

---

# Horseback Riding Injuries Among Children and Young Adults

Grant L. Christey, MB, ChB; David E. Nelson, MD, MPH; Frederick P. Rivara, MD, MPH; Suzanne M. Smith, MD, MPH; and Corrine Condie, MEcon

Christchurch, New Zealand; Atlanta, Georgia; Seattle, Washington; and Belconnen, Australia

---

**Background.** Horseback riding injuries are responsible for an estimated 2300 hospital admissions annually among persons younger than 25 years of age in the United States, but injury rates, patterns of injury, and risk factors for this population have not been well studied.

**Methods.** Study participants were selected from a list provided by a national mail-order company that sells riding equipment. A total of 557 persons younger than 25 years of age who rode horses at least six times a year completed survey questionnaires.

**Results.** Among the study participants, 34 (6.1%) had been hospitalized at least once because of a riding injury and 153 (27.5%) had been treated by a physician within the previous 2 years for such an injury. The overall injury rate was 0.6 per 1000 riding hours. Among those

injured, sprains or strains (41.8%), lacerations or bruises (40.0%), and fractures or dislocations (33.3%) were the most common types of injury. A total of 27.5% of those injured sustained concussions or other head injuries. Riding 15 to 24 hours per month (odds ratio [OR]=2.04), being female (OR=1.81), and riding English style (OR=1.77) were the characteristics most strongly correlated with injury.

**Conclusions.** Horseback riding injuries among participants in this study tended to be serious. Family physicians should inform their patients who ride horses about the risks associated with equestrian activities and should emphasize helmet use.

**Key words.** Sports; athletic injuries; head injuries; accident prevention; head protective devices. (*J Fam Pract* 1994; 39:148-152)

---

An estimated 30 million Americans ride horses each year.<sup>1</sup> Although the number of children and young adults involved in equestrian activities is not known, the American Horse Council estimates that there are more than 1.2 million horse owners younger than 20 years of age in the United States.<sup>2</sup> It is estimated that more than 200,000 4-H Club youth projects involve horses in the United

States annually. In addition to 4-H, there are many other equestrian organizations for children and young adults.<sup>3</sup> Because of the popularity of the sport, many family physicians, particularly those in rural areas, are likely to treat patients who ride horses. Horseback riding can be hazardous: there are an estimated 2300 hospital admissions annually in the United States among riders younger than 25 years of age.<sup>4</sup>

Research on riding injuries has relied on data from medical examiners,<sup>5,6</sup> hospital admissions,<sup>7-9</sup> hospital emergency departments,<sup>4,10-13</sup> and riding clubs.<sup>1,14-16</sup> Few general surveys of riders have focused on injury experiences<sup>14</sup> to establish the risk associated with this sport. Additionally, despite suggestions that several factors may be related to riding injuries (eg, age, experience, riding style),<sup>4,6,17</sup> independent correlations between potential risk factors and injury have not been explored.

To better understand the extent and nature of riding

---

Submitted, revised, April 18, 1994.

From Christchurch School of Medicine, Christchurch, New Zealand (G.L.C.); the National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia (D.E.N., S.M.S.); Harborview Injury Prevention Center and the University of Washington School of Public Health, Seattle, Washington (F.P.R.); and the University of Canberra Faculty of Management, Belconnen, Australia (C.C.). Dr. Nelson is currently with the Behavioral Surveillance Branch, Office of Surveillance and Analysis, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention in Atlanta, Georgia. Requests for reprints should be addressed to David E. Nelson, MD, MPH, Behavioral Surveillance Branch, CDC, 4770 Buford Highway NE, Mailstop K-30, Atlanta, GA 30341-3724.

injuries and risk factors for injury among children and young adults (ie, persons less than 25 years of age), we analyzed a subset of data from a survey of horseback riders.

## Methods

Data for this study were obtained from a survey conducted by mail from July to September 1991. Details have been published elsewhere.<sup>18</sup> A total of 4000 household names (out of 350,000) were randomly selected from the mailing list of a national mail-order company that sells horseback-riding equipment. This company sells equipment to both English-style and Western-style riders. English-style riding traditionally involves activities such as dressage, combined training, hunting, and jumping; Western-style riding primarily consists of pleasure riding, barrel racing, ranching, and rodeo.

Two questionnaires were included with each mailing: one for persons aged 15 or older, and the second for any child  $\leq 14$  years of age in the household who rode horses (if applicable). Young children were encouraged to seek parental assistance as necessary to complete their questionnaires. Those households that failed to respond to the first mailing received a second mailing 6 weeks later. A total of 1848 households returned at least one questionnaire during the survey period (the response rate was 36.9% to the first mailing and 9.3% to the second mailing, for an overall response rate of 46.2%). For this study, we analyzed a subset of data from the original survey consisting of persons younger than 25 years of age. Since we were most interested in the injury experience of persons who rode horses frequently, we restricted our analyses to respondents who had ridden horses six or more times in the past year.

Participants were asked a number of questions concerning demographics, riding style, and riding injuries. Because Western-style and trail-style riders use similar equipment and clothing, we combined these two styles into the "Western" category and categorized riding style as Western, English, and other (eg, bareback). Riders were asked to indicate the one most frequent riding style used; those who indicated more than one style were placed in the "other" riding style category.

Persons who reported having seen a physician in the past 2 years because of a horseback riding injury were asked additional questions about their injuries, including type and location of injury, number of days they were disabled (ie, unable to perform usual daily activities), and site of medical treatment. Persons who had more than one riding incident resulting in injury were asked to answer questions only for the most serious injury incident.

Table 1. Hospitalizations and Physician Visits for Horseback Riding Injuries Among Riders Younger Than 25 Years of Age (N=557)

Injury Management	Riders n (%)
Hospitalizations (no. in lifetime)	
None	523 (93.9)
One	31 (5.6)
Two	2 (0.4)
Three or more	1 (0.2)
Physician's office visit (no. in past 2 years)	
None	404 (72.5)
One	113 (20.3)
Two	27 (4.8)
Three	6 (1.1)
Four or more	7 (1.3)

Because of rounding, percentages do not total 100.

## Statistical Analyses

We calculated the average number of riding hours per month by multiplying the average number of days that people rode each month by the average number of hours per riding occasion. The injury rate was calculated by dividing the total number of injuries reported by the total number of riding hours over the 2-year period.

To determine whether there were independent correlations between several characteristics and injury, unconditional logistic regression was used to fit a final model, which included the following variables: sex, years of riding ( $<5$ , 5 to 9,  $\geq 10$  years), riding style (Western, English, other), safety training within the past 5 years (yes, no), and average number of riding hours per month ( $<15$ , 15 to 24,  $\geq 25$ ).

## Results

Within the households surveyed, there were 565 persons younger than 25 years of age who completed questionnaires; of these, a total of 557 respondents had ridden horses six or more times during the past year. Female respondents accounted for 86% of the study population. Of the study participants, 34 (6.1%) had been hospitalized at least once as a result of a riding injury (Table 1). A total of 153 (27.5%) persons reported at least one injury for which they had been treated by a physician within the previous 2 years. Overall, the injury rate was 0.6 per 1000 riding hours, but it was higher among English-style riders and among riders in the age group 15 to 19 (Table 2).

The vast majority of injuries occurred while riding (49.0%) or jumping (27.5%), although injuries also occurred while persons were performing nonriding activities, such as leading or grooming horses (20.2%). Injuries occurring as a result of jumping were far more common

Table 2. Horseback Riding Injury Rates Among Riders Younger Than 25 Years of Age, by Riding Style and Age (N=557)

Riding Style and Age	Injury Rate*
Riding style	
English	0.9
Western	0.4
Other	0.3
Age (y)	
<10	0.3
10-14	0.5
15-19	0.8
20-24	0.6
Overall injury rate	0.6

\*Per 1000 riding hours.

among English-style riders (33.3% of those injured) than among Western-style riders (9.7% of those injured). Falling off horses (58.2%) and being kicked or stepped on (17.6%) were the most common mechanisms of injury. The most common sites of treatment were hospital emergency departments (51.6%) and physicians' offices (31.4%).

Among those injured, the most common types of injury were sprains or strains (41.8%), lacerations or bruises (40.0%), fractures or dislocations (33.0%), and concussions (19.0%). The upper extremities, head (including eyes and face), and lower extremities were the most common body sites injured (Figure). More than 43% of persons injured were disabled for 7 or more days, and 1.3% of those injured reported that their injury resulted in permanent disability (Table 3).

A total of 42 of 153 injured riders (27.5%) suffered either concussions or other head injuries (excluding face,

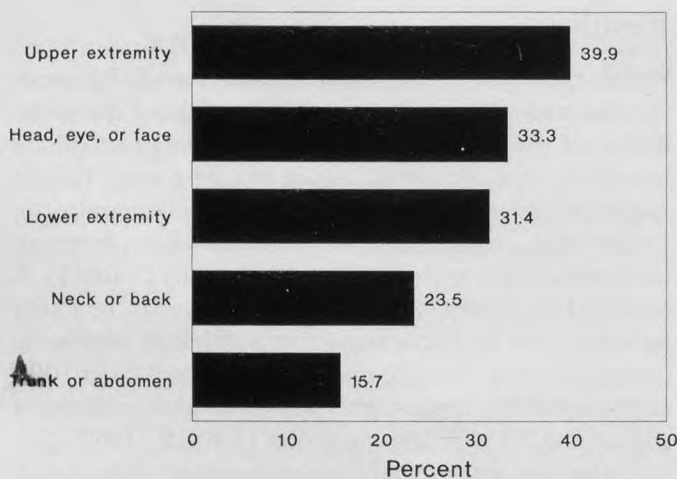


Figure. Sites of injury among children and young adults who were injured while riding (n=153). Note: Percentages do not total 100 because respondents could indicate more than one body part.

Table 3. Disability Related to Horseback Riding Injuries Among Riders Younger Than 25 Years of Age (N=153)

Level of Disability*	Injured Riders n (%)
No. of disability days	
None	23 (15.0)
1-2	34 (22.2)
3-6	22 (14.4)
7-14	26 (17.0)
≥15	38 (24.8)
Permanent disability†	2 (1.3)
Unknown	8 (5.2)

\*Defined as inability to perform usual daily activities.

†Self-reported.

eye, or mouth injuries). Among these riders, 22/42 (52.4%) were aged 15 to 19 years, 36/42 (85.7%) were English-style riders, 41/42 (97.6%) were female riders; 34/42 (81.0%) of these injuries occurred while riding or jumping, and 21/42 riders (50.0%) reported having worn a helmet at the time of concussion or other head injury.

Logistic regression analyses indicated that, after adjusting for all other variables in the model, the strongest correlates of injury were riding 15 to 24 hours per month (odds ratio [OR]=2.04), being female (OR=1.81), and riding English-style (OR=1.77) (Table 4). The number of years of horseback riding (OR=1.11 for 5 to 9 years, OR=1.00 for ≥10 years) was not correlated with a reduced risk of injury.

Table 4. Correlates of Horseback Riding Injuries Among Persons Younger Than 25 Years of Age (N=557)

Variable	Odds Ratio*	95% CI
Sex		
Male	1.00	—
Female	1.81	1.05-3.11
Riding style		
Western	1.00	—
English	1.77	1.00-3.15
Other	0.95	0.62-1.46
Years of riding		
<5	1.00	—
5-9	1.11	0.80-1.53
≥10	1.00	0.75-1.34
Average number of riding hours per month		
<15	1.00	—
15-24	2.04	1.45-2.86
≥25	1.00	0.75-1.34
Safety training in last 5 years		
Yes	1.00	—
No	0.93	0.72-1.19

\*Controlling for all other variables in the model.

CI denotes confidence interval.

## Discussion

Our study suggests that horseback riding injuries tend to be severe. This is supported by the percentage of all injuries that were fractures or head injuries, the number of visits to physicians in the past 2 years, and the extent of disability. Injury prevention efforts should be especially targeted toward English-style riders and riders aged 15 to 19 because of their higher injury rates.

The overall injury rate of 0.6 per 1000 riding hours for children and young adults is similar to injury rates reported by Danielsson and Westlin<sup>11</sup> (<1 per 1000 lessons), Gierup and colleagues<sup>12</sup> (0.7 per 1000 rides), and Bixby-Hammett<sup>1</sup> (3.5 per 1000 equestrian club members over a 5-year period, or 0.7 per 1000 members per year). By comparison, injury rates for other sports are estimated to be 10.7 per 1000 exposures for wrestling,<sup>19</sup> 6.1 per 1000 exposures for football,<sup>19</sup> and 5.7 per 1000 hours of exposure for track and field.<sup>20</sup>

Consistent with previous research, falls were the most common mechanism of injury, and upper extremities were the most common sites of injury.<sup>1,4-15,17</sup> Although more than one half of injured persons were treated in hospital emergency departments, a substantial number were treated in nonhospital settings, suggesting that hospital data underestimate the extent of horseback riding injuries.

The strongest correlate of injury was riding a moderate number of hours per month. It is unclear why riders in this category are at highest risk. Those who ride fewer than a moderate number of hours per month may be less inclined to engage in risk-taking behavior, and those who ride more hours per month may be more familiar with their horses. There was no evidence, however, that increased riding experience, based on the number of years of riding horses, reduced the risk of injury. Further research on the behavioral characteristics of horseback riders is needed.

Previous studies of horseback riding injuries have found that female riders were more commonly injured than were male riders, but the studies did not control for other factors.<sup>1,4-15,17</sup> Our results suggest that being female is an independent risk factor for riding injuries. Further research is needed to determine the reason for the increased risk among female riders. One possible explanation is that females are more likely than males to seek medical care for illnesses and injuries.<sup>21</sup>

English-style riders seem to be at greater risk for injury than are riders using other styles. The most likely explanation for this is that hazardous activities such as jumping are performed more commonly by English-style riders. This was evident in our study results: one third of all injuries among English-style riders occurred while

jumping, compared with less than one tenth of injuries among Western-style riders. English-style saddles, which do not include saddle horns, also may be a factor.

Safety training in the past 5 years was not associated with decreased risk of injury, suggesting that training and educational activities may not have as much impact on reducing injury rates or injury severity as might be expected. The design of the study did not allow evaluation of the extent or content of safety training, nor the amount of lifetime education or training received; therefore, our findings do not prove that education has no effect. More research is needed on the role of education in preventing horseback riding injuries.

Because of their potentially catastrophic nature, concussions and other head injuries are a special cause for concern, and our findings demonstrated that such injuries are not rare. We could not assess what types of helmets were used, if they were being worn properly (eg, adequately secured to the head), or if they prevented a potentially more severe injury in those reporting head injury and helmet use. A previous study (based on this data set) suggests that horseback riding helmets are effective, as 41% of helmet owners reported that their helmets had prevented at least one head injury.<sup>18</sup>

To reduce the risk of head injuries, well-secured hard-shell helmets that meet the standards of the American Society for Testing and Materials<sup>22</sup> should be worn by all riders when riding or working around horses.<sup>4,17,18,23</sup> Protective headgear has been endorsed by the American Medical Association<sup>24</sup> and the American Academy of Pediatrics.<sup>25</sup> In addition to education and helmet use, injury prevention activities should include regular inspection of equipment and replacement of worn parts, selection of a horse that matches the capability of the rider, adequate supervision based on the skill level of the rider, avoiding the use of alcohol before and during riding activities, wearing smooth-soled footwear, and avoiding loose-fitting clothing.<sup>4,17,23,26</sup>

There are limitations to the study. Because the participants were selected from a list supplied by a mail-order riding equipment company, they may not have been representative of all children and young adult riders; they may, in fact, be more representative of riders from affluent families who own horses. Persons with riding injuries may have been more likely to respond to the survey than non-injured persons. Since this study relied on self-reports, we could not verify the accuracy of responses, including medical diagnoses and permanent disability status. Bias in the recall of helmet use, especially among respondents who suffered a concussion or other head injury, may have resulted in overestimating the extent of helmet use. Finally, the study design made it impossible to determine whether

certain characteristics, such as the average number of riding hours per month, changed as a result of injuries.

Family physicians can play an important role in efforts to reduce riding injuries. Patients who ride horses should be informed of the potentially severe nature of injuries associated with riding and encouraged to wear helmets at all times when around horses. They should be advised to receive training from experienced instructors who have completed an accredited horse-safety course. Finally, family physicians should encourage riding clubs, riding stables, and other organizations that sponsor horse-related activities to require appropriate helmet use for all riders.

#### Acknowledgments

Financial support for this study was received under Centers for Disease Control and Prevention grant No. CCR 002570.

We thank the following for their assistance: Shanti Sumartojo, Jack Martin, Silvana Chatrian, Howard Hill, Mary Midkiff, William Brooks, John Peddicord, Doris Bixby-Hammett, Robert Wilson, Christine M. Branche-Dorsey, Iris E. Lansing, Linda E. Saltzman, Martha Highsmith, Jeffrey J. Sacks, Terence L. Chorba, Juan G. Rodriguez, Julie C. Russell, Kenneth E. Powell, Robert Brewer, Ann Shields, James A. Mercy, Alex E. Crosby, Scott R. Lillibridge, Rick Waxweiler, and Tom Bartenfeld.

#### References

1. Bixby-Hammett DM. Accidents in equestrian sports. *Am Fam Physician* 1987; 36:209-14.
2. Bixby-Hammett DM. Youth accidents with horses. *Physician Sportsmed* 1985; 13:105-17.
3. 1990-91 Horse industry directory. Washington, DC: American Horse Council, 1990.
4. Injuries associated with horseback riding—United States, 1987 and 1988. *MMWR* 1990; 39:329-32.
5. Pounder DJ. The grave yawns for the horseman. *Med J Aust* 1984; 141:632-5.
6. Ingemarson H, Grevsten S, Thoren L. Lethal horse-riding injuries. *J Trauma* 1989; 29:25-30.
7. Barber HM. Horse-play: survey of accidents with horses. *BMJ* 1973; 3:532-4.
8. McGhee CNJ, Gullan RW, Miller JD. Horse riding and head injury: admissions to a regional head injury unit. *Br J Neurosurg* 1987; 1:131-6.
9. Barone GW, Rodgers BM. Pediatric equestrian injuries: a 14-year review. *J Trauma* 1989; 29:245-7.
10. Williams LP. The blue-tail fly syndrome: horse-associated accidents. Proceedings of the 103rd annual APHA meeting. Washington, DC: American Public Health Association, 1975.
11. Danielsson LG, Westlin NE. Riding accidents. *Acta Orthop Scand* 1973; 44:597-603.
12. Gierup J, Larsson M, Lennquist S. Incidence and nature of horse-riding injuries. *Acta Chir Scand* 1976; 142:57-61.
13. McLatchie GB. Equestrian injuries—a one year prospective study. *Br J Sports Med* 1979; 13:29-32.
14. Mahaley MS, Seaber AV. Accident and safety considerations of horseback riding. In: Proceedings of The 18th AMA Conference on the Medical Aspects of Sports. Chicago, Ill: American Medical Association, 1976:37-45.
15. Bernhang AM, Winslett G. Equestrian injuries. *Physician Sportsmed* 1983; 11:90-5.
16. Condie C, Rivara FP, Bergman AB. Promoting the use of equestrian helmets: strategies of a successful campaign. *Public Health Rep* 1993; 108:121-6.
17. Bixby-Hammett D, Brooks WH. Common injuries in horseback riding: a review. *Sports Med* 1990; 9:36-47.
18. Nelson DE, Rivara FP, Condie C. Helmets and horseback riders. *Am J Prev Med* 1994; 10:15-9.
19. Eastwood FR. Hazards to health: athletic injuries. *N Engl J Med* 1969; 271:411-3.
20. Zariczny B, Shattuck JM, Mast TA, Robertson RV, D'Elia G. Sports-related injuries in school-aged children. *Am J Sports Med* 1980; 8:318-24.
21. National Center for Health Statistics. Health United States, 1991. Hyattsville, Md: Public Health Service, 1992:219. DHHS publication No. (PHS) 92-1232.
22. American Society for Testing and Materials. Standard specification for headgear used in horse sports and horse-back riding (F1163-88). In: Annual book of ASTM standards. Philadelphia: American Society for Testing and Materials, 1988.
23. Nelson DE, Bixby-Hammett D. Equestrian injuries in children and young adults. *Am J Dis Child* 1992; 146:611-4.
24. Protective headgear for horseback riders: Resolution No. 107 (A-84). Proceedings of the House of Delegates—American Medical Association. Chicago, Ill: American Medical Association, 1984:360.
25. American Academy of Pediatrics Committee on Sports Medicine and Fitness. Horseback riding and head injuries. *Pediatrics* 1992; 89:512.
26. Alcohol use and horseback riding—associated fatalities—North Carolina, 1979-1989. *MMWR* 1992; 41:335-42.