



Evidence Summary: Mountain Biking

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Version 1
February 2018

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Suggested Citation:

Krolikowski M, Black A, Richmond SA, Babul S, Pike I. *Evidence Summary: Mountain Biking*. Active & Safe Central. BC Injury Research and Prevention Unit: Vancouver, BC; 2018. Available at <http://activesafe.ca/>.



Evidence synthesis tool

SPORT:	Mountain Biking	Target Group:	All ages	
Injury Mechanisms:	It is reported that 85% of mountain bike riders will experience some sort of trauma during a season (Aleman & Meyers, 2010). Mountain bikers are at a much higher risk of fractures, dislocations, and concussions compared to on-road bikers (Aleman & Meyers, 2010). Falls are the most predominant reason of injuries seen in hospitals, and injured bikers have reported that riding errors and poor trail conditions were the primary causes of their injuries (Becker et al., 2013; Nelson & McKenzie, 2011).			
Incidence/Prevalence	Risk Factors	Interventions	Implementation/Evaluation	Resources
<p>From 1992 to 2002, there was a reported 300% increase in mountain biking injuries seen in hospitals, correlating with an increase in participation (Kim et al., 2006).</p> <p>The injury incidence rate for mountain biking has been reported at 16.8 injuries/1000 hours of exposure over the course of a season, with 80% of riders sustaining multiple injuries. Most injuries were reported as mild in nature (65%), and the most frequently affected region was the lower leg (27%), followed by the forearm (25%) and the knee (21%). Abrasions and contusions were the most frequently reported injury (64% and 57%, respectively). Liver hematoma has also been reported in mountain bike injuries with the spleen being the most frequently injured organ</p>	<p>There are few studies in the literature that specifically examine risk factors for injury in mountain biking. The following section includes risk factor studies as well as studies that speculate on factors that may increase the risk of injury:</p> <p>Level of experience</p> <p>Expert mountain bike riders were at a higher odds of injury compared to professional riders [Odds Ratio (OR)=1.34, 95% CI:1.02 to 1.75] (Becker et al., 2013).</p> <p>Competition vs. Practice</p> <p>A significantly higher injury rate (OR=1.53, 95% CI:1.16 to 2.01; p=0.01) was reported during competition compared to practice (Becker et al., 2013).</p> <p>Riding Style and Trail Conditions</p> <p>Injured bikers have reported</p>	<p>There are relatively few studies that examine interventions to reduce the risk of injury in mountain biking.</p> <p>Helmets</p> <p>Helmet use has been shown to reduce the risk of head injuries by 39%, and the risk of facial injury by 28%. No difference was found between different types of helmet designs and their effect on reducing injury (Carmont, 2008).</p> <p>Education</p> <p>Following a media information program on the implication of bar ends on abdominal injuries, liver injuries were reported to have drastically reduced. As a result, only one case of liver injury was observed in 1998, and for the next two years no such injuries were reported. (Carmont, 2008).</p> <p>Body Armour</p> <p>Lower body armour has been</p>	<p>There were no studies found that examined the implementation or evaluation of mountain biking interventions.</p>	

<p>(49%) due to the forward-facing bar extensions on handle bars, used for more comfortable and efficient riding (Becker et al., 2013; Carmont, 2008).</p> <p>Mountain bikers are at a much higher risk of fractures, dislocations, and concussions compared to on-road bikers. Children are also at a high risk of cranial trauma (comprising 85% of fatalities). Upper limbs are at a high risk of injury (abrasions, contusions, and sprains) due to the attempting to protect the face during a fall. Additionally, neurovascular complications in the hands could occur due to repeatedly compressing the handlebars and vibration during riding (occurring in 19-35% of cyclists). Scrotal anomalies have been reported to account for 45-46% of injured cases. (Aleman, K. B., & Meyers, M. C. (2010).</p> <p>Mountain Bike Races In cross-country races, 7.2% of people reported an injury, whereas 4.7% of people reported an injury in endurance races. The predominant injury for both types of races was abrasions and lacerations (75% and 60% of reported injuries, respectively); however, there was no observed increased risk of injury in one</p>	<p>that riding errors and poor trail conditions were the primary causes of their injuries (72% and 31%, respectively). Most collisions happened on a curve (43%), during jumps (32%) and sloping terrain (32%) (Becker et al., 2013).</p>	<p>found to reduce lower limb injuries; however, it has not been found to have an effect on upper limb injuries (Aitken et al., 2011).</p>		
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<p>type of race over another (Lareau & McGinnis, 2011)</p>				
<p>Works Cited: Aleman, K. B., & Meyers, M. C. (2010). Mountain biking injuries in children and adolescents. <i>Sports Medicine</i>, 40(1), 77–90.</p> <p>Becker, J., Runer, A., Neunhäuserer, D., Frick, N., Resch, H., & Moroder, P. (2013). A prospective study of downhill mountain biking injuries. <i>British Journal of Sports Medicine</i>, 47(7), 458–462.</p> <p>Kim, P. T. W., Jangra, D., Ritchie, A. H., Lower, M. E., Kasic, S., Brown, D. R., Simons, R. K. (2006). Mountain biking injuries requiring trauma center admission: a 10-year regional trauma system experience. <i>The Journal of Trauma</i>, 60(2), 312–318.</p> <p>Lareau, S. A., & McGinnis, H. D. (2011). Injuries in mountain bike racing: Frequency of injuries in endurance versus cross country mountain bike races. <i>Wilderness and Environmental Medicine</i>, 22(3), 222–227.</p>	<p>Works Cited: Becker, J., Runer, A., Neunhäuserer, D., Frick, N., Resch, H., & Moroder, P. (2013). A prospective study of downhill mountain biking injuries. <i>British Journal of Sports Medicine</i>, 47(7), 458–462.</p>	<p>Works Cited: Carmont, M. R. (2008). Mountain biking injuries: A review. <i>British Medical Bulletin</i>, 85(1), 101–112.</p> <p>Aitken, S. A., Biant, L. C., & Court-Brown, C. M. (2011). Recreational mountain biking injuries. <i>Emergency Medicine Journal</i>, 28(4), 274–279.</p>		

Review of Sport Injury Burden, Risk Factors and Prevention

Mountain Biking

Incidence and Prevalence

It is reported that up to 85% of youth and adolescent riders will experience some form of trauma during a season of mountain biking. A prospective cohort study calculated an injury incidence rate of 16.8/1000 hours of exposure over the course of a season, with 80% of riders sustaining multiple injuries. Most injuries were mild (65%), and the most frequently affected region was the lower leg (27%), followed by the forearm (25%) and the knee (21%). Abrasions and contusions were the most frequently reported injury (64% and 57%, respectively). Liver hematoma has also been highly reported in mountain bike injuries with the spleen being the most frequently injured organ (49%) due to the forward-facing bar extensions on their handle bars used for more comfortable and efficient riding. (Becker et al., 2013; Carmont, 2008).

A prospective cohort study examining college-aged students from Cornell university participating in outdoor education found an injury incidence rate of 7.5/1000 participant-days, the highest of all Cornell Outdoor Education activities. The evacuation rate (4.7/1000 participant-days) was also highest among all activities.

Mountain bikers are at a much higher risk of fractures, dislocations, and concussions compared to on-road bikers. Children are also at a high risk of cranial trauma (comprising 85% of fatalities). Upper limbs are at a high risk of injury (abrasions, contusions, and sprains) due to the attempting to protect the face during a fall. Additionally, neurovascular complications in the hands could occur due to repeatedly compressing the handlebars and vibration during riding (occurring in 19-35% of cyclists). Scrotal anomalies have been reported to account for 45-46% of injured cases. (Aleman, K. B., & Meyers, M. C., 2010).

The most frequent mountain bike injuries that were seen in hospitals and trauma centers were fractures/dislocations (26.5%-68%), especially upper extremity fractures (10.6%-25%) and shoulder fractures (8.3%). Mountain bikers are also at high risk of maxilla-facial trauma, with 28%-55% of injured riders having facial bone fractures. (Nelson, N. G., & McKenzie, L. B., 2011).

In mountain bike races, 7.2% of people were injured in cross-country races, and 4.7% were injured in endurance races (overall injury rate 5.4%). The predominant injury for cross country and endurance races was abrasions and lacerations (75% and 60% of reported injuries, respectively). (Lareau & McGinnis, 2011).

Risk and Protective Factors

Injured bikers have reported that riding errors and poor trail conditions were the primary causes of their injuries (72% and 31%, respectively). Most injuries happened in a curve (43%),

during jumps (32%) and sloping terrain (32%). Falls were by far the most predominant mechanisms of injuries seen in hospitals (69.9%). A significantly higher odds of injury (OR=1.53; 95% CI, 1.16 to 2.01) was reported during competition compared to practice.

Many studies indicate the protective effect of helmet use against catastrophic injury; however, trauma can still occur. Mouth guards may also decrease the risk of dental injury; however, this has not been evaluated in the literature. Some studies report that the use of protective equipment may increase the use of tactically aggressive behaviour resulting in higher velocity impact. No difference was found between different types of helmet designs and their effect on reducing injury. The use of lower limb body armour has been associated with fewer lower limb wounding injuries; however, a protective effect has not been seen in upper body limb body armour.

Mountain bikers that rated themselves as “expert mountain bike riders” were at a higher odds of injury compared to professional riders (OR=1.34; 95% CI, 1.02 to 1.75) (Becker et al., 2013). It has also been reported that a lack of upper body strength in young untrained participants predisposes the individual to a higher prevalence of injury. Lack of attention, loss of control, indecisiveness and overestimation of biking ability have been considered to cause the majority of accidents (Becker et al., 2013).

Opportunities for Prevention: Effective Interventions, Cost-Effectiveness, Implementation and Evaluation

There is a lack of literature that examines interventions to reduce the risk of injury in mountain biking. Researchers recommend that riders be well trained, understand how injuries occur, ride within the level of their capability, dismount safely off the bike, and wear helmets, padded gloves/shorts, and shin protection. Research has shown that helmet use reduces the risk of head injuries by 39%, and the risk of facial injury by 28% (Carmont, 2008).

Following a media information program on the implication of bar ends on abdominal injuries, liver injuries were reported to have drastically reduced. As a result, only one case of liver injury was observed in 1998, and for the next two years no such injuries were reported (Carmont, 2008).

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