

NON-POWERED VEHICLE-RELATED INJURIES

A 7 year old boy was riding his bicycle down a hill in front of his house. He hit a rock, lost control of the bike and flipped over the handlebars. He hit his head on the pavement. He had no helmet on. He died.

Defining The Problem

Bicycle riding is a popular recreational activity, a nonpolluting form of transportation, and an important source of exercise. There are over 100 million bicyclists in the United States (U.S.), approximately 44 million of whom are less than 16 years of age. There are more than 11 million bicycles sold annually in the U.S.¹ Unfortunately, riding a bicycle can cause substantial morbidity and mortality. Every year, more than 800 riders are killed, 20,000 are hospitalized, and 500,000 receive treatment in hospital emergency departments (EDs) for injuries sustained while riding bicycles.

Riding scooters*, in-line skating, roller skating, and skateboarding are increasingly popular activities among children and adolescents. As the number of children exposed to these activities grows, so does, unfortunately, the number of related injuries.

Goals

Reduce injuries and deaths per 100,000 caused by bicycle crashes.

<u>Deaths:</u>		<u>Injuries:</u>	
OH 1999	0.15	OH 1999	identify baseline
US 1999	0.29	US 1999	241 per 100,000

Identify baseline data for other non-powered vehicle-related injuries and deaths.

Data sources: National Vital Statistics System (NVSS), Centers for Disease Control and Prevention (CDC), Consumer Product Safety Commission (CPSC), National Center for Health Statistics (NCHS), National Hospital Ambulatory Medical Care Survey (NHAMCS).

Increase use of helmets by bicyclists and other non-powered vehicle riders.

Potential Data Sources: Consumer Product Safety Commission (CPSC); Behavioral Risk Factor Surveillance System (BRFSS), CDC; World Health Organization Study of Health Behavior in School Children.

Increase number of states with laws requiring helmets for bicycles and other non-powered vehicle riders.

HP 2010 Goal	100% of states will have laws requiring bicycle helmets for riders.
OH 1999	No state law. Local ordinances exist.
U.S. 1999	No states have laws applying to all riders. 10 states have helmet laws for riders 15 years and younger.

Data source: National Safe Kids Campaign

Data

Bicycle-Related Injuries

In the U.S. during 1999, the bicycle-related injury death rate was 0.29 per 100,000 people and the nonfatal injury rate was 241 per 100,000 people. In the same year, there were 24,858 years of potential life lost (YPLL) due to bicycle-related deaths in the U.S. In Ohio, there were 559 YPLL.

Young children ride primarily on sidewalks, playgrounds, and neighborhood streets. Therefore, non-traffic injuries among young children result mostly from falls or collisions with fixed objects. Older children and adults ride more frequently in traffic. Therefore they sustain more motor-vehicle-related injuries. Ninety percent of all bicycle-related deaths result from collisions with motor vehicles; more than 75% of nonfatal injuries do not involve motor vehicles.¹⁻²

Although most injuries are minor and self-limited, head injuries result in most fatal and debilitating injuries sustained by bicycle riders. They account for 3 out of 4 deaths, 2 out of 3 hospitalizations, and 1 out of 3

*Scooters will refer only to non-powered scooters, not powered scooters.

ED visits. An estimated 140,000 children are treated for head injuries annually due to bike crashes. More than 95% of people killed are not wearing helmets.

Helmets reduce the risk of serious head and brain injuries by as much as 85% and upper and mid-face injury by 65%. According to a national survey by the CPSC in 1999, 50% of cyclists regularly wear helmets. This is higher than the 18% reported in the 1991 survey. These numbers, because they are self-reported, are likely to be overestimated. If every bicycle rider wore a helmet, 150 deaths and over 100,000 nonfatal injuries would be prevented each year.

Another cause of serious injuries to bicyclists is handlebar injuries. Many of these injuries result from seemingly innocuous crashes; low speed crashes can result in serious internal injuries. Most of the injuries from handlebars are to the abdomen and pelvis including the intestines, the liver, and the spleen.



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younger than 21 years of age. In 1997, there were 71,000 injuries reported in children less than 21 years of age. More than half of injuries involve males. Less than 2% of injuries result in hospitalization. The most common reasons for injury are losing one's balance due to road surface defects or debris, being unable to stop, speeding out of control, or doing a trick. April, May, and September were the peak months for injuries. The most frequently injured body part is the wrist (40%) followed by the knee, face, and elbow. Five percent of injuries are to the head; about 2/3 of injuries are

fractures. Thirty six people died between 1992 and 1997, 31 of these deaths were due to collisions with motor vehicles.^{1,3}

Roller skating is an indoor activity. In 1994, there were 66,000 visits by

children and adolescents to U.S. EDs for roller-skating injuries, 65% of which were in females. As with in-line skating, the wrist is the most commonly injured body part (43%) followed by the ankle, elbow, knee, finger and hand. Thirty nine percent of injuries were fractures. Peak injury months were January and April.¹

In 1996, approximately 5.8 million children and adolescents participated in skateboarding. There are approximately 50,000 ED visits by children and adolescents for skateboard-related injuries annually and about 1,500 hospitalizations. Most hospitalizations are due to head injuries. Approximately 25% of hospitalized children are hit by motor vehicles. Males are injured about 90% of the time. Peak injury months are May, August, and September. The most commonly injured body parts are the ankle, face, wrist, and elbow. About 1/4 of all injured persons have abrasions or contusions, 1/4 have sprains or strains, and 20% have fractures.¹

In 1994, an estimated 19.5 million people took part in in-line skating. Most participants are young. In 1994, 75% were younger than 25 years of age, and 38% were younger than 12 years. In 1994, there were 31,000 injuries reported, 20,000 of which were in children

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Other Non-Powered Vehicles

In 2000, there were approximately 40,500 scooter-related injuries reported to the Consumer Product Safety Commission (CPSC). From January 2001 through September 2001, there were more than 84,400 injuries treated in EDs. Between January 2000 and September 2001, at least 16 people died from scooter-related injuries, 9 of whom were younger than 15 years of age. About 85% of injuries are to children younger than 15 years old. It is estimated that if all riders wore safety gear, more than 60% of injuries could have been prevented or their severity lessened. Most injuries result from falls. Approximately 1/3 of the injuries are to wrists, elbows, lower arms, and knees; more than 1/4 are to the head and face. About 25% of injuries are fractures or dislocations, mostly to the hands and arms.

Costs & Consequences

National:

The lifetime costs associated with a bicyclist with a severe head injury is over \$4.5 million. The cost associated with the death of a bicyclist is greater than \$200,000. In 1999, there were 24,858 years of potential life lost in the U.S. due to bicycle-related deaths.

There is no information available on other non-powered vehicles.

State:

In 1999, there were 559 years of potential life lost in Ohio due to bicycle-related deaths.

There is no information available on other non-powered vehicles.



Every dollar spent on a bicycle helmet saves \$30 in direct medical costs and other costs to society.

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A poll in April 2000 by the Institute for Policy Research at the University of Cincinnati showed that $\frac{3}{4}$ of Ohioans supported legislation that would require use of bike helmets by all riders, especially all children less than 18 years of age, when riding on public roads.



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Risk Factors

Bicycles

- Bicycle injuries are a leading cause of injury death and disability in children. Bicycles result in more childhood injuries than any other consumer product except motor vehicles.
- Most children are injured on bicycles when they fall from the bike, collide with a fixed object, or lose control due to mechanical problems; a lesser number are injured when they collide with motor vehicles.
- Children 5-14 years of age ride bicycles more than twice as much as those in other age groups.¹ As a result, they suffer a disproportionately large share of bicycle-related injuries. Although children aged 5-14 years account for 40% of cyclists, 66% of injuries treated in EDs occur in this age group. Forty percent of all bicyclist deaths occur in children 5-14 years of age.² Bicycle deaths per million trips are 5 times higher in this age group than in teenagers and almost twice as high as in 20 year-olds. This age group is at maximal risk due to the quantity and quality of their exposure. Fatalities and hospital admissions peak at 10-14 years of age. Young children (5-9) are more likely than older children (10-14) to have head injuries.
- In 1999, children 10-14 years of age had the highest death rate, and 40-44 year olds had the second highest rate, while children 15-19 and 5-9 had the 3rd and 4th highest rates, respectively. Rates in people >75 years of age were lower than that of other groups, but due to their small numbers may be unreliable. African Americans have higher risk of death than Caucasians.
- In all age groups, males have higher injury rates than females. Overall, males have a 7 times higher risk of death than females and a 5 times higher risk of nonfatal injury. They have 1.6 times more injuries in the 5-9 year old age group, 2.6 times more injuries in the 10-14 year old age group, and 4 times more injuries in the 15-19 year old age group.
- Bicycle deaths are most likely to occur in the summer—July through September. The peak time is 5-9 pm. About 1/3 of all deaths occur on weekends.²
- Risk of severe injury and death increases with riding in traffic. Riding at night is an additional risk factor because the cyclist is less visible. Almost ½ of all injuries occur at dusk, at dawn, or in the dark. Irregular road surfaces also increase the risk of injury.
- Unsafe riding practices such as stunt riding, riding double, riding too fast, and riding on a borrowed bike result in increased injuries. Other risk factors include not following the rules of the road and riding a poorly maintained bike with poor steering or braking functions.
- Failure to wear a bike helmet increases risk of head injury 6.6 times and increases risk of brain injury 8.3 times.
- Twice as many bicyclists are killed in urban than rural areas. Death rates are lowest in areas of high per capita income.² One-fourth to one-third of deaths occur at intersections.
- Adult bicyclists have made up an increasing proportion of bicycle fatalities in recent years.² Older bicyclists represent 2/3 of the deaths. Severity of injury and proportion of cases involving motor vehicles increases with age.² Alcohol involvement occurs in about 1/3 of traffic crashes.

Other Non-Powered Vehicles

- Risk factors for scooters, in-line skates, roller skates and skateboards include young age and inexperience, immature motor coordination, speed, risk-taking behavior, lack of protective gear, loss of balance, obstacles and irregular surfaces, hard impact surfaces, and collisions with motor vehicles. Males are at higher risk for injuries due to scooters, in-line skates, and skateboards, while females are at increased risk of injuries due to roller skates. This is probably related to exposure.

Policy Issues

National Legislation:

Bicycle Helmet Standard Law Mandate—Regulated by the CPSC

In 1994 Congress directed the Consumer Product Safety Commission to research existing standards and if needed develop a CPSC standard for bicycles helmets in order to accomplish two things:

1. To eliminate consumer confusion by too many different voluntary standards being used by manufactures.
2. To establish a set of test criteria which would assure consumers all bicycle helmets sold in the US provide a reasonable level of protection, as a minimum. The CPSC has developed a comprehensive standard that builds upon the existing ASTM and Snell standards. The CPSC standard became effective on March 10, 1999 and applies to all bike helmets sold in the US. The Bike Helmet Standard requires among other things, all helmets to be:
 1. Marked with a label so that the following information be legible and easily visible to consumers:
 - a. Model designation
 - b. Proper fitting instructions
 - c. Care instructions
 - d. What to do if a helmet is damaged
 2. Tested for peripheral vision, positional stability and impact quality.
 3. Helmet should be specifically and specially designed for children 1 to 4 years old with additional head coverage.

There is no national legislation regarding other non-powered vehicles.

State Legislation:

In the Ohio Revised Code (ORC):

§ 4511.01 Definitions.

(G) "Bicycle" means every device, other than a tricycle designed solely for use as a play vehicle by a child, propelled solely by human power upon which any person may ride having either two tandem wheels, or one wheel in the front and two wheels in the rear, any of which is more than fourteen inches in diameter.

§ 4511.55 Riding bicycles; motorcycles abreast.

(A) Every person operating a bicycle upon a roadway shall ride as near to the right side of the roadway as practicable obeying all traffic rules applicable to vehicles and exercising due care when passing a standing vehicle or one proceeding in the same direction.

(B) Persons riding bicycles or motorcycles upon a roadway shall ride not more than two abreast in a single lane, except on paths or parts of roadways set aside for the exclusive use of bicycles or motorcycles.

§ 4511.53 Rules for bicycles, motorcycles and snowmobiles.

1. A person operating a bicycle or motorcycle shall not ride other than upon the permanent and regular seat attached thereto, nor carry any other person upon such bicycle or motorcycle other than upon a firmly attached and regular seat thereon, nor shall any person ride upon a bicycle or motorcycle other than upon such a firmly attached and regular seat.
2. No person operating a bicycle shall carry any package, bundle, or article that prevents the driver from keeping at least one hand upon the handle bars.
3. No bicycle or motorcycle shall be used to carry more persons at one time than the number for which it is designed and equipped, nor shall any motorcycle be operated on a highway when the handle bars or grips are more than fifteen inches higher than the seat or saddle for the operator.

§ 4511.56 Signal devices on bicycle.

- (A) Every bicycle when in use at the times specified in section [4513.03](#) of the Revised Code, shall be equipped with the following:
- (1) A lamp on the front that shall emit a white light visible from a distance of at least five hundred feet to the front;
 - (2) A red reflector on the rear of a type approved by the director of public safety that shall be visible from all distances from one hundred feet to six hundred feet to the rear when directly in front of lawful lower beams of head lamps on a motor vehicle;
 - (3) A lamp emitting a red light visible from a distance of five hundred feet to the rear shall be used in addition to the red reflector;
 - (4) An essentially colorless reflector on the front of a type approved by the director;
 - (5) Either with tires with retroreflective sidewalls or with an essentially colorless or amber reflector mounted on the spokes of the front wheel and an essentially colorless or red reflector mounted on the spokes of the rear wheel. Each reflector shall be visible on each side of the wheel from a distance of six hundred feet when directly in front of lawful lower beams of head lamps on a motor vehicle. Retroreflective tires or reflectors shall be of a type approved by the director.

- (B) No person shall operate a bicycle unless it is equipped with a bell or other device capable of

giving a signal audible for a distance of at least one hundred feet, except that a bicycle shall not be equipped with nor shall any person use upon a bicycle any siren or whistle.

- (C) Every bicycle shall be equipped with an adequate brake when used on a street or highway.

§ 4511.54 Prohibition against attaching bicycles and sleds to vehicles.

No person riding upon any bicycle, coaster, roller skates, sled, or toy vehicle shall attach the same or himself to any streetcar, trackless trolley, or vehicle upon a roadway.

No operator shall knowingly permit any person riding upon any bicycle, coaster, roller skates, sled, or toy vehicle to attach the same or himself to any streetcar, trackless trolley, or vehicle while it is moving upon a roadway.

§ 4511.40 Hand and arm signals.

- (A) Except as provided in division (B) of this section, all signals required by sections 4511.01 to 4511.78 of the Revised Code, when given by hand and arm, shall be given from the left side of the vehicle in the following manner, and such signals shall indicate as follows:

- (1) Left turn, hand and arm extended horizontally;
- (2) Right turn, hand and arm extended upward;
- (3) Stop or decrease speed, hand and arm extended downward.

- (B) As an alternative to division (A)(2) of this section, a person operating a bicycle may give a right turn signal by extending the right hand and arm horizontally and to the right side of the bicycle.

[§ 4511.05.1] § 4511.051 Prohibitions on use of freeways.

No person, unless otherwise directed by a police officer, shall:

(B) Occupy any space within the limits of the right-of-way of a freeway, with: an animal-drawn vehicle; a ridden or led animal; herded animals; a pushcart; a bicycle, except on a facility that is separated from the roadway and shoulders of the freeway and is designed and appropriately marked for bicycle use; a bicycle with motor attached; a motor driven cycle with a motor which produces not to exceed five brake horsepower; an agricultural tractor; farm machinery; except in the performance of public works or official duties.

**In the Ohio Administrative Code (OAC):
1501:3-4-04 Motor vehicles, bicycles, horses required to stay on roads or trails; negligent operation.**

- (A) No person shall operate any motor vehicle or ride any APV, snowmobile, bicycle, dog sled, or horse within any state forest except over and upon roads, trails or other facilities designated and provided and posted for such purpose unless authorized by the chief or his authorized agent.

1501:17-9-02 Motor vehicles, bicycles required to stay on roads; vehicles prohibited.

No person shall operate any motor vehicles or ride any bicycle within any nature preserve, scenic river land or natural area except over and upon roads, streets, driveways, paths, or other such facilities which are designated or posted for such purposes. No person shall drive around any barrier or gate which is across a road or trail nor shall he drive a motor vehicle or bicycle upon such barricaded or closed facility.

The following vehicles will be prohibited from use in any nature preserve, scenic river land or natural area: in line skates, street luges, roller skates and skateboards.

1501:41-13-06 Right of way to pedestrians.

The operator of a motor vehicle, bicycle, or horse shall grant the right-of-way to all pedestrians crossing streets, lanes, or highways within any area administered by the Division.

Local Ordinances

The State of Ohio has local bicycle helmet legislation in the following jurisdictions:

City/Town	Age Required	Year Enacted
Akron	Under 16	2001
Beachwood	Under 16	1990
Brecksville	Under 18 *	1998
Centerville	Under 16	1999
Cincinnati	Under 16	2003
Glendale	Under 19 *	2000
Madeira	Under 17 *	2002
Orange Village	6 to 15	1992
Shaker Heights	Over 5	1997
	Inc. passengers	
Strongsville	Under 12	1993
Waynesville	Under 17 *	2000

* Covers in-line skaters, roller skaters and skateboarders.

Existing Programs

National:

CDC National Bike Safety Network: Bike Safety Programs

<http://www.cdc.gov/ncipc/bike/>

Bike safety programs include helmet giveaways, bike rodeos and petition drives to change a law. A variety of programs are described below:

Bikes Belong!

Describes the Intermodal Surface Transportation Efficiency Act, a transportation planning strategy, and ways it can help increase bicycle helmet use and reduce bicycle injury.

The Collaborating Helmet Initiative Program

The World Health Organization showcases some helmet promotion programs it considers exceptional for those interested in designing new programs.

NHTSA Highway Safety Programs

Provides tips on safe biking for children and adults

Bicycle and Pedestrian Program

Provides information and resources regarding programs and efforts to promote bicycle and pedestrian transportation from the Department of Transportation's Federal Highway Administration

Toolkit for Helmet Promotion Programs

Provides resources and materials for helmet promotion programs from the Bicycle Helmet Safety Institute. Includes a promotion manual, statistics, bicycle laws, and helmet purchasing information.

CDC National Bike Safety Network: Education Programs

Education programs focus on increasing the use of bike helmets, educating the public on safe biking behaviors, and making the public aware of possible environmental changes needed to enhance safe biking. Resources to assist in these programs are available here:

Children's Safety Network National Injury and Violence Prevention Center (CSN)

Links to CSN Resource Centers which provide resources to maternal and child health agencies and other organizations seeking to reduce unintentional injuries and violence to children and adolescents. Also links to publications, a newsletter and other safety resources. (Maternal and Child Health Bureau)

Consumer Product Safety Commission

Provides a variety of links to recreational safety publications.

Effective Cycling

The League of American Bicyclists' education program offers specific courses for each part of the varied American family of cyclists, including novice and experienced adults, parents, children, families, off-road cyclists, commuters, and more.

League of American Bicyclists

The League of American Bicyclists was founded in 1880 as the League of American Wheelmen. It promotes cycling for fun, fitness and transportation, and works through advocacy and education for a more bicycle-friendly America. Membership includes 35,000 individuals, 450 recreational clubs, and 45 state and local advocacy organizations.



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Pedestrian and Bicycle Information Center

Funded by the U.S. Department of Transportation and managed by the University of North Carolina Highway Safety Research Center, the Pedestrian and Bicycle Information Center offers technical assistance to communities about bicycle and pedestrian safety. The Center can be reached by telephone at 877-WALKBIKE.

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Through education, enforcement, outreach and legislation, NHTSA's bicycle safety program goals are directed toward reducing bicycle injuries and fatalities. Bicycling is encouraged as an alternate mode of transportation to motor vehicle travel. Additional goals include: increasing the use of bicycle helmets, increasing awareness about sharing the road with cyclists and motorists, and promoting safe bicycle practices.

Safe Routes to School

Safe Routes to School is a toolkit for use by educators and others to promote walking and biking to school that includes sections on mapping the routes to school, activities and outreach, and classroom lessons. The toolkit also includes sample Safe Routes to School forms, press releases, posters, and other resources.

US Department of Transportation Federal Highway Administration:

National SAFE KIDS Campaign

works with Bell Sports to provide helmets to local chapters for about \$7 each. The helmets meet standards of the Consumer Product Safety Commission (CPSC), the American National Standards Institute (ANSI), and the American Society for Testing and Materials (ASTM).

State:

Ohio Department of Health

Under a CDC federal block grant, the Ohio Department of Health funds 20 local health department programs designed to prevent childhood injuries. These local community level projects focus on promoting behavioral changes targeting high risk populations enhanced educational efforts and increasing the use of safety devices to protect children, including bike helmets. Over \$400,000 was allocated during 1998 to local health departments for programs promoting the use of bicycle helmets and injury prevention initiatives.

Other state programs

Children's Hospitals in Ohio have bicycle safety programs. In addition, many local police and fire departments, SAFE KIDS Coalitions, schools and communities have bicycle safety programs



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Recommendations to Prevent Non-Powered Vehicle-Related Injuries

Improve surveillance

1. Develop a statewide surveillance system and a database for bicycle-related and non-powered vehicle-related emergency department visits, hospitalizations, and deaths in order to identify and target high-risk groups. Sources for the data could include the State Trauma registry, the Ohio Hospital Association and Emergency Medical Services incident reports.

Empower communities

2. Develop a multifaceted statewide campaign to increase helmet use in bicycle and other non-powered vehicle riders. The campaign should include education, helmet subsidies or giveaways, and legislation.
3. Support programs that successfully educate parents and children about safe cycling and other non-powered vehicle safety. Education should include the following:
 - Wearing a protective gear and reflective clothing on every ride
 - Helmet fit and replacement criteria
 - Understanding traffic rules and using hand signals
 - Supervising children and limiting riding in traffic until they are competent in riding skills
 - Limiting activities according to developmental abilities
4. Provide incentives for local government to construct bicycle and other non-powered vehicle-friendly communities which physically separate riders from traffic and minimize risk for collision. Bike paths should be developed to encourage young riders to stay away from traffic. Caution must be exercised with bike lanes as they may paradoxically increase crashes.⁴

Legislative Initiatives

5. Enact legislation requiring helmet use by bicycle and other non-powered vehicle riders when riding on public roads.
6. Support legislation requiring energy-absorbing handlebars and other safety design improvements on new bicycles and other non-powered vehicles.

Possible Funding Sources

- **Funding through the State of Ohio.** If all bike riders and non-powered vehicle users wore helmets, risk of injury and death could be reduced. This reduction would mean that medical costs for these injuries would be reduced; therefore the state would save money. Studies have shown that bicycle helmets are very cost-effective.⁶⁻⁷
- **Funding through insurance companies.** Insurance companies could provide discounts to customers if helmets were required for people riding bicycles or other non-powered vehicles. If fewer injuries occurred, insurance companies would decrease costs on emergency department visits and hospitalizations. These funds could be used to fund programs and evaluate their effectiveness.

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Total Population: 1999 Deaths, 2000 Nonfatal	Deaths	Nonfatal
	Rate per 100,000	Rate per 100,000
TOTAL	0.29	241.53
Race and ethnicity		
Black or African American	0.34	238.34
White	0.29	193.22
Gender		
Male	0.53	353.04
Female	0.06	127.84
Age		
5-9	0.37	772.00
10-14	0.47	906.40
15-19	0.42	388.26
40-44	0.43	112.01
45-49	0.35	113.90
50-54	0.29	87.25

Note: Rates are age adjusted to the year 2000 standard population.