Inequalities in the use of helmets by race and payer status among pediatric cyclists

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Background. *Despite nationwide campaigns to increase the use of helmets among pediatric cyclists, many children continue to be injured while riding without a helmet. To determine where programs and policies intended to promote helmet use should be directed, we surveyed a large national dataset to identify variables associated with helmet use.*

Methods. *The National Trauma Data Bank was queried during the years 2007, 2010, and 2011 for children younger than the age of 16 years who were involved in a bicycle accident. Children were grouped based on whether they had a helmet on during the accident. A multivariable logistic mixed-effects model was utilized to determine factors associated with helmet use.*

Results. *Of the 7,678 children included in the analysis, 1,695 (22.1%) were wearing a helmet during their accident. On unadjusted analysis, nonhelmeted riders were more likely to be older (median age 11 years vs 10 years, P < .001), black (10.1% vs 3.7%, P < .001) or insured by Medicaid (32.8% vs 14.3%, P < .001). After adjustment, black children were still less likely to have had worn a helmet compared with white children (adjusted odds ratio 0.38, 95% confidence interval 0.28–0.50). Children on Medicaid were also less likely to have been wearing a helmet compared to children with private insurance (adjusted odds ratio 0.33, 95% confidence interval 0.28–0.39).*

Conclusion. *Children who are black or who are on Medicaid are less likely to be wearing a helmet when involved in a bicycle accident than white children or children with private insurance, respectively. Future efforts to promote helmet use should be directed towards these groups. (Surgery 2015;158:556-61.)*

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CYCLING IS A POPULAR SPORT ENJOYED BY CHILDREN AND ADULTS ALIKE as a form of recreation and aerobic exercise; however, there are also substantial associated safety risks.[1] In the United States, more than 3 million people a year are treated in emergency departments for cycling related injuries, and more than 300 children die each year in cycling related accidents.[2-4] The majority of cycling deaths are related to traumatic head injuries, and a number of population and case-control studies have demonstrated that helmet use reduces the risk of head injury and mortality following a cycling accident.[5-9] As a result, many states have passed laws requiring children younger than the age of 18 to wear helmets while cycling.[1] Nevertheless, despite high-quality evidence supporting the practice of wearing helmets and laws necessitating their use, less than a quarter of children wear a helmet while riding a bicycle.[10,11]

To direct programs and policies intended to promote helmet use among children, it is important to determine which children are at greater risk for not wearing a helmet while cycling. Previous studies have demonstrated disparities in the use of protective devices based on race or socioeconomic status, such as reduced use of child passenger restraints and seat belts among minorities and people of lower socioeconomic status.[12,13] In addition, several reports have demonstrated disparities by race and socioeconomic status in the use of helmets while cycling, although these studies have been limited to single states or locations.[13,14] In an effort to guide future programs and policies for the targeted promotion of helmet

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use among children, we performed a review of the National Trauma Data Bank (NTDB) to determine whether there were racial, socioeconomic, or other demographic disparities in the use of helmets among children who are injured in bicycle accidents on a national level.

METHODS

National Trauma Data Bank. The NTDB is a data repository managed by the American College of Surgeons.[15] More than 2.7 million trauma cases from more than 900 participating trauma centers are included in the NTDB. Variables in the NTDB include patient characteristics, trauma characteristics, initial hospital evaluation, procedures and diagnoses, and short-term outcomes.[15] The NTDB supplies data in a deidentified fashion to participating trauma centers for research purposes.

Patient population. The NTDB research data sets from 2007, 2010, and 2011 were queried for children younger than 16 years of age who were involved in a bicycle accident. The analysis was limited to these years because data on helmet use were available. Children were excluded if their helmet status was unknown or if they were transferred to another hospital. Institutional review board exemption status was obtained before analysis.

Outcome variables and statistical analysis. Children were grouped on the basis of their helmet use. Groups were compared with regard to patient demographics, hospital characteristics, injury characteristics, and outcomes including hospital length of stay and hospital disposition. Continuous variables were compared using the Kruskal-Wallis test. Categorical variables were compared using Fisher's exact test or the χ^2 test. Helmet use by age and by center were plotted to demonstrate the variance of helmet use by each of these variables. For the Figure 1 demonstrating center variation in helmet use, only centers reporting 5 or more patients during the study period were included.

A multivariable logistic mixed-effects model was utilized to determine significant predictors of helmet use. To account for hospital level clustering, a random intercept was included in the model for each hospital. Other predictors included in the model were age, sex, race, region, payer status, and year of presentation to the emergency department. Missing data were considered to be missing at random, and therefore children with unknown predictors were excluded from the model. All continuous variables were tested for linearity before insertion in the model and categorized into groups in the event of nonlinearity. A sensitivity analysis
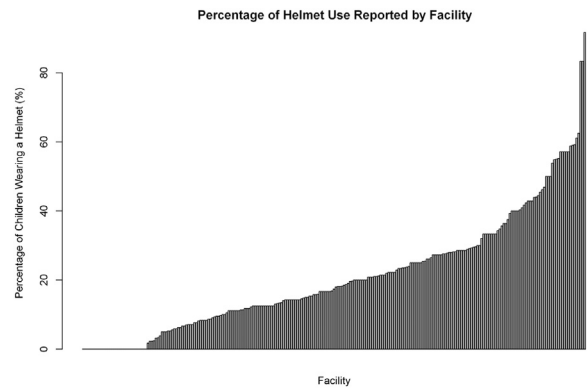

Fig 1. Variation in helmet use by the 249 facilities that reported at least 5 children's helmet status during their bicycle accident.

excluding centers who reported less than 2.5% or greater than 97.5% helmet use was performed to remove centers that may not be reporting helmet use properly. All statistical analyses were performed with R version 3.1.0 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

There were 11,956 children younger than the age of 16 identified as being involved in a cycling accident in the NTDB during the study period. Of these, 3,816 were excluded for unknown helmet status, and 462 were excluded for being transferred to another acute hospital. Of the remaining 7,678 children who met study criteria, 1,695 (22.1%) were wearing a helmet at the time of their bicycle accident. The median age of the study cohort was 11 years (interquartile range 7, 13), and nonhelmeted children were slightly older than helmeted children (11 vs 10 years, $P < .001$, Table I). The proportion of children who were female was 22.7% ($n = 1,741$) in the overall cohort and was not substantially different between the nonhelmeted and helmeted subgroups (22.8% vs 22.4%, respectively). Differences existed between nonhelmeted and helmeted children with respect to race, region, and insurance status. Specifically, nonhelmeted children were more likely to be from a minority racial group, come from the Midwest or South as opposed to the Northeast or West regions, and were less likely to have private insurance.

The relationship of cycling injury and age was specifically evaluated to determine how helmet use varied by age (Fig 2). We found that the number of children involved in bicycle accidents increased with age before peaking at age 13 and decreasing thereafter. Although the number of children