countries in definition or methods.

Some of these data series are more comparable across countries than others. The travel surveys measuring usage of different means of transportation rely on basically the same definitions of transport modes but use varying methodologies for sampling and trip measurement. The data on traffic fatalities are quite reliable. Studies indicate that roughly 95% of all traffic fatalities are reported to the police and thus appear in official records.<sup>21</sup> Moreover, all the countries that we examined define traffic fatalities as occurring within 30 days of the crash.

Traffic injury data are far less comparable. Underreporting of pedestrian and cyclist injuries is a problem in all countries. For the United States, we used the CDC injury estimates from WISQARS, which are based on a representative survey of injuries reported by hospital emergency rooms.<sup>13</sup> Even those estimates underreport total injuries since they exclude minor injuries not requiring a hospital visit. The Dutch and German injury estimates are based on police reports. One study estimated that Dutch police reports captured only 15% of minor injuries to pedestrians and cyclists but 60% of all injuries requiring a hospital visit.<sup>22</sup> German police reports captured 16% of minor injuries but 48% of injuries requiring a hospital visit.<sup>21</sup> Thus, the Dutch and German estimates of injuries should be roughly doubled to make them comparable to the hospital-based injury estimates of the CDC.



Note. Modal split distributions for different countries are not fully comparable owing to differences in trip definitions, survey methodologies, and urban area boundaries. The distributions given here are intended to show the approximate differences among countries and should not be used for exact comparisons.

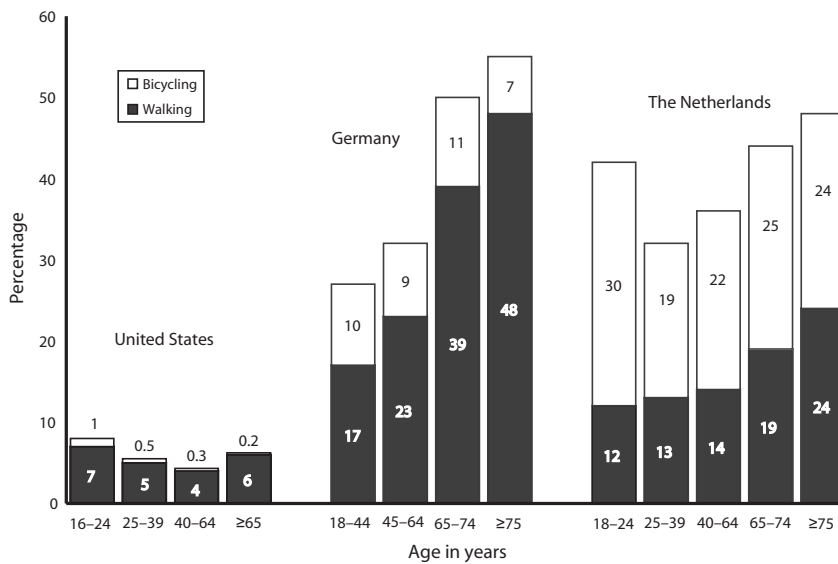
Source. Transportation Research Board,<sup>29</sup> Table 2-2, p. 30.

**FIGURE 1—Percentage of trips in urban areas made by walking and bicycling in North America and Europe, 1995.**

### VARIATION AMONG COUNTRIES IN LEVELS OF WALKING AND CYCLING

Unfortunately, trends in travel behavior in the United States could hardly be worse for public health. The journey-to-work section of the US Census indicates that the percentage of all work trips made by walking fell from 10.3% in 1960 to only 2.9% in 2000.<sup>23</sup> Including all trip purposes, the Nationwide Personal Transportation Survey shows that the percentage of urban trips made by walking and cycling fell from 10.0% in 1977 to only 6.3% in 1995, which is far lower than in most other countries.<sup>9,10</sup> Figure 1 shows the percentage of all urban trips made in 1995 by walking and cycling in the United States, Canada, and 9 European countries.<sup>24</sup> Even Canada has almost twice the percentage of walk and bike trips as in the United States. In most European countries, at least a fourth of urban trips are made by walking or cycling, and a few countries—like Denmark and The Netherlands—report a nonmotorized travel rate of over 40%.

Perhaps even more striking are the large differences in travel behavior between countries as their populations get older. As shown in Figure 2, walking increases with age in both The Netherlands and Germany, while cycling falls off only slightly. Indeed, the Dutch and Germans who are 75 and older make roughly half their trips by foot or bike, compared with only 6% of Americans aged 65 and older. While cycling is almost nonexistent among the American elderly, it accounts for a fourth of all trips made by the Dutch elderly and for 7% of trips made by the German elderly. Equally stunning, walking accounts for 48% of trips by Germans aged 75 and older and 24% of trips made by Dutch aged 75 and older. This not only provides them with valuable physical exercise but also ensures them a level of mobility and independence that greatly enhances their quality of life. It also may contribute to both the longer life expectancy and the longer healthy life expectancy in the Netherlands and Germany—2 years longer than in the United States.<sup>25</sup> As the Dutch and German examples clearly show, the physical and men-



Source. US Department of Transportation,<sup>11</sup> German Ministry of Transport,<sup>14,15</sup> and Statistics Netherlands.<sup>19</sup>

**FIGURE 2—Percentage of trips in urban areas made by walking and bicycling in the United States, Germany, and The Netherlands, by age group, 1995.**

tal limitations that come with aging are not the main impediments to walking and cycling by the American elderly.

For both the elderly and the nonelderly, walking and cycling are discouraged in the United States by longer trip distances, the low cost and ease of auto ownership and use, and a range of other public policies that make walking and cycling inconvenient, unpleasant, and, above all, unsafe.

The more compact land-use patterns in European cities lead to average trip distances that are only about half as long as in American cities and thus are easier to cover by foot or by bike.<sup>26</sup> As explained in previous studies<sup>27</sup> and by other articles in this issue, planning for more compact, mixed-use development in American cities would enhance the feasibility of walking and cycling by reducing trip distances to likely destinations. However, that is a long-term approach that will take many years to implement, if it can be adopted at all. Moreover, as noted earlier, 41% of all urban trips in the United States are already shorter than 2 miles, and 28% are shorter than 1 mile. The potential for more walking and cycling already exists. Thus, the extraordinarily low 6% of trips made by walking or cycling in American

cities cannot be attributed mainly to long trip distances.<sup>28</sup> Indeed, if distance were the overriding factor, one might expect more cycling than walking in American cities, since cycling covers longer distances faster and easier. In fact, walk trips outnumber bike trips 6 to 1.

The much higher cost of auto ownership and use in Europe also helps explain the higher levels of walking and cycling there. High taxes on gasoline and new cars, as well as higher prices for parking, make the overall cost of auto use at least double what it is in the United States.<sup>29</sup> In addition, roadway and parking facilities are much more limited than in American cities. From a political perspective, it has been very difficult to raise taxes on auto ownership and use in the United States, even slightly, let alone to the dramatically higher levels in Europe. With over 95% of all parking free of charge, and with gasoline taxes, roadway tolls, licensing fees, and vehicle taxes among the lowest in the developed world, the United States makes driving a car almost irresistible.<sup>29</sup> That, in turn, discourages walking and cycling.

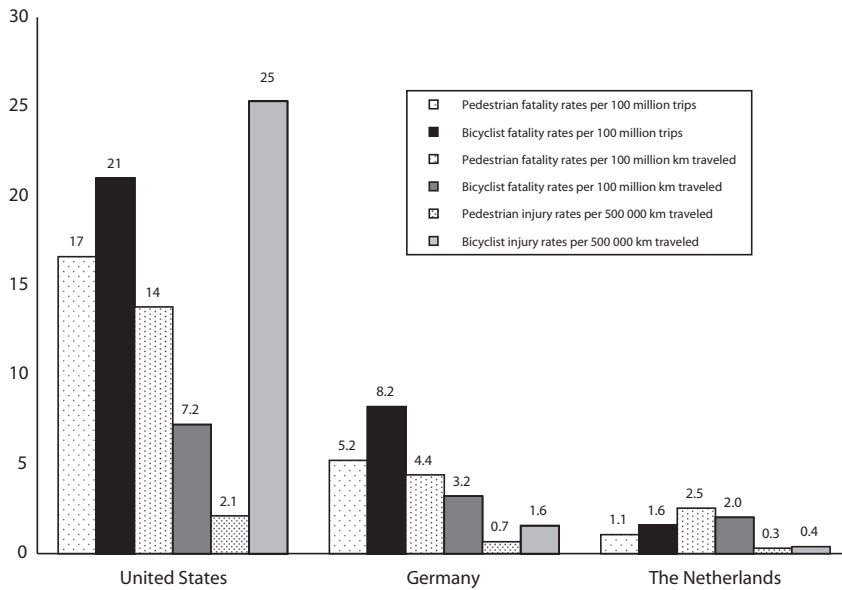
Clearly, however, one of the biggest impediments to more walking and cycling is the appallingly unsafe, unpleasant, and inconven-

ient conditions faced by pedestrians and bicyclists in most American cities. As shown in the next section, the perceived risk of walking and cycling in American cities is based on real dangers. Even without dramatic changes in American land-use and transportation systems, much could be done in the short term to improve walking and cycling conditions to make them both safer and more attractive.

## DANGERS OF WALKING AND CYCLING IN THE UNITED STATES

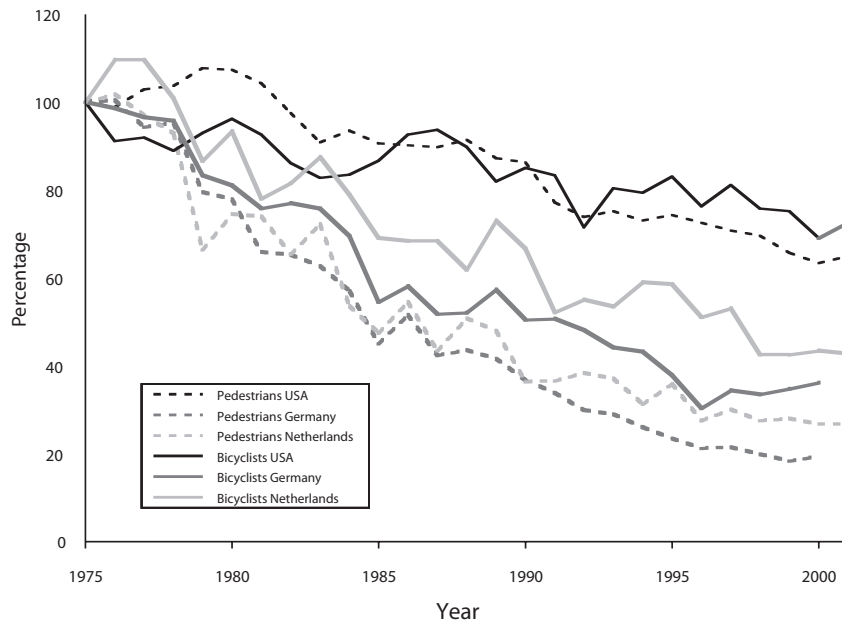
It is much more dangerous to walk or cycle in American cities than to travel by car. Per kilometer traveled, pedestrians were 23 times more likely to get killed than car occupants in 2001 (140 vs 6 fatalities per billion kilometers), while bicyclists were 12 times more likely than car occupants to get killed (72 vs 6 fatalities per billion kilometers).<sup>30</sup> Walking and cycling in American cities are much more dangerous than in many other countries. As shown in Figure 3, nonmotorist fatality rates in the United States are much higher than in The Netherlands and Germany. Per kilometer and per trip walked, American pedestrians are roughly 3 times more likely to get killed than German pedestrians and over 6 times more likely than Dutch pedestrians. Per kilometer and per trip cycled, American bicyclists are twice as likely to get killed as German cyclists and over 3 times as likely as Dutch cyclists.

Because of the unreliability of injury data in all countries, it is far more difficult to compare differences in pedestrian and cyclist injury rates. Nevertheless, they also appear to be much higher in the United States than in The Netherlands or Germany. The CDC data based on hospital reports capture a larger percentage of total injuries than the Dutch and German injury data, which are based on police reports. As noted earlier, studies indicate that the Dutch and German police reports capture only about half of all serious injuries requiring hospitalization.<sup>21,22</sup> Thus, the Dutch and German injury rates shown in Figure 3 should be roughly doubled to make them more comparable to the CDC rates for the United States. Even after



Source. US Department of Transportation<sup>11,12</sup>, Centers for Disease Control and Prevention<sup>13</sup>, German Institute of Economic Research<sup>14</sup>, German Federal Statistical Office<sup>17</sup>, German Federal Traffic Institute<sup>18</sup>, Statistics Netherlands<sup>9</sup>, and Dutch Ministry for Transport, Public Works and Water Management.<sup>20</sup>

**FIGURE 3—Pedestrian and bicycling fatality rates and nonfatal injury rates in the United States, Germany, and The Netherlands, 2000.**



Source. US Department of Transportation<sup>12</sup>, German Federal Statistical Office<sup>17</sup>, German Federal Traffic Institute<sup>18</sup>, Statistics Netherlands<sup>19</sup>, and Dutch Ministry for Transport, Public Works and Water Management.<sup>20</sup>

**FIGURE 4—Trends in pedestrian and bicycling fatalities in the United States, Germany, and The Netherlands, 1975-2001 (1975 = 100%).**

such an upward adjustment, American pedestrians are about twice as likely to get injured as German pedestrians and 4 times as likely as Dutch pedestrians. American cyclists are at even greater risk: they are 8 times more likely to get injured than German cyclists and about 30 times more likely than Dutch cyclists.

Some good news to offset that bad news is that a great deal could be done to make walking and cycling safer in the United States. Germany and The Netherlands, for example, have drastically cut the number of pedestrian and bicyclist deaths over the past 25 years by implementing a wide range of policies to improve safety. Figure 4 shows that from 1975 to 2001, total pedestrian fatalities declined by 82% in Germany and by 73% in The Netherlands. Over the same period, cyclist fatalities declined by 64% in Germany and by 57% in The Netherlands. The drop in cyclist fatalities in Germany is especially impressive because it came during a boom in cycling there, with a doubling in the number of bike trips and 50% growth in the share of total trips made by bike.<sup>10</sup> By contrast, the 27% fall in cyclist fatalities in the United States was due almost entirely to the sharp decline in cycling by children.<sup>31,32</sup>

### HOW TO MAKE WALKING AND CYCLING SAFER

However dangerous walking and cycling currently are in the United States, it is definitely possible, and essential, to make them much safer. As shown by the wide range of coordinated policies in The Netherlands<sup>33,34</sup> and Germany,<sup>35</sup> the necessary techniques and programs already exist and have been proven to work extremely well. They include better facilities for walking and cycling, traffic calming of residential neighborhoods, urban design sensitive to the needs of non-motorists, restrictions on motor vehicle use in cities, rigorous traffic education of both motorists and nonmotorists, and strict enforcement of traffic regulations protecting pedestrians and bicyclists. American cities lack only the political will to adopt the same strategies.

Owing to space limitations, we can only briefly summarize here the 6 categories of

public policy measure implemented in The Netherlands and Germany. For detailed descriptions and illustrations of the Dutch and German measures, readers can consult a range of publications about walking and cycling in Europe.<sup>10,26,36–39</sup>

### Better Facilities for Walking and Cycling

One emphasis of Dutch<sup>40</sup> and German<sup>35</sup> policy has been to improve the transportation infrastructure used by pedestrians and bicyclists. For pedestrians, that has included extensive auto-free zones that cover much of the city center; wide, well-lit sidewalks on both sides of every street; pedestrian refuge islands for crossing wide streets; clearly marked zebra crosswalks, often raised and with special lighting for visibility; and pedestrian-activated crossing signals, both at intersections and midblock crosswalks.

Dutch and German cities also have invested heavily to expand and improve bicycling facilities. From 1978 to 1996, the Dutch more than doubled the extent of their already massive network of bike paths and lanes (from 9282 km to 18 948 km). From 1976 to 1995, the Germans almost tripled the extent of their bikeway network (from 12 911 km to 31 236 km).<sup>10</sup> In addition, there are an increasing number of so-called “bicycle streets,” where cars are permitted but cyclists have strict right-of-way over the entire breadth of the roadway. Unlike the sparse and fragmented cycling facilities in the United States, the bike paths, lanes, and streets in The Netherlands and Germany form a truly coordinated network covering both rural and urban areas. Importantly, Dutch and German bikeway systems serve practical destinations for everyday travel, not just recreational attractions, as with most bike paths in the United States.

The provision of separate rights-of-way is complemented by various other measures: special bike turn lanes leading directly to intersections, separate bike traffic signals with advance green lights for cyclists, bicyclist-activated traffic signals at key intersections, and modification of street networks to create deliberate dead ends and slow, circuitous routing for cars but direct, fast routing for bikes.<sup>10</sup>

### Traffic Calming of Residential Neighborhoods

Traffic calming limits the speeds of motor vehicle traffic, both by law—30 km per hour (19 mph) or less—and through physical barriers such as raised intersections and crosswalks, traffic circles, road narrowing, zigzag routes, curves, speed humps, and artificial dead ends created by midblock street closures.<sup>10</sup> Traffic calming gives pedestrians, bicyclists, and playing children as much right to use residential streets as motor vehicles; indeed, motor vehicles are required to yield to these other users. In both The Netherlands<sup>41</sup> and Germany, traffic calming is area-wide and not for isolated streets. That ensures that faster through traffic gets displaced to arterial routes designed to handle it and not simply shifted from one local road to another.

The most important safety impact of traffic calming is the reduced speeds of motor vehicles. This is crucial not only to the motorist’s ability to avoid hitting pedestrians and bicyclists but also to the survival of nonmotorists in a crash. The British Department of Transport, for example, found that the risk of pedestrian death in crashes rises from 5% at 20 mph to 45% at 30 mph and 85% at 40 mph.<sup>42</sup>

Area-wide traffic calming in Dutch neighborhoods has reduced traffic accidents by 20% to 70%.<sup>43</sup> Traffic calming in German neighborhoods has reduced traffic injuries overall by 20% to 70% and serious traffic injuries by 35% to 56%.<sup>44</sup> A comprehensive review of traffic calming impacts in Denmark, Great Britain, Germany, and The Netherlands found that traffic injuries fell by an average of 53% in traffic-calmed neighborhoods.<sup>45</sup> In short, traffic calming greatly reduces the danger of traffic deaths and injuries in residential neighborhoods. Traffic calming greatly improves not only pedestrian safety but also the safety of bicycling, since much bike use—especially by children—is in residential neighborhoods.

### Urban Design Oriented to People and Not Cars

New suburban developments in The Netherlands and Germany are designed to provide safe and convenient pedestrian and bicycling access.<sup>10</sup> Residential developments

almost always include other uses such as cultural centers, shopping, and service establishments that can easily be reached by foot or bike. Both residential and commercial developments have sidewalks and bicycle paths to serve nonmotorists. Parking lots almost never surround buildings, as in the United States; instead, they are built next to or behind buildings, thus permitting easy access to pedestrians and bicyclists. When an obstacle such as a highway, railroad, or river must be traversed, Dutch and German cities usually provide safe and attractive pedestrian and bicyclist crossings. By comparison, strip malls in American suburbs are difficult and dangerous to reach by foot or bicycle, and most bridges lack provisions for pedestrians and bicyclists.

In the United States, the separation of residential from commercial land uses increases trip distances and makes the car a necessity. Suburban cul-de-sacs further discourage walking and bicycling by making trips circuitous and excessively long. Residential roads often feed directly into high-speed traffic arteries, increasing the danger of any trips outside the neighborhood. The lack of sidewalks in most American suburbs further exacerbates the problem.

### Restrictions on Motor Vehicle Use

Dutch and German cities restrict auto use not only through traffic calming, auto-free zones, and dedicated rights-of-way for pedestrians and cyclists.<sup>10,26,29</sup> They also enforce lower general speed limits for motor vehicles in cities—usually 50 km per hour (31 mph). Parking is much more limited and more expensive than in American cities. In addition, most Dutch and German cities prohibit truck traffic and through traffic of any kind in residential neighborhoods. Motor vehicle turn restrictions are widespread; moreover, right turns on red are illegal.

### Traffic Education

Driver training for motorists in The Netherlands and Germany is much more extensive, thorough, and expensive than in the United States.<sup>46,47</sup> A crucial aspect of that training in The Netherlands and Germany is the need to pay special attention to avoiding collisions with pedestrians and cyclists. Motorists are required by law to drive in a way

that minimizes the risk of injury for pedestrians and cyclists even if they are jaywalking, cycling in the wrong direction, ignoring traffic signals, or otherwise behaving contrary to traffic regulations.

Traffic education of children has high priority in both The Netherlands and Germany.<sup>46,47</sup> By the age of 10, all schoolchildren have received extensive instruction on safe walking and bicycling practices. They are taught not just the traffic regulations but how to walk and bicycle defensively, to anticipate dangerous situations, and to react appropriately. That sort of safety education is completely lacking in the United States.

### Traffic Regulations and Enforcement

Traffic regulations in Germany and The Netherlands strongly favor pedestrians and bicyclists. Even in cases where an accident results from illegal moves by pedestrians or cyclists, the motorist is almost always found to be at least partly at fault. When the accident involves children or the elderly, the motorist is usually found to be entirely at fault. In almost every case, the police and the courts find that motorists should anticipate unsafe and illegal walking and cycling.

In addition, German and Dutch police are far stricter in ticketing motorists, pedestrians, and cyclists who violate traffic regulations. Thus, walking against the light is not allowed in any German city and can easily result in a ticket and fine. Likewise, cyclists caught riding in the wrong direction, running red lights, making illegal turns, or riding at night without functioning lights can expect at least a warning notice and possibly a ticket and fine.

The most significant contrast with the United States is the much stricter enforcement of traffic regulations for motorists in Germany and The Netherlands. Penalties can be high even for minor violations. Not stopping for pedestrians at crosswalks is considered a serious offense and motorists can get ticketed for noncompliance, even if pedestrians are only waiting at the curb and not actually in the crosswalk.<sup>10</sup> Similarly, red traffic signals are strictly enforced, and some intersections in German and Dutch cities have cameras that automatically photograph cars running red lights and stop signs.<sup>37</sup> Finally, the punishment for traffic violations by mo-

torists is far more severe in The Netherlands and Germany than in the United States.<sup>45</sup>

### CONCLUSIONS

The neglect of pedestrian and bicycling safety has made walking and cycling dangerous ways of getting around American cities. Walking and cycling can be made quite safe, however, as clearly shown by the much lower fatality and injury rates in The Netherlands and Germany. There is no good reason why American cities could not adopt many of the same measures to enhance safety. The necessary methods and technology are already available, with decades of successful experience in Europe.

It is important to package safety-enhancing programs in a way that dramatizes their benefits to everyone. The most obvious benefit would be the reduced risk of death and injury from walking and cycling. The safety issue must be brought home to Americans by public campaigns emphasizing the direct impacts on individuals, their families, and their friends. Improved safety also would encourage more people to walk and cycle on a regular basis, providing them with valuable exercise, mobility options, independence, and even fun.

The European countries with the highest levels of walking and cycling have much lower rates of obesity, diabetes, and hypertension than the United States.<sup>25,48</sup> The Netherlands, Denmark, and Sweden, for example, have obesity rates only a third of the American rate, while Germany's rate is only half as high.<sup>48</sup> Moreover, the average healthy life expectancies in those 4 European countries are 2.5 to 4.4 years longer than in the United States,<sup>25</sup> although their per capita health expenditures are only half those of the United States.<sup>49</sup>

Of course, many factors affect differences between Europe and the United States. Nevertheless, the dramatically higher levels of walking and cycling for daily travel certainly contribute to better public health in countries such as The Netherlands, Denmark, Germany, and Sweden. Repeated waves of fad diets, rising memberships in health clubs, exercise equipment in more homes, diet pills, and liposuction have all been total failures in

fighting the current obesity epidemic. Why not try integrating walking and cycling into the daily travel routines of Americans? That clearly would be the cheapest, most reliable, and most practical way to ensure adequate levels of physical exercise.

Walking and cycling also help alleviate traffic congestion, save energy, reduce air and noise pollution, conserve land, and produce various other environmental benefits. It is the broad spectrum of benefits from walking and cycling that explains the widespread public support in The Netherlands and Germany for the impressive range of policies they have adopted to make walking and cycling safer, more convenient, and more pleasant.

The same synergistic benefits have the potential for energizing a broad coalition of groups in the United States to advocate better walking and cycling conditions in American cities. Public health experts should be working together with bicyclist and pedestrian advocates, traffic engineers, urban planners, environmentalists, architects and private developers, community leaders, and government officials at all levels. The public health community probably has the most potential to encourage the necessary changes at the grass-roots level. Unless individual Americans can be convinced that they will directly benefit from better walking and cycling conditions, politicians are unlikely to support the necessary policies. Self-interest is likely to be the strongest motivation to effect changes in travel behavior. Getting enough physical exercise is quite literally a matter of life or death. Health care professionals must convince their patients that walking and cycling on a regular basis for daily travel will help them live longer and healthier lives.

Of course, the public health community cannot do it alone. Transportation professionals, urban planners, architects, and private developers must provide the improvements in walking and cycling conditions so desperately needed to reduce the dangers of walking and cycling in American cities. Those efforts will require the support of local, state, and federal government officials. Public policymakers at all levels must not only provide the necessary funding for better bicycling and pedestrian facilities but also adopt and implement a range of policies to encourage more compact,

mixed-use development that naturally permits and encourages walking and cycling as a part of daily life.

If for no other reason than their large numbers and extensive network of contacts, public health experts have a crucial role to play in mobilizing political support for the necessary policy changes. At the very least, they should publicize more prominently the disastrous public health consequences of an automobile-dependent transportation system and a land-use pattern that make walking and cycling dangerous, inconvenient, unpleasant, and, in some cases, impossible.

In fact, the public health community has already begun developing programs and partnerships to achieve more walkable and bikeable communities that encourage higher levels of physical exercise. The CDC, for example, has developed the Active Community Environments (ACE) program, a multidisciplinary initiative to promote walking and cycling through better urban design, transportation, and land-use policies.<sup>50</sup> The federal CDC program links up with state health departments to encourage similar efforts at the state and local level. For example, the ACE program in the California Department of Human Services funds organizations such as California Walks, the California Bicycle Coalition, the Local Government Commission, and the Rails-to-Trails Conservancy to encourage local community policies that promote walking and cycling.<sup>51</sup> California's ACE also coordinates the state's Safe Routes to School initiative by providing technical assistance and funding community-based projects that promote walking to school.

Complementing such government initiatives, the Robert Wood Johnson Foundation has already spent \$84 million financing a family of Active Living programs, all of which are intended to increase physical activity.<sup>52</sup> Active Living by Design, for example, is funding 25 communities throughout the country to promote changes in urban design, architecture, land use, and transportation that encourage more walking and cycling. Active for Life focuses on incorporating increased exercise into the daily life of adults. The foundation's Active Living Network is intended to integrate the public health agenda into a wide range of other professions crucial to improv-

ing walking and cycling conditions, thus explicitly fostering the necessary partnership and teamwork.

However admirable these initial efforts are, they remain exceedingly modest compared with the enormity of the problem. Public health organizations should publicize far more widely the worsening obesity epidemic in the United States as the national crisis it is. They need to mount massive media campaigns to encourage and improve the conditions for walking and cycling. Only when the public and politicians become fully aware of the severity of the obesity problem—and the huge potential of walking and cycling to mitigate the problem—will public policies change enough to make a real difference.

Some studies predict that obesity will soon overtake smoking as the most important cause of premature death in the United States.<sup>53–55</sup> It is time for the public health community to undertake as vigorous a campaign to promote more physical exercise and improved diet as the decades-long campaign against smoking. ■

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#### Contributors

J. Pucher had primary responsibility for the study design, data collection for Germany and the United States, and writing the text of the article. L. Dijkstra shared in the study design, collected data for The Netherlands, and produced the graphics.

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#### Endnotes

1. A.H. Mokdad, B.A. Bowman, E.S. Ford, F. Vivicor, J.S. Marks, and J.P. Koplan, "The Continuing Epidemics of Obesity and Diabetes in the United States," *JAMA* 286 (2001): 1195–1200.
2. K. Flegal, M. Carroll, C. Ogden, and C. Johnson, "Prevalence and Trends in Obesity Among Adults, 1999–2000," *JAMA* 288 (2002): 1723–1727.
3. C. Dora, "A Different Route to Health: Implications of Transport Policies," *British Medical Journal* 318 (1999): 1686–1689.
4. J. Koplan and W. Dietz, "Caloric Imbalance and Public Health Policy," *JAMA* 282 (1999): 1579–1581.
5. D. Carnall, "Cycling and Health Promotion," *British Medical Journal* 320 (2000): 888.
6. S.P. Wolff and C.J. Gilham, "Public Health Versus Public Policy? An Appraisal of British Urban Transport Policy," *Public Health* 105 (1991): 217–228.
7. M. Hillman, "Health Promotion: The Potential of Non-Motorized Transport," in *Health at the Crossroads: Transport Policy and Urban Health*, ed. T. Fletcher and A.J. McMichael (London: Wiley and Sons, 1997): 177–186.
8. *Physical Activity and Health: A Report of the Surgeon General* (Atlanta, Ga: Centers for Disease Control and Prevention, 1996); *Healthy People 2010: Understanding and Improving Health*, 2d ed. (Washington, DC: US Department of Health and Human Services, November 2000).
9. J. Pucher and J. Renne, "Socioeconomics of Urban Travel: Evidence From the 2001 NHTS," *Transportation Quarterly* 57 (2003): 49–77; based on data from 2001 National Household Travel Survey (Washington, DC: US Department of Transportation, Federal Highway Administration, 2003). Article also available at <http://nhts.ornl.gov/2001/Documents/Pucher-Renne-TQarticle.pdf>. Accessed July 18, 2003. These calculations are for urban areas only, but they include all trip purposes and all means of transportation. The survey description and detailed data are available at: <http://nhts.ornl.gov/2001/index.shtml>. Accessed December 15, 2002.
10. J. Pucher and L. Dijkstra, "Making Walking and Cycling Safer: Lessons From Europe," *Transportation Quarterly* 54 (2000): 25–50. A version without photos is available as a pdf file at: <http://www.vtpi.org/puchertq.pdf>. Accessed December 15, 2002.
11. 1995 Nationwide Personal Transportation Survey (Washington, DC: Federal Highway Administration, 1997); 2001 National Household Travel Survey (Washington, DC: Federal Highway Administration, 2003).
12. *Traffic Safety Fact Sheets* (Washington, DC: US Department of Transportation, National Highway Traffic Safety Administration, annual). Available at: <http://www.nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSF2001/2001pedestrian.pdf> and <http://www.nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSF2001/2001pedal.pdf>. Accessed December 15, 2002.
13. WISQARS: *Web-Based Injury Statistics Query and Reporting System (Online)* (Atlanta, Ga: National Center for Injury Prevention and Control, annual). Available at: <http://www.cdc.gov/ncipc/wisqars>. Accessed December 15, 2002.
14. W. Broeg and E. Erl, *Einflussgrößen der Personenmobilität* (Berlin: German Ministry of Transport, Building, and Housing, 2002).

15. W. Broeg and E. Erl, *Kenngrossen für Fussgänger- und Fahrradverkehr* (Berlin: German Ministry of Transport, Building, and Housing, 1999).
16. German Institute of Economic Research, *Verkehr in Zahlen* (Berlin: German Ministry of Transport, annual).
17. Central German Statistical Office (Statistisches Bundesamt), Stuttgart, special disaggregate tabulations of population, travel, and accidents done for the authors for western and eastern portions of Germany.
18. Federal Traffic Institute (Bundesanstalt für Strassenwesen), *IRTAD: International Road Traffic Accident Database* (Bergisch-Gladbach, Germany: Federal Traffic Institute, annual). Available at: <http://www.bast.de/htdocs/fachthemen/irtad/english/englisch.html>. Accessed December 15, 2002.
19. *Personenvervoer over de weg* (Voorburg/Heerlen: Statistics Netherlands, annual). Available at: <http://www.cbs.nl>. Accessed December 15, 2002.
20. Dutch Ministry of Transport, Public Works, and Water Management, *Nederland-Slachtoffers naar vervoerwijze en aard letsel* (Rotterdam/Heerlen: AVV Transport Research Center, quarterly). Available at: <http://www.rws-avv.nl>. Accessed December 15, 2002.
21. International Road Traffic and Accident Database, *Underreporting of Road Traffic Accidents Recorded by the Police: An International Comparison* (Bergisch-Gladbach, Germany: Organization for Economic Cooperation and Development, Road Research Transport Program, November 1994).
22. Dutch Institute for Road Safety Research, *Victims, Road Accident Victims: General Developments, Official Statistics and the Real Numbers* (Leidschendam, The Netherlands, 1997). Available at: <http://www.swov.nl/en/kennisbank/index.htm>. Accessed December 15, 2002.
23. Pucher and Renne, "Socioeconomics of Urban Travel," Table 1. Available at <http://nhts.ornl.gov/2001/Documents/Pucher-Renne-TQarticle.pdf>. Accessed August 10, 2003.
24. We used the 1995 Nationwide Personal Transportation Survey (NPTS) modal split figures here for the United States even though 2001 National Household Travel Survey (NHTS) statistics are available. Comparable 2000 or 2001 travel survey data are not yet available for the other countries shown in Figure 1. Moreover, the 2001 walk share reported by the NHTS is not even comparable with the earlier NPTS surveys of American walking levels, because 2001 survey methodology was drastically changed to capture more walk trips, definitely exaggerating any real increase in walking between 1996 and 2001.
25. Healthy life expectancy refers to the expected years of life without a major disability or illness that significantly impairs the quality of life. C. Dathers, *Estimates of Healthy Life Expectancy for 191 Countries in the Year 2000: Methods and Results* (Geneva, Switzerland: World Health Organization, October 2001), Annex Table A; Global Programme on Evidence for Health Policy Discussions Discussion Paper No. 38.
26. P. Newman and J. Kenworthy, *Sustainability and Cities: Overcoming Automobile Dependence* (Washington, DC: Island Press, 1999), 68–125.
27. R. Ewing and R. Cervero, "Travel and the Built Environment," *Transportation Research Record* 1780 (2001): 87–114.
28. The 2001 NHTS reports a higher percentage of walk trips in American cities (8.6% in 2001 compared with 5.4% in 1995), but the increase is solely due to a very important change in survey methodology, which introduced multiple prompts by survey interviewers to capture all possible walk trips. Thus, the 2001 walk share figure for the United States is not comparable with earlier NPTS surveys in 1977, 1983, 1990, and 1995. For full details of both the earlier NPTS surveys and the 2001 NHTS survey, as well as detailed analysis of socioeconomic variations and time trends, see Pucher and Renne, "Socioeconomics of Urban Travel." For that reason, and also because we have only 1995 walk share data for most other European countries, we have used the 1995 modal split shares for international comparisons in this article.
29. Transportation Research Board, *Making Transit Work: Insight from Western Europe, Canada, and the United States* (Washington, DC: National Academy Press, 2001).
30. The authors calculated fatality rates based on official mode-by-mode fatality and travel statistics of the US Department of Transportation (National Highway Traffic Safety Administration and Federal Highway Administration). The total numbers of car occupant, cyclist, and pedestrian fatalities were derived from National Highway Traffic Safety Administration, *Traffic Safety Facts 2001* (Washington, DC: US Department of Transportation, 2003). The total number of passenger kilometers of travel by private motor vehicle, bicycle, and foot were calculated for the authors by Mary Ann Keyes of the Federal Highway Administration using unpublished data from the 2001 National Household Travel Survey.
31. N. Templin, "The Bicycle Loses Ground as a Symbol of Childhood Liberty," *Wall Street Journal* (September 10, 1996), A1.
32. J. Pucher, C. Komanoff, and P. Schimek, "Bicycling Renaissance in North America? Recent Trends and Alternative Policies to Promote Bicycling," *Transportation Research A* 33 1999: 625–654. Available at: <http://policy.rutgers.edu/papers>, accessed December 15, 2002.
33. P. Van Vliet and G. Schermers, *Sustainable Safety: A New Approach for Road Safety in the Netherlands* (Rotterdam: Ministry of Transport, Public Works and Water Management; Traffic Research Centre, 2000). Available at: <http://www.rws-avv.nl>. Accessed December 15, 2002.
34. *National Traffic and Transport Plan* (The Hague: Ministry of Transport, Public Works and Water Management, 2000). Available at: <http://www.minvenw.nl>. Accessed December 15, 2002.
35. *Nationaler Radverkehrsplan 2002–2012, FahrRad! Massnahmen zur Förderung des Radverkehrs in Deutschland*. Berlin: Bundesministerium für Verkehr, Bau- und Wohnungswesen, April 2002). Available at: <http://www.bmvbw.de/Fahradverkehr-423.htm>. Accessed December 15, 2002.
36. V. Vuchic, *Transportation for Livable Cities* (New Brunswick, NJ: Center for Urban Policy Research, 1999).
37. C. Zeeger, *FHWA Study Tour for Pedestrian and Bicyclist Safety in England, Germany, and The Netherlands* (Washington, DC: US Department of Transportation, Federal Highway Administration, 1994).
38. R. Cervero, *Transit Metropolis: A Global Inquiry* (Washington, DC: Island Press, 1998).
39. R. Tolley, ed, *Greening of Urban Transport* (Chichester, England: Wiley Press, 1997).
40. *Sign up for the Bike—Design Manual for a Cycle-Friendly Infrastructure* (Ede, The Netherlands: Information and Technology Centre for Transport and Infrastructure, 1998).
41. *Traffic Calming in the Netherlands* (Ede, The Netherlands: Information and Technology Centre for Transport and Infrastructure, 1998).
42. *Mean Streets: Pedestrian Safety and Reform of the Nation's Transportation Law* (Washington, DC: Surface Transportation Policy Project, 1997), Table 4, p. 4.
43. J. Kraay and A. Dijkstra, *Safety Aspects of Urban Infrastructure* (Leidschendam, The Netherlands: Institute for Road Safety Research, 1989).
44. C. Hass-Klau, *Civilized Streets: A Guide to Traffic Calming, Environment, and Transport Planning* (Brighton, England: Brighton Press, 1992).
45. B. Preston, "Cost-Effective Ways to Make Walking Safer for Children and Adolescents," *Injury Prevention* 1 (1995): 187–190.
46. German Traffic Safety Council, *Kind und Verkehr: Nationales Programm des Deutschen Verkehrssicherheitsrats zur Verkehrserziehung in Deutschland* (Berlin: Deutscher Verkehrssicherheitsrat, 2001). Available at: <http://dvr.de/asp/dms.asp?url=programme/kind/inhalt.htm>. Accessed December 15, 2002.
47. Kultusministerium, "Beschluss der Kultusministerkonferenz vom 17.6.1994," *Zeitschrift für Verkehrserziehung* 45 (1995): 4–6.
48. World Health Organization, *Obesity in Europe: The Case for Action* (London: International Obesity Taskforce of the World Health Organization, September 2002). Available at: <http://www.iof.org/media/globalprev.htm>. Accessed December 15, 2002.
49. *Total Expenditures on Health per Capita, 1960–2000, in US Dollars, Purchasing Power Parity* (Washington, DC: Organization for Economic Cooperation and Development, 2002). Available at: <http://www.oecd.org/xls/M00031000/M00031378.xls>. Accessed December 15, 2002.
50. Centers for Disease Prevention and Control, *Active Community Environments* (Atlanta, Ga: National Center for Chronic Disease Prevention and Health Promotion, 2003). Available at: <http://www.cdc.gov/nccdphp/dnpa/aces.htm>. Accessed December 15, 2002.
51. *Physical Activity and Health Initiative* (Sacramento: Department of Health and Human Services, 2002). Available at: [http://www.dhs.ca.gov/cdic/cdcb/epidemiology/Physical\\_Activity/index.htm](http://www.dhs.ca.gov/cdic/cdcb/epidemiology/Physical_Activity/index.htm). Accessed December 15, 2002.
52. *Active Living Resource Center* (Princeton, NJ: Robert Wood Johnson Foundation, 2003). Available at: <http://www.rwjf.org/programs/physicalActivity.jsp>. Accessed December 15, 2002.
53. J.M. McGinnis and W.H. Foege, "Actual Causes of Death in the United States," *JAMA* 270 (1993): 2207–2212.
54. A. Peeters, J.J. Barendregt, F. Willekens, J.P. Mackenbach, A. Al Mamum, and L. Bonneux, "Obesity in Adulthood and Its Consequences for Life Expectancy: A Life-Table Analysis," *Annals of Internal Medicine* 138 (2003): 24–32.
55. R. Sturm, "The Effects of Obesity, Smoking and Drinking on Medical Problems and Costs: Obesity Outranks Both Smoking and Drinking in Its Deleterious Effects on Health and Health Costs," *Health Affairs* 21 (2002): 245–253.