Estimated prevalence of helmet use while bicycling, rollerblading, and skateboarding among middle school students in selected U.S. States—Youth Behavior Risk Survey, 2013–2019

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Abstract

Background: Helmet use helps prevent severe and fatal head and brain injuries from bicycle, rollerblade, and skateboard crashes. This study explores the prevalence of self-reported helmet use among middle school students while bicycling, skateboarding, and rollerblading.

Methods: Data from the Middle School Youth Risk Behavior Survey (YRBS) for selected states were analyzed. Self-reported prevalence (frequency) of helmet use while bicycling, rollerblading, or skateboarding and other variables (sex, grade level, and race/ethnicity) are reported.

Results: The overall prevalence of rarely or never wearing a helmet while bicycling among middle school students in selected states was 68.6%; decreasing from 71.7% in 2013 to 67.1% in 2019. The overall prevalence of rarely or never wearing a helmet while rollerblading or skateboarding in middle school students in selected states was 74.6%; decreasing from 76.4% in 2013 to 73.5% in 2019. Students in 7th and 8th grade and students of non-Hispanic race/ethnicity had significantly higher odds of rarely or never wearing a helmet while bicycling or while rollerblading and skateboarding than students in 6th grade and non-Hispanic White students.

Conclusions: While helmet use among middle school students improved over time, overall helmet use during bicycling, rollerblading, and skateboarding remained low. These estimates illustrate the continued call for universal implementation of helmet use efforts among kids using established strategies.

Practical Applications: Future research on helmet use among youth who rollerblade and skateboard, as well as multi-pronged efforts to promote helmet use among middle schoolers

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who bicycle, skateboard, and rollerblade (inclusive of education, helmet distribution, and social marketing techniques, as well as the provision of helmets at no-cost) may be beneficial for addressing perceived risks for injury and other barriers.

Keywords

Brain injury; Head injury; TBI; Concussion; Skull fracture

1. Introduction

Millions of youth across the United States regularly bike, participate in roller sports (such as rollerblading), and/or skateboard (The Aspen Institute, 2019). Sports and recreational activities such as these yield multiple positive benefits for youth, especially their physical and mental health (Marquez et al., 2020). However, in part due to the potential for high velocity falls and collisions with motor vehicles, participation in bicycling, rollerblading, and skateboarding also increases the risk for injuries (National Transportation Safety Board, 2019; Thompson, Rivara, & Thompson, 2000; Zalavras, Nikolopoulou, Essin, Manjra, & Zionts, 2005). Most severe and fatal injuries to bicyclists, rollerbladers, and skateboarders result from injuries to the upper extremities, head, and brain, including traumatic brain injuries (TBIs) (Thompson et al., 2000; Tominaga, Schaffer, Dandan, Coufal, & Kraus, 2015; Zalavras et al., 2005).

A TBI is caused by a penetrating injury or a bump, blow, or jolt to the head, face, neck, or body that transmits significant force to the brain, causing it to shift or twist inside the skull. This injury may lead to short- or long-term emotional, physiologic, behavioral, and cognitive sequelae in children (Lumba-Brown et al., 2018). Late elementary and middle school age youth (ages 10 to 14 years) have the highest number of emergency department visits for sports- and recreation-related TBIs (Sarmiento et al., 2019). A prior report found that bicycling, roller sports, and skateboarding were associated with an average of approximately 35,000 emergency department visits each year for TBIs among youth over a 7-year period (Sarmiento et al., 2019). In this same report, bicycling alone had the second highest number of emergency department visits for sports- and recreation-related TBIs among males ages 0 to 17 years, exceeded only by American football (Sarmiento et al., 2019).

Although most skate parks and recreational centers across the country require rollerbladers and skateboarders to wear a helmet outside of designated skateparks or centers (e.g., streets, public parks, or other public spaces), only approximately a quarter of states have such requirements. When helmets are worn consistently and correctly during bicycling, rollerblading, and skateboarding, they substantially decrease the likelihood of admission to the hospital (Ganti et al., 2013; Ong, Soundappan, Adams, & Adams, 2018), as well as serious and fatal head injuries (Hoye, 2018a), injuries to the mid and upper face (Thompson et al., 2000), skull fractures (Olivier & Creighton, 2017), and for TBIs more generally (Hoye, 2018a; Williams, Weston, Feinglass, & Crandall, 2018). Specifically, one study (Hoye, 2018a) found that use of bicycle helmets decreased head injury by 48%, serious head injury by 60%, traumatic brain injury by 53%, face injury by 23%, and death or serious injury by 34%. Beginning in the late 1980s (Centers for Disease Control and Prevention

[CDC], 2015), several states and cities have promoted helmet safety for bicyclists, including passaging helmet laws for children. Currently, only 21 states and the District of Columbia have laws on bicycle helmet use, but these laws solely focus on bicycle helmet use among children (Governors Highway Safety Association, 2022). The other 29 states have no helmet law for bicyclists of any age (Governors Highway Safety Association, 2022).

To better understand helmet usage among middle school students and help inform strategies to address helmet usage, this study used data from the Middle School Youth Risk Behavior Surveys (YRBS) conducted in select states to estimate the prevalence of self-reported helmet use while bicycling, rollerblading, or skateboarding. Differences in self-reported helmet use by activity type and by sex, grade, and race/ethnicity were also examined. While prior studies (Finnoff, Laskowski, Altman, & Diehl, 2001; Gulack et al., 2015; Jewett, Beck, Taylor, & Baldwin, 2016) have assessed helmet use and barriers to usage among youth, this article contributes new information focused specifically on middle school students.

2. Materials and Methods

2.1. Study sample

The national Youth Risk Behavior Survey (YRBS) is conducted by CDC, and separate state, territorial, tribal, and school district by each jurisdiction's education and health agency or tribal government. This survey was designed to measure health risk behaviors and experiences among middle and high school students. For this study, middle school YRBS data from states that asked about bicycle helmet use (nine states) or rollerblading or skateboarding helmet use (seven states) were analyzed.

Details regarding the YRBS methodology are described else-where (Brener et al., 2002; Brener et al., 2013). Briefly, the state YRBSs are conducted biennially. Each survey year, an independent two-stage cluster sample design is used to obtain representative samples of middle school students in that state. After the school obtains parent permission following local requirements, students voluntarily complete an anonymous self-administered pencil and paper questionnaire during a regular class period and record their responses on a computer-scannable answer sheet. This study used publicly available data and did not include identification of individuals who participated in the survey; IRB reviews for the district YRBSs are handled by the individual districts.

This study examined middle school YRBS data collected in nine states from 2013, 2015, 2017, and 2019. The overall response rates across the nine states ranged from 58%–88% for a median overall response rate of 76.5% (Table 1). Across the states in the sample, the unweighted student sample sizes ranged from 377 (Kentucky) to 15,659 (Maryland) (data not shown).

3. Measures

Respondents were asked their sex (female or male), grade (6th, 7th, or 8th) and their race and ethnicity. Students were classified into seven racial/ethnic categories: American Indian or Alaska Native, non-Hispanic ("AIAN"); Asian, non-Hispanic ("Asian"); Black,

non-Hispanic ("Black"); Hispanic or Latino of any race ("Hispanic"); Native Hawaiian or Other Pacific Islander, non-Hispanic (NHOPI); White, non-Hispanic ("White") and multiple races, non-Hispanic ("Multiple").

Students were asked two questions regarding helmet use: "When you ride a bicycle, how often do you wear a helmet?" and "When you rollerblade or ride a skateboard, how often do you wear a helmet?" Responses included "did not ride a bicycle" or "I do not rollerblade or ride a skateboard" and "never," "rarely," "sometimes," "most of the time," and "always." For each question (among students who had ridden a bicycle or rollerbladed/skateboarded), this study combined those responses into two categories; rarely or never compared to sometimes, most of the time, or always. Nine states included the bicycle helmet question (Florida, Kentucky, Maine, Maryland, North Carolina, New Mexico, Vermont, Virginia, and West Virginia) and seven states included the rollerblade or skateboard helmet question (Florida, Kentucky, Maryland, North Carolina, Vermont, Virginia, and West Virginia).

3.1. Statistical analysis

A weight based on student sex, race/ethnicity, and grade was applied to each record to adjust for school and student nonresponse to provide estimates. The prevalence and 95% confidence interval (CI) of self-reporting use of a helmet when bicycling, rollerblading or skateboarding, respectively, for each year were calculated in states with available data. The prevalence of helmet use by year was computed for each state. Then data from the available states and years were merged to allow for an aggregate reporting across the states combined, overall, and by sex, grade, and race/ethnicity. Logistic regression analyses were used to assess linear trends during 2013–2019 adjusting for sex, grade, and race/ethnicity, when not assessing their trend. Additionally, multivariate logistic regression models were run to measure associations between time (2013–2019), sex, grade, and race/ethnicity and helmet use while bicycling and while rollerblading or skateboarding (Bieler, Brown, Williams, & Brogan, 2010). Missing data were not imputed. To account for the complex sample design and weighting, SAS-callable SUDAAN Version 11.0.1 (Research Triangle Institute: Research Triangle Park, NC) was used to conduct all statistical analyses.

4. Results

During the study period, the overall prevalence of rarely or never wearing a helmet while bicycling among middle school students in nine states was 68.6% (Table 2). Among the individual states examined, the overall prevalence ranged from 30.4% in Vermont to 78.5% in Kentucky of middle school students self-reporting rarely or never wearing a helmet while bicycling. The overall prevalence of rarely or never wearing a helmet while rollerblading or skateboarding in middle school students in seven states was 74.6% during the study period (Table 2). Among the states examined, the prevalence ranged from 37.6% in Vermont to 81.8% in Kentucky of middle school students self-reporting rarely or never wearing a helmet while rollerblading or skateboarding.

The percentage of respondents who reported rarely or never wearing a helmet while bicycling for 7th and 8th graders, for both females and males, and for White, Black, Asian, and Hispanic students declined from 2013 to 2019 (Table 3). The percentage of respondents

who reported rarely or never wearing a helmet while rollerblading or skateboarding for 7th graders, for males, and for White and AIAN students declined from 2013 to 2019 (Table 4). Overall, there was a significant decrease in rarely or never wearing a helmet while bicycling during 2013 to 2019 (from 71.7% to 67.0%; Table 2), adjusted odds ratio [AOR] = 0.9, 95% confidence interval [CI] = 0.9–0.9 (Table 3). Male students, students in higher grade levels (7th or 8th), and racial and ethnic minority students (except Asian students) had significantly higher odds of rarely or never wearing a helmet while bicycling as compared with female students, students in 6th grade, and White students, respectively; Asian students had lower odds of rarely or never wearing a helmet while bicycling when compared to White students (Table 5). Similarly, there was also a significant decrease in rarely or never wearing a helmet while rollerblading or skateboarding during 2013 to 2019 (from 76.4% to 73.5%; Table 2), AOR = 0.9, 95% CI = 0.9–1.0 (Table 5). Students in higher grade levels (7th or 8th) and racial and ethnic minority students (except Asian and NHOPI students) had significantly higher odds than students in 6th grade and White students of self-reporting rarely or never wearing a helmet while rollerblading or skateboarding, respectively. However, Asian students had significantly lower odds of self-reporting rarely or never wearing a helmet while rollerblading or skateboarding compared to White students (Table 5).

5. Discussion

Despite their safety benefits, findings from this study suggest that more than two-thirds of middle school students self-reported rarely or never wearing a helmet while bicycling and approximately three-fourths of middle school students self-reported rarely or never wearing a helmet while rollerblading or skateboarding in the states examined. While this analysis found that helmet use among middle school students improved over time, overall helmet usage during bicycling, rollerblading, and skateboarding remained low in some states. Moreover, helmet use varied by state. For example, self-reported bicycle helmet use among middle school students differed by 55% between Kentucky and Vermont; and in self-reported rollerblade and skateboard helmet use among middle school students differed by 53% in these same states. Interestingly, neither of these states have a bicycle helmet law, yet they have very different prevalence levels of middle school student helmet use. There is evidence that helmet laws increase helmet use (Jewett et al., 2016; Kraemer, 2016; Macpherson & Spinks, 2007; Venkatraman, Richard, Magee, & Johnson, 2021), though the literature is mixed on whether this might be due to a decrease in bicycle use (Carpenter & Stehr, 2011; Dennis, Potter, Ramsay, & Zarychanski, 2010; Jewett et al., 2016; Kraemer, 2016). These findings, as well as differences in helmet use by race/ethnicity and age, are consistent with prior studies and may suggest the need for a greater focus on community-based interventions for groups at higher risk of injury (Finnoff et al., 2001; Gulack et al., 2015; Jewett et al., 2016; National Transportation Safety Board, 2019; Sullins, Yaghoubian, Nguyen, Kaji, & Lee, 2014).

It is unclear from the findings in this study why helmet use among middle school students varied among the states examined. One limitation is due to the data measured by YRBS. Questions on the YRBS are intended to get prevalence estimates and cannot provide further insights that more in-depths questions might yield. Further, the data do not allow for analysis of why some students (those in 7th and 8th grade, as well as racial and ethnic minority

students [with the exception of Asian students]) were less likely to self-report regular helmet use while bicycling, rollerblading, or skateboarding as compared to others (students in 6th grade and White students). However, prior studies may provide insight into potential barriers to helmet use among youth (Finnoff et al., 2001; Ong et al., 2018; Piotrowski et al., 2020). Ong and colleagues interviewed youth who were seen at an emergency department for a bicycle or other non-motorized wheeled recreational vehicle-related injury and found that one-third (31.9%) of patients did not wear a helmet as they believed helmets only needed to be worn when skating in specific locations, such as a skate park or on a road (Ong et al., 2018). Similarly, the authors noted that another one-third (31.9%) of patients did not wear a helmet due to the perceived low levels of risk (e.g., have enough skill/experience to limit injury risk) (Ong et al., 2018). Examples of other identified potential barriers from previously published studies include poor helmet fit and discomfort, not owning a helmet, limited helmet use among peers and/or parents, and lack of parental rules on helmet use (Finnoff et al., 2001; Ong et al., 2018; Piotrowski et al., 2020).

Importantly, barriers to helmet use may vary between groups. For example, Robertson and colleagues found that parents in rural areas reported unique barriers related to helmet use among their children, including difficulty in finding proper helmets and the belief that activities in rural areas are safer than those in urban areas (Robertson, Lang, & Schaefer, 2014). Other factors that may contribute to the likelihood of helmet use among some groups included insurance status, as well as socioeconomic and certain demographic characteristics (Gulack et al., 2015; Robertson et al., 2014; Sullins et al., 2014). For example, studies examining the association between income and helmet use have been limited. After implementing bicycling helmet legislation in Ontario, Canada, one study found that helmet use increased in lower and middle income areas, but only slightly increased in higher income areas (Parkin, Khambalia, Kmet, & Macarthur, 2003). However, the slight increase in the higher income areas might be due to a ceiling effect or other confounding variables (Karkhaneh, Kalenga, Hagel, & Rowe, 2006), as communities with higher income tend to have a higher proportion of helmet use than communities with mid and low income populations (Harlos et al., 1999; Parkin et al., 1993). Additionally, another study (Jewett et al., 2016) found that White, non-Hispanic children (5–17 years old) were more likely to wear bicycle helmets than other racial and ethnic minority children (i.e., non-Hispanic Black, Hispanic, and non-Hispanic other race), similar to our study. Altogether, this may point to the importance of customizing helmet use interventions at the community level to address potential barriers and actions specifically designed to promote helmet use among middle school students (Owen, Kendrick, Mulvaney, Coleman, & Royal, 2011).

Despite evidence of effective strategies (Venkatraman et al., 2021), improving bicycle helmet use among youth is an ongoing challenge. For example, Sullins and colleagues found that approximately 90% of children involved in bicycle-related crashes and received medical care in Los Angeles County between 2006 and 2011 were not wearing a helmet, and helmet use was lower among older children, racial and ethnic minorities, and those from a low socioeconomic status (Sullins et al., 2014). Bicycle helmet laws are associated with long-term sustained helmet use rates and a 20%–55% reduction in bicycle-related head injuries, including TBIs (Hoye, 2018b; Huybers et al., 2017; Macpherson & Spinks, 2007). However, the effect of policy interventions is limited to only about 15% of the U.S.

population (Governors Highway Safety Association, 2022; Jewett et al., 2016), as fewer than half of U.S. states and only some cities and communities have any kind of helmet law in place for bicycling. As such, a multipronged approach to promoting helmet use, inclusive of programmatic, educational, behavioral, and policy interventions, is considered most beneficial. Effective nonpolicy-related interventions may include community-based programs that consist of education and the provision of helmets at no cost (Owen et al., 2011; Royal, Kendrick, & Coleman, 2007). Further, as helmets are only designed to prevent injuries to the head, face, and neck, the National Transportation Safety Board recommends promoting overall bicyclist safety through actions such as infrastructure changes (e.g., adding bicycle lanes and adding signage and pavement markings at interactions); separation on roadways between cars and bicycles (e.g., adding physically protected bicycle lanes and intersections); decreased presence of road hazards (e.g., potholes); addressing drivers' and bicyclists' behaviors (e.g., reducing or eliminating impaired or distracted driving or cycling, improving awareness and compliance to traffic laws); and increasing awareness of high-risk activities (e.g., bicycling in dark conditions, undesignated street crossing; Helak et al., 2017; Hoye, 2018b; Richard, Magee, Bacon-Abdelmoteleb, & Brown, 2018). Further information can be found at https://www.cdc.gov/transportationsafety/bicycle/index.html.

While there are systematic reviews and reports dedicated to bicycle safety, little to no such detailed scientific reports are dedicated to the effect of policies and programs on rollerblading and skateboarding, nor to the effectiveness of helmet laws for these activities. Still, multiple studies call for helmet use among youth who participate in recreational and competitive skateboarding and rollerblading due to the risk for severe head and brain injuries (McIntosh, Patton, & McIntosh, 2021; Mitchao, Lewis, Jakob, Benjamin, & Demetriades, 2021; Ong et al., 2018; Partiali, Oska, Barbat, Sneij, & Folbe, 2020; Sadeghian et al., 2017). Mitchao and colleagues analyzed skateboard-related injuries over a 10 year period and found that helmet use was significantly associated with a reduced odds of severe TBI (OR 0.534, 95% CI 0.455–0.627, $p < 0.001$; Mitchao et al., 2021). The American Academy of Pediatrics (2021), Consumer Products Safety Commission (2012), American Academy of Orthopaedic Surgeons (2015), SafeKids Worldwide (2022), and others have educational materials that include strategies to reduce the risk for injuries while rollerblading and skateboarding. Injury prevention strategies in these materials not only emphasize wearing helmets and other protective gear, but also inspecting equipment prior to use, not rollerblading or skateboarding alone and when it is dark outside, limiting speeds, and avoiding motor vehicles. The effectiveness of available educational materials on rollerblade and skateboard helmet use and overall safety is not currently available in the published literature. Future efforts to evaluate and identify effective strategies to promote helmet use among youth who rollerblade and skateboard may prove to be effective.

5.1. Practical Applications

Expanding community-level helmet safety policies and interventions that are customized for middle school students may be warranted (Owen et al., 2011), given the low prevalence of helmet use among middle school students while bicycling, rollerblading, and skateboarding in some states. Researchers have had previous success with improving helmet use among middle school students through multi-faceted programs. Van Houten and colleagues

implemented a program in three middle schools that included education, rewards and incentives, and helmet distribution (Van Houten, Van Houten, & Malenfant, 2007). They found that helmet use and appropriate fit of helmets improved during the intervention for all three schools and by more than 80% at one school (52% during baseline to 95% during the intervention; Van Houten et al., 2007). Further, other general injury prevention efforts, including bicycle safety programs, have had success using social marketing techniques, such as customizing messages through mass media, social media, and signage in public areas (e.g., parks and public transit) that address potential risk factors and barriers (e.g., negative social or peer influence) to promote behavior change (Karbakhsh et al., 2019; Karl, Smith, Piedt, Turcotte, & Pike, 2018; Molina-Garcia & Queralt, 2016; Owen et al., 2011; Royal et al., 2007; Smith, Zheng, Lafreniere, & Pike, 2018). Expanding these efforts may be successful in increasing overall helmet use among middle school students, as well as other age groups.

5.2. Limitations

There were multiple limitations to this study. First, YRBS data rely on self-report measures from adolescents, which could result in recall and social desirability bias that may lead to underreporting or overreporting of helmet use (Owen et al., 2011). However, in general, YRBS survey questions demonstrate good test–retest reliability (Brener et al., 2002). Second, the data reported are from a small number of states and the results are therefore not generalizable to other states nor are they nationally representative. Third, these data only apply to middle school students who attend school. Consequently, they are not representative of all youth in this age group or in other age groups. In the 2018–2019 school year, approximately 2% of youth aged 7–13 years were not enrolled in school (Institute of Education Sciences, 2021) and they may have different helmet-wearing habits. Fourth, the YRBS survey lacks data that account for possible reasons why middle school children have low levels of helmet use. Future studies are warranted to understand these reasons and the factors that influence this behavior in order to design educational and other countermeasures that could increase helmet use in this group. Finally, differences in the prevalence of helmet use while rollerblading or skateboarding cannot be determined given the way the question was asked. Future studies that wish to examine the prevalence of helmet use while rollerblading or skateboarding separately may be beneficial.

6. Conclusion

While findings from this study indicate that helmet use among middle school students improved over time, overall helmet usage during bicycling, rollerblading, and skateboarding remained low in some states. Among the states examined, more than two-thirds of middle school students and approximately three-fourths of middle school students self-reported rarely or never wearing while bicycling and rollerblading and skateboarding, respectively. Students in 7th and 8th grade, as well as select racial and ethnic minority students were less likely to report wearing a helmet during while bicycling, rollerblading, or skateboarding as compared to 6th grade students and White students. Several systematic reviews and detailed reports are dedicated to exploring bicycle helmet use and safety; however, there is little to no available research on strategies to promote helmet use among youth who rollerblade and

skateboard. Future research on helmet use among youth who rollerblade and skateboard, as well as multi-pronged efforts to promote helmet use among middle schoolers who bicycle, rollerblade, and skateboard (inclusive of education, helmet distribution, and social marketing techniques) that address perceived risks for injury and other barriers may be beneficial.

Funding

Biographies

Dana Waltzman, PhD, is a behavioral scientist on the Traumatic Brain Injury (TBI) Team in the Division of Injury Prevention (DIP) at the Injury Center. Her work focuses on understanding the public health burden, prevention, and long-term effects of TBI. Dr. Waltzman received a Bachelors of Science degree in Psychology and a Bachelors of Arts degree in Cognitive Science and in French from the University of Georgia, and a Doctoral degree in Cognitive Neuroscience at the University of California, Los Angeles. She completed two post-doctoral fellowships at the Memory and Aging Center at the University of California, San Francisco, and a joint fellowship at Stanford University and the Department of Veterans Affairs, Palo Alto.

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Table 1

Overall response rate[a] (RR) in various states for the middle school sites— Youth Behavior Risk Survey, in selected states, 2013, 2015, 2017, and 2019.

| State | 2013 | 2015 | 2017 | 2019 |
	Overall RR (%)	Overall RR (%)	Overall RR (%)	Overall RR (%)
Florida	83	76	68	69
Kentucky	81	78	76	79
Maine	61	68	63	63
Maryland	86	83	75	83
New Mexico	62	73	70	65
North Carolina	61	58	66	70
Vermont	88	82	83	85
Virginia	79	85	86	77
West Virginia	79	75	77	81

[a] Overall response rate is computed as (number of participating schools/number of eligible sampled schools) * (number of usable questionnaires/number of eligible students sampled in participating schools), rounded to the nearest integer.

Table 2

Estimated percentage of middle school students who self-reported rarely or never wearing a helmet when bicycling, rollerblading, or skateboarding in selected states— Youth Behavior Risk Survey, in selected states, 2013, 2015, 2017, and 2019[a].

State	2013		2015		2017		2019		Total	
	Percent	95% CI	Percent	95% CI	Percent	95% CI	Percent	95% CI	Percent	95% CI
Rarely or never wearing a helmet when riding a bicycle										
Florida	75.6	72.7 78.3	73.0	70.5 75.5	71.8	69.4 74.0	72.7	70.0 75.2	73.3	71.9 74.6
Kentucky	81.6	76.4 85.8	80.4	74.9 84.9	71.3	65.7 76.4	80.4	76.9 83.5	78.5	75.9 81.0
Maine	45.0	39.7 50.5	44.3	40.4 48.2	44.0	40.6 47.5	37.9	33.3 42.7	42.8	40.9 44.7
Maryland	67.2	64.0 70.3	59.5	57.1 61.8	62.7	59.8 65.5	58.0	55.5 60.3	61.9	60.2 63.5
North Carolina	72.8	66.8 78.0	-	-	70.6	66.3 74.6	64.9	58.1 71.2	69.5	66.1 72.7
New Mexico	74.0	69.3 78.2	76.3	71.6 80.4	70.8	66.0 75.2	68.9	61.5 75.4	72.5	69.6 75.2
Vermont	30.2	24.4 36.7	33.8	33.2 34.5	31.2	30.5 31.9	26.3	25.5 27.2	30.4	28.7 32.1
Virginia	64.3	60.4 68.0	58.7	52.7 64.5	59.4	54.6 64.0	60.3	54.2 66.2	60.6	58.0 63.2
West Virginia	70.9	66.9 74.6	73.2	69.6 76.6	68.1	65.3 70.8	71.2	67.6 74.6	70.9	69.2 72.5
Total	71.7	69.9 73.4	68.1	66.2 69.9	67.4	65.8 68.9	67.0	65.0 68.8	68.6	67.6 69.5
Rarely or never wearing a helmet when rollerblading or skateboarding										
Florida	77.8	75.1 80.3	79.0	76.6 81.2	77.5	75.1 79.7	77.2	74.7 79.5	77.9	76.8 79.0
Kentucky	83.2	78.7 87.0	85.7	81.8 88.8	75.1	67.4 81.5	82.6	79.7 85.1	81.8	79.3 84.1
Maryland	73.5	70.9 76.0	65.6	63.2 68.0	68.4	65.9 70.8	65.3	63.1 67.4	68.4	67.1 69.8
North Carolina	79.4	75.0 83.2	-	-	74.7	70.2 78.7	72.3	67.4 76.7	75.7	72.9 78.2
Vermont	33.1	27.4 39.4	43.0	41.7 44.3	-	-	-	-	37.6	34.5 40.9
Virginia	69.7	65.6 73.5	67.0	61.4 72.1	65.1	59.7 70.2	65.4	59.4 71.0	66.9	64.0 69.6
West Virginia	77.6	72.4 82.1	74.9	70.9 78.5	80.0	76.1 83.4	78.9	74.4 82.7	77.8	75.8 79.7
Total	76.4	74.8 77.9	74.8	73.1 76.5	73.7	72.0 75.3	73.5	71.6 75.3	74.6	73.8 75.5

Abbreviations: CI = confidence interval.

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Indicates that data are not available.

[a]Weighted percentages are presented.

Table 3

Estimated number, percent, and linear change of middle school students who self-report rarely or never wearing a bicycle helmet[*] by grade, sex, and race/ethnicity— Youth Behavior Risk Survey, in selected states, 2013, 2015, 2017, and 2019.

Characteristic	2013				2015				2017				2019				Linear Change
	Number	Percent	95% CI		Number	Percent	95% CI		Number	Percent	95% CI		Number	Percent	95% CI		2013–2019
Grade																	
6th	8,870	63.3	60.4	66.1	6,972	60.4	57.1	63.7	7,492	61.4	59.3	63.4	7,429	61.7	58.8	64.6	Unchanged
7th	11,856	72.9	70.9	74.8	10,485	68.2	65.9	70.4	10,615	65.2	62.5	67.8	9,604	67.0	64.3	69.5	Decreasing
8th	11,935	78.8	76.6	80.8	11,049	75.9	73.7	77.9	12,024	75.7	73.8	77.6	10,498	72.2	69.7	74.6	Decreasing
Sex																	
Female	15,306	69.0	67.2	70.8	13,420	65.7	63.5	67.7	14,085	65.4	63.6	67.1	12,942	64.6	62.4	66.7	Decreasing
Male	17,553	74.1	72.1	75.9	15,233	70.3	68.3	72.3	16,143	69.2	67.6	70.8	14,634	69.1	67.0	71.1	Decreasing
Race/Ethnicity [#]																	
White	14,206	64.2	61.9	66.5	13,891	61.1	58.4	63.8	12,932	59.0	57.1	60.9	12,072	59.1	56.9	61.3	Decreasing
Black	6,744	86.6	84.7	88.3	5,163	81.9	79.9	83.9	5,223	81.9	80.1	83.5	4,844	81.8	79.7	83.7	Decreasing
Hispanic[^]	6,462	79.0	76.6	81.2	4,457	76.9	74.9	78.7	6,346	77.1	75.3	78.9	5,685	73.5	71.2	75.6	Decreasing
AIAN	959	79.4	75.8	82.6	954	75.2	71.2	78.8	1,090	76.1	70.9	80.5	831	73.6	68.3	78.3	Unchanged
Asian	820	53.7	48.6	58.7	627	44.7	38.8	50.7	756	46.2	41.8	50.7	713	45.9	41.5	50.4	Decreasing
NHOPI	223	64.0	49.7	76.2	46	75.2	63.6	84.0	196	74.5	63.5	83.1	159	75.0	59.8	85.8	Unchanged
Multiple	1,924	74.5	70.6	78.1	1,732	67.1	63.0	71.0	2,080	73.1	69.9	76.1	1,830	70.6	66.8	74.2	Unchanged

Abbreviations: CI = confidence interval, AIAN = American Indian/Alaska Native, NHOPI = Native Hawaiian/Other Pacific Islander.

[*] Estimates were obtained from nine states: Florida, Kentucky, Maine, Maryland, North Carolina, New Mexico, Vermont, Virginia, and West Virginia.

[#] Races are non-Hispanic.

[^] Hispanic ethnicity includes students of any race.

Table 4

Estimated number, percent, and linear change of middle school students who self-report rarely or never wearing a helmet when rollerblading or skateboarding by grade, sex, and race/ethnicity— Youth Behavior Risk Survey, in selected states, 2013, 2015, 2017, and 2019.

Characteristic	2013			2015			2017			2019			Linear Change [a]
	Number	Percent	95% CI	Number	Percent	95% CI	Number	Percent	95% CI	Number	Percent	95% CI	2013–2019
Grade													
6th	4,767	68.3	65.8 70.6	3,466	65.5	62.0 68.8	3,277	67.9	65.1 70.5	2,995	65.3	62.5 68.0	Unchanged
7th	6,183	78.3	76.2 80.3	5,053	74.6	72.3 76.8	3,876	72.4	69.7 75.0	3,424	74.0	71.4 76.5	Decreasing
8th	6,019	82.4	80.1 84.4	5,325	84.0	81.7 86.0	4,237	81.3	78.9 83.5	3,806	80.8	78.3 83.1	Unchanged
Sex													
Female	8,181	75.5	73.5 77.4	6,963	74.7	72.7 76.6	5,674	73.9	71.9 75.8	5,195	73.9	71.7 76.1	Unchanged
Male	8,936	77.2	75.2 79.1	6,955	75.2	73.1 77.2	5,756	73.4	71.4 75.4	5,074	73.1	70.8 75.4	Decreasing
Race/Ethnicity [#]													
White	7,894	72.8	70.8 74.8	7,042	72.0	69.7 74.2	4,950	69.1	66.7 71.5	4,509	69.4	66.7 71.9	Decreasing
Black	3,643	85.8	83.7 87.6	2,387	81.5	79.1 83.8	2,362	84.5	82.1 86.5	1,952	82.0	79.2 84.5	Unchanged
Hispanic [^]	2,602	78.4	75.4 81.0	1,974	78.7	75.7 81.4	1,966	78.4	76.0 80.6	1,889	76.4	73.7 79.0	Unchanged
AIAN	430	81.9	76.7 86.2	354	70.1	61.7 77.4	283	76.8	69.0 83.1	248	63.8	53.0 73.4	Decreasing
Asian	427	60.6	53.9 67.0	355	60.4	49.6 70.4	289	53.6	45.6 61.3	269	55.6	48.0 62.9	Unchanged
NHOPI	152	74.3	55.2 87.2	84	71.7	52.2 85.4	81	77.9	64.3 87.4	76	87.3	73.2 94.5	Unchanged
Multiple	1,211	80.7	77.0 83.9	950	77.4	72.2 81.8	965	77.2	73.3 80.7	814	80.0	74.8 84.3	Unchanged

Abbreviations: CI = confidence interval, AIAN = American Indian/Alaska Native, NHOPI = Native Hawaiian/Other Pacific Islander.

[*] Estimates were obtained from seven states: Florida, Kentucky, Maryland, North Carolina, Vermont, Virginia, and West Virginia.

[#] Races are non-Hispanic.

[^] Hispanic ethnicity includes students of any race.

[a] Based on linear trend analysis using logistic regression models controlling for grade, sex, and race/ethnicity, p < 0.05.

Table 5

Adjusted odds ratio (AOR) of middle school students who self-reported rarely or never wearing a helmet when bicycling, rollerblading, or skateboarding, Youth Risk Behavior Survey (YRBS), in selected states, 2013, 2015, 2017, and 2019.

Demographic	When you ride a bicycle, how often do you wear a helmet? * Rarely or never vs sometimes/most of the time/always				When you rollerblade or ride a skateboard, how often do you wear a helmet? ** Rarely or never vs sometimes/most of the time/always			
	AOR	Lower 95% CI	Upper 95% CI	p-value	AOR	Lower 95% CI	Upper 95% CI	p-value
Year	0.9	0.9	0.9	<0.001	0.9	0.9	1.0^	<0.001
Sex								
Female	REF				REF			
Male	1.2	1.2	1.3	<0.001	1.0	0.9	1.1	0.735
Grade								
6th	REF				REF			
7th	1.4	1.3	1.5	<0.001	1.5	1.4	1.7	<0.001
8th	2.1	1.9	2.2	<0.001	2.4	2.2	2.6	<0.001
Race/Ethnicity#								
White	REF				REF			
Black	3.3	3.1	3.6	<0.001	2.2	2.00	2.5	<0.001
Hispanic^	2.2	2.0	2.3	<0.001	1.5	1.4	1.6	<0.001
AIAN	2.2	1.9	2.5	<0.001	1.3	1.0^^	1.5	0.028
Asian	0.6	0.5	0.6	<0.001	0.5	0.4	0.6	<0.001
NHOPI	1.6	1.1	2.2	0.006	1.4	0.9	2.3	0.133
Multiple	1.7	1.5	1.9	<0.001	1.6	1.4	1.8	<0.001

Abbreviations: AOR = adjusted odds ratio, CI = confidence interval, REF = reference, AIAN = American Indian/Alaska Native, NHOPI = Native Hawaiian/Other Pacific Islander.

*
In nine states: Florida, Kentucky, Maine, Maryland, North Carolina, New Mexico, Vermont, Virginia, and West Virginia.

**
In seven states: Florida, Kentucky, Maryland, North Carolina, Vermont, Virginia, and West Virginia.

#
Races are non-Hispanic.

^
Hispanic ethnicity includes students of any race.

^
95% CI value is 0.977.

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^^95% CI value is 1.025.