

Reported Bicycle Helmet Use Among Adults in the United States

Julie Russell Bolen, PhD, MPH; Marcie-jo Kresnow, MS; Jeffrey J. Sacks, MD, MPH

This study estimates bicycle helmet use among adults in the United States, examines factors associated with helmet use among adult bicyclists in 1994, and examines other safety-related practices. A telephone survey of 5238 randomly dialed households in the United States was conducted. The participants were randomly selected adult (aged ≥ 18 years) respondents, and the main outcome measure was bicycle riding and helmet use in the last 30 days. We estimate that 20.2% of adults reported riding a bicycle in the 30 days preceding their interview. Of the bicyclists, 18.3% report they always wear their helmet when bicycling. Persons between the ages of 18 and 24 years had the highest proportion of bicycle riders for any adult age group (31.3%) but reported using helmets less than any other adult age group (5.1%). In univariate and multivariate analyses, age older than 24 years, female sex, higher educational level, and living in the west or northeast region of the country were associated with helmet use among adults. Helmet users were also more likely than nonusers to report a higher prevalence of other safety behaviors (ie, always wearing a safety belt, having a smoke detector in the house, and having a fire escape plan). Further efforts to increase the wearing of bicycle helmets by adults are necessary to meet the year 2000 objective of 50% helmet use. Adults should be targeted for increased helmet promotion efforts, especially those between the ages of 18 and 24 years. Increasing consistent use of helmets among adults may also help increase consistent use of helmets among children through role modeling.

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Editor's Note: It is increasingly common to ask children about bicycle helmet use routinely during physical examinations. However, I suspect many of us forget to include this for our adult patients—is it on your standard history or review-of-systems forms?

Marjorie A. Bowman, MD, MPA

In the United States, bicycling is a recreational activity as well as a mode of transportation. There are an estimated 31 million adult bicyclists in the United States who ride at least once a week.¹ Rodgers²

estimates that in 1991 there were active bicyclists in approximately 29% of all US households (HHs) (27.1 million HHs).

Bicycling can be dangerous³⁻⁶; death rates per 100 million trips for bicyclists in 1990 in the United States were estimated to be 4.2 times those of motorists.⁷ In the United States each year, approximately 460 adult bicyclists are killed and 128 000 adults are treated in emergency departments for injuries related to bicycling.⁴ Head injuries account for 62% of bicycle-related deaths,⁴ 33% of bicycle-related emergency department visits, and 67% of bicycle-related hospital admissions.^{5,6} Fortunately, bicycle helmets reduce the risk of bicycle-related head injuries by 74% to 85%⁸; unfortunately, bicycle helmets are still not widely used in this country. Rodgers² estimated that in 1991 between

From the Division of Unintentional Injury Prevention (Drs Bolen and Sacks) and the Office of Statistics and Programming (Ms Kresnow), National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Ga. Dr Bolen is now with the National Center for Chronic Disease Prevention, Centers for Disease Control and Prevention. A complete list of all participants in the Injury Control and Risk Survey Project is given on page 76.

18.5% and 24.6% of adult bicyclists in the United States always or almost always wore a helmet when riding.

There is no ongoing national surveillance system for monitoring bicycle helmet use by adults in the United States. In 1994, the Centers for Disease Control and Prevention, Atlanta, Ga, conducted the Injury Control and Risk Survey. The Injury Control and Risk Survey is a national survey designed to assess various injury risk factors and injuries. This report summarizes findings about adult bicycle riding and adult bicycle helmet use in 1994. In addition, unlike other studies that simply consider demographic predictors of bicycle helmet use,² we study helmet use in relation to other safety-related behaviors such as not wearing a safety belt.

PARTICIPANTS AND METHODS

The Injury Control and Risk Survey was a random digit-dialed telephone survey conducted from April 28, 1994, to September 18, 1994, that resulted in a single-stage, equal probability of selection sample of residential telephone numbers within all 50 states and the District of Columbia. Because there are racial differences in injury rates,^{9,10} all telephone exchanges with 2 or more working numbers contained in a proprietary database were stratified by whether they had 10% or more of HHs occupied by minorities. To improve the precision of minority group-specific estimates, such exchanges were sampled at a higher rate than the remaining exchanges. A minimum of 6 attempts was made to reach each HH.

Because injury rates also differ by sex,¹⁰ we sought an equal sex balance of respondents to improve the precision of sex-specific estimates. Once an HH was reached, we determined the number of adult (aged ≥ 18 years) men and women in each HH. We then randomly selected one sex from those applicable in the HH; if more than one eligible individual was in the sex category, we asked for the individual with the most recent birthday. After giving consent for the interview, an English- or Spanish-speaking adult respondent reported on his or her behavior and HH factors.

Because of the sampling strategy (ie, oversampling minorities and equalizing the respondent sex balance), the data required weighting to be representative of the US population. The final weight is the product of a selection probability weight and a poststratification weight. Selection probability weights are the inverse of the probability of selecting a particular HH and respondent. Poststratification weights scale up the weights of individual records to fully represent similar age, sex, and racial group individuals in the same census region and metropolitan statistical area (MSA).

Adult respondents were asked "During the past 30 days, that is, since (computer fills in date), have you participated in outdoor bicycle riding?" Adults were classified as bicycle riders if they answered yes. Respondents who reported riding in the past 30 days were then asked "During the past 30 days, when you were bicycling, how often did you wear a helmet?"

Riders were classified into 2 categories of helmet use: (1) consistent users (reported always wearing a helmet when riding a bicycle) and (2) inconsistent users (reported wearing a helmet more than half the time, about half the time, less than half the time, or never). The same approach was taken in classifying other behaviors, such as safety belt use.

Because we found little difference in bicycle riding and helmet wearing among 3 categories of MSAs (the 21 largest MSAs, MSAs with $>85\,000$ HHs, and MSAs with $>20\,000$ but $<85\,000$ HHs), these 3 MSAs were collapsed into one population density stratum of more than 20 000 HHs (urban). The second stratum included all remaining counties with less than 20 000 HHs (rural).

We used special survey data analysis software¹¹ that accounts for the complex survey design to generate weighted estimates and 95% confidence intervals. The log-likelihood χ^2 test was used to assess independence, and the adjusted Wald F test was used to assess linear trends.

To examine how influential variables behaved when adjusted for other variables, we used logistic regression modeling to adjust each selected variable for all other variables in the model. The adjusted Wald F test was used to assess the importance of each variable in the model. We did not include an income variable in the model because of its strong correlation with education and because income values were missing for more than 10% of the sample. In addition, we excluded population density from the model because of the few observations for rural areas.

RESULTS

Interviews were completed for 5238 HHs (response rate=5238 completed interviews/[5238 completed interviews+3630 refusals+474 incomplete interviews]=56%).

Of 5236 adult respondents with information on bicycle riding status, 1035 (20.2%) reported riding a bicycle in the past month (**Table 1**) for a weighted estimate of 38.4 million adult bicycle riders. Of these riders, approximately 40% are women and 60% are men, representing 16% of the female population and 25% of the male population, respectively.

Bicycle riding decreased with increasing age. The level of bicycling among Hispanics was similar to the rest of the population (19% vs 20%). Of the adult white population, 21% reported riding a bicycle at least once in the past 30 days; blacks, 12%; and other races, 20%. Differences by race and ethnicity were not statistically significant. Higher educational level and higher income seemed to be associated with bicycling (**Table 1**).

People who reside in the western United States are more likely to be bicyclists than those who reside in other parts of the country.

Self-reported consistent helmet use varied by demographic characteristics (**Table 2**). Women were more likely than men to be consistent helmet wearers ($P<.05$).

Bicyclists aged 55 years and older and bicyclists between the ages of 18 and 24 years were the least likely to wear a helmet. The level of helmet wearing among the

Table 1. Adult Bicycle Riding, by Demographic Characteristics, in the United States, 1994*

Characteristics	No. in Sample	No. of Riders	Weighted No. of Riders	Weighted Percentage (95% Confidence Interval)
Total	5236	1035	38 337 725	20.2 (18.8 to 21.5)
Sex				
F	2555	380	15 513 976	15.7 (14.0 to 17.5)
M	2681	655	22 823 749	25.0 (23.0 to 27.1)
Age group, y				
18-24	599	168	7 792 168	31.3 (26.4 to 36.1)
25-34	1308	367	12 414 580	29.0 (26.0 to 31.9)
35-44	1188	270	9 191 557	23.2 (20.3 to 26.1)
45-54	784	135	4 700 020	15.5 (12.5 to 18.6)
≥55	1289	89	4 060 729	8.1 (6.2 to 10.1)
Educational level				
Postcollege	683	170	5 469 861	25.8 (21.6 to 29.9)
College graduate	772	239	8 737 449	31.9 (27.8 to 36.0)
Some college	1566	339	12 550 438	22.2 (19.7 to 24.8)
≤High school	2182	279	11 287 863	13.5 (11.7 to 15.3)
Income level, \$				
<20 000	1316	169	5 404 869	13.1 (10.9 to 15.4)
20 000-<35 000	1122	212	7 225 581	17.7 (15.0 to 20.3)
35 000-<50 000	864	195	7 773 794	23.8 (20.3 to 27.4)
≥50 000	1278	357	13 572 272	27.5 (24.5 to 30.4)
Census region				
Northeast	839	173	7 602 528	20.1 (16.9 to 23.3)
North central	1068	230	9 966 880	21.7 (18.7 to 24.6)
West	1149	296	10 542 342	27.1 (23.9 to 30.4)
South	2180	336	10 225 975	15.2 (13.3 to 17.1)
Population density†				
Urban	4497	927	32 493 108	20.9 (19.4 to 22.4)
Rural	739	108	5 844 617	17.0 (13.7 to 20.2)

*Not all respondents answered each question.

†Urban indicates metropolitan statistical areas with more than 20 000 households; rural, all areas with less than 20 000 households.

18- to 24-year-old group was significantly different from that of all other age groups ($P \leq .001$).

Reported helmet wearing behavior varied little by ethnicity or race but increased with increasing educational level ($P \leq .001$, test for linear trend). Likewise, there were significant differences in consistent helmet use between people with incomes higher than \$50 000 per year and people with lower incomes ($P < .001$, test for linear trend) (Table 2).

Persons residing in northeast and western areas were more likely to be consistent helmet users than those in north central and southern areas ($P < .05$). Urban dwellers were significantly more likely than rural dwellers to wear helmets ($P < .05$); however, the estimates are considered unstable because of the few observations for bicyclists who are rural dwellers.

The characteristics associated with helmet use in univariate analysis remained predictive after adjustment for other variables (Table 3). After adjusting, consistent helmet users were more likely to be women, older than 24 years, have more than a high school education, and live in the northeast or western United States.

Consistent helmet users were more likely to report consistent safety belt use than bicyclists who inconsistently wore a helmet, were less likely to have been a passenger with a drinking driver, were more likely to have a smoke detector in their homes, and were more likely to have a fire escape plan for their family (Table 4).

COMMENT

Bicycling is a common activity among adults, with approximately 20% reporting riding in the last 30 days. Our estimates, for numbers of adult bicyclists, are consistent with a 1991 estimate.² Increasing the level of bicycling among adults and children is consistent with the *Healthy People 2000* objective for the nation that calls for increased regular physical activity as well as the Secretary of Transportation's initiative to double the percentage of trips made by walking and bicycling from 8% to 16%.^{12,13} Although increasing bicycling as a means of transportation or as a form of recreation will contribute to good health, every effort needs to be made to prevent injuries, especially head injuries, resulting from bicycle crashes. While better training of bicyclists to avoid crashes in the first place holds a great deal of promise, a certain number of crashes will occur nevertheless; thus, helmet use will remain extremely important.

Our 1994 estimate that 18% of adult bicyclists wore helmets is far below the *Healthy People 2000* objective for the nation of 50% helmet use.¹² Most of the attention in this country has been focused on increasing helmet use among children through mandatory helmet legislation and helmet promotion programs.¹⁴ However, adult bicycle-related head injury is

Table 2. Adult Bicycle Helmet Use Among Bicycle Riders, by Demographic Characteristics, in the United States, 1994*

Characteristics	No. of Riders	No. of Consistent Helmet Users	Weighted No. of Helmeted Riders	Weighted Percentage (95% Confidence Interval)
Total†	1033	210	7 019 927	18.3 (15.6 to 21.1)
Sex‡				
F	380	83	3 365 133	21.7 (16.7 to 26.7)
M	653	127	3 654 794	16.0 (12.9 to 19.2)
Age group, y				
18-24	168	10	396 816	5.1 (1.5 to 8.7)
25-34	365	80	2 463 805	19.9 (15.1 to 24.7)
35-44	270	74	2 408 650	26.2 (20.0 to 32.4)
45-54	135	27	994 891	21.2 (12.3 to 30.0)
≥55	89	16	686 139	16.9 (7.7 to 26.1)
Educational level§				
Postcollege	170	61	1 698 026	31.0 (22.9 to 39.2)
College graduate	239	61	2 133 305	24.4 (17.9 to 31.0)
Some college	337	56	2 137 496	17.1 (12.1 to 22.1)
≤High school	279	28	959 294	8.5 (4.9 to 12.1)
Income level, \$\$				
<20 000	169	18	565 080	10.5 (4.8 to 16.2)
20 000-<35 000	211	31	830 330	11.5 (6.9 to 16.2)
35 000-<50 000	195	33	1 073 902	13.8 (8.1 to 19.5)
≥50 000	356	104	3 761 478	27.8 (22.3 to 33.3)
Census region§				
Northeast	173	43	1 831 039	24.1 (16.8 to 31.4)
North central	229	39	1 468 257	14.8 (9.6 to 20.0)
West	296	78	2 368 190	22.5 (16.9 to 28.0)
South	335	50	1 352 441	13.3 (8.8 to 17.7)
Population density§				
Urban	925	206	6 714 538	20.7 (17.6 to 23.8)
Rural	108	4	305 389	5.2 (-0.3 to 10.7)

*Not all respondents answered each question.

†Two riders were excluded from this analysis because of missing information on helmet use.

‡P<.06 (χ² test).

§Significant (P<.05, χ² test) association between consistent helmet use and characteristic.

||The coefficient of variation exceeds 30%, estimate may not be stable.

Table 3. Crude and Adjusted Odds Ratios for Characteristics Associated With Bicycle Helmet Use Among Adult Bicycle Riders in the United States, 1994

Characteristics	Crude Odds Ratios	Adjusted Odds Ratios (95% Confidence Interval)
Sex*		
F	1.4	1.8 (1.2 to 2.6)
M†	1.0	1.0
Age, y*		
18-24†	1.0	1.0
25-34	4.6	3.4 (1.4 to 8.2)
35-44	6.6	5.4 (2.3 to 12.7)
45-54	5.0	4.0 (1.5 to 10.7)
≥55	3.8	3.3 (1.2 to 9.1)
Educational level*		
Postcollege	4.8	4.1 (2.2 to 7.7)
College graduate	3.5	3.1 (1.7 to 5.8)
Some college	2.2	1.9 (1.0 to 3.5)
≥High school†	1.0	1.0
Census region*		
Northeast	2.1	2.2 (1.2 to 3.9)
North central	1.1	1.2 (0.7 to 2.2)
West	1.9	2.1 (1.2 to 3.7)
South†	1.0	1.0

*Significant (P<.05, adjusted Wald F test) predictor of consistent helmet use after adjusting for all other variables in the model.

†Reference values.

Table 4. Relationship of Consistent Bicycle Helmet Use With Other Safety Behaviors Among Adults in the United States, 1994*

Safety Behaviors	Consistent Helmet Users		Inconsistent Helmet Users	
	No. of Users	Weighted Percentage	No. of Users	Weighted Percentage
Total	210	18.3	823	81.7
Always wears a safety belt†				
Yes	178	88.2	508	69.4
No	22	11.8	204	30.6
Rode with a drinking driver†				
Yes	5	2.4	42	7.1
No	186	97.6	638	92.9
Has a smoke detector†				
Yes	203	97.2	713	92.4
No	7	2.8	52	7.6
Has a fire escape plan				
Yes	135	64.4	453	56.4
No	75	35.6	311	43.6

*Not all respondents answered each question.

†Significant (P<.05, χ² test) association between consistent helmet use and other safety behaviors.

Participants in the Injury Control and Risk Survey Project

Principal Investigator

Atlanta, Ga: Jeffrey J. Sacks, MD, MPH.

Project Core Group

National Center for Injury Prevention and Control, Atlanta : Barbara Houston; Marcie-jo Kresnow, MS; Joann M. O'Neil; Suzanne M. Smith, MD, MPH. Battelle, Arlington, Va: James Hersey, PhD; Rick Williams, PhD; Aiman Zeid, MS. DataStat, Ann Arbor, Mich: Sherry Marcy, MPH; Deborah J. Zivan.

Project Associates

National Center for Injury Prevention and Control, Atlanta : Christine M. Branche-Dorsey, PhD; Peter Briss, MD; Terence Chorba, MD, MPH; Alex Crosby, MD, MPH; Yvette Davis, VMD, MPH; Jennifer Friday, PhD; Arlene Greenspan, DrPH, PT; James Mercy, PhD; Phil McClain, MS; Julie Russell Bolen, PhD; Lloyd Potter, PhD, MPH; Kenneth E. Powell, MD, MPH. National Center for Environmental Health, Atlanta: Thomas Matte, MD, MPH.

still a serious problem, accounting for an estimated 290 bicycle-related head injury deaths each year and 34 000 emergency department-treated bicycle-related head injuries (for children, 305 deaths and 147 000 head injuries, respectively).⁴ Increasing helmet use among adults is also important because it is likely that children model the behavior of the adults around them, especially their parents.¹⁵ Studies of child occupant restraint use indicate that adults who always wear occupant restraints are much more likely to restrain their children.¹⁶

This survey has several limitations. First, the response rate of 56% is relatively low for a telephone survey. Although a comparison of the respondent HHs with census data suggests that this survey is a fairly representative cross-section of the US population,¹⁷ average income and educational attainment is higher than in the general population, as is true for most telephone surveys (because low-income HHs are less likely to have telephones). The underrepresentation of lower-income HHs is particularly problematic for this study because helmet ownership and use seems to be associated with HH income.

We took a conservative approach to classifying helmet users into 2 levels (collapsing 5 levels of self-reported helmet wearing into 2) based on a previous study that compared self-reported safety belt use with observed safety belt use for the same individuals.¹⁸ Of those who reported always wearing a safety belt, 87% were observed to be belted; of those who reported wearing a belt most of the time, only 48% were observed to be belted. We do not know if the same pattern of overreporting exists for bicycle helmet use as for safety belt use. The validity of self-reported bicycle helmet use among adults has not yet been adequately studied. There may be some degree of overreporting associated with the question on bicycle riding because some people may report riding a

bicycle within the past 30 days when, in fact, it has been more than 30 days. This could be due to "telescoping" or remembering an event as being more recent than it actually was.¹⁹

We found slightly higher self-reported helmet use than Rodgers,² even though our criteria were more conservative (ie, we only counted "always" wearing a bicycle helmet as use; Rodgers defined use as used a helmet all or most of the time). It is likely that in the 3 years between the survey conducted by Rodgers and this survey, helmet use has increased among adult bicycle riders.

Rodgers found that bicycle helmet wearing was related to HH educational level, age, and amount of riding. The likelihood of helmet use increased with age for bicyclists who ride more than approximately 20 hours per year and decreased with age for those who ride less than 20 hours per year.² Like Rodgers, we found that helmet use increases with the educational level of the rider. A higher educational level has also been observed to be positively associated with safety belt use²⁰ and child safety seat use.¹⁶ Bloomquist²¹ speculates that those with higher educational attainment may be more aware of or more capable of evaluating the benefits of the use of safety devices. Rodgers notes that because education is highly correlated with income, riders in these HHs may be better able to afford bicycle helmets.² However, this differential may also relate to a gamut of health-related behaviors. For example, consistent bicycle helmet users report higher levels of other safety behaviors than inconsistent helmet users.

The results of this survey indicate that approximately 31% of the 18- to 24-year-old group are active bicyclists, the largest proportion of any adult age group, but only 5% report always wearing a helmet. While this group accounts for 13% of adult bicyclists, they have higher bicycle-related fatality rates than any other age group of adults.²² Clearly, more efforts are needed to increase helmet use among this age group.

Efforts should also be focused on increasing adult bicycle helmet use nationwide, particularly in the north central and southern regions of the country, where helmet use is significantly lower than in the northeast and western regions. Increasing helmet use among adults is likely to raise the level of helmet use among children and move us toward our national health objective of 50% helmet use by the year 2000.¹²

Family practitioners can encourage increased bicycle helmet use by counseling their patients and their patients' families to always wear a properly fitted bicycle helmet when riding. The US Preventive Services Task Force found that there is good evidence to support the recommendation that counseling about helmet use be specifically considered in a periodic health examination, although most of the studies on the effectiveness of counseling have looked at helmet use by children.²³ In particular, we agree with suggestions made by Runyan and Runyan²⁴:

Physicians should join other health professionals in providing community leadership for injury prevention efforts that work. They should advocate injury prevention regulation and legislation at the local, state, and national levels and should not shy away from the use of litigation when it becomes necessary. However, they also should not abandon their roles in

providing guidance to patients. When doing so, they should attempt to improve the effectiveness of that education and evaluate it just as vigorously as other preventive and therapeutic measures.

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Reprints: Julie Russell Bolen, PhD, MPH, National Center for Chronic Disease Prevention, Centers for Disease Control and Prevention, 4770 Buford Hwy NE (K-30), Atlanta, GA 30341.

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Clinical Pearl

Once-Daily Aminoglycoside

“Standard and once-daily aminoglycoside dosing regimens are equivalent with regard to bacteriologic cure, and once-daily dosing shows a trend toward reduced mortality and toxicity.” Once-daily dosing is also cheaper and probably preferable. (*Ann Intern Med*. 1996;124:717-725.)