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Horses: How Saddle Style Defines a Culture and the Skeletal System

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ABSTRACT

This paper examines the way in which various parameters affect injury type and prevalence in horse eventing. The human-horse relationship has a long history that has continued to evolve, and their relationship is still strong today, especially in the role of sports and entertainment. In equestrian sports, horseback riding has been found to be extremely dangerous in terms of prevalence and severity of injury. This paper evaluates how saddle style, the sex of the rider, rider experience, and nature of event impacts injury patterns specifically within horse eventing which utilizes an English styled saddle.
Demographic and Injury Distribution in Horse Eventing

Brandy Morgan

Introduction:

Horses have been and continue to be an integral part of many cultures, and are often the basis for the development of new cultural innovations that are commonplace today, including the invention of the trousers (Beck et al., 2014). The relationships between human and horse has had a long coevolution beginning with the horse as a food source for hunter-gatherers (Anthony, 2007). Following their domestication in the Bronze Age, the relationship began to intensify as the utility of the horse was realized for carrying heavy loads and transportation, primarily in warfare (Jansen et al., 2001; Levine, 1999; Bendrey, 2012; Zeder et al., 2006). As the warhorse spread throughout Eurasia, they became a cultural symbol symbolizing power and masculinity. In modern cultures, the horse still symbolizes great strength, grace and power, through their use as mascots and totems (Edwards & Graham, 2011). The emotional relationship between horses and humans has developed over time in varied, and at times, more intimate levels of companionship. For many the horse is now considered alternatively as a work animal, pet, and source of entertainment.

Equestrian entertainment comes in many forms, but it is one of the only sports in which horse and human compete as one entity. Previously, animals were often used in spectator sports, where animals are the spectacle such as in cock fighting or bear baiting, both popular in medieval times when equestrian events started to manifest themselves to the common population. As equestrian related events developed into what we see today, changes in equipment, equestrian knowledge and the demographic of the rider changed vastly. Today, horse-eventing has flipped its gendered demographics from being a predominately male to now a
predominately female-oriented sport (Coulter, 2013). This paper aims to look at the evolution of the sport in terms of demographics as well as the risks associated with participation in terms of injury to the rider.

**Horses in Human History:**

The horse was one of the last herd animals to be domesticated following sheep and cattle during the Bronze Age (Anthony, 2007). Ancient groups in Botai, likely modern Kazakhstan, noticed a benefit in the domestication of horses in that they were much better suited for harsh winters compared to their counterparts. They were also much cheaper to keep. Horses use their hooves to break ice to gain access to the grass beneath, so fodder was not necessary for their keep. Sheep and cattle use only their snouts to obtain nutrition from the ground and often end up with their noses frozen to the ground due to the freezing of the condensation from their breath, so their main diet was of fodder (Zeder et al., 2006; Bendrey, 2012).

The domestication of the horse was relatively slow until mounted riding was established around 3500 BC in Kazakhstan (Levine, 1999), at which point many nomadic groups realized the usefulness of the horse and began their own domestication and trading plans. As tensions started increasing in Eurasia, the horse became a major tool for groups waging war on each other as it gave them speed, mobility, and often nourishment (Lindner, 1981). Cultures such as the Huns would drink the blood of horses for nutrients while on foot, or would drink the milk, which made mares preferred for long voyages. Many other nomadic cultures owe their success in conquest to the horse.

As the domestication of the horse spread through Europe, several training procedures were formed both for training the warhorse and for the advancement of the rider (Hyland, 2003). These training regimes would soon become popular forms of entertainment. Knights were
trained on horseback through tournaments and jousts. The focus was on the communication exhibited between the horse and knight, such as the knight’s ability to illicit intricate patterns of movement out of their horse (McClean, 1985). Jousts were held under very strict rules regarding the area of the performance, the tasks to be completed and those allowed to compete, which was limited only to knights. Jousts and tournaments were integrated into medieval festivities and evolved into a gambling event (McClean, 1985). The military practice spread across Europe and became useful to the cavalry in the New World, whose training regime would follow suit with these medieval designs and become an intricate form of entertainment.

**Horse Eventing and the Olympics:**

Training of cavalry expanded to what is now known as horse eventing, which features three tests. These tests are completed either over a three-day or one-day period. They involved various skilled tasks, which would be beneficial to both horse and rider during wartime. In dressage, the communication between the rider and horse is evaluated, as the horse is required to complete several difficult movements on command and in sync with the rider, such as a pirouette where the horse must complete a 360 degree turn at a canter. The cross-country phase assesses the horse and rider’s endurance and ability to travel over treacherous terrain at optimal speeds. Show jumping tests the communication between horse and rider as well as the
soundness of the horse after conducting the rigorous cross-country phase of the event. Show jumping consists of several smaller fences set up inside an arena that the horse must clear ("About eventing," 2012; Wipper, 2000).

The first competition of this sort was first held in 1902 at the Championnat du Cheval D’Armes in France. They were soon introduced to the Olympic Games in 1912. However the competition was only open to male military officers on active duty and they could be mounted only on military charges. This competition was held over five days, with the first day’s events devoted to endurance, the second a rest day, the third day involving a speed test over steeplechase, the fourth day jumping over fifteen obstacles, and the fifth day being dressage. Horses were required to carry at least 176 pounds to mimic what would have been expected of horses in the cavalry. The 1920s competition included changes to distances, and fence heights, as well as a reduction in the required weight to 165 pounds where it would remain for several decades. During each Olympic Game, small adjustments were made to the rules, until 2004, when major changes happened advancing the safety measures and time requirements of the sport. The traditional endurance test included roads and tracks, steeplechase and cross-country phases. In 2004, all components of this endurance test were removed except the cross-country phase, which was re-labeled into what is now considered "short format," and the standard for all competitions of this sort. This was primarily intended to reduce the amount of space needed to hold the Olympic event, as they often had to be held in other cities and sometimes countries different from that of the standard Olympic Games ("About Cross country phase. ("FEI Nations cup," 2015)
eventing,” 2012). The changes were also made in a response to several incidences that included injury to the horse and rider. In previous competitions, concerns regarding the health of the horse had come up including overheating, increased risk of injury and exhaustion. This rule change has sparked some criticism as some believe it is straying too far from tradition and that the event is not as challenging under the current format. The games now also feature a mandatory veterinary inspection before the horse enters the dressage competition to make sure that they are sound and uninjured after the previous tests (“About eventing,” 2012).

The 1952 Games also saw a dramatic change as women were finally allowed to compete. Before, it was believed that the sport was too dangerous and should be reserved only for that of gentleman status (Wipper, 2000). Currently, women predominate in the eventing world at novice and amateur levels, though there is a shift in the spectrum to the predominance of male at the elite levels (Coulter, 2013).

**Gender:**

Today, horse-eventing and dressage is often accompanied by a perceived correlation with femininity. This trend is slightly surprising due to the sport’s roots being military in essence. Near the middle of the modern twentieth century there was a shift in the way that horses were cared for and treated. This system emphasized a more compassionate approach to training and ascertained the ideals of communication and harmony between the horse and the rider (Coulter, 2013). This shift legitimized girls and women’s activities and participation in equestrian related activity, and made riders adopt a more “delicate” demeanor (Birke et al., 2009). This was a point of feminization of the sport, and men began to slowly remove themselves from the activity. Women were also seen as better trainers and handlers of horses due to their gentle nature (Plymouth, 2013).
The feminization of the sport has resulted in varied media responses. Some male participants have been given a low status image or ignored completely, while some media outlets have attempted to overemphasize the proportion of males participating in eventing. Mr. Rolf-Goran Bengtsson of Sweden won an Olympic silver medal in equestrian sports, but no media mention of it was ever made, though four other competing members, of both genders, in non-equestrian sports, such as soccer, were talked about extensively. These sports are considered to be sports of a higher status than that of horse eventing, due to the fact that it has a feminine connotation associated with it. The shift of female dominance in novice class is not portrayed well in equestrian media outlets. Many horse-orientated magazines over-represent the male population. Several examples have been found and include an article about riding schools, which have a majority of females enrolled, yet the article featured a male team picture, never mentioned females in the text, and utilized mainly male pronouns. Articles such as these appeared in several prominent equestrian magazines including, *Horse & Rider*, and *Equestrian Sports*. The media has a role in shifting the male perception of horseback riding into a more positive one, thus aiding in the recruitment of more male participants in the sport (Plymouth, 2013).

Several male-only teams have been created and are featured as stone faced and powerful entities in several outlets, such as *Horse and Rider* (2010). Their pictures often convey that of solidarity and brute force. Programs have been elicited to pair male individuals with older men competing in the sport to give them a role model to confide in.
and learn from, as male horse eventers are often bullied and ridiculed for their participation (Plymouth, 2013; Coulter, 2013).

Coulter (2013) has looked into the anomaly of the gendered differences we see in competition and has reached several conclusions that are probable contributing factors. In the elite competitions, women are more likely to be associated with behind the scenes work than their male counterparts, due to the machismo attitudes of males. Husband-wife teams are quite common, with the wife often working behind the scenes, and Coulter posits that men are often uncomfortable with working beneath their female significant other. Horse events require a lot of behind the scenes work including managing horse stables, as many elite competitors hold side jobs as horse trainers or giving lessons to other riders. Coulter also proposes that the increase in men at the elite level of competition as compared to novice and intermediate levels may be due to the financial considerations of owning and training horses for competitions. The cost is quite extensive, and in several cultures that participate in eventing, including the United States, males are more likely to be wealthier than their female counterparts.

The nature of horse eventing tends to lend itself more towards the ability of a man to obtain higher success than a woman. Competition rules often mirror the way men are socialized to think and act. Women who must take a leave of absence due to pregnancy, child rearing, and so on are unable to continue to acquire international points, thus lowering their ranking. Meredith Michaels-Beerbaum, in 2010, had to fight the Federation Equestre Internationale governing board, for the ability to have her points frozen rather than lost while she was not actively competing due to her pregnancy. In contrast the males have the ability to continue competition relatively uninterrupted (Coulter, 2013).
In horse eventing, gendered roles are clearly defined and expected at this point in time, though efforts have been taken to attempt to blur the lines that stigmatize the sport as being feminine and allow women an equal opportunity to compete at the elite level alongside their male counterparts. Although there are no defined rules against women competing at the elite level, structural barriers such as the inability to ride when pregnant, financial input, and pre-existing gender roles, exist making it difficult for them to do such. The link between competition level and gender could play a significant role in the way that injury patterns are viewed, due to demographic bias, though gender does not seem to play a direct role in the injury patterns associated with horse eventing.

**Horse-Saddle-Rider Interactions:**

The experience between the rider, horse and saddle are integral in the overall performance and safety of the competitor and horse (Greve et al., 2004). All three factors can have an impact on lameness, injury and degree of performance. Twenty-five percent of British dressage horses had evidence of back-related problems. Poorly skilled riders, incorrectly fitting saddle, and other issues could cause this by inducing crookedness of the rider and saddle. This causes dissipation of the force on the back of the horse in an incompatible way. The difficulty in finding a correctly fitting saddle in horse eventing is that each horse is constantly changing shape due to differences in gait due to pace. Different saddles have been proposed, but neither is a perfect solution. A treed saddle is able to dissipate the weight but does little for the horse’s changing shape, while a treeless saddle allow flexibility, but lack the ability to spread the load (Greve et al., 2004).

The interaction of the pelvis of the rider with the saddle of the horse is one of the most influential factors in determining the skill and overall competitive success of the rider (Munz et
al., 2013). In a study of twenty professional and twenty beginning riders, the pelvis position on the saddle was evaluated. Professionals tended to keep their pelvis further forward toward the midpoint of the saddle, which leads to a better posture of a straighter back and a posterior shift of the shoulder, which obtains a higher score in the arena (Munz et al., 2013). Beginner riders in the study tended to keep their pelvis further to the right and backward which leads to crookedness affecting the posture of the rider, and the weight interaction to the horse (Greve et al., 2004). The effects of posture have been anecdotally indicated to cause lower back pain in the majority of individuals who ride horseback (Kraft et al., 2009).

**Injuries:**

The risk of injury changes based upon skill of the rider as well as the type of the saddle as indicated by several studies (Jagadizinks et al., 2001; Munz et al., 1999). Riders who utilize the English saddle and ride fifteen to twenty hours per week are at an increased risk to injury. The most common form of long-term injury is lower back pain (Kraft et al, 2009; Quinn, 1996). In 1996, a study was conducted of 108 equestrian riders. Each individual was asked to complete survey regarding their experience with back pain as well as the types of riding which they took part in. Out of the 108 members, 48% had experienced back-pain, 66% of whom rode English (general purpose) saddle, the saddle type required for use in eventing. Women had a higher percentage of back pain than men when compared individually with a rate of 72% (Quinn, 1996). A further evaluation into the topic of back pain indicated that although riders have a high prevalence of back pain, Magnetic Resonance Imaging (MRI) data showed that the prevalence of back pain has no cause in undue disk degeneration, spondylolysis or spondylolisthesis (Kraft et al., 2009). This same study indicated that there was a high rate of pathological T2 signal intensity, which indicates soft tissue abnormalities, of the lumbar intervertebral disk, on the MRI
scans, among dressage riders. This difference was not significant when compared to that of the controls.

Another form of long-term trauma associated with English style riding is an asymmetry in the left leg of riders (Munz et al., 1999). Right-handed people flex their right hip more strongly when riding, and also have further tension in their right shoulder due to reign pressure. These behaviors can cause bone pathology, which can be indicative of riding when examination of remains occurs. One such indication is the apparent lengthening of the left leg caused by the elevation of the right ischium and posterior ilium caused by the rotation of the ilium anteroventrally (Munz et al., 1999).

Traumatic injury associated with horse eventing occurs almost exclusively during the cross-country phase of the event. Injury data reported by an on-site doctor at thirty-five equestrian competitions in South Australia from 1990-1998, reveal an injury rate of 0.88% per competition per event. Over the eight year span, thirty-seven individuals were injured; nineteen were head and neck injuries, 3 were lower limb fractures, 3 were rib fractures, and 5 were soft tissue damage of the thoracolumbar spine, (those not admitted to the hospital out of the thirty-seven were not included in this inventory) this information is summarized in table 1 featured below. One case in which the horse cartwheeled over a jump and fell on a rider was fatal due to a ruptured aorta, liver and diaphragm. A second case, which occurred in the same manner, was life threatening due to a flail chest and pneumothorax injury. All 37 injuries occurred during the cross-country phase of the event. The author also hypothesized that increasing difficulty lead to a higher probability of injury (Paix, 1999). Cross country phases of horse eventing have been found to be 180 times more dangerous than all other forms of horse riding combined, and only professional rodeo riders have a higher reported injury rate, though their injuries tend to be less
severe (Singer et al., 2003). Other studies determined an injury rate of 1.1% and also featured a predominance of head and facial fractures which represented 31% of all injuries. Two fractures occurred to the spine at the twelfth thoracic vertebra. Horseback riding had an average death rate of 16 per year between 1982 and 1998 in the United States (Whitlock, 1992).

### Injury distribution among sample

<table>
<thead>
<tr>
<th>Injury type</th>
<th>Head and Neck</th>
<th>Lower Limb Fracture</th>
<th>Rib Fracture</th>
<th>Soft tissue damage-thoacolumbar spine</th>
<th>Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of sample with injury*</td>
<td>51%</td>
<td>8%</td>
<td>8%</td>
<td>13%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Table 1. Injury distribution for Paix study (Paix, 1999).

**Discussion:**

This paper has examined the way that rider experience, knowledge, physiological sex and gendered expectations, as well as the nature of the event all play a role in the type and injury rate associated with horse eventing. Often it is easy to examine each parameter independently, but each of the factors tends to have an effect on one another. Based on the above data, several considerations need to be taken into effect. Due to the high prevalence of injuries appearing among female riders, some would claim that females are more susceptible toward obtaining the injury. However, it must be remembered that in horse eventing, women predominate in the amateur and lower classes, both of which have been found to have a higher risk of injury, whereas males predominate in the categories of elite status competition, which has been found to have a lower risk of injury. The rider experience also has an effect on injury rate as those at the intermediate level have a higher rate of injury at 7.9/1000 rides, pre-novice 5.9, novice 5.4 and advanced 5.6 (Singer et al., 2003; Table 2). At the elite level of competition often the rate of injury is less than the pre-novice or intermediate, but the severity of the injury is often greater.
than injuries caused at lower levels of competition, though more studies are in the works examining this hypothesis (Singer et al., 2003).

<table>
<thead>
<tr>
<th>Skill level of rider</th>
<th>Pre-novice</th>
<th>Novice</th>
<th>Intermediate</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injury per 1000 riders</td>
<td>5.9</td>
<td>5.4</td>
<td>7.9</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Table 2. Effect of skill level on injury rate per 1000 rides (Singer et al., 2003)

The more experienced riders are able to maintain more control over the horse and themselves due to their established core muscles and determination in riding. In doing so they limit the chance of injury to themselves or the horse, but the saddle of choice also lends to injury itself. As the amount of time spent riding increase, the risk of lower back pain and other soft tissue damage also increases. This is in part due to the stirrup length that must be maintained to allow for jumping. The stirrup length most commonly associated with English saddles places the leg at a 30-40 degree angle, thus creating a natural flattening of the lumbar lordosis, which takes on a load of approximately 68% of an individual’s body weight. In a recent study individuals who utilized longer stirrups were also evaluated and were less likely to experience long-term back pain. Other parameters such as the stage of the event also influences injury rates.

As noted earlier, the majority of injuries at events occur during the cross-country phase of the competition. Murray et al. (2006) and Singer et al. (2003) investigated which circumstances of the cross-country phase were higher risk compared to the others. Their results indicated that the number of course obstacles, type of obstacle, and rider experience were all major factors in rate of injury. A greater risk of falling is associated with courses featuring a greater number of jumps, the category feature 24+ jumps was associated with a 27-fold increase in risk when compared to the lowest quantity (Murray et al., 2006). There appeared to be a leveling off of risk in the medium length course. Horse and rider fatigue are attributed to the increased risk in longer
races, and the decrease in injury rate in the medium length course may be due to the increase pressure to do well and more careful riding. The style of jump also had a major impact on the rate of injury. Fences, which feature ditches in front of them or were focused down hill resulted in increased risk of falling. This is due to the horse’s natural jumping arc, which is followed when jumping ascending spread jumps, whereas those seated downhill significantly alter the horse’s center of gravity (Singer et al., 2003). Murray et al. (2006) looked at several parameters associated with the cross-country phase. They examined potential explanations for increased risk of falling. They found an increased risk for those jumping in or out of water, taking off from too soft or too hard ground, and the mental state of the rider all had an increased risk of falling. Riders who knew they were in the lead going into the cross-country phase of the competition were more likely to fall.

Based on the current focus on the cross-country phase of competition, there will more than likely be significant changes to the rules and regulations of this phase of the race in the near future. Based on past changes made to the competition, these adjustments will be met with some scrutiny for the riders that wish to keep the traditions of the sport alive. However, the attention to the rules is due to significant increases in horse and rider injury: one in three falls result in horse injury and one in one hundred in horse fatality (“About eventing,” 2012). As the sport continues forward various other issues need to start being taken into account other than just the nature of the sport. Rider skill and knowledge of proper saddle fitting, and experience need to be considered. Checkpoint regarding properly fitting saddles, or incorrect riding postures, need to be established to prevent injury to horse and rider. There has currently been a trend in increased hyperflexion of the horses neck in competition to obtain higher scores, yet this type of riding is dangerous to both the horse and rider and the horse is forced into an unnatural pose, causing
undue stress to their neck and potentially making their movements unpredictable (Christensen et al., 2014).

**Conclusion:**

The importance of the horse in modern culture, agriculture, therapy and especially sports and entertainment has not ceased nor does it appear to being doing so anytime soon. The human-horse interaction is able to represent a vast history associated with power, victory, and in some cases majestic origins, due to horses’ critical use in war, and diverse cultural relevance to various groups. This legacy is able to carry on today through the human-horse relationship. Modern history has allowed a feminization of the relationship, which brings forth a duality in which the same participant in the sport can exhibit, both a feminine and masculine demeanor.

Horse-eventing allows one to portray both genders through the entire process, by allowing a tomboy appearance off the arena, and a feminine demeanor on the area. Participation in eventing often signifies a sense of status and authority to the participant due to the sport’s roots in knighthood, transitioning into the training of the military. This provides a vast outlook where an individual can be prized for being both masculine and feminine, while obtaining a sense of power and prestige. As discussed earlier, the original feminization of the sport increased the participation of females greatly except at elite levels. Now, various associations are attempting to masculinize the sport in order increase the male participation. With these efforts as well as the efforts of the FEI to create and enforce rules that would allow male and female participants to compete on equal fields, the future of horse eventing may become one of the few sports in which males and females are able to compete equally as well as culturally accepted on
equal terms. Because of this, horse eventing may become an increasing popular sport, making research into safety important.

While there have been several studies aimed at specifying the precise reasons for increased risk of injury in horse eventing there are still a lot of changes that can be made to reduce this risk. Although overuse injuries have been linked to saddle structure, it appears the rate of injury has more to do with the nature of the event and other parameters discussed in this paper. These parameters, in particular (list) require further evaluation in order to increase safety in the sport. Most of the studies discussed in this paper attempt to examine these parameters as individual aspects instead of looking at the way in which they interact with one another. Although there have been some adjustments made to regulations and safety equipment, further evaluation is in order. Changes should be made to the policies and procedures of horse eventing addressing saddle fit, cross-country obstacles, and a focus on the training of novice riders in order to address the issues associated with overuse injuries, which often account for over half of the reported injuries.
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