ACTIVE & SAFE

Evidence Summary: Horseback Riding

Maciej Krolikowski, MSc

Version 1
February 2018

BC INJURY research and prevention unit

The British Columbia Injury Research and Prevention Unit (BCIRPU) was established by the Ministry of Health and the Minister's Injury Prevention Advisory Committee in August 1997. BCIRPU is housed within the Evidence to Innovation research theme at BC Children's Hospital (BCCH) and supported by the Provincial Health Services Authority (PHSA) and the University of British Columbia (UBC). BCIRPU's vision is *to be a leader in the production and transfer of injury prevention knowledge and the integration of evidence-based injury prevention practices into the daily lives of those at risk, those who care for them, and those with a mandate for public health and safety in British Columbia.*

Author: Maciej Krolikowski

Editors: Sarah A Richmond, Amanda Black

For any questions regarding this report, contact:

BC Injury Research and Prevention Unit
F508 – 4480 Oak Street
Vancouver, BC V6H 3V4
Email: bcinjury1@cw.bc.ca
Phone: (604) 875-3776
Fax: (604) 875-3569
Website: www.injuryresearch.bc.ca

Suggested Citation:

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

UBC BC Children's Hospital Research Institute

Evidence synthesis tool

SPORT:	Horseback Riding	**Target Group:**	All ages
Injury Mechanisms:	Falls are the most common injury mechanism in horseback riding (Abu-Kishk et al, 2013; Ball et al., 2007; Davidson et al., 2015; Ekberg et al.,, 2011; Kiss et al., 2008; McCrory & Turner, 2005; Smartt & Chalmers, 2009; Thomas et al., 2006). The majority of injuries occur in the head, trunk, and upper extremities (Abu-Kishk et al., 2013; Davidson et al., 2015; Ekberg et al., 2011; Kiss et al., 2008; McCrory & Turner, 2005; Papachristos et al., 2014; Smartt & Chalmers, 2009; Thomas et al., 2006). The predominant injury types are fractures, soft tissue injuries, and head injuries (Abu-Kishk et al., 2013; Balendra et al., 2007; Eckert et al., 2011; Ekberg et al., 2011; McCrory & Turner, 2005; Papachristos et al., 2014; Thomas et al., 2006).		

Incidence/Prevalence	**Risk Factors**	**Interventions**	**Implementation/Evaluation**	**Resources**
Children Horseback riding-related injuries are reported to occur in 21% of young riders per year. Injury estimates vary between 76 000 to 100 000 injuries per year (Havlik, 2010). **Fractures** Fractures of the limbs account for 17.9% of injuries recorded in show jumpers, 40% of injures recorded in Swedish eventing athletes, and 42.5% of career-ending injuries in horse racing jockeys (Balendra et al., 2007; Ekberg et al., 2011; Gass et al., 2016). Two studies found that of all equine-related injuries, 25.2% - 28.3% are fractures (reported in emergency departments in the United States) (Loder, 2008;	**Riding Style** A full-foot riding style increased the risk of falls for jockey and track workers (IRR=2.37, 95% CI: 1.46-3.85) (Hitchens et al., 2011) **Physiological Attributes of the Rider** Lower anaerobic strength and aerobic fitness, as well as higher muscular strength and power were associated with greater risk of falls (Hitchens et al., 2011) **Jockey Age** Increased jockey fall rates have been associated with age; however, the age most at risk varies by study. An Australian study examining event racing jump jockeys noted those over 35 years of age were at a higher	**Helmets** While the use of protective riding helmets has been associated with a fivefold reduction in head injuries, one study reports that fewer than 40% of riders are wearing helmets at the time of injury, with some finding numbers as low as 9% (Havlik, 2010).	**Mouth Guards** The study by Gass et al., (2016) investigated the use of mouth guards in horseback riders. Twenty-three percent of the sample reported finding mouth guards unnecessary in equestrian sports, 26.3% reported they did not wear one due to other riders not wearing mouth guards, 16.5% reported a mouth guard would be annoying, 17.2% have never worried about it, 13.1% cannot say why they do not wear one, and 3.3% claim that a mouth guard is not available for equestrian sports. Future work needs to be done to assess the effectiveness of mouth guards on dental injuries in this population. (Gass et al., 2016)	**Websites** http://horse.on.ca/programs/safety/ https://www.brainline.org/article/equestrian-safety

Thomas et al., 2006). In 2008, it was reported that ankle injuries account for 34.5% of fractures. (Ceroni, 2007). In point to point racing, most of the fractures occur in the clavicle and upper limb (72% - 74%). (Balendra et al., 2007) **Contusion/Crush** Contusions account for 30.8%-31.4% of equine-related injuries reported in the United States (Loder, 2008; Thomas et al., 2006) and are the most common injury in point-to-point racing.(Balendra et al., 2007) **Traumatic Brain Injury (TBI)/Head Injuries** A 2015 study demonstrated that concussions accounted for 9.5% of show jumping injuries (Gass et al., 2016). Of all equine-related injuries resulting in hospitalization, 48-53.9% are head injuries (Abu-Kishk et al., 2013; Papachristos et al., 2014). Further, 11.6% of equine injuries reported to hospitals in the United States were TBIs (Loder, 2008). In eventing, the neck/head were the most common recorded injury (22.7% of all injuries). (Ekberg et al., 2011). Similarly, a	risk of falls (Hitchens et al., 2011). Another study reported that jockeys ages 13-15 and 10-29 had the highest rates of injury (Havlik, 2010). In hurdle racing, higher jockey age resulted in 1.41 higher risk of falls resulting in injury (95% CI: 1.23, 1.62) (Hitchens et al., 2011) **Hurdle Racing** 'License' B jockeys, larger field size, higher club level, higher race grade, and older jockey age were associated with injurious falls (IRR=1.68, 95% CI:1.30, 2.16; IRR=4.37, 95% CI:3.62, 5.27; IRR=1.62, 95% CI 1.30, 2.03; IRR=1.72; 95% CI 1.47, 2.02; IRR=1.41; 95% CI 1.23, 1.62, respectively) (Hitchens et al., 2011). **Steeplechase Racing** For steeplechase racing, 'License B' jockeys, larger field size, longer race distance, and higher club level were associated with increased risk of falls (IRR=1.35, 95% CI:1.01, 1.81; 0.91; IRR 1.41, 95% CI:1.12, 1.77; IRR=1.44, 95% CI:1.10, 1.89; IRR=1.59; 95% CI:1.21, 2.10) (Hitchens et al., 2011). Having had fewer previous rides in the meeting, lower prize money at stake was found to be protective against			

New Zealand study found that the most frequent horse-related injury was to the head (23% of cases). (Smartt & Chalmers, 2009). In the US, 23.2% of hospitalized horse-related injuries were reported as head and neck injuries. (Thomas et al., 2006)	the risk of falls (IRR=0.70, 95% CI:0.54; IRR=0.41, 95% CI:0.34, 0.50) (Hitchens et al., 2011). **Multiple Day Events** Two- and three- day events were noted to be associated with a higher risk of a horse falling (0.91 falls per 1000 jumping efforts, 95% CI 0.69, 1.18) compared to one-day events (0.27 falls per 1000 jumping efforts, 95% CI 0.23, 0.33) (Murray et al., 2005) **Sex** Females are reported to be at a higher risk of falls compared to males (IRR=1.11, 95% CI:1.00-1.23) (Hitchens et al., 2011).			
Works Cited: Abu-Kishk, I., Klin, B., Gilady-Doron, N., Jeroukhimov, I., & Eshel, G. (2013). Hospitalization due to horse-related injuries: has anything changed? A 25 year survey. *Israel Medical Association Journal: 15*(4), 169–172. Balendra, G., Turner, M., & McCrory, P. (2007). Career-ending injuries to professional jockeys in British horse racing (1991-2005). *British Journal of Sports Medicine*, *42*(1), 22–24. Ceroni, D. (2007). Support and safety features in preventing foot	**Works Cited:** Havlik, H. S. (2010). Equestrian sport-related injuries: A review of current literature. *Current Sports Medicine Reports*, *9*(5), 299–302. Hitchens, P., Blizzard, L., Jones, G., Day, L., & Fell, J. (2011). Predictors of race-day jockey falls in jumps racing in Australia. *Accident Analysis and Prevention*, *43*(3), 840–847. Murray, J. K., Singer, E. R., Morgan, K. L., Proudman, C. J., & French, N. P. (2005). Risk factors	**Works Cited:** Havlik, H. S. (2010). Equestrian sport-related injuries: A review of current literature. *Current Sports Medicine Reports*, *9*(5), 299–302.	**Works Cited:** Gass, M., Kühl, S., Connert, T., & Filippi, A. (2016). Dental trauma in showjumping - A trinational study between Switzerland, France and Germany. *Dental Traumatology*, *32*(3), 174–179.	

and ankle injuries in equestrian sports. *International Sport Medicine Journal*, *8*(3), 166–178. Ekberg, J., Timpka, T., Ramel, H., & Valter, L. (2011). Injury rates and risk-factors associated with eventing: a total cohort study of injury events among adult Swedish eventing athletes. *International Journal of Injury Control and Safety Promotion*, *18*(4), 261–267. Gass, M., Kühl, S., Connert, T., & Filippi, A. (2016). Dental trauma in showjumping - A trinational study between Switzerland, France and Germany. *Dental Traumatology*, *32*(3), 174–179. Havlik, H. S. (2010). Equestrian sport-related injuries: A review of current literature. *Current Sports Medicine Reports*, *9*(5), 299–302. Loder, R. T. (2008). The demographics of equestrian-related injuries in the United States: injury patterns, orthopedic specific injuries, and avenues for injury prevention. *The Journal of Trauma*, *65*(2), 447–460. Smartt, P., & Chalmers, D. (2009). A new look at horse-related sport and recreational injury in New	for cross-country horse falls at one-day events and at two-/three-day events. *Veterinary Journal*, *170*(3), 318–324.			

Zealand. *Journal of Science and Medicine in Sport*, *12*(3), 376–382. Thomas, K. E., Annest, J. L., Gilchrist, J., & Bixby-Hammett, D. M. (2006). Non-fatal horse related injuries treated in emergency departments in the United States, 2001-2003. *British Journal of Sports Medicine*, *40*(7), 619–626.				

Review of Sport Injury Burden, Risk Factors and Prevention

Horseback Riding

Incidence and Prevalence

A review of equestrian injuries in the pediatric population reports that 21% of young riders in a year, will report a horseback riding-related injury (Havlik, 2010). Injury estimates for all horseback riding related injuries vary between 76 000 to 100 000 injuries per year (Havlik, 2010). Falls are the most common injury mechanism in horseback riding while mounted (Abu-Kishk et al, 2013; Ball et al., 2007; Davidson et al., 2015; Ekberg et al.,, 2011; Kiss et al., 2008; McCrory & Turner, 2005; Smartt & Chalmers, 2009; Thomas et al., 2006); while not mounted, the most common mechanism of injury is being kicked by the horse. The majority of injuries occur in the head, trunk, and upper extremities, with the predominant injury types being fractures, soft tissue injuries, and head injuries (Abu-Kishk et al., 2013; Davidson et al., 2015; Ekberg et al., 2011; Kiss et al., 2008; McCrory & Turner, 2005; Papachristos et al., 2014; Smartt & Chalmers, 2009; Thomas et al., 2006).

Fractures of the limbs account for 17.9% of injuries recorded in show jumpers, 40% of injures recorded in Swedish eventing athletes, and 42.5% of career-ending injuries in horse racing jockeys (Balendra et al., 2007; Ekberg et al., 2011; Gass et al., 2016). In the United States, emergency departments report that 25.2%-28.3% of all equine-related injuries are fractures (Loder, 2008; Thomas et al., 2006). Further, it has been reported that ankle injuries account for 34.5% of all fractures (Ceroni, 2007). Contusions account for 30.8%-31.4% of equine-related injuries reported in the United States (Loder, 2008; Thomas et al., 2006), and are the most common injury in point-to-point racing (Balendra et al., 2007).

Approximately half (48-53.9%) of equine-related injuries resulting in hospitalizations are head injuries (Abu-Kishk et al., 2013; Papachristos et al., 2014). Further, 11.6% of hospitalized injuries were diagnosed as traumatic brain injuries (TBIs) (Loder, 2008). Concussions account for 9.5% of show jumping injuries (Gass et al., 2016). In eventing, the neck/head were the most common recorded injury (22.7-23% of all injuries) (Ekberg et al., 2011).

Risk and Protective Factors

Riding Style

A full-foot riding style increased the risk of falls for jockey and track workers (IRR=2.37, 95% CI: 1.46-3.85) (Hitchens et al., 2011)

Physiological Attributes of the Rider

Lower anaerobic strength and aerobic fitness, as well as higher muscular strength and power were associated with greater risk of falls (Hitchens et al., 2011)

Jockey Age

Increased jockey fall rates have been associated with age; however, the age most at risk varies by study. An Australian study examining event racing jump jockeys noted those over 35 years of age were at a higher risk of falls (Hitchens et al., 2011). Another study reported that jockeys ages 13-15 and 10-29 had the highest rates of injury (Havlik, 2010). In hurdle racing, higher jockey age resulted in 1.41 higher risk of falls resulting in injury (95% CI: 1.23, 1.62) (Hitchens et al., 2011)

Hurdle Racing

'License' B jockeys, larger field size, higher club level, higher race grade, and older jockey age were associated with injurious falls (IRR=1.68, 95% CI:1.30, 2.16; IRR=4.37, 95% CI:3.62, 5.27; IRR=1.62, 95% CI 1.30, 2.03; IRR=1.72; 95% CI 1.47, 2.02; IRR=1.41; 95% CI 1.23, 1.62, respectively) (Hitchens et al., 2011).

Steeplechase Racing

For steeplechase racing, 'License B' jockeys, larger field size, longer race distance, and higher club level were associated with increased risk of falls (IRR=1.35, 95% CI:1.01, 1.81; IRR=1.41, 95% CI:1.12, 1.77; IRR=1.44, 95% CI:1.10, 1.89; IRR=1.59; 95% CI:1.21, 2.10) (Hitchens et al., 2011). Having had fewer previous rides in the meeting, lower prize money at stake was found to be protective against risk of falls (IRR=0.70, 95% CI:0.54; IRR=0.41, 95% CI:0.34, 0.50) (Hitchens et al., 2011).

Multiple day events:

Two- and three- day events were noted to be associated with a higher risk of a horse falling (0.91 falls per 1000 jumping efforts, 95% CI 0.69, 1.18) compared to one-day events (0.27 falls per 1000 jumping efforts, 95% CI 0.23, 0.33) (Murray et al., 2005)

Sex:

Females are reported to be at a higher risk of falls compared to males (IRR=1.11, 95% CI:1.00-1.23) (Hitchens et al., 2011).

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

While the use of protective riding helmets has been associated with a five-fold reduction in head injuries, one study reports that fewer than 40% of riders are wearing helmets at the time of injury, with some finding numbers as low as 9% (Havlik, 2010).

Implementation and Evaluation

While the use of protective riding helmets has been associated with a fivefold reduction in head injuries, one study reports that fewer than 40% of riders are wearing helmets at the time of injury, with some finding numbers as low as 9% (Havlik, 2010).

The study by Gass et al., (2016) investigated the use of mouth guards in horseback riders. Twenty-three percent of the sample reported finding mouth guards unnecessary in equestrian sports, 26.3% reported they did not wear one due to other riders not wearing mouth guards,

16.5% reported a mouth guard would be annoying, 17.2% have never worried about it, 13.1% cannot say why they do not wear one, and 3.3% claim that a mouth guard is not available for equestrian sports. Future work needs to be done to assess the effectiveness of mouth guards on dental injuries in this population. (Gass et al., 2016)

References

Abu-Kishk, I., Klin, B., Gilady-Doron, N., Jeroukhimov, I., & Eshel, G. (2013). Hospitalization due to horse-related injuries: has anything changed? A 25 year survey. *Israel Medical Association Journal, 15*(4), 169–172.

Balendra, G., Turner, M., McCrory, P., & Halley, W. (2007). Injuries in amateur horse racing (point to point racing) in Great Britain and Ireland during 1993-2006. *British Journal of Sports Medicine*, *41*(3), 162–166. doi:10.1136/bjsm.2006.033894

Ball, C. G., Ball, J. E., Kirkpatrick, A. W., & Mulloy, R. H. (2007). Equestrian injuries: incidence, injury patterns, and risk factors for 10 years of major traumatic injuries. *American Journal of Surgery*, *193*(5 SPEC. ISS.), 636–640. doi:10.1016/j.amjsurg.2007.01.016

Ceroni, D. (2007). Support and safety features in preventing foot and ankle injuries in equestrian sports. *International Sport Medicine Journal*, *8*(3), 166–178.

Davidson, S. B., Blostein, P. A., Schrotenboer, A., Sloffer, C. A., & Vandenberg, S. L. (2015). Ten years of equine-related injuries: Severity and implications for emergency physicians. *Journal of Emergency Medicine*, *49*(5), 605–612. doi:10.1016/j.jemermed.2015.03.025

Ekberg, J., Timpka, T., Ramel, H., & Valter, L. (2011). Injury rates and risk-factors associated with eventing: a total cohort study of injury events among adult Swedish eventing athletes. *International Journal of Injury Control and Safety Promotion*, *18*(4), 261–267. doi:10.1080/17457300.2010.545129

Gass, M., Kühl, S., Connert, T., & Filippi, A. (2016). Dental trauma in showjumping - A trinational study between Switzerland, France and Germany. *Dental Traumatology*, *32*(3), 174–179. doi:10.1111/edt.12242

Havlik, H. S. (2010). Equestrian sport-related injuries : A review of current literature. Current Sports Medicine Reports, 9(5), 299-302. doi: 10.1249/JSR.0b013e3181f32056.

Hitchens, P., Blizzard, L., Jones, G., Day, L., & Fell, J. (2011). Are physiological attributes of jockeys predictors of falls? A pilot study. *BMJ Open*, *1*(1), e000142. doi:10.1136/bmjopen-2011-000142

Kiss, K., Swatek, P., Lenart, I., Mayr, J., Schmidt, B., Pinter, A., & Hollwarth, M. E. (2008). Analysis of horse-related injuries in children. *Pediatric Surgery International*, *24*(10), 1165–1169. doi:http://dx.doi.org/10.1007/s00383-008-2214-9

Loder, R. T. (2008). The demographics of equestrian-related injuries in the United States: injury patterns, orthopedic specific injuries, and avenues for injury prevention. *Journal of Trauma*,

65(2), 447–460. doi:10.1097/TA.0b013e31817dac43

McCrory, P., & Turner, M. (2005). Equestrian injuries. *Medicine and Sport Science*, *48*, 8–17. doi:10.1159/000084280

Murray, J. K., Singer, E. R., Morgan, K. L., Proudman, C. J., & French, N. P. (2005). Risk factors for cross-country horse falls at one-day events and at two-/three-day events. *Veterinary Journal*, *170*(3), 318–324. doi:10.1016/j.tvjl.2005.05.003

Papachristos, A., Edwards, E., Dowrick, A., & Gosling, C. (2014). A description of the severity of equestrian-related injuries (ERIs) using clinical parameters and patient-reported outcomes. *Injury*, *45*(9), 1484–1487. doi:10.1016/j.injury.2014.04.017

Smartt, P., & Chalmers, D. (2009). A new look at horse-related sport and recreational injury in New Zealand. *Journal of Science and Medicine in Sport*, *12*(3), 376–382. doi:10.1016/j.jsams.2008.04.001

Thomas, K. E., Annest, J. L., Gilchrist, J., & Bixby-Hammett, D. M. (2006). Non-fatal horse related injuries treated in emergency departments in the United States, 2001-2003. *British Journal of Sports Medicine*, *40*(7), 619–626.