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# On and off the horse: Mechanisms and patterns of injury in mounted and unmounted equestrians

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ABSTRACT

*Introduction:* The purpose of this study is to determine whether discrepant patterns of horse-related trauma exist in mounted vs. unmounted equestrians from a single Level I trauma center to guide awareness of injury prevention.
*Methods:* Retrospective data were collected from the University of Kentucky Trauma Registry for patients admitted with horse-related injuries between January 2003 and December 2007 ($n = 284$). Injuries incurred while mounted were compared with those incurred while unmounted.
*Results:* Of 284 patients, 145 (51%) subjects were male with an average age of 37.2 years (S.D. 17.2). Most injuries occurred due to falling off while riding (54%) or kick (22%), resulting in extremity fracture (33%) and head injury (27%). Mounted equestrians more commonly incurred injury to the chest and lower extremity while unmounted equestrians incurred injury to the face and abdomen. Head trauma frequency was equal between mounted and unmounted equestrians. There were 3 deaths, 2 of which were due to severe head injury from a kick. Helmet use was confirmed in only 12 cases (6%).
*Conclusion:* This evaluation of trauma in mounted vs. unmounted equestrians indicates different patterns of injury, contributing to the growing body of literature in this field. We find interaction with horses to be dangerous to both mounted and unmounted equestrians. Intervention with increased safety equipment practice should include helmet usage while on and off the horse.


## Introduction

Approximately 1 in 63 Americans is involved in some capacity with the horse industry and an estimated 30 million people ride horses each year in the United States, resulting in 78,279 visits to the Emergency Department in 2007 [1–3]. Several studies estimate the rate of injury to range from 1 per 350–1000 h of horseback riding or 18.7 injuries per 100,000 horse-related interactions [4–6]. By comparison to other sports, such as wrestling (10.7/1000 h) or football (6.1/1000 h), equestrian injury is less frequent, though the injury type and severity may differ. Hospital admission is common among equestrians by comparison to motorcyclists and snow skiers [4,7]. Between 20% and 30% of adult equestrians and up to 50% of children (3–18 years) presenting to the Emergency Department are admitted to the hospital, and one in 10,000 riders dies in a given year [5,7–9].

Kentucky represents a US national focal point of equitation with 1 in 22 residents actively involved in the horse industry and 50% of horses being utilized for recreation [3]. This environment facilitates a broad spectrum of participation from recreational riding to professional racing, training, diverse competition and the equine veterinary sciences. In comparison to a prior 5-year study at the same center, horse-related injuries have significantly increased at the University of Kentucky, a Level I trauma center in central Kentucky (0.75% vs. 2.2%, $p < 0.01$) [10]. This suggests an increase in equestrian interaction throughout the state. To identify opportunities for injury prevention, we re-evaluated equestrian injuries at our center by examining differences in patterns of injury among mounted and unmounted equestrians via our own trauma database. It is hypothesized that mounted and unmounted equestrians have distinctly different patterns of injury and that specific targets for injury prevention can be identified.

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**Table 1.1**
Demographic indices of patients identified in the University of Kentucky Trauma Registry between January 2003 and December 2007 ($n=284$), separated as mounted ($n=208$) vs. unmounted ($n=76$). Statistical significance ($^*p<0.05$) comparison between mounted and unmounted.

| Category | Mounted Mean (sd) | Unmounted Mean (sd) | $p$ Value |
|---|---|---|---|
| Age (years) | 38.1 (16.7) | 34.8 (18.6) | 0.16 |
| Length of hospital stay (days) | 3.7 (3.5) | 2.9 (2.3) | 0.08 |
| Length of ICU stay (days) | 0.5 (3.5) | 0.25 (0.9) | 0.58 |
| Glasgow coma scale | 14.6 (1.7) | 14.3 (2.6) | 0.41 |
| Injury severity score | 11.5 (7.8) | 10.2 (9.6) | 0.25 |
| **Category** | **Mounted $n$ (%)** | **Unmounted $n$ (%)** | **$p$ Value** |
| Male patients | 99 (48%) | 46 (60%) | 0.07 |
| Female patients | 109 (52%) | 30 (40%) | |
| Recreational | 191 (92%)* | 52 (68%) | <0.01 |
| Occupational | 17 (8%) | 24 (32%)* | |
| Helmet usage | 12 (6%)* | 0 | 0.04 |
| Mortality | 0 | 3 (4%)* | 0.04 |

## Methods

Equestrian injury data were sampled from the University of Kentucky Trauma Registry between January 2003 and December 2007. Data points included age, gender, injury severity score (ISS), abbreviated injury score (AIS) by body region, Glasgow coma scale score (GCS), safety equipment usage, blood alcohol level, surgical procedures, length of hospital stay, length of stay in the ICU, discharge disposition, and whether the injury was occupational or recreational in nature. Age, gender, length of hospital stay, length of ICU stay, GCS, and injury severity score were compared via unpaired $t$-test and reported as mean and standard deviation. Occupational vs. recreational injuries, helmet usage, mortality, AIS scoring and surgical procedures were compared by doubling the one-tailed probability from Fisher's exact test and reported as significant when $p < 0.05$. Severe head injuries were defined by an AIS score of 5; moderate, 3–4; and mild, 2.

## Results

Between 2003 and 2007, 12,668 injuries were entered into the University of Kentucky Trauma Registry due to blunt force trauma. Of total blunt trauma, 284 (2.2%) cases were due to interaction with horses. Demographic data are summarized in Table 1.1. Mean age upon admission was 37.2 years (S.D. 17.2, 2–79). 51% were male. Three deaths occurred (3/284, 1%), all in the unmounted cohort, due to kick to the chest, kick to the head, or head injury after fall from a trailer while loading a horse. The mean ISS scores of mounted vs. unmounted groups are 11.5 (S.D. 7.8) and 10.2 (S.D. 9.6), respectively. The mounted group had more injuries during recreation while the unmounted group had more during occupation (92% vs. 68%, and 32% vs. 8%, $p < 0.01$). Females within the mounted group were younger than males (34.7 vs. 41.8, $p < 0.01$) and had a lower mean GCS score (14.3 vs. 14.8, p = 0.05) upon admission, as summarized in Table 1.2.

**Table 2**
Mechanisms of injury in mounted and unmounted equestrians ($n=290$).

| Mechanism | Mounted $n$ (%) | Unmounted $n$ (%) |
|---|---|---|
| Thrown/fall | 157 (73) | 1 (1) |
| Thrown and dragged | 5 (2) | 0 (0) |
| Thrown and crushed | 39 (18) | 0 (0) |
| Kicked | 5 (2) | 59 (78) |
| Crushed | 0 (0) | 15 (20) |
| Carriage related | 5 (2) | 1 (1) |
| Hit by vehicle while riding | 3 (1) | |

Patients were most commonly injured while engaged in recreation (85%), most frequently following a fall from mount (54%) (Table 2). Other injuries were less common, attributable most commonly to a kick (22%). Extremity fracture (33%) and head injuries (27%) were most common overall. Whereas facial and abdominal injuries were more common among unmounted equestrians ($p < 0.01$, $p < 0.01$, respectively), chest and leg injuries were more common in the mounted group ($p = 0.03$, $p < 0.01$, respectively). However, the rate of head injury was not different between mounted and unmounted equestrians. AIS data are summarized in Tables 3.1 and 3.2 and comparison of head injury severity in unmounted vs. mounted equestrians is in Table 4.

Surgery was required in 118 cases (42%) with lower extremity fracture fixation the most common surgical procedure in both mounted and unmounted equestrians (51% and 39%, Table 5). Significantly more pelvic fracture repairs were performed among mounted equestrians (20% vs. 0%, $p < 0.01$).

## Discussion

The purpose of the present study is to determine whether discrepant patterns of horse-related trauma exist in mounted and unmounted equestrians at a single Level I trauma center in an area of dense equine–human interaction. Prior studies have indicated that both riders and handlers are at risk of significant injury and that safety equipment should be employed when in close proximity to the animal [11,12]. In order to guide further injury prevention efforts, we describe the mechanisms and patterns of injury in mounted and unmounted equestrians.

Internationally, the most commonly injured equestrian is a young (≤30 years) female falling from mount during recreation, a pattern similarly demonstrated in the present study [13,14]. Indices of age, length of hospital/ICU stay, GCS, and ISS were not different overall between mounted and unmounted equestrians. Females were significantly younger within the mounted group and had lower GCS scores upon admission, owing to a GCS <8 in 5 female riders vs. 1 male. Only one female patient was wearing a helmet at the time of injury. This pattern is well described in

**Table 1.2**
Demographic indices comparing males and females within either mounted ($n=208$) or unmounted ($n=76$) cohorts. Statistical significance ($^*p<0.05$).

| Category | Mounted | | | Unmounted | | |
|---|---|---|---|---|---|---|
| | Males ($n=99$) Mean (sd) | Females ($n=109$) Mean (sd) | $p$ Value | Males ($n=46$) Mean (sd) | Females ($n=30$) Mean (sd) | $p$ Value |
| Age (years) | 41.8 (16.1)* | 34.7 (16.5) | <0.01 | 37.0 (19.1) | 31.5 (17.5) | 0.2 |
| Length of hospital stay (days) | 4.0 (4.0) | 3.4 (3.0) | 0.23 | 3.0 (2.0) | 2.8 (2.7) | 0.7 |
| Length of ICU stay (days) | 0.3 (1.7) | 0.6 (4.5) | 0.6 | 0.3 (0.9) | 0.2 (0.9) | 0.5 |
| Glasgow coma scale | 14.8 (1.3)* | 14.3 (2.0) | 0.05 | 14.4 (2.5) | 14.2 (2.8) | 0.8 |
| Injury severity score | 11.1 (6.3) | 11.9 (9.1) | 0.5 | 9.5 (6.2) | 11.3 (13.3) | 0.4 |