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Original Research

Equestrian-related injuries, predictors of fatalities, and the impact on the public health system in Sweden

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ABSTRACT

Objectives: Horse riding is a popular activity but has also been found to lead to many injuries and even fatalities. No reduction in the numbers of those being admitted to hospital for equestrian-related injuries have been seen in Sweden in recent years. The aim of this work was to examine injuries, fatalities, and predictors of fatalities in equestrian-related activities and to investigate the cost of these injuries to the public health system.
Study design: The study is a retrospective analysis of hospital data.
Methods: National Swedish hospital and mortality registers were retrospectively examined, inclusive of the years 1997–2014. Logistic regression was used to examine the predictors of fatal injuries, and cost of hospital treatment was considered.
Results: Over the study period, there were an observed 29,850 injured cases and 51 fatalities. Women comprized almost 90% of those injured and 70% of fatalities. The average age was 26.8 years (range 0–91, standard deviation [SD] = 16.1) for injured and 43 years (range 7–78 years, SD = 20.5) for fatal cases. Men dominated both injured and fatal samples in the older age ranges (Fatal: >50 years; Injured: >70 years), although overall numbers were small. Injuries to the head contributed more than any other body region for both injured and fatal cases, and fractures were the most frequently seen injury type. A chi-squared analysis confirmed that injury type and injured body region were not independent of age. Logistic regression examining the association between fatality and age, gender, home region, and year of injury, indicating trends over time, found that there was an increase of 5.1% in the odds of fatality for every year increase in age of the patient and men had 2.2 times higher odds to be in the fatal sample than women. The conservative estimated cost of injury was 1800 Euro per injury event, equating to over 3 million Euro per year.

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Conclusion: Equestrian-related injury events present a major public health concern. Observed decreases in fatalities suggest improved health care, yet head injury and fatality rates are still high, indicating a need for further intervention. The type of injury changes with the age group, and a better understanding of injury patterns with age is needed to identify protective measures for the different user groups.

Introduction

Horse riding is a popular activity in many countries, with approximately one million people coming into regular contact with horses in Sweden,[1] yet it can also be dangerous, providing its own set of unique risks. A horse's unpredictable behavior combined with its strength, weight, and ability to travel at high speeds provide an element of risk, which is not present in many other sports.[2] As such, unique countermeasures must be developed to protect participants involved in equestrian-related injury events. Horse riding has also been found to have the highest insurance claims incident rate per 1000 participants in New Zealand when compared with other adventure sports, being two times greater than the rate for mountain biking and four times that for tramping/hiking.[3] In addition, although decreasing trends for other sports and traffic injuries were observed, equestrian-related injuries in Sweden have remained constant, indicating a need for development and improvement of prevention measures.[4]

Fatalities resulting from equestrian-related injuries are not infrequent and are most often the consequence of neurological trauma,[5–7] resulting from either falls from horseback or, while unmounted, being kicked in the head by the horse.[8] Helmets have been developed as a prevention measure for head injuries and have previously been shown to be an effective tool for preventing these injuries.[9,10] A study by Guyton et al.,[11] found that in Oregon, California, of the three deaths due to horse-related injury events, two were due to intracranial hemorrhage and neither of these fatally injured riders were wearing a helmet. In 2015, Davidson et al.[8] reported on 90 equestrian-related injuries occurring in Michigan, six of which resulted in fatality. In all six cases, extensive head injuries were the cause of death and none of these patients wore a helmet.

Fatalities in equestrian-related injury events have also been linked to abdominal injuries, with results from an investigation into equestrian-related fatalities in Alberta, Canada, by Aronson and Tough finding that although 22 of 38 (58%) died because of head injuries, the remaining 16 (42%) died as a result of truncal injuries.[7] These injuries normally occurred when the rider was either crushed by the horse[6] or suffered a kick to the chest.[12] Protective vests can be worn by horse riders and, in the laboratory and human body modeling settings, have been shown to significantly reduce the energy transferred to the rider from a direct impact.[13,14]

Despite developments in protective devices, it is unclear whether the pattern of equestrian-related injuries and fatalities has changed in Sweden. In addition, the cost for consultation and treatment of these injuries in the Linköping University Hospital in Sweden was reported to be approximately 1400 Euro per injury event in 2004,[15] but these cost estimates have not been updated since. Finally, although other studies have investigated factors associated with falls from horseback,[16] severity of injury including Injury Severity Score and length of hospital stay,[9] occurrence of any injury,[17] and occurrence of long term disability,[18] there is no known study examining factors associated with fatalities in equestrian-related injury events in Sweden.

Equestrian-related injuries and fatalities are an ever present and serious public health issue. This study aimed to examine the patterns of both injuries and fatalities due to equestrian-related trauma nationally in Sweden and identify factors associated with these fatalities. The impact of equestrian-related injuries on the public health system was also investigated to provide updated national figures on the cost of consultation and treatment of these injuries.

Methods

Fatalities

National fatality data were obtained from the Swedish National Board of Health and Welfare's 'Causes of Death' Register (DOR) for the years 1997–2014. This register contains records of all deaths resulting from both unintentional and intentional injury in Sweden. All equestrian-related fatalities (unintentional) were extracted and examined. Information available in the register included patient details (age, gender), home region (address), date of the fatality, and type of injuries as categorized using the Swedish version of the International Classification of Diseases, version 10—ICD10 (National Board of Health and Welfare, 1999), and the primary cause of death was determined and noted by a medical professional.

Injuries

In addition to the death register, there were two sources of injury data investigated. The first data source was the Injury Database Sweden (IDB) which included hospital visits for those residing in catchment areas for four hospitals in Skaraborg county 2001–2013 (Skövde, Lidköping, Mariestad, Falköping), the three hospitals serving Värmland county 2007–2013 (Karlstad, Arvika, Torsby), Norrlands University Hospital in Umeå 2001–2013 serving six of the municipalities in Västerbotten county, and Uppsala University Hospital 2013 serving parts of Uppsala county. The total population of all catchment areas combined was reported to

be 682,782 residents in 2013, comprizing 7% of the total Swedish population, with injury registration being systematically performed over the last four decades.[20] IDB involved a self-reported questionnaire completed at the time of registration at one of the participating facilities, regardless of whether the patient was admitted or not.[19] The data that were collected during the self-report questionnaire included information regarding the circumstances of the injury event and location, patient demographics and home region, hospital admission details including the hospital name, admission and discharge date and, finally, injury details. The database allowed for a maximum of three injuries to be coded per patient, with injuries categorized using ICD10 codes and ordered by a medical professional in terms of perceived severity. The primary injury was the injury with the highest perceived severity.

The second data source for injury data was the National Patient Register (PAR) data set which is an ongoing registration of all national discharge data for patients in Sweden who required hospital care because of either unintentional or intentional injuries. Data were available from January 1997 to December 2013. Information which was collected in PAR included patient details (age, gender), home region, admission details including the hospital name, ward, length of admission, any surgical procedures or other treatment types, and injury details categorized using ICD10 codes, with primary, or most severe injury also indicated as judged by a medical professional.

Analysis

The two injury datasets were combined, and duplicates were identified using common identification codes which were present in each dataset. The duplicates fell into one of the two categories: riders who had suffered two separate horse-related injury events and duplicate cases of the same rider in the same injury event that had the same information included in both IDB and PAR datasets. Where a rider had suffered two separate injury events, both cases were kept as separate cases. Where the injury event had been recorded in both IDB and PAR, the IDB record was removed.

Descriptive statistics were conducted on available variables for patient details (age, gender), year of injury, home address, treatment (surgery, length of admission), and injury details, with ICD10 injury codes for the primary injury recategorized into injury type (fracture or dislocation, soft tissue injury, injury to an internal organ, neurological injury, muscle or tendon injury) and injured body region (head, neck, upper extremities, lower extremities, torso). Information on the cost of hospital care was provided by Västra Götalandsregionen, the county council governing the territory Västra Götaland in Sweden, and used as an estimate for all regions in Sweden. These were given for 2016 to be 2500 SEK for an outpatient visit only and 9700 SEK for a day of care in hospital for admitted patients. These figures excluded costs of treatments and diagnostic or surgical procedures, which were not available. Figures were adjusted based on European inflation rates,[21] and then costs were converted into Euro, with average conversion rates between SEK and Euro taken for every year in the study period.[22] The total number of visits and total number of days of care for every year was calculated and multiplied by the cost for a visit or a day of care for that year. The total cost for all years was summed and then divided by the number of injury events.

Age was categorized into three groups (0–18, 19–49, and 50+ years) as previously grouped by Bilaniuk et al.[10] The association between age and injury type as well as age and injured body region was explored using Chi-squared tests of independence.

Logistic regression was used to explore the association between the outcome, fatality, and the available variables of age, gender, home region, and year of injury event, indicating trends over time. These were the variables which were consistently reported in all datasets, with home region grouped into the three main regions in Sweden (Götaland, Svealand, and Norrland). The IDB dataset was not included in the logistic regression analysis, as the sampling changed over the course of the study period. Binary logistic regression with clustering on case ID for repeated measures was used to allow for analysis including people involved in multiple injury events.

Analysis was conducted using SPSS statistics 24.[23]

Results

Description of injured and fatal cases

During the years 1997–2013, the combined records from all three datasets presented 30,897 entries pertaining to horse-related injuries, with 30,846 being injury cases and 51 being fatal cases. Of the 30,846 injured cases, there were 9750 recorded as visiting a hospital in the IDB dataset and 21,096 recorded as being admitted to hospital in the PAR dataset. There was only a small overlap of the datasets with 981 of the injury cases were recorded in both PAR and IDB databases and 15 of the fatal cases were recorded in both PAR and DOR; the remaining 36 fatal cases existing exclusively in DOR when a patient died before admission into a hospital (Fig. 1).

Once duplicates were removed, the final dataset consisted of 29,850 cases of equestrian-related injuries, which resulted in a mean number of 1756 cases per year (8769[IDB]+981[both]+20,100[PAR] = 29,850[total]). Of these 29,850 injury cases, 2866 were cases where a patient had been involved in a second, unrelated injury event.

In a total of 28.4% (n = 8490) of the injured cases, the rider suffered multiple injuries resulting from the same injury event. With the total of 51 fatalities, there was an average of three deaths per year, resulting in an approximate risk of fatal

Fig. 1 – Number of injured cases in IDB and PAR. IDB, Injury Database Sweden; PAR, National Patient Register.

injury of 0.03/100,000 population. All of the fatal cases suffered multiple injuries resulting from the injury event. As can be seen in Fig. 2, the number of those admitted to hospital (PAR) increased over the study period (from 995 to 1228). Contrastingly, the number of fatalities had a decreasing tendency over the study period.

Women represented 89.6% of all injured people and 66.7% of all fatalities in equestrian-related injury events. The average age of all injured was 26.8 years (range 0–91, median = 21, standard deviation [SD] = 16.1), whereas for fatalities, the average age was higher, 43 years (range 7–78 years, median = 42, SD = 20.5).

As can be seen in Fig. 3, women represented the highest proportion of all injured cases in the younger age groups. The largest number of injured women was in the age group from 0 to 18 years. All of those fatally injured under the age of 39 years were women. Men started to dominate in both the injured and fatal cases in the older age ranges (older than 50 years for fatal cases and older than 70 years for injured cases). The median age for men in the injured sample was 45 years, whereas in the fatal sample, the median age was 64 years. The median age for women was 20 years for the injured sample and 35.5 years for the fatal sample.

For both fatal and injured cases, the head was the most frequently injured body region, being the primary injured region in 52.9% of fatal cases and 28.3% of injured cases (Table 1). For the injured cases, upper extremities were the second most frequently injured body region (24%), followed by the torso (20.9%) and the lower extremities (19.9%). Other body regions frequently injured in fatal cases were the torso (22.7%) and the neck (13.6%). There was one fatality which resulted from a lower leg fracture. However, this patient experienced early complications due to the trauma and pulmonary embolism. There were no fatalities resulting from an injury to the upper extremities.

In the 0- to 18-year age injured group, there was a higher incidence of head injuries than the older age groups, whereas in the older age groups, torso injuries were more common. There was a significant association between age groups and the injured body region ($P < 0.00005$, based on χ^2 test). For fatal cases, the head was the most commonly injured region for all age groups and injured region was not significantly associated with age group ($P = 0.672$, based on χ^2 test).

For all age groups, fractures were the most frequent type of injury for both fatal (35.3%) and injured (40.5%) cases. For fatal cases, this was closely followed by neurological trauma (29.4%) and then injury to the internal organs (15.7%). For injured cases, fractures were followed by soft tissue injuries (24.4%) and concussion or other brain injury (21.8%). There was a higher incidence of neurological trauma in younger riders, whereas fractures increased for older rider groups. Some soft tissue injuries (organs and muscles) were not as age dependent. A significant association was found between injury type and age group using a χ^2 test for the injured cases ($P < 0.00005$, based on χ^2 test) but not for the fatal cases ($P = 0.907$, based on χ^2 test) because of the small number in the sample.

Predictors of fatalities

The results of the multivariate logistic regression examining the association between fatality and age, gender and year of

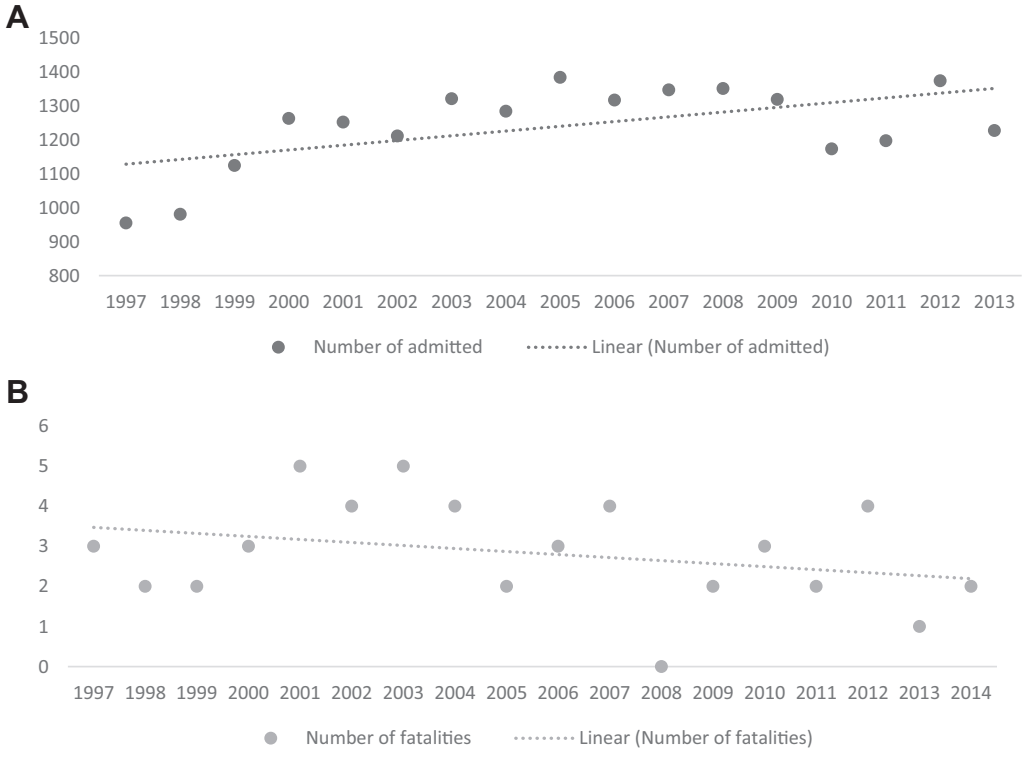

Fig. 2 – Total number of (A) admitted (PAR) and (B) fatal patients (DOR) for each year with linear line of best fit for both fatal and injured samples. DOR, Death Register; PAR, National Patient Register.

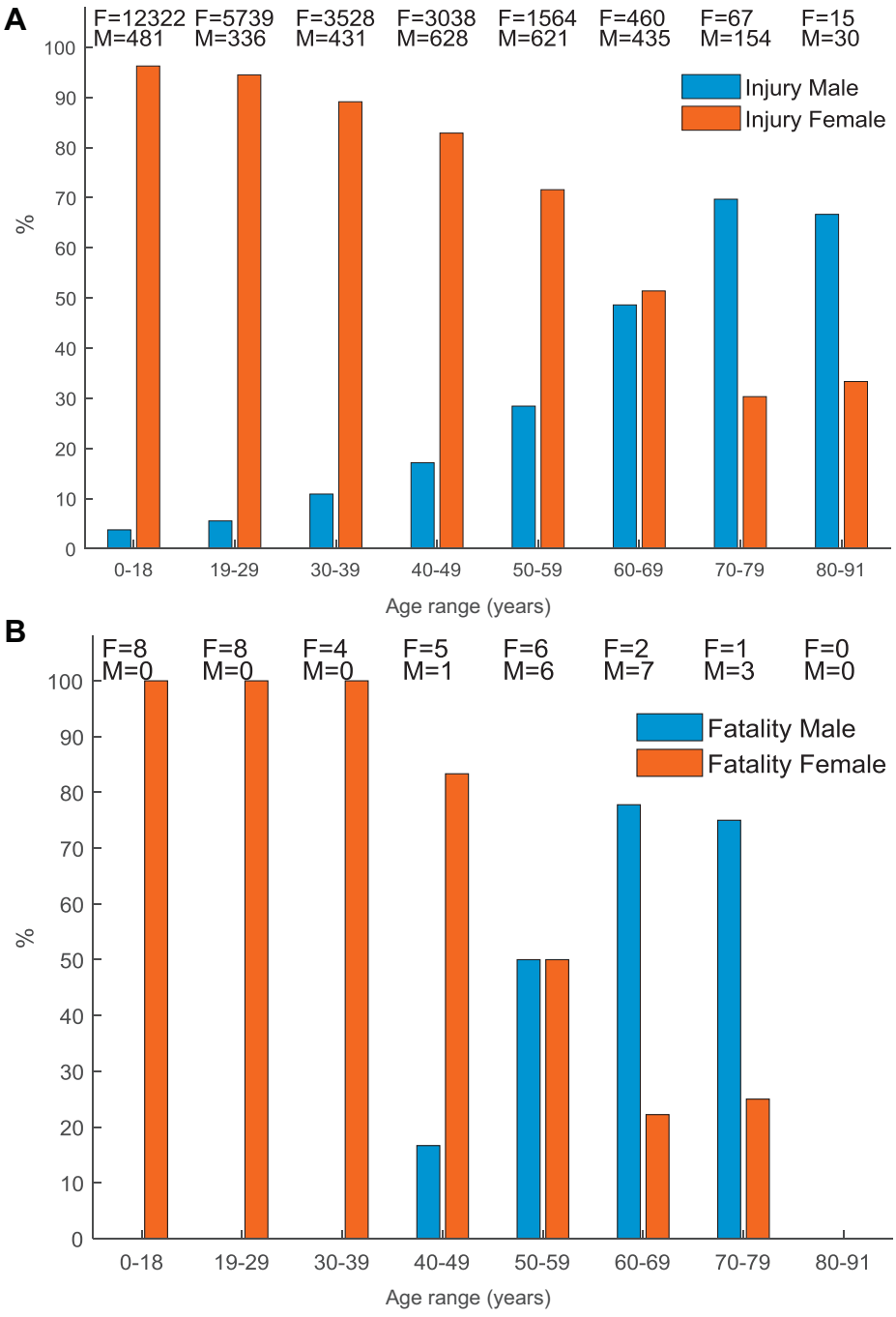

Fig. 3 – Age and gender of patients who (A) were injured and (B) died due to equestrian-related injury events for the entire study period.

the injury can be seen in Table 2. Both age and gender were significantly associated with fatalities. There was an increase of 5.1% in the odds of fatality for every year increase in age of the patient. Men had 2.2 times higher odds to be in the fatal sample than women. Home region was found to be associated with fatality when examined using univariate logistic regression, but the association was not significant when explored in a multivariate binary logistic regression model. No significant association between year of injury and fatality was observed.

Impact on the public health system

For those patients suffering an injury due to a equestrian-related injury event, the median number of days admitted to hospital was 1 day, with the longest admission being reported at 149 days and a mean of 1.9 days. Approximately 70% of cases were not admitted or only admitted for one day—see Table 3. A total of 21% were admitted for two to five days, whereas only 7.8% were admitted for six or more days.

Table 1 – Injured body region and injury type by the age group for both fatal and injured cases.

Injury region/type	Injured age, n(%)			Fatal age, n(%)		
	0–18 years	19–49 years	50+ years	0–18 years	19–49 years	50+ years
Injured region						
Head	4365 (34.1)	3422 (25.0)	664 (19.8)	6 (75)	10 (66.7)	11 (52.4)
Neck	337 (2.6)	512 (3.7)	143 (4.3)	1 (12.5)	1 (6.7)	4 (19)
Lower extremities	2017 (15.8)	3140 (22.9)	788 (23.6)	0	1 (6.7)	0
Upper extremities	3776 (29.5)	2694 (19.7)	694 (20.7)	–	–	–
Torso	1846 (14.4)	3472 (25.3)	929 (27.8)	1 (12.5)	3 (20)	6 (28.6)
Unknown	464 (3.6)	459 (3.4)	128 (3.8)	0	3 (16.7)	4 (16)
Total	12,805 (100)	13,699 (100)	3346 (100)	8 (100)	18 (100)	25 (100)
Injury type						
Neurological trauma	3500 (27.3)	2515 (18.4)	493 (14.7)	2 (25)	5 (27.8)	8 (32)
Fracture or dislocation	4549 (35.5)	5804 (42.4)	1741 (52.0)	4 (50)	6 (33.3)	8 (32)
Muscle or tendon injury	587 (4.6)	837 (6.1)	147 (4.4)	–	–	–
Soft tissue injury	3196 (25.0)	3446 (25.2)	637 (19.0)	–	–	–
Internal organs	320 (2.5)	359 (2.6)	127 (3.9)	1 (12.5)	3 (16.7)	4 (16)
Other/unknown	653 (5.1)	738 (5.4)	201 (6.0)	1 (12.5)	4 (22.2)	5 (20)
Total	12,805 (100)	13,699 (100)	3346 (100)	8 (100)	18 (100)	25 (100)

Table 2 – Logistic regression examining predictors of fatal injuries.

Predictor	P-value	OR	95% CI
Age	<0.00005	1.051[a]	1.033–1.069
Gender			
Male	0.011	2.209[a]	1.202–4.060
Female	Reference	–	–
Year	0.775	1.008	0.953–1.067
Home region			
Götaland	0.498	1.407	0.524–3.775
Svealand	0.697	0.811	0.281–2.336
Norrland	Reference	–	–

OR, odds ratio; CI, confidence interval.
[a] Significantly associated with fatality.

Table 3 – Number of days of admission in hospital (0 days representing non-admission or admission for less than 24 h).

Number of days	Number of cases, n(%)
0	10,494 (35.16)
1	10,759 (36.04)
2 to 5	6264 (20.99)
6 or more	2331 (7.81)

Västra Götalandsregionen reported the cost for a visit to the emergency department at a hospital in 2016 to be 2500 SEK and the cost for a day of care in hospital to be 9700 SEK. After inflation was taken into consideration and figures were converted into Euro, this resulted in a conservative cost of 3.2 million Euro annually or 1800 Euro per injury event, based on current costs.

Information on ward and treatment was only available for those patients recorded in the PAR dataset. For these 21,096 patients, the most common wards to be admitted were the surgical wards (38.4%), orthopedic wards (34.6%), and child and adolescent care wards (13%). A total of 7484 people received some sort of surgery or in-hospital treatment. The most common procedures involved repositioning of fractures, including closed reposition of fracture in the elbow or forearm (2.6%, n = 198), closed reposition of a fracture in the shoulder or upper arm (1%, n = 78), or closed reposition of a fracture in the hand or wrist (1%, n = 75). Other common treatment procedures included insertion of a thorax drain (1.1%, n = 85), monitoring of vital organs and ultrasound (0.8%, n = 60) and monitoring of vital signs (0.5%, n = 41).

The counties where the patients from PAR and DOR datasets had their registered address can be seen in Fig. 4. The main region affected was Västra Götaland in the South of Sweden, accounting for 15.9% of the cases (n = 3197). Another 12.7% were from Skåne (n = 2559), and 13.7% were from Stockholm (n = 2751).

Discussion

Fatalities due to equestrian-related injury events affected on average three people every year, resulting in an approximate risk of injury of 0.03/100,000 population in Sweden, compared with a previously found figure of 0.17/100,000 population in New Zealand.[5] Although the number of fatalities decreased over the study period, the number of those injured in horse-related injury events increased.

There was a dominance of women in both injured and fatal samples. However, there was a higher percentage of men involved in fatalities than in the injured sample, which is consistent with previous reports.[24] In the older age ranges, men dominated, and the median age of patients in fatal sample was 42.96 years compared with 21 years for the injured sample. The high percentage of women in the sample can be linked to increased exposure of this group, with women reportedly representing 91% of those riding horses in Sweden.[25] However, the larger representation of men in the older age groups perhaps reflects the greater number of occupational equestrian-related injuries in the older age groups[26]

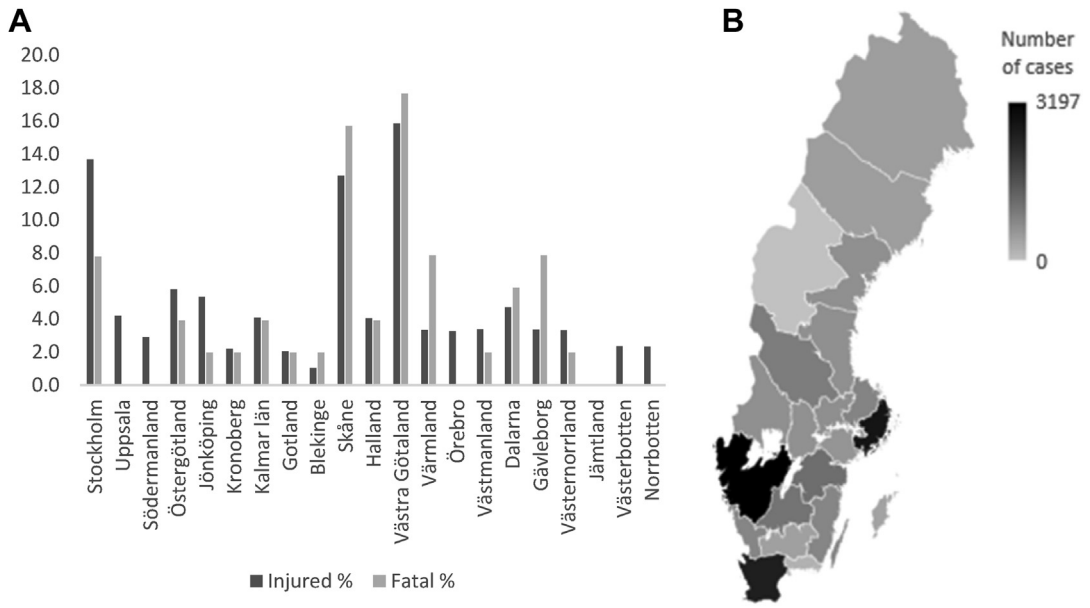

Fig. 4 – (A) The percentage of all those injured and all fatalities in the study and (B) the total number of injured (PAR) and fatal (DOR) cases by geographical county in Sweden. DOR, Death Register; PAR, National Patient Register.

with which men are more frequently engaged.[27] Men had over two times the odds of fatality than women and potentially this can be linked to these differing tasks and men being more frequently involved in higher risk activities.

Older riders were more likely to suffer a fatality than their younger counterparts, which may be because of inherent fragility in older patients similarly as seen in high fatality rates among older drivers of vehicles.[28] The higher number of men in the fatal cases is perhaps indicative of the older age of the fatal cases and linked to increased exposure of men in the older age ranges.

Home region was significantly associated with fatality during univariate logistic regression. However, this association was not significant in the multivariate model. The lack of significant association between home region and fatality during multivariate binary logistic regression perhaps indicates that the age and gender distribution of riders may vary in the different regions in Sweden. The Swedish Board of Agriculture reported on the number of horses in the different regions in Sweden.[29] The regions with the greatest proportion of the Swedish horse population were Skåne (16.35%), Västa Götalands (15.9%), and Stockholm (7.7%). These regions corresponded with the three regions with the highest number of injuries and fatalities. This indicates that the number of injuries is linked to exposure, although the exposure figures were based on the number of horses, not the number of riders as this was not available. The lack of complete exposure data limits the capacity of the data to observe how the results are reflective of exposure or of risk.

The results of this study suggested that, in the injured sample, the injury type and injured body region were not independent of age, and the injuries to the younger riders most frequently involved the head, whereas older riders more frequently experienced torso injuries, with the percentage of the riders in the oldest age group with torso injuries being double that of the youngest age group. It is unclear why there is a tendency for younger riders to suffer more head injuries. Information on helmet usage was not available in the data used for this study, but perhaps there is a propensity for older riders to be wearing helmets. We only examined the primary injury in this investigation, and it is also possible that older riders are still suffering many head injuries, but other injuries are more serious in this age group.

A study by Bilaniuk et al.[10] also reported a significant relationship between age group and injury using Chi-squared analysis, yet this difference was only found to be significant in terms of percent of patients with rib fracture injuries in the different age groups. In Bilaniuk's study, a total of 22% of patients older than 50 years suffered a rib fracture, whereas only 2% and 8% of patients had a rib fracture in the 0- to 18-year and 19- to 49-year age groups, respectively. The predominance of fractures in the older age groups was attributed to physiological weakness in the bones of the older patients, which could also be reflected in the high number of fractures reported in the older age groups in our investigation.

Bilaniuk et al.[10] also suggested that larger numbers of upper extremity fractures in younger patients were due to quicker reflexes during a fall and higher numbers of injuries involving the soft tissue structures in the 19- to 49-year-old group was because of higher muscle mass. In our study, soft tissue injuries were more common in the younger two age groups, which could reflect higher muscle mass. However, younger riders had a lower proportion of upper extremity injuries than the older riders, which contrasted to that presented previously.

Similarly to previous reports,[5,6] the head was the most frequently injured body region for both injured and fatal cases, and fractures accounted for the largest number of injuries. In addition, these head injuries were most frequently observed in the younger patients (0–18 years). Injuries to the

torso and internal organs were common and were the second most frequent cause of fatality. Helmet and protective vest usage information was not available for the datasets examined in this study. Therefore, the effect of helmet and vest usage on head and abdominal injury and fatality rates could not be explored. However, it is possible that the decreasing trend observed in fatality rates could be linked not only to an improvement in health care but also to improvements in design or increased usage of these protective devices. Yet, the substantial number of head and abdominal injuries still being observed in our investigation indicates a need for further improvement of design or increased usage rates.

The type of injury changes with the age group, and more information on the type of neurological and fractures sustained in these cases should be further explored to identify the specific protection needs. As described earlier, the study could not determine if the decrease in neurological trauma with age was because of lower injury incidence or limitations in the data. A better understanding of the loading mechanisms and head injury patterns with age is needed to identify helmet design needs for the different user groups.

The estimated cost was found to be 1800 Euro per injury event or 3.2 million Euro per year, with patients spending on average two days in hospital, with one patient requiring 149 days of care. This cost was based on the best available information but provides only a conservative estimate of the associated costs as it did not include the cost of procedures or any societal costs. The work by Altgärde et al.,[15] reported a cost of consultation and treatment of approximately 1400 Euro per injury event in 2004. Given inflation rates, this would equate to approximately 1700 Euro in today's figures, similar to the costs report in our study. However, of this cost, they reported that operation cost contributed a total of 36,000 Euro for children and 58,000 Euro for adults. Surgical costs were not available for procedures reported in the PAR dataset, but using the cost estimates as given in Altgärde et al.,[15] this roughly equates to an additional total surgical cost of 0.47 million Euro per year. This would increase the average cost per injury event to almost 2100 Euro. Surgical procedures most frequently involved reposition of fractures, both closed and open. Other commonly conducted non-surgical procedures included insertion of thorax drains and monitoring of vital organs.

Our figures reported that on average, 1756 people visit hospital for equestrian-related injuries nationally in Sweden every year, with a total of 29,850 visits for the entire study period. There were 8769 injury events reported in IDB over the study period which were not reported in the hospital discharge dataset (PAR), suggesting that many patients visit hospital without requiring admission every year. As the IDB dataset only included some hospitals within Sweden and the sampling areas changed over the course of the study period, the numbers of those visiting hospital without being admitted may be severely under-represented in this study. This means that there would be additional hospital costs and lower severity injuries which are not captured in the present study. Unfortunately, there were no national outpatient data available, so the present data were the most comprehensive dataset available to investigate non-admitted patients. The PAR data set provided national equestrian-related injuries, however, limited to cases of higher severity which required hospital admission. It is important to keep in mind that the results of the binary logistic regression only included the PAR cases, and as such, is limited to serious injuries. Furthermore, the reported figures only reflect those who have visited hospital and may be underrepresenting all those with equestrian-related injuries who may not have required hospital treatment but may have visited other medical services. A previous investigation[30] reported that there were on average 488 equestrian-related injuries annually in Skaraborg, Sweden, when records of hospital, medical centers, and public dental services were investigated. Our results reported 292 injury events per year for the same region, indicating almost 200 additional cases of cases where a patient visited a general practitioner or dental service rather than hospital. Västra Götalandsregionen estimated a cost of 180 Euro for a visit to a medical center, and this equates to an additional cost of 36,000 Euro annually for Skaraborg region alone. In addition, we did not calculate any societal costs, such as social welfare, sick leave, and long-term disability care.

Conclusion

Equestrian-related injuries present a major public health concern, resulting in an average of three fatalities and close to 2000 injuries every year in Sweden alone. Young women accounted for the largest proportion of both injured and fatal samples. Head injuries were found to be the main cause of both injuries and fatalities, yet injury type was not independent of age. Design and marketing of protective equipment can, therefore, be targeted to specific age groups. An increase in age led to increased odds of a fatality, and men had 2.2 times higher odds than women to be in the fatal sample. Decreases in fatalities over the years suggested improvements in health care or protective measures, yet injury rates are still high,a and there is a need for continued intervention.

Author statements

Ethical approval

Ethics approval for this study was obtained through 'Regionala etikprövningsnämden i Göteborg'.

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Competing interests

None declared.

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