

## Helmet Safety

### **Introduction**

The most recent data from 2018 shows that 17.1 deaths per 100,000 persons were due to a brain injury. Brain injuries can occur from events such as falls, car crashes, and self-harm. Healthy People 2030 aims to reduce the number of deaths from 17.1 to 16.9 by 2030<sup>1</sup>. A preventable and realistic method to reduce the number of traumatic brain injuries is to encourage helmet use. Wearing a helmet has been proven to help reduce head injuries, yet most children and adults do not wear a helmet during recreational activities. Bicycling is one of the most popular recreational activities in the United States. It is estimated that 44.3 million children under the age of 21 ride bicycles in the United States<sup>2</sup>. Wearing helmets in activities such as biking, skateboarding, skiing, and other sports can help reduce the amount of traumatic brain injuries.

### **Populations at Risk for Brain Injury**

Although everyone can benefit from wearing a helmet, children are more likely to be injured with a traumatic brain injury. Between 2009-2018, there were 596,972 emergency department visits due to bicycle-related traumatic brain injuries in the United States. The highest were among children between the ages of 10-14. Children  $\leq 17$  years old were twice as likely to be sent to the ED for bicycle-related traumatic brain injuries compared to adults<sup>3</sup>. These severe brain injuries have lasting effects that impact an individual's lifestyle and daily activities, as well as affecting the relationships with their friends and family.

### **Benefits of Wearing a Helmet**

Can wearing a \$10 certified plastic helmet really help prevent these severe brain injuries? From 2006 to 2015, an estimated 2,219,742 children 5-17 years old were treated in the emergency department for bicycle related injuries, which averages 608 injuries per day. Children 5-17 years old were 2.9 times more likely to be hospitalized if they were not wearing a helmet and 4.3 times more likely to have a traumatic brain injury<sup>4</sup>. The Insurance Institute for Highway Safety is an independent, nonprofit organization that works to reduce injury and death on the roads. In their data collection, out of 843 deaths in 2019, 62% of the deaths involved the bicycle rider not wearing a helmet. Only 15% of the riders were wearing a helmet, while the other 23% of riders were unknown<sup>5</sup>. Advances in technology have also provided opportunities to simulate bicycle accidents in which helmet use was or was not utilized. Researchers found that simulations where a helmet was used for protection showed a 54% reduction in risk of concussion. Fractures were also observed in the simulations, and helmet use reduced fractures by up to 98%<sup>6</sup>. Furthermore, the cost of the helmet does not impact effectiveness. Performance tests showed that three helmets over \$150 had similar safety results than 3 helmets that were less than \$20<sup>7</sup>. It is estimated that every \$10 bike helmet purchased will save society around \$570 in medical costs, future earnings, and quality of life costs<sup>7</sup>.

### **Mechanism of Helmet Safety**

Helmets prevent or lessen the impact when hitting your head. It reduces the severity of the brain injury by absorbing some of the energy and dissipating that force through a larger area of the helmet over a slightly longer length of time. By dissipating the energy in this way, one smaller portion of your head is not absorbing all the energy from the impact. A bicycle helmet is made from a rigid, crushable foam that helps to dissipate energy. If the helmet is intact and worn correctly, it can significantly reduce the severity of the brain injury<sup>8</sup>.

Safety standards have been implemented for helmets by a few organizations. Since 1999, the Consumer Product Safety Commission (CPSC) has been nationally recognized as the organization that sets the standard for bike helmet safety in the United States. The American Society for Testing and Materials (ASTM) also sets standards, but focuses more on other types of helmets, such as for skating, skiing, and downhill bike racing. Many tests are performed to pass safety standards. Some tests include a drop test onto an anvil, strap and buckle strength test, and a positional stability test to make sure the helmet will stay on the head at impact<sup>7</sup>.

### **Presentation of a Brain Injury**

Helmets help prevent injury, especially concussions and severe brain injury. One study found that helmets provide a reduction in head, brain, and severe brain injury by 63-88%<sup>9</sup>. A person is at risk of a concussion when their head has a hard impact. A concussion is caused by an impact on the skull, such as a bump, blow, or jolt. It can also be caused by sudden jerking movement including whip lash. In the skull, the brain floats in cerebrospinal fluid. When the skull suddenly moves, the brain bounces inside the skull causing damage to the brain cells<sup>10</sup>. Some symptoms of concussion include headache, nausea, vomiting, balance problems, dizziness, photophobia, and feeling hazy/foggy. Things observed when someone else has a concussion include difficulty recalling events around the concussion, appearing dazed or stunned, confusion, answering questions slowly, briefly losing consciousness, and showing behavior or personality changes. These signs and symptoms can appear right after the incident or even hours or days after the onset of the concussion<sup>10</sup>. If the brain injury is serious enough, blood can accumulate inside the skull, called a hematoma. The accumulation of blood increases the pressure in the skull because there is not an outlet for the pressure or fluid to escape. If the pressure is great enough, this can damage brain cells and be life threatening. Things to look for in a severe concussion include one

pupil larger than the other, a headache that is progressively worse, slurred speech, weakness, numbness, or decreased coordination, repeated nausea and vomiting, seizures, increasing confusion or agitation, and a loss of consciousness for any amount of time<sup>11</sup>. When someone has a minor concussion, they will usually return to their normal health, but a severe concussion or brain injury can have lasting effects. A severe brain injury can cause problems and deficits with thinking, memory, learning, coordination, balance, speech, hearing, vision, and emotions. These deficits can affect many aspects of a person's life including interpersonal relationships, work, household chores, hobbies, and other normal daily activities<sup>10</sup>.

### **Perceived Barriers to Helmet Use**

It is estimated that around 55% of children in the United States are not always wearing a helmet when riding a bike<sup>12</sup>. A group of researchers observed video recordings to determine how many bicycle riders were wearing helmets in mandatory helmet areas in a populated city. They found that 98.3% of more than 27,000 riders were wearing helmets. They also found that children were less compliant than adults with wearing a helmet<sup>13</sup>. There are many reasons why children choose not to wear a helmet. One of the more common reasons is because of discomfort. Wearing a helmet adds another layer that traps the heat. When a bicyclist is exerting a lot of effort and sweating, a helmet can be uncomfortable. A couple of ways this has been improved is by making the foam in the helmet dissipate more heat and by adding ventilation holes in the helmet to allow heat to escape without losing the integrity of the helmet. There is also a lack of education in the importance of a helmet. If a child is riding close to home and only casually riding, they are less likely to wear a helmet<sup>4</sup>. A child may only see the importance of a helmet in more intense biking, such as mountain biking or race bicycling. Style plays a key factor and acts as an excuse to not wear a helmet. If the child is not thrilled with how the helmet looks or how he or she looks with a

helmet on, they are more resistant to wearing a helmet. The last common reason for a child to not wear a helmet is due to peer pressure. If a child sees their friends not wearing helmets, they might feel uncomfortable and pressured to also not wear a helmet<sup>8</sup>.

### **Activities for which Helmet Use is Recommended**

Some states or cities require helmet use for certain populations when biking or participating in outdoor activities. Because helmets are highly effective at protecting the brain from injury, helmets should be worn whenever there is a greater risk of falls, hits, or collisions. Many sports require helmets, such as football, baseball, hockey, and lacrosse. Other times, wearing a helmet is not required and the wearer has the choice to decide whether to wear a helmet. Some activities where helmets should be worn but are not always required include skiing, snowboarding, sledding, and riding bikes, skateboards, motorcycles, ATVs, and scooters<sup>14</sup>.

### **Proper Helmet Fit**

A helmet is most effective when it is worn correctly. When buying a helmet, there are some things to keep in mind. Certified helmets will have a sticker on the inside of the helmet with the safety standard organization's title. Also, just as important, the fit of the helmet should be appropriate. In general, a helmet should be snug, level, and stable. The entire inside of the helmet should be in contact with the head and sit as low as it can. It should be level and stable enough so that if a person were to vigorously shake their head or hit their helmet, it will stay in place. Lastly, the strap should fit snug and comfortably<sup>7</sup>.

### **Promoting Helmet Use in Children**

It can be difficult to get a child to wear a helmet. A parent has a considerable influence on their child's behavior, which includes teaching their children safety. Research shows that parents do not utilize their influence to its potential in reducing their child's injury risk. Part of the issue is that parents are not educated in bicycle safety and do not know how to appropriately promote bicycle safety<sup>15</sup>. Resources, such as The Injury Prevention Program (TIPP) can help educate parents to help their child wear a helmet. They recommend that children wear helmets as a passenger on the back of a parent's bike and as soon as they start riding a tricycle. Getting in the habit of wearing a helmet will improve their future decision to choose wearing a helmet. It can also be helpful to let the children pick out their own helmet. If they like the design of the helmet, they are more likely to wear it. Children should see parents wearing a helmet since parents are role models for their children. The best way for a child to wear a helmet is if they see their parents wearing a helmet as well. A parent can convince their children of the importance of helmet safety by using examples of others wearing helmets, such as professional athletes, bicycle racers, etc. Parents can also reward children with treats or privileges when they wear their helmet without someone telling them to. Parents can set boundaries and not allow their children to ride a bike unless they are wearing a helmet<sup>16</sup>.

Medical providers can also promote helmet use. One study showed that children ages 5 to 17 years old that had sought medical attention in the emergency department were 57% more likely to wear a helmet after a medical provider counselled them on helmet safety, gave them a helmet if they did not have one, and had the child sign an agreement to wear a helmet<sup>17</sup>. Providers should also educate the parents as well because of the parent's impact on their children.

Beyond educating the family, providers should encourage state and local governments to enact legislation requiring helmet use and mandate helmet use when renting a bicycle. They can also encourage school districts to make helmet mandates when biking to and from school. Retail outlets should be encouraged to provide affordable helmets and include them in the purchase of new bikes. Bicyclists in popular media sources, such as television, advertisements, movies, etc. should consistently wear helmets so children see wearing a helmet as a societal norm<sup>8</sup>.

Helmet mandates by law have shown useful in getting children to wear their helmets. In Oregon, a helmet law enacted in 1997 doubled helmet use in children<sup>18</sup>. Only 22 states have a statewide mandate for helmet use and an additional 17 states have some form of city or county mandate within the state<sup>7</sup>. People that think their state has a helmet mandate, even if the state does not, are more likely to wear a helmet regularly<sup>19</sup>. An enacted helmet mandate has been shown to increase helmet use, which would also decrease the number of brain injuries.

Another way to effectively educate children in helmet safety is by showing them videos about helmet safety. Videos should contain information such as when a child should wear a helmet, how to properly fit a helmet, and why it is important to wear a helmet. Researchers have found it highly effective to tailor the video to the children's culture. One way they found effective was by making a connection between a phone case and a helmet. The video discussed how the child's brain is more important than a cell phone, but more children have phone cases on their cell phone than there are children that wear helmets when biking<sup>20</sup>. Making a connection with something that is relevant to an aspect of a child's life helps to portray the importance of a helmet and solidifies the information to remember the next time they get on a bike or use their cell phone.

One reason children are not wearing helmets during recreational activities is a lack of education regarding the importance of wearing a helmet. For my community presentation, I will address this topic with 10-14 year old children. A one-time presentation about helmet's effectiveness in preventing concussion and severe brain injury has shown to be beneficial in improving regular helmet use based on the studies provided<sup>17, 20</sup>. The target audience for my presentation will include children 10-14 years old because they are least likely to wear a helmet and they will better understand the consequences of not wearing a helmet.

## **Conclusion**

Helmet use during recreational activities such as bicycling, skiing, skateboarding, and other sports have considerable evidence of reducing the likelihood of concussion and severe brain injury. Helmets are affordable, accessible, and most importantly, highly effective. Children at the age of 17 or younger are least likely age group to be wearing a helmet during activities, especially ages 10-14 years old<sup>3</sup>. Educating this population about a helmet's effectiveness in reducing concussion and severe brain injuries is important to reduce the number of brain injuries and help reach Healthy People 2030's goal of reducing the number of deaths to 16.9 from 17.1 per 100,000<sup>1</sup>. Teaching children good habits will contribute to a safer and healthier future.

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