CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

February 17, 1995 / Vol. 44 / No. RR-1

MMWR

Recommendations and Reports

MORBIDITY AND MORTALITY WEEKLY REPORT

Injury-Control Recommendations: Bicycle Helmets

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
and Prevention (CDC)
Atlanta, Georgia 30333

The *MMWR* series of publications is published by the Epidemiology Program Office, Centers for Disease Control and Prevention (CDC), Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA 30333.

SUGGESTED CITATION

Centers for Disease Control and Prevention. Injury-control recommendations: bicycle helmets. MMWR 1995;44(No. RR-1):[inclusive page numbers].

Copies can be purchased from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9325. Telephone: (202) 783-3238.

Contents

Consultants — Continued

The following CDC staff members prepared this report:

Robert D. Brewer, M.D., M.S.P.H.
Mary Ann Fenley
Pamela I. Protzel, M.P.H.
Jeffrey J. Sacks, M.D., M.P.H.
Timothy N. Thornton
Nancy Dean Nowak, R.N.
Benjamin Moore, M.P.H.
James Belloni, M.A.
National Center for Injury Prevention and Control

Injury-Control Recommendations: Bicycle Helmets

Summary

These recommendations on the use of bicycle helmets are the first in a series of Injury-Control Recommendations that are designed for state and local health departments or other organizations for use in planning injury control programs. Each publication in the series of Injury-Control Recommendations will provide information for program planners to use when implementing injury control interventions.

These guidelines were developed for state and local agencies and organizations that are planning programs to prevent head injuries among bicyclists through the use of bicycle helmets. The guidelines contain information on the magnitude and extent of the problem of bicycle-related head injuries and the potential impact of increased helmet use; the characteristics of helmets, including biomechanical characteristics, helmet standards, and performance in actual crash conditions; barriers that impede increased helmet use; and approaches to increasing the use of bicycle helmets within the community. In addition, bicycle helmet legislation and community educational campaigns are evaluated.

INTRODUCTION

Each year, nearly 1,000 persons die from injuries caused by bicycle crashes, and 550,000 persons are treated in emergency departments for injuries related to bicycle riding. Approximately 6% of the bicycle riders treated in emergency departments require hospitalization. Head injuries account for 62% of bicycle-related deaths, for 33% of bicycle-related emergency department visits, and for 67% of bicycle-related hospital admissions.

The use of bicycle helmets is effective in preventing head injury (*1*). Community programs to increase bicycle helmet use can reduce the incidence of head injury among bicycle riders, thereby reducing the number of riders who are killed or disabled. Increasingly, state and local laws are being developed that will make mandatory the use of bicycle helmets.

These guidelines were developed for state and local agencies and organizations that are planning programs to prevent head injuries among bicyclists through the use of bicycle helmets. The guidelines are based on a review of literature on bicycle-related injuries, bicycle helmets, and the evaluation of legislation and community programs. The guidelines have been reviewed and approved by the Advisory Committee for Injury Prevention and Control and by other experts in the prevention of bicycle-related injuries.

BACKGROUND

Bicycling is a popular activity in the United States. Bicycles are owned by approximately 30% of the U.S. population, and 45% of bike owners ride at least occasionally

(*2*). Approximately 80%–90% of children own a bicycle by the time they are in second grade (*3*).

From 1984 through 1988, an annual average of 962 U.S. residents died from and 557,936 persons were treated in emergency departments for bicycle-related injuries (*4*). Approximately 6% of persons who are treated for bicycle-related injuries require hospitalization (*5,6*). The annual societal cost of bicycle-related injuries and deaths is approximately $8 billion (*7*).

Head injury is the most common cause of death and serious disability in bicycle-related crashes (*1*). Head injury accounts for 62% of bicycle-related deaths (*4*). In addition, approximately 33% of all bicycle-related emergency department visits and 67% of all bicycle-related hospital admissions (*5,8*) involve head injuries (*1,4,5*).

Head injury accounts for approximately 44% of all deaths resulting from injury in the United States (*9*), and approximately 7% of brain injuries are bicycle-related (*2*). Among survivors of nonfatal head injuries, the effects of the injury can be profound, disabling, and longlasting (*9*). Even after minor head injuries, persons may experience persistent neurologic symptoms (e.g., headache, dizziness, reduced memory, increased irritability, fatigue, inability to concentrate, and emotional instability). These symptoms are sometimes referred to as the "postconcussional syndrome" (*10*).

From 1984 through 1988, >40% of all deaths from bicycle-related head injury were among persons <15 years of age (*4*). In all age groups, death rates were higher among males. Death rates from bicycle-related head injury were highest among males 10–14 years of age. During the same years, >75% of persons treated in emergency departments for bicycle-related head injury were <15 years of age. Rates for bicycle-related head injury were also higher for males than females in all age groups; the rates were highest among males 5–15 years of age (*4*).

Nearly 90% of deaths from bicycle-related head injury result from collisions with motor vehicles (*4*). However, motor vehicle collisions cause <25% of the nonfatal bicycle-related head injuries that are treated in emergency departments (*1,11*). Excluding collisions with motor vehicles, common causes of nonfatal bicycle-related head injuries include falls, striking fixed objects, and collisions with other bicycles (*1,11*).

BICYCLE HELMETS AND THE PREVENTION OF HEAD INJURY

The implementation of effective bicycle helmet programs could have a substantial impact on rates for fatal and nonfatal bicycle-related head injury (*4*). For example, from 1984 through 1988, if a presumed helmet-use rate of 10% had been increased to 100% (i.e., universal helmet use), an average of 500 fatal and 151,400 nonfatal bicycle-related head injuries could have been prevented each year (*4*).

Several researchers (*2,5,8,12*) have recommended that bicyclists use helmets to prevent head injuries. However, controlled studies evaluating the effectiveness of bicycle helmets in bicycle crashes have not been available until recently. In particular, the results of a case-control study in Seattle in 1989 indicated that the use of bicycle helmets reduced the risk for bicycle-related head injury by 74%–85% (*1*). The findings of other studies that have compared the proportions of helmeted and unhelmeted riders who sustained head injury in bicycle crashes (*13–15*) detected higher risks for head injury among unhelmeted riders (crude odds ratio=4.2 [*13*], 19.6 [*14*], and

4.5 [*15*]). Although other strategies may be useful in preventing bicycle-related injuries (i.e., proper road design and maintenance; improvement in bicycle design, manufacturing, and repair; and bicycle safety training [*5,16,17*]), the use of these strategies does not eliminate the need for bicycle helmets.

Biomechanical Characteristics of Helmets

Helmets are designed to protect the brain and the skull during an impact (*5*). Field tests and laboratory studies have been used to assess helmet characteristics and determine the relative effectiveness of different helmet designs.

The testing of bicycle helmets approved by either the American National Standards Institute (ANSI) or the Snell Memorial Foundation indicated that using any helmet will protect the brain and neck during a crash more effectively than not using any helmet at all (*18*). However, these tests identified potential problems with helmet design, including a tendency for all helmets to slip out of proper position with the unequal application of force; a tendency for hard-shell helmets to slide on concrete, potentially increasing the risk for facial injury in a crash; and a likelihood for soft or no-shell helmets to catch or drag on concrete surfaces, causing the head to decelerate at a faster rate than the rest of the body, which potentially increases the risk for neck injuries (*18*). Subsequent tests indicated that helmets covered with a hard shell or a microshell (i.e., a very thin plastic covering) were least likely to cause injury to the head and neck region (*19*).

The impact protection provided by different brands of bicycle helmets varies considerably depending on type and brand (*20,21*). When helmets with crushable polystyrene liners were damaged internally during an impact, they provided less protection during future impacts (*21*).

Helmet Standards

Three organizations—ANSI, the Snell Memorial Foundation, and the American Society for Testing and Materials (ASTM)—have developed voluntary standards for bicycle helmets (Table 1). Helmets are tested for the amount of impact protection they provide by dropping the upper torso and helmeted head of a crash-test dummy (i.e., a "helmeted headform") onto a metal anvil and measuring the amount of force on the headform (*22*). Testing for strap-system strength is done by dropping a weight on the fastened strap; the weight causes weaker strap systems (i.e., straps or buckles) to break. Helmets that meet Snell standards provide better protection against bicycle-related head injury than do helmets that meet the less rigorous ANSI standards (*18*). The Consumer Product Safety Commission is developing federal standards for bicycle helmets. These standards will apply to all helmets sold in the United States and will most likely be similar to the existing standards.

All three existing standards require that manufacturers include warning labels that advise consumers that helmets are for bicycle use only (e.g., "not for motor-vehicle use" [*23*]) (*24, 25*). In addition, manufacturers are required to warn consumers (e.g., by including a warning label in the helmet) that a) a helmet that has sustained an impact should be returned to the manufacturer for inspection or be destroyed and replaced, and b) helmets need to be fitted and securely fastened to the bicyclist's head to provide maximum protection.

Performance in Crash Conditions

The use and performance of bicycle helmets also must be assessed under actual crash conditions (*26,27*). For example, an assessment of helmets worn by bicyclists who had sustained an impact in a bicycle crash indicated that most impacts occurred below the area of the helmet that is usually tested for impact protection (i.e., the test line) (*26*). In addition, many of the helmets had been damaged before the crash, particularly those helmets worn by bicycle riders <15 years of age. However, none of the riders who were wearing their helmets correctly at the time of the crash sustained serious head injuries, despite the severity of many of the impacts (*26*).

Current testing standards do not take into account that children <6 years of age cannot tolerate the same head impact as older children and adults (*27*). Furthermore, helmets generally are not designed to fit the heads of children <6 years of age; thus, a separate helmet standard may be needed to ensure that helmets provide adequate protection for children in this age group (*27*).

Barriers to Helmet Use

Although bicycle helmets provide effective protection against bicycle-related head injury, only approximately 18% of bicyclists wear helmets all or most of the time (*7*). Rates of bicycle helmet use are lowest among those groups for whom rates for bicycle-related head injury are highest (i.e., school-age children). Approximately 15%

TABLE 1. Testing standards and postmarketing surveillance for bicycle helmets

Types of testing and surveillance	Snell Memorial Foundation B-90* (*25*)	American Society for Testing and Materials (ASTM) F1446, F1447 (*28*)	American National Standards Institute (ANSI) Z90.4 (*24*)
Impact testing†			
Flat anvil§	2.0-m drop	2.0-m drop	1.0-m drop
Hemispherical anvil¶	1.3-m drop	1.2-m drop	1.0-m drop
Curbstone anvil**		1.2-m drop	
Strap-system-strength testing††	38 kg dropped from 2 cm	4 kg dropped from 60 cm	2 kg dropped from 100 cm
Postmarketing surveillance§§	Yes	No¶¶	No

* Snell performs testing and certification in its own labs. Snell also conducts supplemental testing for positional stability, which is described in the Snell B-90 supplement (*29*). Helmets that pass the tests receive a special decal. In addition, Snell has a standard for multi-use helmets (Snell N-94) (*30*); helmets that meet this standard also may be used for bicycling.
† Helmets are tested for impact protection by dropping a "helmeted headform" onto a metal anvil. The amount of force on the headform is then measured.
§ Simulates the impact from falling onto flat pavement.
¶ Simulates the impact from falling onto a stone or corner.
** Simulates the impact from falling onto a curb or pipe.
†† Strap-system (i.e., straps and buckles) strength is tested by dropping a weight onto the fastened strap.
§§ Includes ongoing testing of helmets in the marketplace to assure compliance with helmet standards.
¶¶ Although ASTM does not conduct helmet testing, bicycle helmet manufacturers can contract with the Safety Equipment Institute (SEI) to have helmets tested based on this standard. SEI also conducts postmarketing surveillance of helmets (*31*).

of riders <15 years of age wear helmets (*7*), a prevalence substantially lower than the year 2000 objective—a helmet-use rate of at least 50% (*32*).

Barriers to helmet use include cost, the wearability of bicycle helmets, and a lack of knowledge regarding helmet effectiveness (*33*). In addition, some school-age children (i.e., children <15 years of age) believe that wearing a helmet will result in derision by their peers (*34*). Among older children and adults, rates for helmet use are influenced by some of the same demographic factors as rates for seat belt use (e.g., age, education, income, and marital status) (*14,33*), and some of the reasons given for not wearing helmets are similar to those given for not wearing seat belts (e.g., rider was on a short trip, helmets are uncomfortable, and negligence) (*14*). Approaches to overcoming some of these barriers to helmet use include community-based programs (*33*) and bicycle helmet legislation, which may be particularly effective among school-age children (*34–37*).

INCREASING THE USE OF BICYCLE HELMETS

The goal of bicycle helmet programs is to increase the use of bicycle helmets, thereby reducing the number of head injuries and deaths caused by bicycle crashes. State and local health departments are in a unique position to undertake bicycle helmet campaigns because of their a) knowledge of the specific problems affecting their states and communities; b) ability to provide technical expertise and credibility in health matters that affect their states and communities; c) ability to work with community groups that are involved with health issues; and d) ability to place bicycle helmet programs within the framework of other injury and health activities.

State- or Local-Level Programs

State and local health departments may be responsible for the following tasks when conducting community campaigns:

- Collecting and analyzing data relevant to a bicycle helmet campaign or providing assistance to the local program in this task. These data include deaths and injuries attributable to bicycle-related head injury, age-group-specific rates for helmet use, and barriers to helmet use. In addition, state and local health departments can collect and provide information on programs or organizations responsible for similar or complementary activities.
- Overseeing the development of a coalition of individuals, agencies, and organizations that is interested in bicycle helmet programs; has the resources to support a bicycle helmet campaign; or has the influence necessary to establish credibility and support for the campaign in the community.
- Identifying resource needs and sources, including funding and training.
- Providing assistance to local programs in planning intervention activities and in developing educational and promotional materials.
- Developing a statewide process for program evaluation and collecting and analyzing data on the program to evaluate process, impact (i.e., the change in helmet-use rates), and outcome. This process should begin before the program is implemented.

- Conducting statewide educational campaigns to create an awareness of the need for and value of bicycle helmets.
- Developing legislation in conjunction with coalitions and local leaders that requires the use of bicycle helmets (Appendix A).

Community Programs

Educational and promotional campaigns for bicycle helmet use are usually most effective when conducted at the local (i.e., community) level. At this level, strategies that encourage persons to wear bicycle helmets can be adjusted to the needs of a specific community. Several organizations publish materials (e.g., program guides, videotapes, and training materials) that communities can use for developing a bicycle helmet program (Appendix B). Components of a community program include building a coalition and planning, implementing, and evaluating the program (Appendix C).

Legislation for Bicycle Helmet Use

Legislation that mandates the use of bicycle helmets effectively increases helmet use, particularly when combined with an educational campaign. Education often facilitates behavioral change; however, education alone is rarely effective. Laws mandating helmet use supplement and reinforce the message of an educational campaign, requiring people to act on their knowledge.

Several states and localities have enacted laws requiring bicycle helmet use (e.g., California; Connecticut; Georgia; Massachusetts; New Jersey; New York; Oregon; Pennsylvania; Tennessee; several counties in Maryland [Howard, Montgomery, and Allegheny]; and the city of Beechwood, Ohio). Other groups that require helmet use include the United States Cycling Federation—the governing body of amateur bicycle racing and Olympic training—and the Greater Arizona Bicyclist Association.

Once enacted, bicycle helmet laws should be enforced. However, enforcement of helmet laws should be carried out through education rather than punishment. For example, local police officers could tell persons who violate the bicycle helmet law about the benefits of helmet use and provide them with discount coupons for the purchase of a helmet. Fines for the first citation could be waived if the person shows that he or she has acquired a helmet.

Bicycle helmet laws contain stipulations concerning enforcement. For example, in the California and New York legislation, the first violation is dismissed if the person charged proves that a helmet meeting the standards has been purchased. Otherwise, the violation is punishable by a fine of not more than $20 and $50, respectively. Other areas have a fine for the first offense of $25–$50 and a fine of up to $100 for any subsequent offenses. The fines for noncompliance vary among jurisdictions.

Regardless of the specific penalties that are used to enforce the law, enforcement must be accompanied by the active involvement of the law enforcement community (e.g., participation in community education). This involvement should begin when the state or community is developing and advocating for a bicycle helmet law.

Evaluation of Legislation and Community Programs

Both community bicycle helmet programs and the legislation mandating helmet use have been evaluated (Table 2). Although these studies indicate that bicycle

helmet campaigns increase the use of helmets, the relative merits of any individual component of the campaigns are more difficult to assess. The studies do suggest, however, that community campaigns must include several strategies; single interventions do not have the same impact as multiple interventions. Furthermore, some studies indicated that helmet ownership and use were greater among children from high-income than low-income families (*38,39*). Potential barriers to increased helmet use among children from low-income families may include both the cost of helmets and language barriers (*39*). These studies highlight the importance of considering other issues that may influence the purchase and use of helmets (e.g., perceived risk of bicycle-related head injury) when planning a community-based bicycle helmet program.

RECOMMENDATIONS

The following recommendations are based on current data regarding the occurrence of head injury among bicyclists and the ability of helmets to prevent or reduce these injuries. These recommendations are for state and local agencies and other organizations that are planning programs to increase the use of bicycle helmets.

Recommendation 1: Bicycle helmets should be worn by all persons (i.e., bicycle operators and passengers) at any age when bicycling.

Although operators and passengers of all ages are at risk for bicycle-related head injuries, communities that must focus on a particular risk group should consider children <15 years of age as the primary target group for the following reasons:

- The majority of children ride bicycles.
- Rates for all bicycle-related head injuries are high among children.
- In most communities, helmet-use rates among children are lower than those among adults.
- Persons who begin using helmets as children are more likely to continue to use them as adults.

However, even in communities in which efforts or programs focus on children, adults also should be included in the bicycle helmet program because of their educational influence on children. As programs gain resources, they should expand to include older age groups because adults are also at risk for head injury.

Recommendation 2: Bicycle riders should wear helmets whenever and wherever they ride a bicycle.

Bicyclists are always at risk for falling and thus for head injury, regardless of where they are riding (e.g., a driveway, park, or sidewalk). Laws that encourage helmet use only in certain settings (e.g., riding to and from school) only partially address the problem and do not reinforce the need to wear helmets at all times.

TABLE 2. Evaluation of legislation and community programs to increase the use of bicycle helmets — selected locations

Location	Years evaluated	Program type	Helmet-use rates for children*		Comments
			Pre-program	Post-program	
Victoria, Australia (*35*)	March 1983–March 1990	Community campaign	6%†	36%†	Included education, mass media publicity, support by professional associations and community groups, involvement of bicycling groups, and $10 government rebate for helmet purchases.
	March 1990–March 1991	Helmet legislation introduced	36%†	73%†	Hospitalizations for bicycle-related head injuries also decreased by 37%.
Howard County, Maryland (*36*)	1990–1991	Helmet legislation and community campaign	4%	47%	Activity prompted by bicycling deaths of two children. Use determined by observation.
			11%	37%	Use determined by school-based survey.
Montgomery County, Maryland (*36,37*)	1990–1991	Community campaign	8%	19%	Use determined by observation.
			8%	13%	Use determined by school-based survey.
Baltimore County, Maryland (*36,37*)	1990–1991	No specific helmet promotion activities	19%	4%	Served as control county. Use determined by observation.
			7%	11%	Use determined by school-based survey.

TABLE 2. Evaluation of legislation and community programs to increase the use of bicycle helmets — selected locations — Continued

Location	Years evaluated	Program type	Helmet-use rates for children*		Comments
			Pre-program	Post-program	
Seattle, Washington (*33,40,41*)	1987–1988	Community campaign	5%	14%	Included education of parents by physicians; advertising in newspapers, on television, and on radio; school presentations; and discount coupons for helmets.
	1988–1990	Community campaign	14%	33%	Follow-up evaluation of bicycle helmet campaign.
	1990–1993	Community campaign	33%	60%	Follow-up evaluation of bicycle helmet campaign. Bicycle-related head injuries decreased approximately 67% among children 5–14 years of age who were members of a health maintenance organization.
Portland, Oregon (*33*)	1987–1988	No specific helmet promotion activities	1%	4%	Control community.
Barrie, Ontario (*42*)	1988–1989	Educational program	0%	0%	Use determined by a limited number of observations.
	1988–1989	Educational program and helmet subsidy	0%	22%	Use determined by a limited number of observations.

*See references for the specific ages of the children included in the studies.
†Helmet-use rates for bicyclists of all ages.

Recommendation 3: Bicycle helmets should meet the standards of ANSI, the Snell Memorial Foundation, or ASTM.

Three organizations currently have voluntary standards for bicycle helmets; however, optimal helmet design (e.g., hard vs. soft shell helmets, differences in the needs of children <6 years of age, and how well different types of helmets protect in actual crash conditions) has not been established. Additional research is needed on the biomechanics of bicycle helmets before more definitive recommendations for biomechanical standards can be made. However, despite differences in helmet design, wearing an approved helmet is better than wearing no helmet at all. Furthermore, all standards emphasize that a helmet that has sustained an impact should be returned to the manufacturer for inspection or be destroyed and replaced.

Recommendation 4: To effectively increase helmet-use rates, states and communities must implement programs that include legislation, education and promotion, enforcement, and program evaluation.

Communities and states have used several strategies to increase helmet use, including laws that require helmet use among different age groups; community awareness campaigns; educational programs in schools and children's groups; and incentive campaigns that encourage use of helmets through giveaway programs, coupons, and rebates. Helmet-use laws should be implemented statewide; however, beginning this process with a demonstration program in one or several communities may be practical before expanding the program statewide. Laws are most effective when combined with educational programs.

References

1. Thompson RS, Rivara FP, Thompson DC. A case-control study of the effectiveness of bicycle safety helmets. N Engl J Med 1989;320:1361–7.
2. Kraus JF, Fife D, Conroy C. Incidence, severity, and outcomes of brain injuries involving bicycles. Am J Public Health 1987;77:76–8.
3. Waller JA. Bicycle ownership, use and injury patterns among elementary school children. Pediatrics 1971;47:1042–50.
4. Sacks JJ, Holmgreen P, Smith SM, Sosin DM. Bicycle-associated head injuries and deaths in the United States from 1984 through 1988: how many are preventable? JAMA 1991; 266:3016–8.
5. Friede AM, Azzara CV, Gallagher SS, Guyer B. The epidemiology of injuries to bicycle riders. Pediatr Clin North Am 1985;32:141–51.
6. Selbst SM, Alexander D, Ruddy R. Bicycle-related injuries. Am J Dis Child 1987;141:140–4.
7. Rodgers GB. Bicycle and bicycle helmet use patterns in the United States: a description and analysis of national survey data. Washington, DC: US Consumer Product Safety Commission, 1993.
8. Guichon MP, Myles ST. Bicycle injuries: one-year sample in Calgary. J Trauma 1975;15:504–6.
9. Kraus JF. Epidemiologic features of injuries to the central nervous system. In: Anderson DW. Neuroepidemiology: a tribute to Bruce Schoenberg. Boca Raton, FL: CRC Press, 1991:333–53.
10. Lundar T, Nestvold K. Pediatric head injuries caused by traffic accidents: a prospective study with 5-year follow-up. Child's Nervous System 1985;1:24–8.
11. Belongia E, Weiss H, Bowman M, Rattanassiri P. Severity and types of head trauma among adult bicycle riders. Wis Med J 1988;87:11–4.
12. Weiss BD. Bicycle helmet use by children. Pediatrics 1986;77:677–9.
13. Dorsch MM, Woodward AJ, Somers RL. Do bicycle safety helmets reduce severity of head injury in real crashes? Accid Annal Prev 1987;19:183–90.
14. Wasserman RC, Waller JA, Monty MJ, et al. Bicyclists, helmets and head injuries: a rider-based study of helmet use and effectiveness. Am J Public Health 1988;78:1220–1.

15. Wasserman RC, Buccini RV. Helmet protection from head injuries among recreational bicyclists. Am J Sports Med 1990;18:96–7.
16. CDC. Bicycle-related injuries: data from the National Electronic Injury Surveillance System. MMWR 1987;36:269–71.
17. Weiss BD. Childhood bicycle injuries: what can we do? Am J Dis Child 1987;141:135–6.
18. Hodgson VR. Impact, skid and retention tests on a representative group of bicycle helmets to determine their head-neck protective characteristics. Detroit, MI: Wayne State University, Department of Neurosurgery, 1990.
19. Hodgson VR. Skid tests on a select group of bicycle helmets to determine their head-neck protective characteristics. Detroit, MI: Wayne State University, Department of Neurosurgery, 1991.
20. Bike helmets: unused lifesavers. Consumer Reports 1990;55:348–53.
21. Bishop PJ, Briard BD. Impact performance of bicycle helmets. Can J Sport Sci 1984;9:94–101.
22. Kukula K. Head protection is becoming easier to live with. Bicycling 1986(May);28–35.
23. American Society for Testing and Materials Committee on Standards. Standard specification for protective headgear used in bicycling (F1447-93). Philadelphia, PA: American Society for Testing and Materials, 1993.
24. American National Standards Institute. American national standard for protective headgear—for bicyclists (ANSI Z90.4-1984). New York: American National Standards Institute, Inc., 1984.
25. Snell Memorial Foundation. 1990 Standard for protective headgear for use in bicycling. St. James, NY: Snell Memorial Foundation, Inc., 1990.
26. Williams M. The protective performance of bicyclists' helmets in accidents. Accid Anal Prev 1991;23:119–31.
27. Cass DT, Gray AJ. Paediatric bicycle injuries. Aust N Z J Surg 1989; 59:719–24.
28. American Society for Testing and Materials Committee on Standards. Standard test methods for equipment and procedures used in evaluating the performance characteristics of protective headgear (F1446-93). Philadelphia, PA: American Society for Testing and Materials, 1993.
29. Snell Memorial Foundation. 1994 Supplementary standard for protective headgear for use with bicycles. St. James, NY: Snell Memorial Foundation, Inc., 1994.
30. Snell Memorial Foundation. 1994 Standard for protective headgear for use in non-motorized sports (Snell N-94). St. James, NY: Snell Memorial Foundation, Inc., 1994.
31. Graitcer PL. Standards and certification. Headlines: the Newsletter of the WHO Helmet Initiative 1993;2(3):1–2.
32. Public Health Service. Healthy people 2000: national health promotion and disease prevention objectives. Washington, DC: US Department of Health and Human Services 1990;DHHS publication no. (PHS)91-50213.
33. DiGuiseppi CG, Rivara FP, Koepsell TD, Polissar L. Bicycle helmet use by children: evaluation of community-wide helmet campaign. JAMA 1989;262:2256–61.
34. Howland J, Sargent J, Weitzman M, et al. Barriers to bicycle helmet use among children. Am J Dis Child 1989;143:741–4.
35. Vulcan AP, Cameron MH, Heiman L. Evaluation of mandatory bicycle helmet use in Victoria, Australia. 36th Annual Proceedings. Portland, OR: Association for the Advancement of Automotive Medicine, 1992.
36. Cote T, Sacks JJ, Lambert-Huber DA, et al. Bicycle helmet use among Maryland children: effect of legislation and education. Pediatrics 1992;89:1216–20.
37. Dannenberg AL, Gielen AC, Beilenson PL, Wilson MH, Joffe A. Bicycle helmet laws and educational campaigns: an evaluation of strategies to increase children's helmet use. Am J Public Health 1993;83:667–74.
38. Towner P, Marvel MK. A school-based intervention to increase the use of bicycle helmets. Fam Med 1992;24:156–8.
39. Parkin PC, Spence LJ, Hu X, et al. Evaluation of promotional strategy to increase bicycle helmet use by children. Pediatrics 1993;91:772–7.
40. Rodgers LW, Bergman AB, Rivara FP. Promoting bicycle helmets to children: a campaign that worked. J Musculoskeletal Med 1991;8:64–77.
41. Rivara FP, Thompson DC, Thompson RS, et al. The Seattle children's bicycle helmet campaign: changes in helmet use and head injury admissions. Pediatrics 1994;93:567–9.

42. Morris BAP, Trimble NE. Promotion of bicycle helmet use among schoolchildren: a randomized clinical trial. Can J Public Health 1991;82:92–4.

APPENDIX A: Bicycle Helmet Legislation

Legislation requiring bicycle helmet use can vary according to the needs of the state or county passing the law. Persons who draft laws requiring the use of bicycle helmets should consider the following components:

1) **Ages covered**—Bicycle helmets should be worn by persons of all ages, including both bicycle operators and passengers, when they are on bicycles. Therefore, the most protective option is to include operators and passengers of all ages in the law. However, some states have been reluctant to pass laws that cover all ages because of difficulty with enforcement of the law. The alternative option is to include only children <15 years of age. (See Recommendation 1.)
2) **Helmet standards**—Helmets worn by bicyclists should meet or exceed the current standards of either the American National Standards Institute, the Snell Memorial Foundation, or the American Society for Testing and Materials. (See Helmet Standards.)
3) **Locations where riders must wear helmets**—The law should require helmet use in all places where bicyclists ride. A law that does not require helmet use in public parks, on trails, on boardwalks, or in other areas set aside for bicycle or pedestrian use does not provide adequate protection for the rider. (See Recommendation 2.)
4) **Enforcement Provisions**—Bicycle helmet laws can be enforced in several ways. In Howard County, Maryland, the law requires that children <16 years of age wear helmets and that a warning letter be given to a child's parent or guardian after the first and second offenses. On the third offense, a citation with a $50 fine is given. In New Jersey, the state law includes a $25 penalty for each incident in which a child <14 years of age fails to wear a bicycle helmet. Each subsequent fine is $100. In addition, all fines in New Jersey are deposited in a Bicycle Safety Fund to be used for bicycle safety education. Other methods of enforcement include confiscation of the bicycle. For example, in Beechwood, Ohio, the police can temporarily take possession of the child's bicycle until the child's parent or guardian has been notified. Several of the current laws waive the penalty if proof of helmet ownership or purchase is provided. Communities may decide to issue discount coupons along with a warning or citation to encourage the purchase of bicycle helmets. Existing laws also address the liability of the manufacturers and retailers of bicycle helmets and renters of bicycles.

APPENDIX B: Organizations that Provide Information on Bicycle Helmet Campaigns

Several organizations have guidelines or instructional manuals for conducting bicycle helmet campaigns. These materials outline strategies and activities that state and local organizations can use to develop campaigns that are consistent with the needs and resources of the communities they serve. Listed below are the names and addresses of several of these organizations as well as a listing of some of the materials that are available to the public:

- National SAFE KIDS Campaign
  111 Michigan Ave NW
  Washington, DC 20010
  (202) 884-4993

  Materials include *SAFE KIDS Cycle Smart*, a guide for community bicycle safety programs and resource materials list; a kit for medical professionals regarding bicycle helmets and injury prevention; a teacher's guide on bicycle helmets; a brochure for parents; a bicycle helmet poster; a traffic safety magazine for children; public service announcements for television; and a chart of legislation mandating bicycle helmet use.

- American Trauma Society
  8903 Presidential Parkway
  Suite 512
  Upper Marlboro, MD 20772-2656
  (800) 556-7890

  Materials include a campaign kit and a resource catalog.

- National PTA
  330 North Wabash Avenue
  Suite 2100
  Chicago, IL 60611-3690
  (312) 670-6782

  Materials include a guide, *Bike Injury/Bike Rodeos*, which lists bicycle safety resources and provides guidelines to help local PTAs organize bicycle rodeos and promote bicycle safety.

- American Academy of Pediatrics
  Publications Department
  141 Northwest Point Boulevard
  Box 927
  Elk Grove Village, IL 60009-0927
  (800) 433-9016

  Materials include *Physician's Resource Guide for Bicycle Safety Education*; " Bicycle Safety Camp," which is a videotape for elementary school students

concerning the importance of wearing helmets and other safety issues while riding bicycles; and bicycle safety sheets from The Injury Prevention Program. The safety sheets cover such topics as encouraging children to wear helmets, myths and facts about bicycle safety, choosing the right size bicycle for a child, and child passengers on adults' bicycles.

- Harborview Injury Prevention and Research Center
  University of Washington
  325 Ninth Avenue, ZX-10
  Seattle, WA 98104
  (206) 521-1537

  Materials include *Developing a Children's Bicycle Helmet Safety Program: A Guide for Local Communities.*

- The Johns Hopkins Injury Prevention Center
  The Johns Hopkins School of Hygiene and Public Health
  624 N. Broadway, 5th and 6th Floors
  Baltimore, MD 21205-1996
  (410) 955-7625

  Materials include *Injuries to Bicyclists: A National Perspective*. This monograph is available from the National Center for Injury Prevention and Control, CDC, mailstop F-36, 4770 Buford Highway, Atlanta, GA 30341-3724. A videotape produced by the Center, "ADVOKIDS: Kids Advocating Change," is available through AAA Foundation for Traffic Safety; telephone: (202) 638-5944.

APPENDIX C: Components of a Community-Based Bicycle Helmet Campaign

Bicycle helmet campaigns should include a number of specific components, regardless of the actual activities (e.g., bicycle rodeos, coupon programs, and helmet giveaways) that are included in the campaign.

A Coalition

A coalition of appropriate individuals, agencies, and organizations that represent all facets of the community should participate in all phases of the campaign, beginning with the development of a plan and the selection of target groups, through implementing the interventions and evaluating the effort. The following organizations should be considered for inclusion in campaigns: health departments; schools; parent-teacher-student organizations; police departments; churches; neighborhood and tenant associations; health care providers, including physicians, nurses, and emergency response personnel; community organizations (e.g., Kiwanis and Junior League); youth clubs (e.g., Girl Scouts of America, Boy Scouts of America, and 4-H); businesses, such as bicycle shop owners; and local government leaders and political organizations.

A Plan

A campaign to promote bicycle helmets should begin with a well organized plan that includes the following components:

1) Goals and objectives that reflect what the community wants to achieve, what it determines is feasible, and the activities that are needed to achieve them. The goals and objectives should also reflect current rates of bicycle helmet use in the community.
2) A description of the primary target group for the campaign (e.g., children <15 years of age). Information on bicycle helmet use and rates of bicycle-related injury in the community should be used to select this target group.
3) A description of the intervention program(s) that will be used. The program should address barriers to helmet use in the target group (e.g., the cost of helmets) and include strategies for overcoming these barriers (e.g., discount coupons). In addition, the messages of the campaign should be designed so they are easily understood and accepted by the target group. Finally, programs should be offered in locations where the target group can be reached.
   The following are educational and promotional strategies that have been used in some communities:
   - **Media campaigns** often begin with a kick-off press conference and continue throughout the campaign to increase awareness and help create a community norm of wearing bicycle helmets. These campaigns can include public service announcements; newspaper articles; radio and television news programs and talk shows; and distribution of brochures, posters, fact sheets, and other printed materials.
   - **Educational campaigns** may be offered through schools and youth organizations, churches, and civic and business organizations in the community. Speakers' bureaus are an effective way to conduct many of these activities.

- **Events such as bicycle safety and skill rodeos** combine fun and learning for both children and adults. These events demonstrate and promote helmet use along with other aspects of bicycle safety, provide good opportunities to distribute educational materials, and allow participants to interact with persons who have avoided injury by using bicycle helmets.
- **Promotional activities, such as discount coupons for bicycle helmets and giveaway programs**, provide incentives for acquiring bicycle helmets, particularly for persons who have difficulty affording one. Coupons can be obtained from helmet manufacturers or local bicycle shops. The program could also provide other incentives to obtain a helmet.

4) An evaluation component to determine if the program is reaching its goals. This evaluation should assess bicycle helmet use before and after the intervention(s) is conducted and at specific intervals thereafter.
5) A strategy for making bicycle helmet use a societal norm so that the public will maintain or increase levels of helmet use.

The *Morbidity and Mortality Weekly Report (MMWR)* Series is prepared by the Centers for Disease Control and Prevention (CDC) and is available on a paid subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; telephone (202) 783-3238.

The data in the weekly *MMWR* are provisional, based on weekly reports to CDC by state health departments. The reporting week concludes at close of business on Friday; compiled data on a national basis are officially released to the public on the succeeding Friday. Inquiries about the *MMWR* Series, including material to be considered for publication, should be directed to: Editor, *MMWR* Series, Mailstop C-08, Centers for Disease Control and Prevention, Atlanta, GA 30333; telephone (404) 332-4555.

☆U.S. Government Printing Office: 1995-633-175/05052 Region IV