Profiling Cycling Trauma throughout the Body with and Without Helmet Usage in a Large United States Health-care Network

Shanna Elizabeth Williams, Laura Cook, Tyler Goff, Reema Kashif, Rachel Nelson, Melissa Janse
Department of Biomedical Sciences, University of South Carolina School of Medicine Greenville, Department of Emergency Medicine, Greenville Health System, Greenville, SC, USA

Abstract

Background: This study aimed to characterize bodily injury patterns associated with helmet usage by comparing trauma sustained by helmeted and helmetless cyclists admitted to a large US health-care system. Materials and Methods: A prospective trauma registry associated with a large regional United States health-care network was queried for bicycle injuries resulting in hospital admission over a 5-year period. Data pertaining to helmet usage, demographics, injury description (s), Abbreviated Injury Scale score, Injury Severity Score, and hospital length of stay were collected from 140 patients treated for bicycle-related injuries. Mann–Whitney tests were performed. Results: Fifty-six of the injured cyclists were helmeted (40%) and 84 were not helmeted (60%). A significantly greater proportion of helmeted cyclists exhibited abrasions and a higher incidence of injury across all injury types ($P < 0.001$ and 0.003). The number and severity of injury to the external body ($P < 0.001$ and 0.001) and overall injury severity ($P = 0.004$) for patients with multiple injuries were also significantly greater among helmeted cyclists. Helmeted cyclists did demonstrate significantly shorter hospital stays ($P = 0.021$). Conclusion: While the helmeted and helmetless riders admitted to the emergency department exhibit few differences in injury patterns, when significant injury differences were detected, they were more prevalent in helmeted riders. These differences were represented by minor-to-moderate injuries relative to morbidity and mortality, suggesting that the trauma profile of the helmeted and helmetless riders is relatively comparable. Yet, helmetless wearers did have significantly longer hospital stays, which may indicate underlying health disparities and/or behavioral differences.

Keywords: Bicycle trauma, cycling, helmet, trauma registry

INTRODUCTION

Over the past several decades, cycling has become an increasingly popular activity, providing numerous health benefits. As cycling participation grows, safe practices should be encouraged and promoted. While extensive research cites the benefits of helmet usage in reducing head trauma, evidence regarding whether this benefit also results in fewer and/or less severe postcranial injuries compared to helmetless cyclists is limited.[1-5] To address this topic, various bicycling injuries by type, region, severity, and length of hospital stay were examined in helmeted and helmetless cyclists admitted to emergency departments (EDs) associated with a US health-care network.

MATERIALS AND METHODS

A retrospective study was performed on 140 injured bicyclists admitted to seven emergency centers within the Greenville Health System (GHS), which is among the largest regional health-care networks in the Southeast United States and is based in Greenville, South Carolina. GHS has eight inpatient locations. Seven of these hospitals have emergency centers. Of these seven emergency centers, one is a Level 1 trauma center, whereas the other six are not ranked.[6] This system serves metropolitan (Greenville–Anderson–Mauldin Metro Area) and micropolitan (Oconee County) statistical areas located within the westernmost part of South Carolina. Greenville-Anderson-Mauldin Metro Area has a population of 884,975 people with a median household income of $50,644.

Address for correspondence: Prof. Shanna Elizabeth Williams, Department of Biomedical Sciences, University of South Carolina School of Medicine Greenville, 607 Grove Road, Greenville, SC 29605, USA.
E-mail: will3992@greenvillemed.sc.edu

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The median age is 38.5 years and the population is 73% European American, 16.4% African American, and 6.69% Hispanic. Oconee County, meanwhile, has a population of 75,375 people, of which 85.2% is European American, 7.29% is African American, and 4.91% is Hispanic. The median age of the county is 44.9 years and the median household income is $41,818. Both of these areas are represented by pockets of urban development surrounded by rural communities. All cases of injured adult bicyclists were identified through an electronic search of the GHS Trauma Registry. This database is used to archive medical and demographic data related to patients admitted to GHS. Access to the database was granted by the GHS Institutional Review Board (Pro00035945). Patients over the age of 18 years admitted to GHS between January 2010 and December 2014 for cycling-related trauma were included within the study. Information relative to the patients’ mode of hospital arrival (i.e., ambulance, helicopter, and power-operated vehicle) was not available.

Demographic data extracted from the registry included race, gender, and age. Patients under the age of 18 years were excluded from the study as Abbreviated Injury Scale (AIS) and Injury Severity Score (ISS) perform differently in pediatric trauma patients compared to adult patients. Given the wide range of ages represented within the sample, patients were grouped into young adult (18–34 years), middle age (35–54 years), and older adult (≥55 years) for descriptive purposes, based on age categorizations from the literature. Racial designations, as outlined by the Office of Management and Budget guidelines, included European American, African American, American Indian, Asian, or others.

Patient injury information extracted from the trauma registry included injury description(s), AIS scores for six body regions, ISS, hospital length of stay (LOS), and mortality. Given the volume and diversity of injuries, the cyclists presented with patient injuries were grouped into one of 12 categories: laceration, amputation, concussion, contusion, spinal cord injury, herniation, hematoma, internal organ injury, muscular tear, fracture, abrasion, and dislocation. Once categorized, the injuries were sorted into one of six body regions: head and neck, face, chest, abdomen, extremities (including pelvic girdle), and external body to align with regional AIS scoring parameters and to allow comparison of regional injury frequency with severity. Using parameters laid out by Bolorunduro et al., ISS was categorized as mild (<9), moderate (9–15), severe (16–24), and profound (≥25) to allow for descriptive comparison of the severity of trauma between the helmeted and helmetless cyclists.

Univariate statistical analyses were conducted with the statistical software package SPSS version 22.0 (IBM, New York, USA). Helmet usage was treated as an independent variable, whereas injury patterns and hospital LOS were treated as dependent variables. As the data did not fit a normal distribution, Mann–Whitney nonparametric tests were performed relative to helmet usage. Statistical significance (α) was set at 0.05.

**RESULTS**

The research population was predominantly male (male = 109; female = 31) and European American (n = 110). The non-European American component of the population consisted of African American (n = 22), American Indian (n = 1), Asian (n = 1), and others (n = 6). The vast majority of helmeted cyclists were European American (94%) and male (77%). A similar pattern was seen among the helmetless group (i.e., 68% – European American; 79% – male) [Table 1]. Within the three age groups, the greatest percentage of helmeted cyclists were ≥55 years (50%), whereas the greatest percentage of helmetless cyclists were 35–54 years (42%) [Table 1]. Based on ISS ranges, trauma severity was comparable between the two groups. When comparing the helmeted group to the helmetless group, the trauma ranges were as follows: mild trauma, 36% versus 33%; moderate trauma, 41% versus 40%; severe trauma, 18% versus 16%; and profound trauma, 5% versus 10%. The trauma mortality rate was 4% in the helmeted group and 6% in the helmetless group [Table 1].

Of the 140 bicyclists admitted to GHS over a 5-year interval, the helmeted-to-helmetless ratio is 1:1.5. Injury prevalence results by type, region, and severity for these two groups are provided in Tables 2 and 3. Continuous variable data within group are presented as mean ± standard deviation (SD), whereas descriptive data are characterized using number and percentage. Of the 12 injury types, 8 were present in at least 10% of the helmeted and helmetless patients. A greater

**Table 1: Demographic, injury severity score ranges, and mortality differences in helmet usage**

| Category | Helmet (n=56), n (%) | No helmet (n=84), n (%) |
|----------|---------------------|-----------------------|
| **Race** |                     |                       |
| European American | 53 (94) | 57 (68) |
| African American | 0 | 22 (26) |
| American Indian | 1 (2) | 0 |
| Asian | 1 (2) | 0 |
| Other race | 1 (2) | 5 (6) |
| **Gender** |                     |                       |
| Female | 13 (23) | 18 (21) |
| Male | 43 (77) | 66 (79) |
| **Age** |                     |                       |
| 18-34 | 6 (11) | 16 (20) |
| 35-54 | 22 (39) | 35 (42) |
| ≥55 | 28 (50) | 31 (38) |
| **ISS ranges** |                     |                       |
| Mild (<9) | 20 (36) | 28 (33) |
| Moderate (9-15) | 23 (41) | 34 (40) |
| Severe (16-24) | 10 (18) | 14 (16) |
| Profound (≥25) | 3 (5) | 9 (10) |
| Mortality | 2 (4) | 5 (6) |

ISS: Injury Severity Score
Table 2: Cyclist injury prevalence with helmet usage

| Injury type         | Helmet (n=56), n (%) | No helmet (n=84), n (%) | P     |
|---------------------|----------------------|-------------------------|-------|
| Lacerations         | 20 (36)              | 25 (30)                 | 0.376 |
| Amputations         | 0                    | 1 (1)                   | 0.417 |
| Concussions         | 24 (43)              | 25 (30)                 | 0.102 |
| Contusions          | 16 (29)              | 20 (24)                 | 0.285 |
| Spinal cord injury  | 3 (5)                | 4 (5)                   | 0.862 |
| Herniation          | 2 (4)                | 3 (4)                   | 0.671 |
| Hematoma            | 17 (30)              | 29 (35)                 | 0.498 |
| Internal organ injury| 10 (18)             | 18 (21)                 | 0.562 |
| Muscular tear       | 1 (2)                | 3 (4)                   | 0.368 |
| Fracture            | 44 (79)              | 69 (82)                 | 0.413 |
| Abrasions           | 42 (75)              | 47 (56)                 | <0.001 |
| Dislocations        | 5 (9)                | 3 (4)                   | 0.883 |
| Total injuries      | 56 (100)             | 84 (100)                | 0.003*|

Injury values represent number of cyclists presenting with one or more of injury type and percentage of within-group injury type; *P<0.05

Table 3: Cyclist regional injuries and outcomes with helmet usage

| Injuries and outcomes          | Helmet (n=56) | No helmet (n=84) | P     |
|--------------------------------|---------------|------------------|-------|
| Head and neck                  |               |                  |       |
| Injuries, n (%)                | 38 (68)       | 49 (58)          | 0.638 |
| AIS, x±SD                      | 3±1.0         | 3±1.3            | 0.963 |
| Face                           |               |                  |       |
| Injuries, n (%)                | 5 (9)         | 12 (14)          | 0.387 |
| AIS, x±SD                      | 2±0.5         | 2±0.6            | 0.207 |
| Chest                          |               |                  |       |
| Injuries, n (%)                | 27 (48)       | 38 (45)          | 0.454 |
| AIS, x±SD                      | 2±0.7         | 2±0.7            | 0.699 |
| Abdomen/pelvic contents        |               |                  |       |
| Injuries, n (%)                | 7 (13)        | 5 (6)            | 0.184 |
| AIS, x±SD                      | 2±0.5         | 2±0.4            | 0.997 |
| Extremities/pelvic girdle      |               |                  |       |
| Injuries, n (%)                | 20 (36)       | 34 (40)          | 0.571 |
| AIS, x±SD                      | 2±0.5         | 2±0.5            | 0.980 |
| External                       |               |                  |       |
| Injuries, n (%)                | 50 (89)       | 58 (69)          | <0.001*|
| AIS, x±SD                      | 1±0.2         | 1±0.0            | 0.001*|
| ISS, x±SD                      | 12±7.5        | 12±8.2           | 0.004*|
| Hospital LOS, x±SD (days)      | 3±3.5         | 7±9              | 0.021*|

AIS: Abbreviated injury score; ISS: Injury severity score; LOS: Length of stay

proportion of helmeted cyclists presented with one or more laceration, concussion, contusion, and abrasion injury, whereas a greater proportion of helmetless cyclists were diagnosed with hematomas, internal organ injuries, and fractures. However, only abrasions and total number of injuries significantly differed in prevalence with more helmeted cyclists than helmetless cyclists exhibiting these injuries [Table 2].

When examined in terms of anatomical region, more helmeted cyclists exhibited trauma by region than helmetless cyclists, with the exception of facial injuries and extremities/pelvic girdle injuries, which were more frequently found among helmetless cyclists [Table 3]. However, only the prevalence and severity of injuries to the external body (i.e., abrasions, contusions, lacerations, and hematomas) significantly differed between the two groups. These injuries were concentrated to the upper and lower extremities. Significant group differences were also noted in ISS [Table 3]. In all of these instances, a greater proportion of helmeted cyclists exhibited more severe or prevalent injuries than helmetless cyclists. While the mean and SDs for injury severity in these two categories are relatively comparable in each group (i.e., within-group variance), variance between the groups accounts for this significant difference in severity [Table 3]. In addition, hospital LOS was significantly longer for helmetless cyclists. Average LOS for helmetless cyclists at the time of injury was 7 days, whereas helmeted cyclists had an average LOS of 3 days [Table 3].

**Discussion**

While extensive literature suggests that helmet usage reduces the risk of head injuries in bicycle-related accidents, exploration of the relationship between the safety conscious choice to wear a helmet and bicycling injuries to the rest of the body is limited.[1-5] This study expands upon this topic by comparing helmeted and helmetless cyclists admitted to EDs associated with a large health-care network by injury type, region, severity, and hospital LOS. The overall trauma profile between these two groups was relatively similar in terms of injury prevalence and severity. A few differences, however, were found. Specifically, a significantly greater proportion of helmeted cyclists experienced abrasions to their body and a higher incidence of overall injuries. When cycling trauma is explored by the body region, significantly more helmeted cyclists presented with (1) a greater number of injuries, (2) more severe external injuries, and (3) more severe overall injuries. Yet, these differences were related to injuries which constitute minor-to-moderate trauma. Indeed, while ISS was significantly greater in helmeted riders, the average score for this group (n = 12) is below the threshold (n > 15) to be categorized as major trauma.[18] The results noted in this study differ somewhat from Zibung et al. analysis of trauma patterns in cyclists admitted to a Swedish trauma center.[5] The authors found a greater risk of limb injury among helmeted cyclists but a decreased risk of head and facial injuries compared to helmetless cyclists. However, it should be noted that their injury groupings differ to some extent from the categories used in this study and thus are not entirely comparable.[5]

Another potential explanation for these findings may be behavioral in nature. More specifically, risk compensation theory posits that cyclists wearing helmets engage in riskier behavior because of an increased sense of protection, thereby negating the protection afforded by the helmet.[19,20] Research directly examining this phenomenon has shown both increased heart rate and cycling speed among helmeted riders.[21-23] Thus, while this study found bodily injury prevalence and severity...
to be fairly comparable with and without helmet use, the confidence which comes with helmet usage may lead to riskier behavior which increases the amount and severity of external damage to the body associated with a cycling accident. This is speculative as the design of this study evaluates cycling outcomes, as opposed to directly evaluating cycling behavior. However, the possible link between cyclist behavior and injury patterns warrants further investigation.

Finally, this study found helmet usage to be significantly associated with a shortened LOS in the hospital. The average LOS for helmeted cyclists was almost 3 days shorter than helmetless riders. This difference equates to a 45% reduction in hospital stay length. No such findings were noted by Zibung et al.[23] However, again, methodological and data incompatibility between these two studies could explain these differences. It is possible that the shorter LOS among helmeted cyclists is a consequence of safety conscious behavior, wherein helmeted cyclists are more likely to seek medical attention for less serious injuries. Alternatively, the current findings may be moderated by demographic differences linked to helmet usage. Previous research utilizing this study population found significant racial differences in helmet usage, wherein non-European American cyclists (i.e., combined minority groups) were significantly less likely to be wearing a helmet at the time of injury than European American cyclists.[23] To explore the potential influence of racial status on hospital LOS, the study population was separated into European American and non-European American groups and additional Mann-Whitney nonparametric tests were performed. LOS was found to be significantly greater among the non-European American cyclists ($P = 0.026$). This could suggest that being a non-European American, helmetless cyclist is associated with significantly extended hospital LOS. Greater LOS among non-European American patients has been noted elsewhere in the literature relative to such procedures as pancreateoduodenectomy, knee or hip arthroplasty, and laminectomy and/or fusion spine surgery.[24-26] Attempts to explain this variability in LOS relative to race/ethnicity have been multifactorial in nature. For instance, Rooks et al. noted that African American and Hispanic patients were more likely to be affected by chronic medical comorbidities, whereas Schneider et al. found that patients with more comorbid illness were more likely to have longer LOS.[24,27-29] Furthermore, Lad et al. noted that African American patients were more likely to experience postoperative complications with spinal surgery than European Americans, which could also lead to prolonged hospital LOS.[30] Unfortunately, medical histories were not available for this patient population to evaluate these factors. Further research including such variables could shed further light on this issue.

**Limitations**

This study does, however, have several limitations. A cause-and-effect relationship between helmet usage and trauma patterns cannot be explicitly established with this research, given its retrospective nature. Moreover, this study examines injuries globally and does not define the type of cycling activity which may have precipitated the injuries produced. Information pertaining to type of crash (single vehicle vs. collision), experience level (i.e., professional vs. recreational cyclist), cycling frequency, alcohol use, type of bicycle ridden (mountain, road, or cruiser bike), and the presence of additional protective equipment (e.g., kneepads) was not available for this study and could serve as contributing factors to the patterns seen within. While gathering data from a single community controlled for informational bias and minimized heterogeneity in the cycling terrain and community cycling culture experienced by the research participants, it also constrained the sample size and ability to speak to regional and national injury trends. Expanding on this research by extracting similar data from the National Electronic Injury Surveillance System would allow researchers to broaden this analysis moving forward.

**Conclusion**

Using trauma registry data associated with a large US health-care network, the effect of helmet usage on the trauma profile of cyclists admitted to the ED was analyzed. Helmet usage was found to be associated with an increased risk of minor-to-moderate trauma but decreased overall length of hospital stay. This study advances clinical awareness of cycling trauma profiles throughout the body, as well as possible readmission conditions which might influence hospital LOS. However, additional studies are necessary to further tease out potential biological, social demographic, and/or behavioral factors which may be contributing to these findings.

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**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Amoros E, Chiron M, Martin JL, Thélot B, Laumon B. Bicycle helmet wearing and the risk of head, face, and neck injury: A French case – Control study based on a road trauma registry. Inj Prev 2012;18:27-32.
2. Bambach MR, Mitchell RJ, Grzebieta RH, Olivier J. The effectiveness of helmets in bicycle collisions with motor vehicles: A case-control study. Accid Anal Prev 2013;53:78-88.
3. Castle SL, Burke RV, Arbogast H, Upperman JS. Bicycle helmet legislation and injury patterns in trauma patients under age 18. J Surg Res 2012;173:327-31.
4. Sethi M, Heidenberg J, Wall SP, Ayong-Choo P, Slaughter D, Levine DA, et al. Bicycle helmets are highly protective against traumatic brain injury within a dense urban setting. Injury 2015;46:2483-90.
5. Zibung E, Riddez L, Nordenwall C. Helmet use in bicycle trauma patients: A population-based study. Eur J Trauma Emerg Surg 2015;41:517-21.
6. S.C. Trauma System. Columbia (SC): South Carolina Department of Health and Environmental Control; c2018.Available from: https://www.scdhec.gov/health-professionals/sc-trauma-system. [Last accessed on 2018 Nov 10].

7. Greenville-Anderson-Mauldin, SC Metro Area. Cambridge (MA): Data USA; c2018. Available from: https://www.datausa.io/profile/geo/greenville-Anderson-mauldin-easley-sc-metro-area/. [Last accessed on 2018 Nov 10].

8. Oconee County, SC. Cambridge (MA): Data USA; c2018. Available from: https://www.datausa.io/profile/geo/oconee-county-sc/. [Last accessed on 2018 Nov 10].

9. South Carolina-Rural Definitions: State-Level Maps – USDA ERS. Washington (DC): United States Department of Agriculture Economic Research Service; c2018. Available from: https://www.ers.usda.gov/webdocs/DataFiles/53180/25595_SC.pdf?v=0. [Last accessed on 2018 Nov 10].

10. Brown JB, Gestring ML, Leeper CM, Sperry JL, Petitzman AB, Billiar TR, et al. The value of the injury severity score in pediatric trauma: Time for a new definition of severe injury? J Trauma Acute Care Surg 2017;82:995‑1001.

11. Dill J, McNeil N. Four types of cyclists? Examination of typology for better understanding of bicycling behavior and potential. Transp Res Rec 2013;2387:129‑38.

12. Reis RS, Hino AA, Parra DC, Hallal PC, Browson RC. Bicycling and walking for transportation in three Brazilian cities. Am J Prev Med 2013;44:e9‑17.

13. Thai KT, McIntosh AS, Pang TY. Bicycle helmet size, adjustment, and stability. Traffic Inj Prev 2015;16:268‑75.

14. Office of Management and Budget. Revisions to the Standards for the Classification of Federal Data on Race and Ethnicity; 1997. Available from: https://www.whitehouse.gov/omb/fedreg_1997standards. [Last accessed on 2017 Aug 07].

15. States JD. The abbreviated and the comprehensive research injury scales. STAPP Car Crash Journal. New York: Society of Automotive Engineers, Inc.; 1968.

16. Bolorunduro OB, Villegas C, Oyetunji TA, Hauft ER, Stevens KA, Chang DC, et al. Validating the injury severity score (ISS) in different populations: ISS predicts mortality better among hispanics and females. J Surg Res 2011;166:40‑4.

17. IBM Corp. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp; 2013.

18. Copes WS, Champion HR, Sacco WJ, Lawnick MM, Keast SL, Bain LW. The injury severity score revisited. J Trauma 1988;28:69‑77.

19. Hedlund J. Risky business: Safety regulations, risks compensation, and individual behavior. Inj Prev 2000;6:82‑90.

20. Gamble T, Walker I. Wearing a bicycle helmet can increase risk taking and sensation seeking in adults. Psychol Sci 2016;27:289‑94.

21. Phillips RO, Fyhri A, Sagberg F. Risk compensation and bicycle helmets. Risk Anal 2011;31:1187‑95.

22. Messiah A, Constant A, Contrand B, Felonionn ML, Lagarde E. Risk compensation: A male phenomenon? Results from a controlled intervention trial promoting helmet use among cyclists. Am J Public Health 2012;102 Suppl 2:S204‑6.

23. Williams SE, Nelson R, Kashif R, Goff T, Simon L, Janse M. Demographic variation in the injury patterns of adult cyclists admitted to a large US healthcare network: A five-year review. Trauma 2017; https://doi.org/10.1177/1460408617740903.

24. Schneider EB, Calkins KL, Weiss MJ, Herman JM, Wolfgang CL, Makary MA, et al. Race‑based differences in length of stay among patients undergoing pancreatectoduodenectomy. Surgery 2014;156:528‑37.

25. Ibrahim SA, Stone RA, Cohen PZ, Henderson WG, Khuri SF, Kwoh CK. Race, ethnicity and length of hospital stay after knee or hip arthroplasty. Curr Orthop Pract 2008;19:556‑63.

26. Seicean A, Seicean S, Neuhauser D, Benzel EC, Weil RJ. The influence of race on short‑term outcomes after laminectomy and/or fusion spine surgery. Spine (Phila Pa 1976) 2017;42:54‑41.

27. Rooks RN, Simonsick EM, Klesges LM, Newman AB, Ayonayon HN, Harris TB. Racial disparities in health care access and cardiovascular disease indicators in black and white older adults in the health ABC study. J Aging Health 2008;20:599‑614.

28. Davis AM, Vinci LM, Okwuosa TM, Chase AR, Huang ES. Cardiovascular health disparities: A systematic review of health care interventions. Med Care Res Rev 2007;64:295‑100S.

29. McWilliams JM, Meara E, Zaslavsky AM, Ayanian JZ. Differences in control of cardiovascular disease and diabetes by race, ethnicity, and education: U.S. Trends from 1999 to 2006 and effects of medicare coverage. Ann Intern Med 2009;150:505‑15.

30. Lad SP, Bagley JH, Kenney KT, Ugiliweneza B, Kong M, Bagley CA, et al. Racial disparities in outcomes of spinal surgery for lumbar stenosis. Spine (Phila Pa 1976) 2013;38:927‑35.