percent. Unlike having a Pap test, which is usually taken only during a pelvic examination, and sometimes without the woman's knowledge, having a mammogram is a discrete event which occurs at a time or a place other than the medical examination and thus is less likely to be confused or forgotten.

Although further studies in other populations should be done to confirm the results found here, these data provide a basis for optimism. If the findings are replicated, it appears that women's self-reports can be used accurately to monitor national changes in mammography utilization.

ACKNOWLEDGMENTS

This research was supported by NCI PHS Grant CA 45834 and institutional grants awarded to Fox Chase Cancer Center—NIH Grant Nos. CA 06927 and RR 05895 and an appropriation from the Commonwealth of Pennsylvania. We are grateful for the help of Linda Crossley, Rob McLaughlin, Sue Montgomery, Janet Seay, and Wendy Wyatt in obtaining the data and Ann Jones for word processing. We thank Suzanne Haynes, PhD, Larry Kessler, PhD, and the Breast Screening Consortium for encouraging us to undertake this research.

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Incidence of Bicycle-Related Injuries in a Defined Population

DIANE C. THOMPSON, MS, ROBERT S. THOMPSON, MD, AND FREDERICK P. RIVARA, MD, MPH

Abstract: Population-based incidence rates for head injuries and total injuries resulting from bicycle crashes were calculated in a Seattle, Washington health maintenance organization population. Overall rates were 163 per 100,00 for all injuries and 42/100,000 for head injuries. Individuals between 5 and 14 years of age are at highest risk for bicycle-related injuries. The data are presented for their potential utility in program planning. (*Am J Public Health* 1990; 80:1388–1389.)

Introduction

Bicycling is an increasingly popular sport in the United States. Injuries due to bicycling accounted for approximately 574,000 emergency room visits and 1,300 deaths in 1985, with head injuries accounting for the major morbidity and mortality.[1,2] Helmets have been shown to be an effective means of preventing these injuries.[3] Programs to promote helmet use have been successful.[4] The present study was undertaken to provide information on the incidence of these injuries for use in community bicycle helmet campaigns and safety programs.

Methods

Injured cyclists were identified during a one year surveillance of hospital emergency rooms in Seattle, Washington (December 1, 1986 to November 30, 1987). The methods are detailed elsewhere.[3] Cyclists for this study are limited to those treated at the facilities serving Group Health Cooperative of Puget Sound (GHC), a large staff-model health maintenance organization, thus allowing the calculation of population-based rates. GHC membership is demographically similar to the surrounding population in the Seattle metropolitan area, but differs from the US population by its greater educational level and underrepresentation of Blacks. Group Health Cooperative members are highly educated; 67 percent have more than a high school education. The ethnic composition of GHC membership is 91 percent Caucasian, 3 percent Black, 4 percent Asian/Pacific Islander, and 2 percent other, compared to 83.4 percent, 11.7 percent, 1.7 percent, and 3.2 percent, respectively in the US population.

GHC Central and East regions include 223,298 members who receive nearly all their outpatient, emergency, and hospital care at GHC facilities. There were two severely injured cyclists treated at the regional trauma center; these were included in the study. Review of the medical examiners' records for the study period indicated no deaths at the

Address reprint requests to Diane C. Thompson, MS, Research Coordinator, Harborview Injury Prevention and Research Center, 3225 Ninth Avenue, ZX-10, Seattle, WA 98104. Dr. R. Thompson is Senior Director of Preventive Care Research, Department of Preventive Care, Group Health Cooperative of Puget Sound; Dr. Rivara is Director of Harborview Injury Prevention and Research Center, as well as Professor of Pediatrics and Adjunct Professor of Epidemiology, University of Washington School of Medicine. This paper, submitted to the Journal December 11, 1989, was revised and accepted for publication April 9, 1990.

accident scene. Bicyclists injured outside the Seattle metropolitan area or treated at other area medical facilities were not included.

Exposure to cycling was measured by asking the frequency of riding and the number of miles and hours cycled per week. Self-reported mileage figures were used to calculate the mean number of miles cycled per week, and to estimate injuries per 100 miles ridden.

Incidence rates of emergency room treated injuries resulting from bicycle crashes were calculated using the mid-year 1986 population of the GHC East and Central regions.

Results

There were 364 Group Health members treated in the emergency room for bicycle-related injuries. One hundred-one (28 percent) were head injured. Thirty (29.7 percent) of the head injured experienced brain injuries; 4 percent were hospitalized. The 364 cyclists constituted 54.5 percent of all cyclists seen in the five area hospitals.

Table 1 displays age- and sex-specific injury rates. Head injury rates were highest in the 5–9 year age group while rates for all bicycle injuries were highest in the 10–14 year age group. Males had higher injury rates than females. When the incidence of bicycle-related injuries was age-adjusted to the US population, the rate was 51 per 100,000 for head injuries and 187 per 100,000 for all bicycle injuries.

Fifty-six of the 364 injured cyclists (15.4 percent) were wearing helmets at the time of the crash; only seven of the 56 head-injured were helmeted. Helmet use was very low among riders under 15 years of age (4.3 percent), but increased to 23 percent among 15–24 year olds and to 44 percent for those 25 years of age and older. There were no significant differences in rates of helmet use by sex.

Exposure to cycling is summarized in Tables 2 and 3. The injury rate per 100 miles ridden per year is highest for 5–14 year olds. Seventy-seven percent of the ER visits were between April and September.

TABLE 1—Incidence of Bicycle-Related Head Injuries and All Injuries per 100,000 population by Sex

Age (years)	Injuries (N)	Sex: Male	Sex: Female	Total	SE*
Head Injuries					
0–4	10	94.3	41.9	68.6	22
5–9	43	414.7	147.1	283.0	43
10–14	27	295.1	72.6	188.3	36
15–19	5	59.9	—	30.2	14
20–24	3	38.6	14.9	25.2	15
25–44	10	14.8	21.1	13.3	4
45–64	3	14.3	—	6.7	4
All ages	101			42.2	
All Bicycle Injuries					
0–4	12	121.2	41.9	82.3	24
5–9	102	907.1	414.6	671.3	66
10–14	116	1260.9	246.9	809.0	75
15–19	43	443.6	72.9	259.6	40
20–24	18	250.6	74.5	151.3	36
25–44	55	109.7	43.4	73.2	10
45–64	17	52.3	25.3	38.0	9
All Ages	364			163.0	

*Standard Error

TABLE 2—Mean Miles per Week Cycled and Injuries per 100 Miles Ridden per year According to Age and Type of Injury

Age Group (years)	Mean Miles per Week Cycled: Head Injuries	Other Injuries	All Injuries	Injuries per 100 Miles Ridden per Year
0–4	5.7	3.5	5.3	4.4
5–9	7.4	6.0	6.6	30.0
10–14	10.3	12.8	12.3	18.1
15–19	10.0	48.7	43.8	1.9
20–24	71.3	40.9	45.9	0.8
25–44	47.8	65.7	63.0	1.7
45–64	9.0	56.9	47.9	0.7
65+	—	—	1.0	—

TABLE 3—Distribution of Season and Week of All Bicycle Injuries

Season Injured	%	Day of Week Injured	%
January–March	13.0	Saturday/Sunday	41.0
April–June	42.0	Monday	10.2
July–September	35.3	Tuesday	11.3
October–December	9.1	Wednesday	9.1
		Thursday	16.6
		Friday	11.6

Discussion

Although helmet use has a direct effect on head injuries,[3] it does not explain why the peak ages of head injuries and overall injuries are different or why the ratio of head to all injuries is higher for young children. Our cycling exposure data, which are similar to those of other studies[1,5–7], do not explain the differences. Possible explanations are differential ascertainment of injury types and increased injury severity in older children.[8]

We assume most cycling mileage was estimated based on distance between destinations rather than actual measurement. The number of bicycle odometers used is unknown. Mileage data indicate children 5–9 years old are at highest injury risk.

Friede and co-workers (SCIPP) reported 87.8 bicycle injuries per 10,000 person years (0–19), with the injury rate highest in 6–12 year old males.[5] Our overall injury rate for this age group was 45 per 10,000. Reasons for the discrepancy are not clear. Lack of case ascertainment in the present work does not appear to be the explanation because it was a closed system of care. Other potential explanations for the differences include SCIPP'S use of all pedal cycle accidents (bicycles, tricycles, other pedal powered vehicles), sampling methods (SCIPP used a 25 percent sample of accidents over a two-year period),[5] and the proportion of all types of GHC injuries treated in the ER (40 percent) versus primary care (60 percent).[8] This latter study indicated that GHC overall rates (clinic and ER combined) appear closer to ER rates obtained by SCIPP[9] and NEOTS.[10] Two other studies[11,12] reported incidence rates of medically treated injuries similar to rates at GHC.[8] Waller (1971) reported higher bicycle injury rates. His denominator, all bicycle owners, yields higher rates than using the general population.[7]

Brain injury rates are comparable to other studies. Kraus, *et al*, reported population-based rates of brain injuries from bicycle crashes requiring hospitalization of 13.5 per 100,000 with the highest injury rates in children under age 15.[13] The rate for all brain injuries from the present work was 12.5 per 100,000.

The rates of injuries reported here are conservative since they represent only ER treated injuries. Many injured cyclists, possibly the majority, were treated at home or in outpatient clinics. Bicycling injuries contribute substantially to health care utilization and are a chief cause of recreational injury.[1,6,14–20] Children age 5–14 are at greatest risk of injury, and are an appropriate target for the application of available and effective prevention programs.[2,3,5,21]

The data presented are offered for their potential utility to the communities planning bicycle safety helmet campaigns.

ACKNOWLEDGMENTS

Funding for this study was from a grant from the Foundation of Group Health Cooperative of Puget Sound, and the Harborview Injury Prevention and Research Center, Grant CCR 49-002570.

We are indebted to the Emergency Department staffs at Central and Eastside Group Health Cooperative of Puget Sound. We wish to express our appreciation to Lincoln Polissar, PhD, for statistical consultation.

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