

Painting the picture of horse-related injuries in Sweden and factors for preventing injuries to the head

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I. INTRODUCTION

Head injuries are a frequently occurring injury in horse-related injury events and are also the leading cause of death in such events [1]. Falls from horseback have been found to be the most common incident type in horse-related injury events, and they frequently involve the rider's head [2]. Falls have also been found to be most frequently responsible for maxillofacial injuries [3] and to be associated with intracranial haemorrhage [4]. Unmounted injury events, including kicks, bites and being crushed between the horse and a stationary object, have also been found to frequently involve the head [5].

This study aimed to investigate how incident type is associated with head injury in order to inform the development of appropriate protective devices.

II. METHODS

This investigation utilised data from an ongoing medical register called the Injury Database (IDB Sweden) [6], which contains information collected from both in-patient and out-patient visits to hospitals, local healthcare centres and public dental services within the Skaraborg district in the southwest of Sweden (pop. c. 255,000). Information obtained from IDB includes data from medical staff and a self-reported questionnaire completed at the time of registration at one of the participating facilities. The information included injury event details (date, time, place, injury event type), rider demographics (age, gender) and injury details (type, location). The use of helmets (yes/no) was also investigated, but no information was provided in 9% of the cases. Horse-related injury events for those both mounted and unmounted at the time of the accident were examined from January 2001 to December 2016. To explore the effect of incident type on head injury, the incident type and any variables found to be significant during univariate regression exploration were entered into a multivariate binary logistic regression. Whether an injury event involved multiple incident types (yes/no) was also included, even when not independently significantly associated with head injury, because of a previously identified association with severity of injury [7].

III. INITIAL FINDINGS

Over the 16-year period, 324,297 people were registered in IDB for any injury, and 7,815 (2.4%) of these were due to horse-related injury events. The mean age of the sample was 27 years (range 0–84 years). Females accounted for 88% of the entire sample. However, above the age of 60, males made up a larger proportion of horse-related injuries than females, accounting for 80% of all injuries to those over 80 years, although the overall numbers were small. The most common activity was riding the horse (62.8%), followed by horse handling (28.5%). The most frequently occurring incident types were fall from or with the horse (58.4%), or other injury due to contact with the horse (19.8%). Horse-contact injuries mostly involved being kicked (n=817, 41.4%) or trampled or trodden on by the horse (n=623, 31.5%).

Of the 7,815 patients involved in this investigation, the highest proportion of injuries involved upper extremities (33%) and 19.2% of patients sustained some form of head injury. From the 19.2% of riders who suffered a head injury (n=1,502), there were 1,680 separate head injuries amongst them (some riders had multiple injuries). These head injuries consisted of soft tissue injuries (56.3%), concussion (33.4%), fractures or dislocation (7.9%), sprain or tear to the muscle or tendon in the jaw (0.1%) or other (2.1%). The head regions most frequently injured were the brain (34.1%) and the skull (30%), followed by the lips and mouth cavity (6.2%). Head injuries not including concussions, were most commonly caused by a fall from or with a horse (53.1%), yet 31.9%

of head injuries occurred due to contact with the horse.

Concussions also predominantly occurred due to a fall from or with the horse (82%). Helmets were reportedly worn by 58.1% of all participants, and 73.7% of those with a concussion reported they were wearing a helmet at the time of the injury. Of those who fell from horseback, 85.6% reported they were wearing a helmet, while only 18.7% reported wearing a helmet during an incident involving other contact with the horse.

Table I displays the results of the binary logistic regression, which examined the effect of incident type on any head injury while controlling for other risk factors. Factors that were significantly associated with any head injuries were age, type of incident and multiple incident types. The older the rider, the lower the likelihood of suffering a head injury (OR=0.989, $p < 0.00005$, 95% CI: 0.985–0.993). Riders who were in an injury event that involved only a single incident type had a higher likelihood of suffering a head injury (OR=1.292, p -value=0.011, 95% CI: 1.061–1.573). Lastly, riders whose primary incident type involved an injury without any horse contact had lower odds of head injury (OR=0.604, $p < 0.00005$, 95% CI: 0.497–0.734). Riders who fell from a carriage or other height and those who were injured through contact with the horse had no statistical difference in the likelihood of head injury when compared to those who fell from or with the horse.

TABLE I
LOGISTIC REGRESSION EXAMINING THE EFFECT OF INCIDENT TYPE ON HEAD INJURY WHILE CONTROLLING
FOR OTHER RISK FACTORS

Variable	Odds ratio	p-value	95% CI
<i>Gender</i>			
Female	0.810	0.976	0.801–1.189
Male	reference	-	-
<i>Age</i>			
	0.989	<0.00005*	0.985–0.993
<i>Multiple incident types</i>			
No	1.292	0.011*	1.061–1.573
Yes	reference	-	-
<i>Incident type</i>			
Other injury with no horse contact	0.604	<0.00005*	0.497–0.734
Other injury due to contact with horse	0.930	0.303	0.809–1.068
Fall from carriage or other height	0.682	0.139	0.411–1.132
Fall from or with horse	reference	-	-

IV. DISCUSSION

A fall from or with a horse was the main cause of horse-related injury and was largely responsible for the head injuries in this investigation, in common with previous reports [2]. However, there was no statistical difference found between the odds of suffering a head injury when a rider fell from or with a horse and when a rider was injured either due to contact with the horse (kick, bite or crush) or when they fell from a carriage or other height. This aligns with previous studies, which noted that head injuries may be seen more frequently and may even be of higher severity in unmounted injury events than in falls from horseback [3][8]. Wearing a helmet while unmounted has been suggested as a potential countermeasure to those head injuries that have been found to occur during horse-handling activities. Helmet use could potentially prevent some of these injuries but may not be sufficient to protect those face injuries occurring due to a horse kick directly on the face. Additionally, there were many concussions observed, even for those wearing helmets. This is indicative of insufficient energy absorption in the helmets. A study by Clark *et al.* [9] concluded that riding helmets may not be designed for softer grass surfaces, with most (14/16) riders who landed on the grass suffering a concussion. Unfortunately, there was no information available on the type of helmet worn by the riders in this investigation, but the high numbers of head injuries suggest improvements need to be made in helmet design.

V. REFERENCES

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