ARTICLE: Is Cycling Dangerous?

Fearmongering discourages vehicular cycling and by doing so increases the number of deaths; bicycling is at the worst no more dangerous than driving an automobile and has compensatory health benefits that greatly overshadow the risks.

Questions

What reasons do people give for not bicycling? Why do they want mandatory helmet laws and bike paths? How common is bicycle-related fearmongering? How can a fear of automobile traffic lead to a greater number of bicycling accidents and fatalities? Who were the victims of most cycling fatalities in the 70's? Who do most pedalcycle fatalities happen to in the 90's? What caused the bicycling death rate among adults to increase? What is vehicular cycling? How does vehicular cycling affect the accident rate? How did the safety messages change in the 80's? How well do adults obey the traffic laws nowadays? Why is sidewalk cycling dangerous? Why are pedestrians safer on sidewalks and crosswalks than bike riders? What bike-car collisions are the most likely to cause fatalities? How do failing to look both ways, to look before merging left, failing to scan to the rear, traveling on the wrong side of the road, and failing to use lights and reflectors contribute to pedalcycle crashes? What responsibility do motorists, the government, and parents have in preventing accidents? Why is a bicycle a safe vehicle? How does the fatality rate for cycling compare with other activities?

Is Cycling Dangerous?

The idea that bicycling is very dangerous is common. When I ask people why they don't ride a bicycle, the most frequent reasons are, "It's too dangerous" and "It's too difficult." The perception that cycling is dangerous even causes some who value cycling and who are not worried about it being too difficult to confine their cycling to off-road trails. And it also leads to calls for mandatory helmet laws and for separate bike paths. Some of this fear stems from our own fears of driving cars in traffic among aggressive drivers. But for those who obey the traffic laws, cycling is actually safer than traveling in an automobile.

Fearmongering Is a Major Problem

Parade, the magazine which comes with the Sunday newspaper, published an article on April 11, 1999, that said

> One friend of mine is terrified of flying. But flying is very safe ... The other day I saw this friend riding his bicycle in traffic without a helmet. Per miles traveled, bikes rank among the most dangerous forms of transportation. By relying on his "intuitive" assessment of risk, my friend made questionable choices.

Opening a book by chance in the library recently, I found an article discussing how we misperceive danger. The most dangerous activity? Bicycling, of course.

Fearmongering websites discussing bicycle safety have sprung up everywhere which distort the evidence. They say 1,000 cyclists are killed each year (not true since 1975), refer to "hundreds of children killed" which allows the imagination to expand the number, call every bicycling injury a hospitalization (less than 3% are according to the CPSC study), and assume that nearly every injury is a serious head injury (about 1.5% of the total cycling injuries according to John Hopkins).

There are some published statistics which seem to prove that riding a bike is dangerous. John Pucher and Lewis Dijkstra wrote (in Making Walking and Cycling Safer: Lessons from Europe), "The neglect of pedestrian and bicycling safety in the United States has made these modes dangerous ways of getting around. Pedestrian fatalities are 36 times higher than car occupant fatalities per km traveled, and bicycling fatalities are 11 times higher than car occupant fatalities per km." However, these figures, which sound very authoritative, use the most pessimistic government statistics for bicycling mileage, and they count

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How to Avoid Traffic Accidents while Bicycling A discussion of how collisions between bicycles and motor vehicles occur and how to avoid them.

Elsewhere

Three Lessons for a Better Cycling Future by Malcolm J. Wardlaw. This article discusses whether cycling is safe and how it can be made safer.

Traffic Safety Facts 1997 National Highway Traffic Safety Administration data on motor vehicle fatalities and injuries in 1997. NOTE: *This is a pdf file.*

Modalshift.org -- The Oxon Cycling Report Dr. Harry Rutter has completed a study of the health advantages of increasing bicycling traffic in Oxfordshire, England. The report also summarizes progress made so far to encourage cycling

Why are motor vehicles more dangerous? Why is the lifetime danger of traveling in a motor vehicle greater? How much time do people spend traveling to work? How else could we calculate the cycling health risk? How does the population risk for cycling compare with other kinds of injury-related deaths? Does the average cyclist have frequent injuries? How does cycling injuries compare with those in other sports? What risks are faced due to a lack of exercise? How does the health benefit of cycling compare with the health risk? How can bicycling help against these risks? How can regular bicycling help everyone?

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automobile *occupants* only, rather than all motor vehicle caused fatalities. Pucher and Dijkstra could have used other government statistics instead which make bicycling appear 30 times safer, but they used pessimistic figures in order to argue for the construction of bicycle facilities.

My Purpose in Writing This Web Page

There is absolutely no way that I can furnish definite proof that bicycling is a safe activity. Those of us who bicycle on a regular basis while following the traffic laws know that it is a safe activity from years of experience, but we are also aware that other cyclists have frequent accidents, we assume due to different behavior. Nor can I do anything to reconcile my various sources of statistics. However, I think I can easily establish that cycling is much less dangerous that what the fearmongers insist and that it has compensating benefits which are more important than the risks involved. I think you will agree when you finish reading this that bicycling is very far from being the dangerous activity that the fearmongers like to make it appear.

Why Fear Is Dangerous

To some extent, this fear of cycling actually leads to additional deaths. For instance, parents do not instruct their children how to ride in the street, but instead they just tell them to "watch for cars" and "to get off the road." However, the day comes when these primitive rules aren't good enough, and the traffic report reads something like this: "The child was riding after dark without a light, on the wrong side of the road, and failed to stop for a stop sign. The motorist couldn't stop quickly enough." In fact, the majority of cycling deaths are accidents like this one; that is, the behavior of the bike rider made no sense at all.

Cycling Deaths Among Children

In the 70's, the majority of cycling deaths happened to children. The 1978 NHTSA statistics show clearly the connection between age and death:

Fatal Bike Accidents		
Age Group	1978	1992
1-9	238	109
10-19	422	219
20-29	92	98
30-39	43	117
40-49	16	83
50-59	17	58
60-up	21	93

Unfortunately, I don't have any information about the percentage of adult cyclists on the road in 1978. It could be true that more children rode bikes than adults in 1978, but I doubt it. First, most children ride bikes for only about ten years. Second, the baby boomers were adult age by this time. Third, the cycling boom among adults had started in the late 60's; in fact, 1973 was the peak year for bicycle sales, so many adults were riding bikes by this time. I certainly remember seeing more adult cyclists then than I do now. But even if more children were riding bikes than adults, I'm sure the adults were riding many more miles. Children seldom ride out of their neighborhoods; adults ride to work and across the USA. During this period of time, thousands of adult cyclists were crossing the United States every year on the Bikecentennial trail.

throughout England. This is a clear discussion, with charts, facts and figures, and sources.

How Safe is Riding a Bike? Excellent charts from Canadian data that demonstate the low fatality rate for cycling. Also check out related pages linked to this one.

Destroying Travel Myths: "It's not safe to walk and cycle" Mayer Hillman points out that in England, driving a car is supposed to be 17 times safer than walking and 27 times safer than riding a bicycle, using accepted figures. However, he also points out that in England, motorists are responsible for 97% of all pedestrian and cyclist fatalities. Looking at the matter another way, he points out that the death rate is extremely low per kilometer per pedestrian or cyclist (32 and 28 million kilometers), while the health problems caused by lack of exercise are much greater; thus the health benefits outweigh the risks by twenty to one.

Freedom from Fear Mighk Wilson provides evidence from Florida that injuries and fatalities happen mostly to those who aren't obeying the traffic laws and provides information about how to ride safely.

Stepping Stones to a Better

Climbing Adult Cycling Fatalities

More recent statistics, such as the 1992 figures above, show a surprising change. The proportion of adults getting killed has risen dramatically even though the total number of deaths have dropped. In the early 70's, 2/3rds of the deaths were to children 16 or younger, now 2/3rds are to people older than 16. (However, children still have a higher death rate.)

What could bring about such a change? One important change has been our attitude towards drunken drivers. Between 1985 and 1996, this helped diminish the rate of death per 100,000 children in automobiles from .95 to .70, while walking from .39 to .19, and when bicycling from .24 to .09 (statistics from an Associated Press newspaper article on 12-04-97 which cited the Centers for Disease Control and Prevention). However, I also believe that there has been a decline in the amount of time that children spend cycling during the same time; I'm afraid that we're raising a generation of couch potatoes.

None of these declines can explain the large increase in the number of adults killed while cycling; in fact, the number of adults killed should have also dropped due to the decrease in drunk driving. My experience in traveling by bike around the country tells me that we have a new generation of cyclists who no longer obey the traffic laws, so I think that their behavior is responsible for most of this change.

The Importance of Vehicular Cycling

You see, those of us who began riding in the 60's and 70's had a strong belief that bicycles should be operated as vehicles. As a result, we adopted the behavior of riding in traffic in a safe, visible, and predictable manner as operators of vehicles, according to the law. The effect of vehicular cycling can be seen in the following statistics from John Forester's *Bicycle Transportation* (2nd ed, 1994, pg 41):

Accidents per Million Miles	
Child Cyclists	720
College-associated Adults	500
League of American Bicyclists	113
Cyclists' Touring Club of England	66

However, during the mid-80's, there was a shift in the message going out. Many of these newer riders did not learn that they had an equal right to use the road. And cycling magazines and brochures no longer explained how to behave in traffic but started preaching, "Wear a helmet at all times!" This new message did not teach the newcomers how to avoid accidents, and it emphasized how dangerous cycling was. At the same time, mountain bikes were introduced, making sidewalk riding more practical and making useful road speeds more difficult due to their heavy tires.

Now I frequently see adult bike riders riding on the sidewalks, on the wrong (left) side, through red lights and stop signs without even looking, and at night without lights, all violations of the traffic laws and all behavior that they would not do when driving cars. It's quite ironic to see some well-dressed, responsible-looking adult wearing a helmet for safety and ignoring every law and safety rule. It's disgraceful behavior too: Andy and Barney used to arrest even the little kids in Mayberry who rode their bicycles on the sidewalk.

Cycling Future
Malcolm Wardlaw discusses the risks of cycling in England, providing some fresh ideas on the subject.

Post Hoc Ergo Propter Hoc This analysis provides proof of a vast drop in the number of children riding bicycles and walking within the US.

Why Sidewalk Cycling is Dangerous

People wonder how riding bikes on sidewalks can be dangerous. First, there is a greater chance of minor collisions with cyclists and pedestrians due to poorer visibility and restricted room and also a greater chance of falling down. However, the likelihood of a collision with a motor vehicle also increases. These accidents occur at intersections and driveways, the former more deadly. Unwilling to dismount and often unwilling to wait for the light, the bike rider starts across the intersection parallel to the main road, completely hidden from a turning motorist until the last second, when it's often too late for the motorist to stop. A study of these risks was made in 1994 and showed that sidewalk cycling is almost twice as dangerous as cycling in the street, and cycling against the traffic on the sidewalk is over four times as dangerous as cycling in the street. For a good discussion, see The Dilemmas of Bicycle Planning.

Pedestrians are safer than sidewalk cyclists because 1) they are moving more slowly, 2) they can look behind more easily, and 3) they can jump to one side. However, even if these sidewalk cyclists were as safe as pedestrians, they wouldn't be very safe, since seven times as many pedestrians are killed each year as cyclists and since pedestrians have more fatalities per mile of travel than cyclists. (The Environmental Benefits of Cycling and Walking estimates 21 to 44 billion miles of walking and 6 to 21 billion miles of cycling.)

The Most Common Cause of Cycling Fatalities

Two of the strongest causes for fatalities, then, are 1) a common misperception that a cyclist has no rights on the road and 2) a fatalistic belief that cycling in traffic is dangerous per se and that traffic accidents are unavoidable. But not only does the cyclist have full rights to the road, but the cyclist is also safer on the road than the motorist. To show that accidents are avoidable, here is a list of the most serious kinds of bike-car collisions, the ones most likely to result in death, from a recent study (Crash-Type Manual for Bicyclists by Carol Tan):

1. 5.1% The bicyclist exited a driveway in front of an on-coming vehicle.
2. 4.3% The bicyclist turned left in front of a passing vehicle.
3. 3.9% The motorist was overtaking the bicyclist, cause of the accident unclear.
4. 2.7% The bicyclist was struck while traveling on the wrong (left) side of the road.
5. 1.4% The bicyclist, on the wrong side, turned right in front of a vehicle.
6. 1.3% The motorist was overtaking the bicyclist and failed to see him.
7. 1.2% The bicyclist lost control and swerved into the path of the vehicle.
8. .8% The bicyclist made a normal left turn but ignored on-coming traffic.
9. .6% The motorist lost control of the car and struck the bicyclist.
10. .5% The motorist struck a play vehicle (big wheel, bike with training wheels).

Together, these crashes, the ones most likely to result in death, accounted for 21.8% of the total number of bike-motor vehicle collisions in the study. Let's look at some of them individually.

In the first, the cyclist pulling out of a driveway has the responsibility

of looking both ways and making sure that doing so is safe. That's all that was necessary. Half of these accidents happened to very young children and most to children.

In the second, a cyclist turning left in traffic needs to look behind and then move into the correct turning position or lane when it is safe to do so. If the rider is unable or afraid to get into that position, he can ride to the curb, dismount, and walk across. Most of these accidents happened to children as well.

Fear of the third kind of collision, when the cyclist gets struck from the rear, encourages people to ride bikes on sidewalks or on the wrong side of the road. But the cyclist does not have to be the naive victim of such crashes. The cyclist can listen to approaching vehicles and/or scan to the rear occasionally, looking back or using a rear-view mirror, and thus be aware if the vehicles are passing carefully and safely. By keeping to the right, moving even further to the right, or even pulling off of the road when it seems warranted, the cyclist can avoid getting hit. See my article on Fear of Traffic from the Rear.

The fourth kind of collision is caused by the cyclist traveling on the wrong side of the road (against traffic). This is both illegal and highly dangerous. See Wrong Way Cycling for this discussion.

The fifth also involves a rider on the wrong side, but in this case, he turns in front of traffic. This kind was more common among children. Here the rider is making two deadly errors.

The sixth accident involves a motorist failing to see the cyclist on the road ahead. These accidents happened almost entirely to adult cyclists. The problem of visibility was mostly due to darkness or glare from the sun. Again, the cyclist does not have to be the naive victim. Even though very few bike riders use them, both reflectors and lights are required by law at night. Wearing bright colored clothes during the day also reduces such risks. Just as important, the cyclist must pay attention to each approaching vehicle when the sun is low or at night. He must also remember that motor vehicle headlights will shine on reflectors only when the vehicle is aimed at the bicycle, thus a cyclist on a curve or a dip may be invisible until the last moment. A bright and/or flashing rear light to supplement a large rear reflector is an excellent safety device. See my article on Fear of Traffic from the Rear for more information on this as well.

In the seventh accident, the loss of control on the part of the cyclist caused the crash. Many motorists tell me that they worry about this kind of accident. Very young children were frequent victims as were middle-aged cyclists, many of whom had been drinking.

There's less to say about the last three. It should be obvious that a cyclist needs to wait for on-coming traffic, that motorists who have lost control are dangerous, and that children on play vehicles are at great risk.

The Responsibility of the Motorist

In all of these cases, I have talked only about what the cyclist could do, but motorists need to become more responsible as well. It makes no sense to have safer vehicles and roads and then for motorists to drive like idiots. A part of being a good driver is staying alert for hazards on the road, whether they are other motor vehicles, pedestrians (including children), dogs, farm animals, rocks and tree limbs, or

cyclists (also including children). Many motorists who are otherwise careful forget to slow down in poor visibility, to pass only when they can see clearly ahead, and to observe posted speed limits.

How Governments Can Help

Our state and local governments control driver education, they have opportunities for teaching children safer riding in the schools, and they are responsible for police enforcement. While our governments cannot end traffic deaths, they can work to diminish the number. Enforcing speed limits, especially in urban and residential areas is probably the most effective change. Enforcing limits not only reduces the average speed but also catches reckless and drinking motorists. Enforced speed limits would not only help cyclists, but would make driving a motor vehicle or taking a walk more safe. Governments also need to improve the safety of the roadway which is often too narrow or contains hazards for cyclists.

What Parents Can Do

Parents also need to take time to explain the traffic laws to any children old enough to leave their sight. At the youngest age, children must be taught to stop and look before entering or crossing a street. When children are old enough to ride a bike on the street, they must be taught traffic behavior and about traffic signs. A good way to teach them is to ride with them. Children should not be allowed to ride in traffic alone until in their teens, but they can ride on lightly traveled streets and roads in the meantime. Learning good traffic skills and consideration for others is important even when riding bikes with other children on residental neighborhoods and will pay off when the child later rides the bike on the road and even later gets a car. See my article on instructing children.

Why Bicycling Is Safe

The point that I'm making here is that it's very important to give up fatalistic notions and to recognize that collisions between bikes and motor vehicles are avoidable. The bike rider has an excellent machine for doing so. He has 180° of unobstructed vision at all times, and he can easily scan another 45° on either side. He has stereo hearing, so he's not only aware of how far away the approaching car is, but also if it's passing him safely. He has excellent brakes at his normal cruising speed and can stop in less than a car's length. He has even faster turning ability and can slide off of a steep shoulder without harm if necessary. Finally, operating a vehicle only six feet long and 18 inches wide, he presents a small target for another vehicle to hit.

For the motor vehicle operator, safety must come from seat belts and air bags because there is no way to avoid many collisions, as the vehicle takes up most of the available space on the road, and leaving the road at high speeds can be more dangerous than a collision. Forty-two percent of the "good" motorists -- that is, motorists killed in accidents who did not commit a fault -- were killed in high-speed, head-on collisions which they could not avoid (*Reader's Digest*, July 2001). Cyclists can usually avoid these collisions, but sometimes they do not, especially when traveling in groups.

Some Cautions about the Following Statistics

Throughout the rest of this web article, I will be furnishing statistics about bicycle fatalities and injuries. Please keep in mind that these figures include the careless and the careful, the inexperienced and the experienced, and the law abiding and the law breakers alike. For

example, riding at night is extremely dangerous, according to general statistics, but on smaller surveys given to cyclists, those who ride at night have a better safety record than average, the difference due to riding lawfully and using lights. Undoubtedly, even the most experienced and careful cyclist still has a risk of injury or death, but what that risk is, it is impossible to tell; all I can do is to furnish statistics which apply to everyone.

All of my data, except for one chart, is from the United States. The greatest problem with statistics from the US is that we have made only a feeble attempt to establish the amount of bicycling that takes place. Nonetheless, these figures are the most relevant for the majority of my readers.

In my charts, I am going to be supplying data from both fatalities and injuries, but I am separating them because the data is so different by nature. First, over 90% of all cycling deaths are due to collisions with motor vehicles, yet over 90% of all injuries are due to other causes which are less serious. Second, we know the exact number of those killed while bicycling yet have only estimates of the number of injuries; on the other hand, we can use small surveys to determine additional information about injuries because they are much more common, but only large population studies can tell use anything about fatalities.

Fatality Information

Survivability in A Traffic Collision

It seems both intuitive and logical that while a cyclist might more easily avoid a collision than a motorist, surviving such a collision would be more difficult. It's pretty obvious that a head-on collision at 50 mph is more survivable within a steel frame and protected by seat belts and air bags. However, bicyclists rarely have these kinds of collisions. For a real-world comparison, that is, a comparison based on the actual collisions which cyclists have, we can use the NHTSA (National Highway Traffic Safety Administration) FARS (Fatality Data Reporting System) and GES (General Estimates System which estimates injuries) to calculate the ratios between injury and death to find out what the actual odds are. These figures show that the odds of surviving a collision with a motor vehicle on a bike are similar to the odds of surviving a motor vehicle collision in an SUV (sports utility vehicle):

Odds of Death vs. Injury in Crashes by Vehicle

Vehicle	Deaths	Injuries	Odds
Bus	17	17,000	1 in 1000
Car, Station Wagon	21,969	2,378,000	1 in 108
Pickup, SUV, Van	10,224	768,000	1 in 75
Bicycle	813	58,000	1 in 71
Large Truck	717	31,000	1 in 43
Motorcycle, Motorbike	2,106	54,000	1 in 26
On Foot	5,307	77,000	1 in 15

Data From *NHTSA Traffic Safety Facts 1997*

There are some other bits of significant information that can be learned by calculating these odds. Bicycle collisions with automobiles (odds: 1 in 113) are more than twice as survivable as collisions with pickups, SUV's, and vans (odds: 1 in 47) which are three times more survivable than collisions with trucks (odds: 1 in 14). On which part of the motor vehicle the collision occurs makes a dramatic difference; when the front of an automobile and a cyclist collided, which

happened 25,000 times in 1997, 346 cyclists died (odds: 1 in 72), but when the right side of an automobile and a cyclist collided, which happened 12,000 times, only 13 died (odds: 1 in 926). Women cyclists (odds: 1 in 110) survive vehicle collisions nearly twice as often as men (odds: 1 in 66). Older cyclists (odds: 1 in 30 at age 65) have less than half the chance of surviving a collision as younger ones (odds: 1 in 88 at age 21). The odds of surviving a bicycle-motor vehicle collision at night (between 6 PM and 6 AM), when half of all cyclists die, range from 1 in 63 (weekdays, 6 to 9 pm) to well below 1 in 20 in the wee hours on the weekends. A recent John Hopkins study in Maryland, indicates that many cyclist fatalities are alcoholics who have lost their driving licences, which might explain the large numbers of fatalities during the wee hours. The majority of nighttime fatalities happened to cyclists who were not properly equipped with headlights and taillights, whether drunk or not. In fact, Riley Geary says that 56% of adult fatalities were caused by riding at night without lights.

The Fatality Rates Per Million Population

Looking at survivability tells us nothing about how likely a fatality is. In 1991 (published in 1994), the Consumer Products Safety Commission made the most thorough survey of cycling ever undertaken in this country. Using randomly chosen phone numbers, the survey established accurate figures for the number of phone-owning bicycle users in the US. (This survey did exclude many cyclists who do not own telephones -- the Amish, simple lifers, and many college students.) Unfortunately, to determine the amount of usage, only one bike rider per family was interviewed, and this tended to be the one nearest to the phone, who would more likely be the youngest, and the question was about how much time the person spent riding a bicycle. The results by hours of use are therefore unusable, as children spend more time playing with their bikes than riding on them, and those who bicycled a few hundred miles a year reported more time than those who bicycle thousands of miles a year. In fact, there is a steady decline from 317 hours a year for bike riders under ten to 105 hours for bike riders over fifty. Some other surveys show that people ride more as they get older (although there are fewer of them). However, the population figures from the CPSC study are sound. The figures below include all bicycle-related fatalities, not just those to the riders or those involving motor vehicles. Likewise, the motor vehicle figures include all motor vehicle-related deaths, not just those to the driver and passengers. I have included the entire US population for figuring the motor vehicle fatality rate, as very few people are not at some risk.

Fatality Rate Per Population	
Motor Vehicle Travel	**Bicycle Travel**
267.6 million (total US pop.)	67 million bicycle riders
42,000 killed	890 killed (1989 data)
156.8 fatalities per million	13.3 fatalities per million
1 in 6,371 killed	1 in 75,281 killed
Traffic Safety Facts 1997	*CPSC 1994*

The Fatality Rate Per Hour

It would be nice if we could use the CPSC figures per hour, as that survey estimated fifteen billion hours of bicycle use and thus just .067 fatalities per million hours, making bicycling over seven times as safe as operating a motor vehicle per hour. Failure Associates, Inc. (now know as Exponent, which performs accident and failure testing, came up with the following figures (a more complete list can be found at the OCBC web site):

Fatalities per Million Exposure Hours			
Skydiving	128.71	Snowmobiling	.88
General Flying	15.58	Motoring	.47
Motorcycling	8.80	Water skiing	.28
Scuba Diving	1.98	Bicycling	.26
Living	1.53	Airline Flying	.15
Swimming	1.07	Hunting	.08
Data compiled by Failure Analysis Associates, Inc.			

Based on these figures, bicycling is nearly six times as safe as living! What does that mean? It means that the risk of dying from some other cause (more about these other risks later) is six times as great as the risk from bicycling on an hourly basis, even though we face these other risks 24 hours a day, not just the one or two hours that a regular cyclist would spend on a bicycle. We can also see from these figures that cycling is only 55% as dangerous as traveling in an automobile per hour.

One problem with the Failure Associates figure is that we don't know how it was derived. By figuring backwards, we can conclude that Failure Associates was either using statistics from some smaller group of cyclists than the entire nation (say from a state) or was estimating a total of between 2.8 and 3.8 billion hours of bicycling in the US per year (based on 723 {1992} to 1,003 {1975} deaths per year). I formerly included some estimates using figures from the Bicycle Institute of America. Since then, I have learned that the BIA figures were not based on any survey, so I won't quote them again. Also, I used an average of 3,000 miles and 250 hours per regular cyclist, which is a little high, according to surveys by Moritz, which found 2,600 and 2,800 miles per year. At any rate, for 67 million US bike riders (those who do not ride on a regular basis) to accomplish the entire 2.8 to 3.8 billion hours, they would have to ride 40 to 57 hours each on the average, which seems high. If regular cyclists rode the entire distance, averaging 225 hours per year, there would have to be 12 to 16.9 million of them, which also seems high. However, if we assume that half the travel was by regular cyclists and the rest by bike riders, then there would have to be 6 to 8.5 million regular cyclists in the US, and the bike riders would have to average 22 to 32 hours apiece, which does seem quite reasonable. Of course, what is reasonable may not be true, but with one government survey saying that cyclists rode 15 billion *hours* and another saying they rode 4 billion *miles* (see immediately below), some of the data is not even reasonable.

Other Estimates of Bike Travel

There are other estimates of bicycle use that call into question the Failure Associates figures. The National Personal Transportation Survey -- a survey focused on automobile traffic -- estimated just four billion miles of bicycle travel in 1990 (NPTS data, although from 1995, was used by Pucher and Dijkstra). And, The Environmental Benefits of Cycling and Walking provides a low estimate of six billion miles. These estimates make cycling much more dangerous than driving per mile and per hour, but I don't believe them. Using the same 50-50 split as above, these figures would mean that in the US there are only 740,000 to 1,100,000 regular cyclists and that the bike riders would average only 30 to 45 miles each per year. Although there is no firm way of establishing the number of regular cyclists in the US, census data from 2000, using a very restrictive definition, indicates 400,000 to 700,000 bicycle commuters. The 1990 Rodale survey (found in the back of the CPSC study), was more interested in bicycle purchasers than bicycling miles and thus gathered data only from those

who purchased their last bike new and also gave them an extremely low maximum choice of 81 miles per month which prevents us from knowing what their actual total miles were. Nonetheless, using the Rodale survey data for mean mileage and numbers of cyclists one can calculate that 32 million cyclists who purchased their last bike new bicycled 1.127 billion miles a month. This understated data therefore proves that the NPTS figures are wrong.

The high estimate of The Environmental Benefits of Cycling and Walking shows 2.8 million commuters riding 3.6 billion miles (1,285 miles each), 5 million "personal" riders traveling 3.2 billion miles (640 miles each), half a million commercial cyclists negotiating 1.8 billion miles (3,600 miles each), 27.5 million recreational cyclists enjoying 9.6 billion miles (349 miles each), and 15 million children traveling some 2.6 billion miles (173 miles each). This estimate of 50.8 million cyclists and 21 billion miles can yield the table below if we use it to estimate the rate per hour (I have included low estimates of miles per hour because this would include both occasional and very young riders):

Fatalities per Million Exposure Hours			
----------	8 mph	10 mph	12 mph
700 fatalities per year	.267	.333	.400
1,000 fatalities per year	.380	.476	.571
Data based on 21 billion miles of bike use			

Note that the lowest figure nearly agrees with the Failure Associates fatality rate for bicycling (.26 per million hours), and that only one figure is significantly higher than the Failure Associates fatality rate for automobile use (.47 per million hours).

Additional Reasons Why Cycling Is Safer

Even assuming that bicycling has an equal or lower fatality rate per hour than driving a car, isn't it possible to say that cycling is more dangerous than traveling by car anyway because it takes longer to travel the same distance by bike than by car? No, that's not exactly true either.

First, automobiles cause almost all the injuries. Over 90% of cycling fatalities are caused by the cyclists being struck by motor vehicles; on the other hand, there are no motor vehicle operators killed by bicycles. When we look at pedestrian deaths, we find that 5,600 pedestrians are struck and killed each year in the United States by motor vehicles and occasionally one or two by bicycles. This indicates that motor vehicles are dangerous, not bicycles. While it's true that bicycles are not used as much as motor vehicles in this country, statistics from counties where bicycles are used heavily also support the comparative innocence of bicycles in causing traffic deaths. This distinction is not just quibbling; removing all cyclists from the roads would reduce the death rate by less than 2%; removing all motor vehicles from the road would reduce the death rate by more than 95%. The real safety problem is the motor vehicle, not the bicycle.

Second, motorists spend more time traveling than do cyclists. The average speed of automobiles is much less than people like to pretend; while one quarter of our cars are on the freeway averaging 58.5 mph, even larger numbers are averaging 13 mph in city driving, and the rest are stuck somewhere between. For instance, Hugh Smith of San Jose, California, installed a timer on his vehicle that measured the hours the engine was running over an eleven year period (or 125,000 miles) and found he averaged just 17 mph during all that time. Using the Failure

Associate figures, an average of 1.4 people per car, and the 1.6 trillion miles driven by automobiles, I calculate an average US speed of just 25 mph. This is the same figure also furnished by a cyclist from France for the average speed in his country (I could not find a figure for our country).

Third, the average motorist travels over four times as many miles in a year as the average cyclist (by cyclist here, I mean the person who rides on a regular basis). Combining the greater mileage with the speed, we find that the motorist has a higher yearly risk, even if the risk per hour is the same. How much risk? The average number of miles per car is about 12,000 per year or 480 hours per year. Assuming that people travel that many miles either as passengers or as drivers from the cradle to the grave (75 years), and using the Failure Associates rate, the driver/passenger has a 1/60th chance of dying in an automobile. (I also encountered this same 1/60th chance of dying in a motor vehicle mentioned in newsgroup discussion, but I couldn't find the source).

Finally, for many years, I have stated that people tend to spend about the same amount of time traveling to work no matter what method of transport they use; thus when better roads are built, people simply move farther from the city. This argument has been often hotly denied, but the transportation issue of *Scientific American* establishes this as statistical fact. The average person, worldwide, travels for about 66 minutes a day to and from work. This suggests that the average pedestrian lives about a mile and a half from the job, the average cyclist about six miles, and the average motorist about twelve miles. Then, if traveling to work takes the same amount of time whether by car or by bicycle, the cyclist still comes out ahead.

Calculations Based on Miles Instead of Hours

Even though calculations based on exposure make more sense, as I have just explained, many vastly prefer statistics based on miles. However, data based on miles creates a bias. Consider a comparison between travel by jet with travel by car. Since the jet is 20 times faster, a comparison based on miles makes the jet look 20 times safer. Of course, if we are assuming the same distance will be covered, comparison by miles is quite fair, but bicycles and cars do not travel the same distance, as I just pointed out. Even a car-free cyclist is going to ride far below the 11,600 miles of the average motor vehicle.

Fatalities Per Mile	
Motor Vehicle Travel	**Bicycle Travel**
42,000 killed	813 killed
2.56 trillion miles	21 billion miles
.016 fatalities per million miles	.039 fatalities per million miles
Data from *Traffic Safety Facts 1997* and *The Environmental Benefits of Cycling and Walking*	

Thus, while the risk of a fatal injury per mile is nearly 2½ times greater for the cyclist, since cyclists travel shorter distances, the total risk is going to be less. Using these figures and 12,000 miles per year, there is a chance of 1/69 of being killed in or of killing someone else with a motor vehicle during a lifetime; for the occupants alone, the risk is 1/83. The lifetime risk for riding a bicycle will be given below.

Calculations Based on Trips

Finally, there is one other way of doing these statistics: instead of being based on population, time, or distance, they could be based on

trips. Using trips to compute the accident rate seemed somewhat illogical to me; after all, we can't determine either miles or hours from it, and then I thought, maybe risk is closer related to the number of trips rather than the distance involved. The people who ride the shortest distances generally are the ones who ignore the traffic laws. That's just a guess, though.

At any rate, the John Hopkins Injury Prevention Center (funded by Snell) uses trips as a basis for measuring risk. The center says there are 1.8 billion bicycle trips per year in the US with one death for every two million trips. These figures cannot be reconciled with the ones from Failure Associates, unless we assume that the average trip was over an hour and a half long, which seems high. Also, compared to The Environmental Benefits of Cycling and Walking figures, the average trip would be 11.7 miles long, which again seems high, unless by trip we mean mileage for the entire day.

The Lifetime Risk of Cycling

Whichever set of figures we use, we discover a very low danger from cycling. Let's say the a cyclist rides 250 hours per year, say 3,000 miles, somewhat higher than the amount for a regular cyclist. And we'll say that this person rides 60 out of the normal 75 years of life, or 15,000 hours and 180,000 miles total. Using the Failure Associates figures, this person is going to have to have a 1/256 chance of getting killed while cycling during his lifetime. Using The Environmental Benefits of Cycling and Walking figures and using the mileage data from 1997, the cyclists has a 1/142 chance of getting killed while cycling during a lifetime. Using the John Hopkins figures, we can suppose our cyclist makes 250 bike trips a year for those 60 years; that's 15,000 trips. Then he has a 1/133 chance of dying with his bike shoes on. Compare these with the lifetime risk of dying in a motor vehicle of 1/60 and 1/83, which I calculated above.

However, these figures assume that this cyclist is no safer than any other cyclist. In truth, anyone who rides this much is going to have to acquire real cycling and traffic skills; it's the children and the child-like riders who are more likely to bite the dust.

Cycling Fatalities Compared to Other Injury-Related Deaths

When we look at other causes of death in the US, cycling deaths seem insignificant. The total number of injury-related deaths are 150 to 200 times the number of cycling deaths.

Injury-Related Deaths	
Motor Vehicle	40,982
Suicide	30,484
Homicide	25,488
Falls	12,646
Poisonings	7,082
Fires/Burns	4,803
Drowning	4,186
Other	19,984
Total	145,655
CDC 1992	

When over 50 times as many people are killed in cars or walking across the street, over 40 times as many commit suicide, over 30 times as many get murdered, over 15 times as many die from falling, over 9 times as many get poisoned, over 6 times as many die of burns, over 5 times as many drown, and over 25 times as many die of various and sundry causes, why is *cycling* perceived to be dangerous?

The Dangerous Hamburger

To look at just one cause of death, over 500 people die from salmonella while eating hamburgers each year. A company that processes hamburger meat was found guilty of having salmonella bacteria in their raw meat and was asked to clean up, but instead the company took the dispute to court and won. Essentially, the court said it is OK to sell contaminated hamburger. After all, it kills only about 500 or so people each year. When you add to the danger of salmonella, the danger of choking on the burger, the danger of spoiled meat, and the risk caused by eating high-fat foods, the hamburger is a greater health problem than the bicycle.

Injuries While Bicycling

As I said earlier, injuries are quite different from fatalities statistically. In the case of fatalities, we know exactly how many occurred and even how they occurred, but we are still uncertain about the rate, since estimates of the amount of cycling vary so much. In the case of injuries, we have only estimates for how many occurred, and we have two separate kinds of injuries, those involving motor vehicles, which I will call "collisions" or "crashes" for convenience, and those not involving motor vehicles, which I will call "falls" for convenience (even though some involve collisions with other cyclists or objects). Because injuries are much more frequent than fatalities, we are able to use surveys among small groups of cyclists to discover more data about them.

One obvious difference between motor vehicles and bicycles is that it is much easier to fall down on a bicycle. Another is that motor vehicle occupants are better protected against minor injuries, so in the event of a fender-bender, usually no one is injured. On the other hand, a cyclist who falls off the bike is likely to have cuts or bruises.

Serious Injuries

Based on the above information, someone could argue that while the opportunities for death while cycling are not greater than those while driving a motor vehicle, the opportunities for serious injury are much greater. However, the statistics do not show that to be true. First, let's look at collisions once again. Our data showed that the risk of a fatal injury on a bicycle was about the same as an SUV (sports utility vehicle). How much more likely is the cyclist to be seriously injured in a collision with a motor vehicle?

Percent of Incapacitating Injuries

Vehicle	Incapacitating Injuries	Total Injuries	Percent
Bus	1,000	17,000	5.9%
passenger car	262,000	2,378,000	11.0%
Large Truck	4,000	31,000	12.9%
Light Truck	103,000	768,000	13.4%
Bicycle	8,000	58,000	13.8%
On Foot	20,000	77,000	26.0%

Motorcycle	15,000	54,000	27.7%

Data from *Traffic Safety Facts 1997*

As we can plainly see, the percentage of incapacitating injuries is about the same for a cyclist as for the occupant of a light truck, van, or SUV, as was true with fatal collisions.

Well, what about falls? While the CPSC study reported 588,000 bike accidents which resulted in a trip to the emergency room, less than 3% of those injuries required hospitalization. That would be less than 17,600. Since about 8,000 incapacitating injuries occurred because of motor vehicle collisions and since other cyclists injured in collisions with motor vehicles would also require hospitalization, we can assume that the bulk of all serious injuries occur through collisions with motor vehicles. Since approximately 90% of cyclist fatalities occur from motor vehicle collisions, I would assume that 90% of serious injuries would occur by that method as well.

Injury Rates Per Million Population

Now, we need to answer the question of whether bicycle travel is more dangerous in terms of injuries to the whole population of bicycle and motor vehicle users. And the answer is that it is not. Motor vehicles are much more likely to be the cause of injury than riding a bike.

Injury Rate Per Population	
Motor Vehicle Travel	**Bicycle Travel**
267.6 million total pop.	67 million bicycle riders
3,400,000 injured	58,000 injured in collisions 530,000 injured in falls
12,700 injuries per million	866 crash injuries per million 7,910 fall injuries per million
1 in 79 injured	1 in 1,155 injured in collisions 1 in 126 injured in falls

Traffic Safety Facts 1997 and *CPSC 1994*

To put these injuries into a greater perspective, I must point out that there were 95 million emergency room visits in 1995 (39 visits per 100 persons), although only about 40% were due to injuries. Thus only about 1/65th of all emergency room injuries were due to bicycling, yet bicycling is the third most popular exercise activity.

Injury Rate Per Hour

Here, I lack any Failure Associates data to compare the rate of injury while traveling in motor vehicles or cars to the rate of injury on bicycles. We can quickly estimate what that data would be by multiplying the fatality rate times the odds of a fatality vs. an injury. This results in a rate of 18.46 injuries per million hours for bicycle collisions with motor vehicles and 50.76 injuries per million hours for collisions in automobiles. However, the chances of a fall are much greater, and when these are figured in, we would say that there is a rate of about 185 injuries of all kinds per million hours when riding a bike. These figures do not agree with the figures for injury per mile given below unless we assume a speed of less than 14 mph for the motor vehicle and less than 7 mph for the bicycle. However, keep in mind that I very well might be using the wrong data comparison; for

instance, the fatality rate per million miles dropped in half for automobiles between 1974 and 1997.

I do have a source for injury rates per hour on a bicycle, but it comes from Australia. Pedalling Health compares the injury risks of cycling (falls and collisions) to the risks of some of other sports that children engage in. It seems very fair to me to compare the risks of falls to another sport rather than to driving a motor vehicle. Note that the threshold for these injuries was a trip to the hospital, which I assume means hospitalization rather than the emergency room:

Injuries per Million Hours	
Football	1,900
Squash	1,300
Basketball	1,100
Soccer	600
Bicycling	50

The figures demonstrate that cycling is not dangerous when compared to these sports activities. I don't have any hourly data for the US, but there are 2.6 million emergency room sports injuries in the US to those 24 years old and younger each year. While I don't have the figures for bicycling injuries for those under 24, it would have to be under 1/5th of all sports activities, yet bicycling is the third most popular activity in the US (after walking and swimming).

Injury Rate Per Mile

There is a good bit of data for injuries per mile while bicycling, both from the sources we have been using and from private surveys.

Injuries Per Mile	
Motor Vehicle Travel	**Bicycle Travel**
3,400,000 injured	58,000 injuried in collisions 530,000 injuried in falls
2.56 trillion miles	21 billion miles
1.33 injuries per million miles	2.76 crash injuries per million miles 25.2 fall injuries per million miles
Data from *Traffic Safety Facts 1997* and *The Environmental Benefits of Cycling and Walking*	

Two good sources for data about injuries to regular cyclists are the surveys by William E. Moritz, one of bicycle commuters and one of LAB members in 1996. They show the following injury rates, based not on an hospital visit but on a cost of $50 or more, which included "injuries" to the bicycle. About 70% of the travel was on regular streets):

Risk of Crash Per Million Miles (333 years)		
	Commuters	LAB members
Major streets	77.6	66
Minor streets	65.7	95
Lanes/Bike routes	30.8	42/51
Paved Trail/Off-road	41.0	142/454
Other (sidewalks)	327.1	1661

These statistics show that cycling on roads and streets safer than cycling on sidewalks, trails, and off-road. They also indicate years between accidents on roads and highways.

Another detailed source is the Bikecentennial 1976 report. In 1976, the first year of the cross-country touring trips on the National Bike Trail, a strong effort was made to record every single accident which required first-aid treatment or damage to the bicycle of more than $25. It should be noted that while many of these cyclists were veterans, more were making their very first (and perhaps their very last) long bicycle trip. Nonetheless, it can be assumed that they were more careful than the average cyclist. Their accident rate was 80 per million miles, a figure that was affected by the loads on their bikes, as those who traveled unloaded had 22 accidents per million miles. Two reasons probably explain this: first, very few of the bikes were touring bikes, and thus the load was mounted in the rear unbalancing the bike, and second, the greatest number of accidents came late in the day, when the cyclists were tired, and the extra weight probably contributed to making them more tired. In looking at the results of the injuries, 70.4% did not visit the hospital, 20.1% went to the hospital but were released the same day, and the remaining 9.5% had to stay at least overnight. Thus the accident rate for those going to the emergency room was about 24 per million miles and for those being hospitalized was about 7.6 per million miles.

Injury Rate Per Trip

Once again, we are back to the The John Hopkins Center data, which is based on trips. This source informs us that there are 300 cycling injuries requiring an emergency room visit for every million trips.

Amount of Time Between Injuries

The data does not agree, but based on it, we can estimate the amount of time between injuries severe enough to send the person to the emergency room. Again, we will assume a regular cyclist who travels 3,000 miles and 250 hours per year, 180,000 miles in a lifetime, and 250 trips per year. Based on the figures per hour, she would travel some 217 years between collisions with motor vehicles and 21 years between falls. Based on the figures per mile (from *Traffic Safety Facts 1997* and *The Environmental Benefits of Cycling and Walking*), she would travel 121 years between collisions with motor vehicles and 13.2 years between falls. Based on the Bikecentennial figures, she would travel some 13.8 years between both kinds of injuries. Finally, based on the John Hopkins Center figures for trips, she can expect to go 12.5 years between injuries severe enough to send her to the emergency room. Again, these are only average figures; those who are more careful will have fewer injuries and those who are not will have more. The risk of injury or death has to be balanced against the positive health benefits, which will be discussed next.

Risk from Lack of Exercise

Now that we have looked at the harm caused by bicycling, let's look at the benefits. The risk involve in not bicycling (or getting some equivalent form of exercise) has much more serious and more certain results. According to results published in *Pedalling Health* (from the USA), a sedentary lifestyle fosters coronary heart disease, strokes, obesity, and type II diabetes. An excellent way to fight such life destroyers is to travel by bicycle, and *Pedalling Health* indicates that the equivalent of 60 miles a week provides the necessary protection. Henry Thoreau once said, "A man *sits* as many risks as he runs" and

for once Thoreau understated it. According to *Pedalling Health*, a person who bicycles six hours a week reduces his chance of death by coronary heart disease alone by over four times as much as he increases his chance of death through a traffic accident. Mayer Hillman of the British Medical Association has estimated that the total health benefit of cycling is twenty times the risk.

The True Health Risks

Here are the primary causes of early death, including the risks that one runs by *not* riding a bicycle:

The Top Ten Causes of Death for 1995

Cause	*No. of deaths*		*How to avoid (cycling-related methods only)*		
Heart Disease	737,563	✓	Exercise	Diet	Stress Management
Cancer	538,455				
Strokes	157,991	✓	Exercise		Stress Management
Lung Disease	102,899	✓	Exercise		
Adverse effects	93,320				
Pneumonia, flu	82,920				
Diabetes	59,254	✓	Exercise	Diet	Weight Management
AIDS	43,115				
Suicide	31,284	✓	Exercise		
Liver Disease	25,222				

National Center for Health Statistics

These figures show an opportunity for bicycling to help save over one million lives in the US each year. (Note: The American Cancer Association announced in 2002 that exercise can prevent 1/3 of all cancers as well.) The primary benefit would be through the exercise itself, which strengthens the heart, lungs, and circulatory system and cheers up the depressed. In addition, cycling would be beneficial in weight and diet management, by helping to burn excess fat. Finally, riding a bike could help get rid of stress. Cycling alone could not entirely stop or prevent all these ailments, but it would have a powerful ability to reduce them. For example, riding a bike just 30 miles a week (half the distance we should be riding every week) reduces the chance of heart disease by 50% (from *Pedalling Health*).

However, in another sense, the million people listed above are not the ones we should be worried about. Many of them could have been helped only with prayers and medication. However, there are millions of other people who are slowly becoming like them: the 5.7 million already showing signs of heart disease, the people carrying too much weight, the people who no longer have enough energy, the people who are spending more time sitting down than they used to, and even the young people who are not building up strong bones, muscle, and hearts; all these people may someday die in one of these horrible ways unless they start exercising now. But no matter whether people start exercising early or late, cycling has the ability to regenerate their bodies and to keep them from joining the million lives lost a year, and that is a lifetime risk of not 1/256 or 1/133 but of 1/3. In addition, most other people, who are already getting enough aerobic exercise to avoid these diseases, would feel younger and stronger if they would exercise

more.

Riding 3,000 miles a year, enough to ensure full health benefits, does not have to take any extra time or money. Over three quarters of all car trips in the US are for distances under ten miles and nearly 60% are for distances under five miles. All that is necessary to get enough exercise is to ride the bike to work, to run errands, to visit friends, and to enjoy the countryside. Riding the bike instead of driving the car can save up to 53¢ a mile and thousands of dollars in a year's time (see Auto Costs). In addition, the cyclist will be getting more fun out of life, and helping reduce pollution and global warming at the same time.

At any rate, if someone tells you that bicycling is dangerous, point out that heart disease alone -- which can be prevented by riding a bicycle -- kills almost 1,000 times as many people each year.

Summary

I have decided that I better add a summary to this discussion, since some people still don't get it. To the question, is bicycling dangerous, we have to acknowledge that there are between 700 and 1,000 fatalities in the US each year, which is a small number compared to the million or so who die from diseases that cycling could help prevent and the approximately 150,000 people killed in other kinds of accidents. In comparing the fatality rate of cyclists and motorists, we find that the statistics about bicycle use do not all agree; however, it seems that bicycling is less dangerous or no more dangerous per hour than driving a car, and since motorists spend more time driving, the lifelong risk of the average motorist is two to four times greater than that of the average cyclist without the 20X compensating health benefits of cycling. In addition, motor vehicles kill over five thousand pedestrians each year while bicycles kill at most one or two. Finally, the majority of cycling deaths occur to the minority who are not following such simple safety proceedures as riding with the traffic, stopping for traffic lights and stop signs, and using lights at night. Then, when looking at injuries, we find that the serious injuries are only a small part of the total, and that the amount of time between injuries is great. Again, the number of injuries can be reduced by being careful.

Putting all this together, a person who choses a bicycle over an automobile for daily travel and who obeys the traffic laws and uses care at all times will experience greatly improved health and a greatly reduced risk of death as a result. Thus rather than being dangerous, cycling greatly reduces major health risks.

The End