ORIGINAL RESEARCH

Injuries and Illnesses Occurring on a Recreational Bicycle Tour: The Great Ohio Bicycle Adventure

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Objective.—Recreational multiday cycling events have grown popular in the United States; however, little has been published regarding the injuries and illnesses that occur during these events. The objective of this study was to describe injuries and illnesses that occur in the Great Ohio Bicycle Adventure (GOBA) and to examine associated risk factors.

Methods.—Injury and illness data collected from an on-site medical clinic during the 2013 and 2014 GOBA tours were merged with rider registration data for analysis. Diagnoses were classified as acute injury, overuse injury, or medical illness. The odds ratios of sustaining at least 1 injury/illness, as well as sustaining an acute injury, were assessed adjusting for riders' demographics.

Results.—A total of 4005 (2172 in 2013 and 1833 in 2014) cyclists participated in GOBA, with an age of 50.7 ± 17.6 (2–86) years (mean $\pm$ SD [range]), of whom 59.8% were male. During the tours, 143 (3.6%) riders reported at least 1 injury/illness, which resulted in 220 clinical diagnoses, including 114 (51.8%) acute injuries, 27 (12.3 %) overuse injuries, and 79 (35.9%) medical illnesses. The lower extremities were the most commonly injured body site ($n=71$, 50.4%). “Superficial/Abrasions/Contusions” was the most common injury/illness type ($n=68$, 30.9%). Riders who had no previous tour experience or who were at least 50 years old had a greater risk of injury/illness than their counterparts.

Conclusions.—The prevalence of injury and illness is relatively low in multiday recreational cycling events. Our findings provide important data for planning and preparing for medical coverage at mass recreational cycling events.

Keywords: bicycling, athletic injuries, epidemiology

Introduction

Organized recreational bicycle touring continues to grow in popularity in the United States, yet bicycle safety remains a concern.^{1–3} The injury rates and severity of injuries seen during recreational bicycle tours are relatively low.^{4–10} Speed, specialized equipment, riding

surface, weather conditions, and human factors contribute to a wide variety of traumatic and nontraumatic injuries documented among recreational touring cyclists at all experience levels.^{11–18} The Great Ohio Bicycle Adventure (GOBA) is a multiday recreational cycling event held annually in mid-June for 1 week. During the event, approximately 2000 cyclists ride an average of 50 miles per day for 7 days and camp overnight.¹⁹

GOBA, unlike many multiday recreational cycling events, provides a daily, on-site, no-fee medical clinic. The clinic, staffed by 25 volunteer board-certified primary care and sports medicine physicians, registered nurses, and medics, was housed out of a recreational vehicle or within a fixed building space where the riders were based for the day. The clinic provided care for

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basic illnesses and injuries, including advanced wound care (“road rash”), laceration repair, and oral or intravenous hydration for stable patients. More serious conditions seen in the medical clinic were transported to local emergency facilities by a dedicated on-site emergency medical services (EMS) unit.

Care was provided along the route by a privately contracted company that supplied 3 EMS units and 6 certified medics. Communication between the contracted EMS units and GOBA communication staff was achieved by placing an amateur radio operator (“ham”) in the medic units. Riders also sought care en route by activating the local EMS/911 systems, from Good Samaritans, and through self-care.

Due to the large number of riders with a wide range of ages, cycling experience, and personal medical histories, it can be challenging to provide proper medical care with the limited resources available at an on-site medical clinic. Existing studies demonstrate that collection and analysis of clinic data on injury and illness at cycling events are an important part of careful planning for rider safety and mass event medical coverage.^{5–7,9,15,20} A paucity of published data over the last 35 years describing injuries and illnesses that occur during recreational bicycling events calls for more research in injury prevention.^{4–10,15} The purpose of this study was to 1) describe the injuries and illnesses that occurred during 2 consecutive years of a multiday bicycle tour using medical clinic visit and registration data, and 2) examine risk factors associated with increased likelihood of injury or illness.

Methods

PARTICIPANTS AND DATA SET

Two datasets were merged by rider identification (ID) for analysis in this study: 1) 2013 and 2014 GOBA electronic demographic registration data (eg, rider ID, sex, age, place of residence, and previous rider experience) and 2) GOBA medical clinic visit data (paper records) maintained for all patients seen during the 2013 and 2014 tours, including rider ID, date of clinic visit, date of illness/injury, characteristics of injuries and illness sustained during the tour, and treatment received from the clinic. This study was approved by the institutional review board of the authors’ institution.

VARIABLES AND MEASURES

Injury or illness was defined as occurring during GOBA and receiving initial medical attention in the GOBA medical clinic. Clinic physicians recorded each diagnosis during the clinic visit using diagnosis codes from the

International Classification of Diseases, Ninth Revision. For this study, diagnoses were classified as “acute injury,” “overuse injury,” or “illness” by 2 of the authors (board certified sports medicine physicians) who were part of the GOBA medical team. For patients who presented at the GOBA medical clinic with multiple diagnoses of injury and/or illness, each diagnosis was recorded as 1 observation in the analysis. Clinic physicians also recorded the following characteristics of each injury/illness during the clinic visit: date of clinic visit, date of injury, type of injury/illness, injured body site, and treatment received. Only new visits were included in this study. Any follow-up visits related to a rider’s initial visit were not included.

Treatment was defined as any intervention dispensed by the GOBA medical clinic, including instructions for rest or follow-up care. Treatment variables included rest, ice, compression, and/or elevation; changes in medication; wound care; and recommendations for follow-up and/or missing at least 1 day of the bicycle tour. Demographic variables included in this study were study year, age, sex, place of residence, and previous GOBA tour experience.

DATA ANALYSIS

Descriptive statistics were used to summarize riders’ demographics and the characteristics of injury and illness. To facilitate a better understanding of the injury and illness patterns, analysis was conducted at multiple levels—rider, visit, diagnosis, and treatment—where each rider could have multiple visits and each visit could have multiple diagnoses and/or treatments. χ^2 tests or independent *t* tests were used to compare the differences across subgroups, where appropriate. Adjusted logistic regressions were used to model 1) the odds of sustaining at least 1 injury or illness versus no injury or illness and 2) the odds of sustaining an acute injury versus an overuse injury or illness, with 95% confidence intervals. Both adjusted models included 5 mutually adjusted independent variables (study year, sex, age group, place of residence, and previous tour experience). Individuals who participated in both years were counted as 2 separate riders, 1 for each year. All data analyses were conducted using SAS 9.3 (SAS Institute, Cary NC), and statistical significance was set at $\alpha = .05$.

Results

DEMOGRAPHIC CHARACTERISTICS OF THE RIDERS

A total of 4005 riders who registered for the 2013 and 2014 GOBA were included in this study, including 2172

Table 1. Characteristics of riders and injury/illness

Variable	All riders (N=4005)			Injury/Illness (N=220)		
	All riders n (%)	Number of injured or ill persons (n=143) n (%)	P value	Number of injury/illness n (%)	Rate (per 1000 persons)	Rate ratio (95% CI)
Year of participation						
2013	2172 (54.2)	76 (3.5)	.79	120 (54.6)	55.3	1.0 (0.8–1.3)
2014	1833 (45.8)	67 (3.7)		100 (45.5)	54.6	Reference
Sex						
Male	2393 (59.8)	84 (3.5)	.80	133 (60.5)	55.6	1.0 (0.8–1.4)
Female	1612 (40.3)	59 (3.7)		87 (39.6)	54.0	Reference
Age (years)						
≤30	642 (16.0)	19 (3.0)	.15	30 (13.6)	46.7	Reference
31–40	206 (5.1)	12 (5.8)		16 (7.3)	77.7	1.7 (0.9–3.2)
41–50	541 (13.5)	21 (3.9)		25 (11.4)	46.2	1.0 (0.6–1.7)
51–60	1311 (32.7)	36 (2.8)		58 (26.4)	44.2	0.9 (0.6–1.5)
61–70	1055 (26.3)	45 (4.8)		78 (35.5)	73.9	1.6 (1.1–2.5)
≥71	250 (6.2)	10 (4.0)		13 (5.9)	52.0	1.1 (0.6–2.2)
Residence						
Ohio	2847 (71.1)	106 (3.7)	.41	154 (70.0)	54.1	0.9 (0.7–1.3)
Other	1158 (28.9)	37 (3.2)		66 (30.0)	57.0	Reference
Previous tour experience						
No	1070 (26.7)	53 (5.0)	<.01 ^a	83 (37.7)	77.6	1.7 (1.3–2.3)
Yes	2935 (73.3)	90 (3.1)		137 (62.3)	46.7	Reference

^a Denotes significance (<.05).

riders in 2013 and 1833 riders in 2014 (Table 1). Of these, 2393 (59.8%) were male and 1612 (40.3%) were female, with an age of 50.7 ± 17.6 (2–86) years (mean $\pm$ SD [range]). A majority of riders were from Ohio (n=2847, 71.1%), and others came from 41 other states and 4 other countries. More than 70% of riders (n=2935) reported having prior bicycle tour experience.

RATE AND RATE RATIO OF INJURY AND ILLNESS BY RIDER CHARACTERISTICS

Seventy-six (3.5%) of the 2013 riders and 67 (3.7%) of the 2014 riders experienced at least 1 injury and/or illness (Table 1). Of a total 143 riders (collapsed over 2 years) with injuries and/or illnesses, 84 (58.7%) were male and 59 (41.3%) were female, and 40 had more than 1 injury and/or illness. A statistically significant association was observed between injury/illness occurrence and previous tour experience ($P < .01$). No statistically significant differences, however, were observed in injury rates when comparing across study year, sex, age group, and place of residence.

A total of 220 unique diagnoses were identified (Table 1). The rates of injury/illness diagnosis were 55.3 and 54.6 per 1000 persons in 2013 and 2014, respectively. No differences in rates of injury/illness diagnosis were observed between male and female

participants, between in-state Ohio and out-of-state residents, or among different age groups. However, the rate of injury/illness diagnosis among individuals with no tour experience (77.6 diagnoses per 1000 persons) was statistically significantly greater than the rate among those with prior tour experience (46.7 diagnoses per 1000 persons).

Little variation in rates of injury/illness diagnosis between 2013 and 2014, male and female participants, and Ohio versus other states was observed (Table 1). However, compared with the youngest age group (≤ 30 years), individuals between the ages of 31 and 40 years had 1.7 times the rate of injury/illness, and individuals between the ages of 61 and 70 years had 1.6 times the rate of injury/illness. Finally, individuals with no previous tour experience had 1.7 times the rate of injury/illness compared with individuals with tour experience.

CHARACTERISTICS OF INJURY AND ILLNESS

The most frequent diagnosis types were “acute injuries,” followed by “illness” and “overuse injuries,” at approximately 52, 36, and 12%, respectively (Table 2). The most common diagnosis among acute and overuse injuries was “superficial/contusions/abrasions” (n=68). The most common illness diagnosis was “infection” (n=40), with 60% of infection diagnoses recorded as

Table 2. Injury/Illness type (N=220)

Variable	All n (%)	Sex		Age (years)	
		Male	Female	<50	≥50
Injury type					
Acute injury	114 (51.8)	70	44	23	91
Superficial/Contusions/Abrasions	68 (30.9)	39	29	16	52
Sprains/Strains	20 (9.1)	13	7	6	14
Internal derangement of joint	9 (4.1)	5	4	0	9
Fractures	7 (3.2)	7	0	1	6
Open wounds	7 (3.2)	5	2	0	7
Internal organ	2 (0.9)	0	2	0	2
Blood vessels	1 (0.5)	1	0	0	1
Overuse injury	27 (12.3)	13	14	14	13
Patellofemoral syndrome	6 (2.7)	1	5	4	2
Iliotibial band syndrome (knee)	5 (2.3)	2	3	4	1
Achilles tendonitis	5 (2.3)	4	1	1	4
Rotator cuff tendonitis	2 (0.9)	2	0	0	2
Pes anserine bursitis (knee)	2 (0.9)	1	1	2	0
Other ^a	7 (3.2)	3	4	3	4
Illness	79 (35.9)	50	29	25	54
Infection	40 (18.2)	25	15	16	24
Medical	28 (12.7)	18	10	7	21
Environmental	11 (5.0)	7	4	2	9

^a “Other” includes Morton’s neuroma, synovitis (wrist), cervical radiculopathy, bursitis (knee), patellar tendonitis, tenosynovitis (ankle), and rhabdomyolysis.

“infection/inflammation of skin,” including sunburn. Detailed categories and descriptions within “illness” are presented in Table 3. For most general injury and illness types, male participants had a higher frequency of diagnosis than female participants, and individuals aged 50 years or older had a higher frequency than individuals younger than 50 years, although statistical significance was not observed.

A majority of acute and overuse injuries were observed in the lower extremities (71 of 141 [50.4%] diagnosed acute and overuse injuries) (Table 4). This pattern was also observed for both male and female participants and for individuals younger than 50 years and individuals 50 years or older.

TREATMENT RECEIVED

Of the total 220 unique diagnoses of injury or illness, 201 (91.4%) received at least 1 treatment, with a total of 490 treatments prescribed (Table 5). Of these, “rest, ice, compression, and/or elevation” was the most commonly prescribed treatment, followed by “change in medication” and “wound care/dressing.” Approximately 21% (n=102) of treatments consisted of a change of medication, such as new pharmaceutical prescriptions, recommendations for over-the-counter medication use (eg, nonsteroidal anti-inflammatories, allergy, cold), and

instructions to discontinue any current medications. Only 8% (n=41) of injuries/illnesses resulted in a recommendation to miss at least 1 day of riding, and only 3% (n=16) of treatments required an emergency department (ED) visit. A total of 37 (7.6%) treatments recommended either follow-up with a GOBA medical clinic physician during the ride (n=19) or the rider’s primary care physician (n=18) after the ride.

ADJUSTED ODDS RATIO—ODDS OF INJURY/ILLNESS

Adjusted odds ratios (Table 6) indicated that those individuals without previous GOBA tour experience were 1.8 times (95% CI 1.2–2.5) more likely to have an injury/illness compared with those with previous experience. All other demographic variables (year of participation, sex, age group, and place of residence) did not demonstrate statistically significant associations, suggesting that they had no meaningful influence on the odds of sustaining at least 1 injury and/or illness.

ADJUSTED ODDS RATIO—ODDS OF “ACUTE INJURY” VERSUS “OVERUSE INJURY/ILLNESS”

Adjusted odds ratios (Table 5) indicated that individuals 50 years or older were 2.5 times (95% CI 1.3–5.0)

Table 3. Detailed breakdown of illness type (N=79)

Illness	All	
	<i>n</i>	(%)
INFECTION	40	50.6
Infection, general		
Viral syndrome	1	1.3
Infection/Inflammation of skin		
Contact dermatitis	7	8.9
Cellulitis/Abcess	6	7.6
Sunburn	4	5.1
Folliculitis	3	3.8
Insect bite	2	2.5
Tinea (pedis, cruris)	1	1.3
Herpes simplex virus (cold sore)	1	1.3
Infection, head, eyes, ears, nose, and throat		
Conjunctivitis	8	10.1
Pharyngitis	3	3.8
Sinusitis	2	2.5
Otitis media	1	1.3
Upper respiratory infection	1	1.3
MEDICAL	28	35.4
Medical, general		
Generalized fatigue	2	2.5
Diabetes	1	1.3
Medical, cardiovascular		
Hypertension	1	1.3
Supraventricular tachycardia	1	1.3
Atrial fibrillation	1	1.3
Cardiac arrhythmia	1	1.3
Hypotension	1	1.3
Atypical chest pain	1	1.3
Medical, gastrointestinal		
Nausea/Vomiting	7	8.9
Gastroenteritis/Diarrhea	3	3.8
Abdominal pain	1	1.3
Hemorrhoids	1	1.3
Medical, genitourinary		
Urinary tract infection	2	2.5
Hematuria	1	1.3
Medical, neurological		
Headache (non-migranous)	2	2.5
Headache (migraine)	2	2.5
ENVIRONMENTAL	11	13.9
Dehydration	7	8.9
Heat exhaustion	4	5.1

more likely to sustain an acute injury versus overuse injury/illness compared with those younger than 50 years. Additionally, participants in 2013 were 3.0 times (95% CI 1.7–5.2) more likely to sustain an acute injury compared with those who participated in 2014. Sex, place of residence, and previous tour experience demonstrated no significant associations with acute injury versus overuse injury/illness,

Table 4. Acute and overuse injury site (N=141)

Injury site	<i>n</i>	%
Lower extremity	71	50.4
Upper extremity	31	22.0
Other, multiple, unspecified	21	14.9
Spinal cord and vertebral column	7	5.0
Head and neck	5	3.5
Torso	5	3.5
Systemwide	1	0.7
Total	141	100.0

suggesting that they had no meaningful influence on occurrence.

Discussion

Over the last 3 decades, there has been a paucity of data describing injuries and risk of injuries during multiday, recreational bicycle tours, despite the popularity of such events.^{4,5,7–10,15} Results of the current study show overall injury/illness rates for participation in GOBA during 2013 and 2014 were 55.3 and 54.6 per 1000 riders, respectively. Similar to other studies dating back to 1978,^{4–10} serious traumatic injuries were rare and there were no reported fatalities during the 2013 and 2014 GOBA. Our results suggest participation in GOBA is a safe form of recreational exercise for a wide range of ages, cycling experience levels, and for both male and female participants.

Although the literature on injuries during multiday recreational bicycle tours remains small, there is wide variation in the research approaches used in these studies, including study population and data collection methods. Although similar to GOBA in several aspects (number of participants and days ridden), Townes et al reported an injury rate of 116 per 1000 riders during a 6-day recreational tour,⁹ which was higher than the rate observed in GOBA. One possible explanation for the higher injury rate was that the rider population included many individuals who had a chronic disease or were HIV positive.⁹ Another study reported a very low incidence of injury during a week-long bicycle tour, with only 419 out of at least 50,000 total participants requiring on-site medical care, likely because of under-reporting due to the tour's medical system logistics.⁴ Our findings, along with those of others, suggest that direct comparison of injury rates across studies could be challenging because of the varying quantities and characteristics of the events and the differing methodology for data collection and injury rate reporting.^{4,5,7,8,10}

Table 5. Injury/Illness treatment, disposition, participant impact (N=490)

Variable	All	Sex		Age (years)	
	n (%)	Male	Female	<50	≥50
Treatment					
RICE	165 (33.7)	96	69	43	122
Change in medication	102 (20.8)	50	52	43	59
Wound care/DSG	69 (14.1)	41	28	18	51
Rehydration	29 (5.9)	19	10	8	21
Sunburn care	17 (3.5)	6	11	1	16
Laceration repair	2 (0.4)	2	0	0	2
Disposition					
Follow-up in GOBA medical clinic	19 (3.9)	14	5	3	16
Follow-up with primary physician	18 (3.7)	8	10	4	14
Emergency room	16 (3.3)	12	4	4	12
Participant impact					
Miss at least 1 day due to injury/illness	41 (8.4)	28	13	8	33
Other ^a	12 (2.5)	7	5	3	9
Total	490 (100.0)	283	207	135	355

RICE, rest, ice, compression, or elevation; DSG, dry sterile gauze; GOBA, Great Ohio Bicycle Adventure.

^a “Other” includes providing a diphtheria–tetanus booster, or instructing rider to apply heat or to follow a home exercise plan.

Consistent with previous study findings on the demographic composition of participants in mass event bicycling tours,^{5,6,8,10,21} we also found that the male to female ratio of participants in GOBA was 60:40. Although rider sex did not predict an increased risk of injury or illness in our study, previous research has reported that female sex was associated with greater risk

of injury and increased likelihood of requiring transport to the ED for injury.^{4,6,10} Additionally, the age of GOBA participants is similar to 1 study with a participant age range of 7 to 79 years,⁵ but with a higher mean age compared with those reported by other studies, which ranged from 23 to 41 years.^{6,8,10} Because prior studies were conducted on bicycling tours dating back 18 to

Table 6. Odds ratios of injury/illness, and acute injury

Variable	Injury/Illness “Yes” versus “No” (n=4005)		“Acute Injury” versus “Overuse Injury” and “Illness” (n=220)	
	Adjusted ^a odds ratio	95% CI	Adjusted ^a odds ratio	95% CI
Year of participation				
2013	1.0	0.7–1.3	3.0	1.7–5.2 ^b
2014	1	Reference	1	Reference
Sex				
Male	1.0	0.7–1.4	0.8	0.4–1.4
Female	1	Reference	1	Reference
Age group				
<50	1	Reference	1	Reference
≥50	1.2	0.8–1.7	2.5	1.3–5.0 ^b
State of residence				
Ohio	1.3	0.9–1.9	1.6	0.9–3.0
Other	1	Reference	1	Reference
Previous tour experience				
No	1.8	1.2–2.5 ^b	1.2	0.6–2.2
Yes	1	Reference	1	Reference

^a Adjusted for year, sex, age group, state, and previous tour experience.

^b Denotes significance.

38 years, our higher mean age may reflect the demographic makeup of the midwestern United States for the current era. Additionally, GOBA riders who were at least 50 years old had more than double the risk of acute injury (versus overuse injury or illness) compared with riders less than 50 years of age. This finding is supported by Boeke et al.,⁴ who reported that men 60 to 69 years of age were more likely to have an acute injury and require transport to an ED, but is contrary to other studies in which younger riders were at higher risk for injury.^{5,6} Older participants in our study might have been more susceptible to minor trauma from crashes or more willing to seek medical care from the GOBA clinic. Finally, our finding that lack of previous tour experience was a significant predictor for increased risk of overuse injury or illness is supported by previous study findings.⁵ Hence, additional education and preventive efforts should be directed toward first-time tour participants.

Interestingly, although there is no difference in the 2 tour years regarding risk of injury and/or illness, riders in GOBA 2013 were statistically more likely to sustain an acute injury, compared with overuse injuries and/or illness, than riders in GOBA 2014. This may be explained by the fact that the 2013 route posed less of a challenge to riders, as it featured a smaller elevation change compared with the 2014 course. Consequently, riders were more condensed within the flatter terrain in 2013 and thus more prone to crashes and collisions.¹⁹ Furthermore, weather conditions during the 2013 and 2014 GOBA tours were similar (average temperatures of 21°C and 22°C and average daily wind speeds of 6.2 and 5.0 mph, respectively), with the exception of the average daily heat indexes (21°C and 37°C, respectively).²² Weather conditions seemed to have minimal impact on heat illness, which was uncommon, with just 2 cases each year observed in our study; however, all mild dehydration cases treated in the medical clinic occurred during the warmer 2014 tour. Given the recreational nature of this ride, participants could participate at their own pace. Thus, riders had the ability to adjust their effort according to the terrain, their fitness, and the daily weather, thereby mitigating the risk for exertional heat illness.

Unlike prior studies that used EMS call records, EMS run reports, and postride surveys,^{5,8,10} our results were based on retrospective chart review from care delivered on site during the tour itself. The majority of riders who presented to our clinic required at least 1 intervention. Seventy-six percent of these interventions involved joint, wound, and skin care, and 8% necessitated missing at least 1 day of riding. Additional care included some type of rehydration, follow-up in the GOBA medical clinic and with their primary physician, and transport to a local

ED. By collecting detailed data from a large tour over 2 years, this study provides empirical data on the patterns of injury and illness sustained by modern-day tour riders and the interventions delivered to each injured and ill rider during a multiday, recreational bicycle tour. Our findings suggest that using standardized medical recordkeeping methods to document the frequency of injuries/illness and number of medical interventions required to care for riders is invaluable for event planning and staffing.

The low overall injury rates and low number of serious events observed in our study may have been lowered by several preventative interventions put into place before and during GOBA. Before the tour, riders received a series of 4 mailed newsletters containing education on proper cycling etiquette, proper hydration and nutrition, and the location of food and rest stops on the route. Riders also received advanced topographic data for each day of the ride so they could adjust their training and prepare their bikes with proper gearing for that year. During on-site registration the evening before the start of the ride, riders signed a safety pledge and were encouraged to view a safety video. Additionally, all riders were required to wear helmets during the tour. During the week of the ride, the daily weather conditions, route changes, and other pertinent safety information were delivered to riders through a centrally located information board and regularly updated at the campground's information center.

LIMITATIONS

This study has some limitations. First, data were from riders who voluntarily presented to the GOBA medical clinic for care. Thus, riders who used local EMS and/or other medical care resources or who performed self-care were not included. Second, our data were based on cyclists participating in a multiday tour in the midwestern United States, and a majority of riders were from this region. Therefore, results may not be generalizable to bicycle tours in other regions or to tours of different distance and time lengths. Third, because rider IDs were reassigned each year, there was no way to identify and link the riders who participated in both years. Additionally, although the vast majority of GOBA-registered riders participated on most days of the tour, riders participated "at will" and were not equipped with tracking or timing devices. Thus, we were unable to determine actual day-to-day participation or to calculate starting and finishing rates. Finally, it was not possible to determine injury risk as "injuries per 100,000 person miles" because GOBA offered 2 established "layover days," where riders had the option to ride a looped route

or not ride at all, resulting in all participants not cycling identical mileages.^{5,6,9}

IMPLICATIONS FOR FUTURE TOURS

The vast majority of recreational bicycle tours are organized and funded through nonprofit organizations with limited budgets. The results of this study may help organizers and medical directors allocate their precious resources to address the injuries/illnesses anticipated during their tours. More specifically, knowing the scope and breadth of expected injuries and illnesses will allow for proper staffing in terms of the desired medical expertise of the staff and the needed emergency medical resources (including selection of proper type and amount of medical supplies). Finally, during the pretour planning stage, intimate knowledge of the nuances of the route will allow for specific preventative efforts from tour organizers and medical staff to educate and warn riders of road hazards or dangerous descents.

Conclusions

Our results indicated that multiday recreational bicycle tours are a safe form of physical activity for a wide age range of participants. This study contributes to the knowledge of demographic characteristics of tour participants, most common injuries and illness, injury rates, risk factors, and the typical treatments in the existing literature. With knowledge of the types of and risks for injury/illness during multiday, recreational bicycle tours, tour organizers and medical providers can develop more effective prevention strategies during pretour planning and improve delivery of health services during a given tour.

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