ABSTRACT

Title of Thesis: SURVEY ON HORSE-RELATED INJURES AND SAFETY PRACTICES IN MARYLAND AND VIRGINIA

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Horseback riding is a leading cause of sports injury. This thesis identifies socio-demographic characteristics of adults sustaining horse-related injuries, and factors associated with receipt of medical treatment and improvement of safety behaviors among those injured. A web-based, cross-sectional survey was conducted in Maryland and Virginia during July 1st - September 1st 2010 (n=908). Ninety-four percent (93.7%) of respondents had ever sustained a horse-related injury. Women and adults with ≥15 years of experience with horses had higher odds of injury than men and adults with <15 years of experience. Roughly half of the injured (48.2%) had received emergency treatment. The odds of receiving medical treatment for injuries occurring at a competition/show were 2.42 (1.08-5.44) times the odds of receiving medical treatment for injuries occurring at home. Provision of informational and emotional support from friends/family, healthcare professionals, or equine industry professionals was significantly associated with improving safety practices among the injured.

SURVEY ON HORSE-RELATED INJURIES AND SAFETY PRACTICES IN MARYLAND AND VIRGINIA

by

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List of Abbreviations

CI= confidence interval
MD= Maryland
OR= odds ratio
VA= Virginia

Chapter 1: Introduction

Occurrence of Horse-Related Injuries

Injury is an important area of public health research because injuries are the leading cause of death and disability worldwide (1, 2). Injuries can be classified as intentional (e.g., homicide, violence) or unintentional (e.g., falls, water hazards). Sports injuries are included in the unintentional category (2). Injuries from sports are listed among the top ten common causes of injuries by the Centers for Disease Control and Prevention (CDC), ranking second in the 25-64 year old age group and third in the 10-24 year old age group (3). Horseback riding is one of the leading causes of sports injuries, especially among 18-34 year old females (4).

When comparing incidence rates of injuries across sports, some authors have suggested that horseback riding is more dangerous than motorcycle riding, skiing, rugby, and football (5-11). Hospital admission rates for horseback riding have been reported to be 0.49/1000 hours compared to 0.14/1000 hours for motorcycle riding (8, 10). The injury incidence rate has been estimated to be approximately 1 injury per 1,000 hours of riding (12). Paix et al. (1999) reported an injury incidence of 0.88% per competitor per event, which is roughly three times the incidence of motorcycle riding (0.24%) and car racing (0.14%) (11-12).

Despite these dangers inherent in handling horses, horseback riding is a very popular sport, with an estimated 30 million Americans riding horses each year (13-14). Approximately 50,000 equestrians are treated each year in emergency rooms, and 2,300 equestrians under 25 years of age are admitted to the hospital (13-15). With the rates of injuries attributable to horses, it is apparent that it is very important to have

epidemiologic data describing the pattern and occurrence of injury so that some prevention efforts can be implemented.

In order to explain the high injury risk among equestrians, researchers have cited the unique nature of the sport in that one member of the team is non-human, with its own athletic abilities and temperament (10). The rider is situated precariously aboard an unpredictable animal with his or her head three meters above the ground (8). However, injuries do not only occur when riding a horse, as handling a horse from the ground also holds dangers. Worley at el. (2009) found that 15-30% of injuries occurred while people were handling horses from the ground (e.g., being stepped on, kicked, or bitten). Similarly, Smartt et al. (2009) found that 21% of horse-related injuries occurred among bystanders and Northey et al. (2003) found that 25% of horse-related injuries occurred while un-mounted. Therefore, this research will include all horse-related injuries since excluding un-mounted injuries could miss a large proportion of horse-related injuries.

Characteristics of Horse-Related Injuries

Different studies have identified different sites of injury and types of injury as the most common. The most common site of injury that has been reported ranges from the head and face region (7, 9-11, 13-14, 17-19), to the chest region (8), arm region (16), and lower limb region (20). The most common type of injury that has been reported ranges from contusions and abrasions (17), to orthopedic injuries (21, 22), fractures (16, 23), or soft tissue injuries (20). There is more agreement regarding the most common mechanism of injury: up to 83% of horse-related injuries occurred while falling or being thrown from

the horse (7-9, 12-14, 16-17, 20, 24). This indicates that more research is needed in order to better characterize the sites and types of horse-related injuries.

One reason for the different findings of the most common sites and types of injury could be that there is wide variation in where studies on horse-related injuries have been conducted. Many studies on the topic of horse-related injuries have been conducted on a national level (e.g., Loder et al. (2008) used the National Electronic Injury Surveillance System) and in other countries, for instance Australia (11, 18, 25, 26), New Zealand (7, 16), Hong Kong (5), Netherlands (4), Switzerland (27), and Canada (8, 10). However, we need studies conducted at local and regional levels because there is large regional variation in horse-related activities. For example, along the east coast English riding predominates, but in the western states Western riding is much more prevalent than it is along the east coast. This variation in the types of horse-related activities that are practiced in different areas could lead to differences in the most common types of injuries that are seen in that area.

Even though there is disagreement about what the most common type of injury is, there is agreement that horse-related injuries can be severe and costly injuries. When horse-related sports injuries among females age 18-34 years were compared with injuries from other sports, it was found that not only did horse-related sports have higher than average injury rates, but they also covered two-thirds of all direct and indirect costs associated with sports injuries (4). Another study found that horse-related injuries had higher costs and more on-going claims than rugby injuries (16).

Use of Safety Equipment

The most widely acknowledged safety equipment for horseback riders is the helmet. There is considerable evidence that wearing helmets can greatly reduce injury severity to the head. For example, children not wearing helmets are more likely to require hospital admission (64%) than those wearing helmets (39%) (21). Patients not wearing a helmet had a significantly higher modified injury severity score of 12.9 than those who had been wearing a helmet (2.8) (28). A higher modified injury severity score indicates more severe injury.

Although the use of helmets has been proven to reduce the risk and severity of injuries, there is evidence that helmet use is inconsistent. Bond et al. (1995) found that 66% of injured children less than 15 years of age wore helmets, and they acknowledged that the high helmet use rate could be a result of helmet requirements for minors at commercial stables, pony clubs, and organized competitions. However, some studies not limited to children have also found high use of helmets. In 1987, Lloyd et al. reported that 93% of participants always wore protective headgear (average age was 21 years). More recently, Lim et al. (2003) reported that 81% of those injured wore helmets (average age was 25 years). Conversely, other studies have found that the majority of riders do not wear helmets. Kriss et al. (1997) found that 80% of 3-64 year old injured patients did not wear helmets, and Hughes et al. (1995) found that 81% of those injured were not wearing protective head gear (average age of 30 years).

To explain low helmet use rates, studies have found that riders perceive helmets as uncomfortable, expensive, and inappropriate for some riding styles (30). These epidemiologic findings have led to the conclusion that more educational programs are

needed, especially education focusing on safety equipment, horse behavior, and the riding environment (16-17, 31).

Outcomes after Horse-Related Injuries

In addition to studying the injury itself and factors surrounding the occurrence of the injury, it is also important to study the patient's outcome after the injury. Outcome after injury can include disability. In the northern hemisphere, riding, outdoor soccer, and skiing have the highest incidence of long term disability (8). Disabilities experienced by riders can include physical conditions such as chronic pain. Ball et al. (2009) found that 55% of patients suffered chronic physical pain following a riding injury. Mental disabilities are also seen such as personality changes, chronic headaches, memory deficits, and hearing loss. Hughes et al. (1995) found that 40% of equestrians experienced at least one of these mental disabilities following their injury. Rehabilitation services exist in order to help patients overcome these types of disabilities, but it has been found that rehabilitation services are underutilized by patients following riding injuries, and there is also a need for psychosocial support following severe equestrian injuries (8).

Psychosocial support is an important factor to consider because not only can it buffer the adverse mental health outcomes that may result from physical injury, but it can also provide the person with needed support and assistance for changing their behaviors following the injury. Changing behaviors when working with horses to become more safety conscious is important because previous studies have shown that the majority (87%) of patients injured from horse-related activities returned to riding (8). Recidivism,

or returning to the same unsafe practices, is common, with recidivism rates ranging from 37%-47% (8, 22).

Since returning to horse-related activities following the injury is very common, it is important to continue to conduct studies that describe the prevalence and characteristics of horse-related injuries so that prevention programs can be better implemented. It is also important to collect more information on ways to improve patient outcome after injury, such as receiving professional medical treatment and changing one's safety behaviors. In addition, many studies have concluded that more education on horse-related injuries and safety around horses is needed. While this is a valid conclusion, they have not offered any insight regarding the most effective way of delivering this education. Therefore, this study attempted to capture safety practices that are most neglected by people involved in horse-related activities, the reasons for which they are being neglected, and where people feel safety information should be provided.

Potential Confounders

Potential confounding variables were drawn from the literature: two socio-demographic variables (age and sex), and two equine interaction variables (years of experience with horses and type of interaction with horses).

There is variation in the literature regarding the socio-demographic characteristics of those at greatest risk for equine related injuries. One might assume that injuries would be most common in females as equestrian sports are dominated by female participants, and while many studies have concluded this (16-17, 22, 29, 32), other studies have reported higher prevalence of injury among males (5-6, 33). For example, a study conducted in the

northwestern region of the U.S. (Oregon, Washington, and Idaho) found that injuries were most common among females (34), but a study conducted in Colorado found that most of the injured were males (33).

The findings on age have been similarly split, with some studies reporting more injuries among riders over 30 years of age (5-6, 13, 17, 34), and some studies reporting more injuries among riders younger than 20 years (16, 29, 32, 35). Mayberry et al. (2007) found that injuries increased with increasing skill level and years of experience, but also found that the incidence of injury was highest among more inexperienced riders. Similarly, Newton et al. (2005) found that injury occurrence was related to rider inexperience with 55% of those injured indicating that they were inexperienced or beginner riders. Meanwhile, Kriss et al. (1997) found no association between age, gender, or level of experience and the occurrence of injury. Eighty-one percent (81%) of head injuries and all severe, life threatening injuries were caused by falling off or being thrown from the horse (29).

Research Questions and Hypotheses

This study explored characteristics of horse-related injuries in Maryland (MD) and Virginia (VA). This included describing the population being injured by socio-demographic and equine interaction characteristics, as well as identifying factors associated with receiving medical treatment for the injury and improving safety behaviors following the injury. The following questions were posed:

1.) Among adults engaged in horse-related activities in MD and VA, does the occurrence of an injury vary by age, sex, years of experience with horses, type of

interaction with horses [(e.g., riding discipline, caring for the horse on the ground), and use of safety equipment (e.g., helmet, vest)]?

H0: The occurrence of injury among adults engaged in horse-related activities in MD and VA will not vary by age, sex, years of experience, type of interaction, or use of safety equipment.

H1: The occurrence of injury will vary by sex (women are more likely to be injured), age (30-49 year olds are more likely to be injured), type of interaction (pleasure riders are more likely to be injured), years of experience (those with more years of experience are more likely to be injured), and use of safety equipment (those using more safety equipment are less likely to be injured).

2.) Among adults engaged in horse-related activities in MD and VA who have been injured, does the receipt of professional medical treatment vary by type of injury, severity of injury, ownership status of the horse, location of where the injury occurred, or whether another person was present?

H0: The receipt of professional medical treatment will not vary by type of injury, severity of injury, ownership status of horse, location where injury occurred, or whether another person was present.

H1: The receipt of professional medical treatment will vary by type of injury (fractures/broken bones and head injuries are more likely to receive treatment), severity (more severe injuries are more likely to receive treatment), ownership (not owning the horse are more likely to receive treatment), location (injuries occurring at boarding/lesson stables and competitions/shows are more likely to receive treatment), and whether another person was present (alone when the injury occurred are less likely to receive treatment).

3.) Among adults engaged in horse related activities in MD and VA who have been injured, is the receipt of emotional and informational social support associated with improving one's safety behaviors following the injury?

H0: The receipt of emotional or informational support will not be associated with improving one's safety behaviors following the injury.

H1: The receipt of emotional and informational support will be associated with improving one's safety behaviors following the injury (receive support are more likely to improve safety behaviors).

Chapter 2: Methods

The study design was a cross-sectional self-administered survey using a web-based standardized questionnaire. The survey was posted online using Survey Monkey (36). The survey questions were formatted according to the principal investigator's knowledge and experience in the horse industry. Additionally, questions were taken and adapted from previous questionnaires on horse-related injuries (see appendix) and the survey was distributed to people in the horse industry for comments. The survey took approximately 5-10 minutes to complete and consisted of three different sections. Section 1 asked about basic demographic characteristics and background on the participant's experience with horses. Section 2 was for any of the participants that indicated that they had ever sustained a horse-related injury, and asked details about the injury (type of injury, circumstances surrounding the occurrence of the injury, treatment received for the injury, outcome). Section 3 was for all respondents and asked about safety measures that were practiced by the respondent.

Study Population

A convenience sample of participants was recruited to take part in the survey through five sources: 1) Virginia Equestrian.com posted an advertisement and link to the survey on their website, 2) the Virginia Horse Council sent out an email with the link to the survey to all of their members, 3) the Equiery magazine sent out an e-blast to their email list with a link to the survey, posted a link to the survey on their website, and ran an ad about the survey in their print magazine, 4) the Horse Show Times ran a story about the principal investigator in their newspaper and included an advertisement for the survey,

and 5) the Virginia Horse Journal ran an ad in their e-newsletter. VirginiaEquestrian.com has roughly 160,000 visitors to the website each month, the VA Horse Council has an email list of 200 members that they sent the survey to, the Equiery magazine and the Virginia Horse Journal both reach approximately 30,000 people monthly through web and print sources, and the Horse Show Times reaches approximately 3,000 readers.

Participants in the survey were adults at least 18 years of age who voluntarily took part in the survey. Participation in the survey was limited to those at least 18 years of age because special consent must be obtained from parents in order to include minors in the study. While this limited the generalizability of the results to adults, the results still give valuable information. Children under the age of 18 are often required to practice safety measures such as wearing a helmet, both because parents enforce it and policies at public riding venues require it for minors. However, adults are usually not under these same requirements for safety measures as children and they are free to choose for themselves whether or not they will practice safety measures. These results provide an indication regarding whether or not adults are choosing to engage in safety measures, the specific reasons for which they are not, and channels through which to target adults to improve safety practices.

Location and Timing

These sources were used because the scope of this survey was to characterize injuries in the VA and MD region, and these sources provided a representative sample of the people engaged in horse-related activities in VA and MD. It is useful to have information on horse-related injuries specific to the MD and VA region, because studies have been

done on the national scale (17), but there is a lack of information specific to the MD and VA region. Horse-related activities are also very popular in this area, with an estimated 215,000 horses in VA (37), an estimated 153,000 horses in MD, and an estimated 65,600 Marylanders involved in the horse industry as owners, service providers, employees, or volunteers (38).

The survey was launched July 1st and closed September 1st 2010. The survey was open for two months to provide ample time for people to answer the survey.

Incentive

In order to motivate participation in the survey, a gift certificate for $50 was donated by Dover Saddlery. Once the participants completed and submitted the survey they were automatically re-directed to a second data collection instrument created using Survey Monkey. The only question on this survey was to enter their email address in order to be entered into a drawing for the gift certificate. The responses were downloaded into an excel file and a random number generator (http://www.randomizer.org/form.htm) was used to select the winner. The winner was selected on Friday, September 3rd and contacted by email. The contacted winner sent me their mail address and I mailed them the gift certificate on Thursday, September 9th.

Ethical Issues

Prior approval was obtained from the University of Maryland College Park (UMCP) Institutional Review Board (IRB). Only participants over the age of 18 were surveyed in order to ensure proper receipt of consent. The link through “survey completion option”

was used in Survey Monkey in order to collect information for the drawing while keeping survey responses anonymous. Using this option, two survey data collection instruments are created, the first one being the survey questionnaire to collect the data and the second one being a form for the participants to enter into the drawing for the gift certificate. The two data collection instruments each had their own "collector," and they were linked together through "survey completion redirect," which upon completion of the first survey automatically directed the participants to the second data collection instrument where they could enter into the drawing. Since each data collection instrument had its own "collector," the information collected in each survey was kept separate. This enabled anonymous participation in the survey since identifiable information was not linked to survey responses.

Dependent Variables

Three dependent variables were examined in this study for each research question. For the first research question, the prevalence of having ever been injured was the dependent variable. Prevalence of having been injured was ascertained from the following question:

"Have you EVER had ANY injury as a result of horse-related activities?"

Survey responses were 'yes', 'no', 'don't remember', and no response. Responses of 'don't remember' (n=5) and no response (n=23) were deleted so that I was left with dichotomous responses. This question was adapted from Mayberry et al.'s survey (see appendix).

Among those who responded that they had ever been injured, a further question was asked to determine whether they had been injured during the past 12 months. The prevalence of having been injured during the past 12 months was ascertained from the following question:

"Within the PAST 12 MONTHS have you had ANY injuries as a result of horse-related activities?"

Survey responses were 'yes', 'no', 'don't remember', and no response. Responses of 'don't remember' (n=5) and no response (n=3) were not included in the analysis in which I compared injury characteristics of those who had been injured during the past 12 months and those who had been injured more than 12 months ago.

For the second research question, the dependent variable was receipt of professional medical treatment. Professional medical treatment was further divided into emergency treatment and other medical treatment, including emergency, during the analysis. Receipt of emergency treatment was ascertained by the following question:

"Did you receive emergency treatment as a result of the injury?"

Survey responses were 'yes, WITH hospitalization', 'yes, WITHOUT hospitalization', 'no', and 'prefer not to answer'. The dependent variable created for the analysis was 'emergency', which included receiving emergency treatment with or without hospitalization (n=393). Those who answered 'prefer not to answer' (n=4) or did not provide a response (n=32) were not included in the analysis.

Receipt of other medical treatment was ascertained with the following question:

"Did you receive any other treatment for the injury? (Check all that apply)"

Choices included: no other treatment, visit to regular physician, visit to chiropractor, visit to physical therapist, visit to mental/psychological therapist, treatment at home from family member, self-treatment at home, and prefer not to answer. The variable 'medical_trt' was created for the analysis, which included those respondents who had answered that they had received at least one of the following forms of treatment: emergency (with or without hospitalization), visit to regular physician, visit to chiropractor, visit to physical therapist, and visit to mental/psychological therapist.

The dependent variable for the third research question was improvement of safety behaviors following the injury. This was ascertained from the following question:

"Have you improved your safety behaviors when handling, riding, or working with horses as a result of the injury?"

Survey responses included 'yes', 'no', 'I no longer work with horses', and no response. This question was adapted from the Hughes et al. survey (1995) (13). Responses of no longer working with horses (n=4) and no response (n=33) were not included in the analysis.

Independent Variables

Age was collected in the survey as a continuous variable from the question:

"Age at your last birthday (in years)"

From these responses, age categories were created. The categories were created to match categories found in the literature to facilitate comparisons.

Sex was collected as a dichotomous variable with respondents checking 'male' or 'female'. The variable was 'var2'.

Years of equine experience was collected as a continuous variable from the question:

"Please indicate the number of years you have been involved with horses"

The responses were converted into a categorical variable by means of forming quintiles from the continuous responses. During analysis, these quintiles were further collapsed so that it became the dichotomous variable 'yrs_exp_1' of <= 15 years and >= 15 years. This question was used from the Riding Safely survey and Mayberry et al.'s 2007 survey (34) (see appendix).

Type of interaction was ascertained from the question:

"Which best describes the primary type of interaction you usually have with horses: (Choose only one)"

Choices included: pleasure/trail rider, dressage rider, hunter/jumper rider, eventer, fox hunter, western rider, instructor/trainer, stable manager, groom/stable worker, primary care taker, veterinarian, farrier, and 'other' for write in responses. For analysis, the variable 'interaction' was formed which included primary type of interaction as riding (pleasure/trail rider, dressage rider, hunter/jumper rider, eventer, fox hunter, western rider), primary type of interaction as ground (stable manager, groom/stable worker, primary care taker, veterinarian, farrier), and other (instructor/trainer, other responses including driving). This question was adapted from Mayberry et al.'s 2007 survey (34), the Riding Safely Survey, and the Brown University Equestrian Injury Survey (see appendix).

Type of injury was ascertained from the following question:

"Which of the following best describes the type of injury?"

Choices included: contusion (bruise) or abrasion; fracture or broken bone; sprain or strain; head injury, concussion, or traumatic brain injury; laceration (cut or scrape); and a write in 'other' type of injury response. The variable was 'type_of_injury'. The types of injuries that I chose to include as responses were taken from the WHO Guidelines for Conducting Community Surveys on Injury and Violence (1).

The location of where the injury occurred was ascertained from the question:

"Where did the injury occur?"

Choices included: home, boarding/lesson stable, competition/show, trail/open field, and a write in 'other' location category. The variable was 'where_location'. This question was adapted from the Riding Safely survey (see appendix).

Accompaniment when the injury occurred was ascertained from the following question:

"Please indicate whether or not another person was present when the injury occurred"

Responses were 'I was alone', 'Someone else was present', and no response. The variable was 'someone_else_present'.

The severity of the injury was determined from the following proxy question:

"For how many days were you limited in your daily activities as a result of the injury?"

Survey responses included '0-7 days' (mild), '8-21 days' (moderate), 'more than 21 days' (severe), 'don't remember', and no response. The variable 'severity' was created with categories of mild (0-7 days) and severe (8-21 days and more than 21 days). This question was taken from the 'Equestrian Injury Reporting Form' (http://sma.org.au/wp-content/uploads/2009/12/ddequest.pdf).

Receipt of emotional support (i.e., encouragement, comfort, sympathy) was collected using a likert scale with 5 ordinal categories from ‘strongly agree’ to ‘strongly disagree’. The respondents indicated with level of emotional support that they felt they received from friends/family, a professional in the equine industry (e.g., instructor, trainer), and a healthcare professional (e.g., doctor, nurse, therapist). The variables were ‘ff_emot_support’, ‘pe_emot_support’ (equine professional), and ‘phc_emot_support’ (healthcare professional) with three categories of strongly agree/agree, neutral, and disagree/strongly disagree. The variable of ‘total_emotional’ was also created with the categories of 0, 1, 2 or 3 to indicate from how many of each of the sources the respondent indicated that they strongly agreed or agreed that they received emotional support.

Receipt of informational support (i.e., guidance and advice on how to improve safety behaviors when working around horses) was collected using a likert scale with 5 ordinal categories from ‘strongly agree’ to ‘strongly disagree’. The respondents indicated with level of informational support that they felt they received from friends/family, a professional in the equine industry (e.g., instructor, trainer), and a healthcare professional (e.g., doctor, nurse, therapist). The variables were ‘ff_info_support’ (friends/family), ‘pe_info_support’ (equine professional), and ‘phc_info_support’ (healthcare professional) with three categories of strongly agree/agree, neutral, and disagree/strongly disagree. The variable of ‘total_informational’ was also created with the categories of 0, 1, 2 or 3 to indicate from how many of each of the sources the respondent indicated that they strongly agreed or agreed that they received informational support.

The situation in which the injury occurred was ascertained from the question:

“When the injury occurred where you”

Survey responses included ‘riding the horse’, ‘on the ground and other situation (e.g., driving the horse). The variable was ‘riding_ground’. This question was adapted from the Riding Safely survey (see appendix).

Those respondents who answered that the injury occurred when riding the horse answered the following question:

“How did the injury occur?”

Survey responses included: thrown/fell off horse, crushed by falling horse, foot got caught in stirrup and dragged by horse, and the write in category for injuries occurring some other way. The variable was ‘riding_injury”. This question was adapted from Mayberry et al.’s 2007 survey (34) (see appendix).

Those respondents who answered that the injury occurred on the ground answered the following question:

“How did the injury occur?”

Survey responses included: kicked by the horse, trampled by bolting horse, struck by rearing horse, stepped on by horse, bitten by horse, and the write in category for injuries occurring some other way. The variable was ‘ground_injury’. This question was adapted from Mayberry et al.’s 2007 survey (34) (see appendix).

Information on the use of safety measures was collected using a likert scale with 5 ordinal categories from ‘always’ to ‘never’. The safety measures included: wear a helmet, wear a body protector/safety vest, wear gloves, wear footwear with a heel and hard toe (e.g., paddock boots), have another person present, carry a cell phone, use safety equipment on your horse (e.g., break away halter, chain lead rope), and use safety equipment on your saddle (e.g., safety stirrups, grab strap). Several variables were

created in order to look at the safety measures used. The variable 'helmet' was created from the responses of wearing a helmet with the categories of always/most of the time, sometimes, and occasionally/never. The dichotomous variable 'safe' was created with categories of safe (always use >=3 safety measures) and unsafe (always use <=2 safety measures). The variable 'safe_clothes' was created, in which responses were categorized by always/most of the time, sometimes, and occasionally/never wearing gloves, a safety vest, or footwear. The variable 'safe_people' was created, in which responses were categorized by always/most of the time, sometimes, and occasionally/never having another person present or carrying a cell phone. The variable 'safe_horse' was created from the responses of using safety equipment on the horse with the categories of always/most of the time, sometimes, and occasionally/never. The variable 'safe_saddle' was created from the responses of using safety equipment on the saddle with the categories of always/most of the time, sometimes, and occasionally/never. The safety questions were adapted from the Riding Safely survey, the Brown University Equestrian Injury Survey, and Mayberry et al.'s 2007 survey (34) (see appendix).

Confounders

In order to determine which variables to control for in analysis, I tested whether potential confounding variables were significantly associated with the exposure and the outcome and used my knowledge whether determine if the confounding variable was in the causal pathway or not. The four basic socio-demographic and equine interaction variables that were identified as potential confounders from the literature were age, sex, years of experience, and type of interaction. Even if one of these four basic socio-

demographic or equine interaction characteristics was not significantly associated with the exposure or the outcome I still included it because these types of basic characteristics are normally controlled for in epidemiologic studies.

The emergency and medical treatment models were controlled for sex, years of experience, if the injury occurred while riding or on the ground, severity of the injury, and safety. Age was not included as a confounding variable because it was highly correlated with years of experience, so only one of the two variables could be included in the model. Years of experience was included instead of age because it was more significantly associated with the outcome of receiving emergency or medical treatment and the exposures of ownership, location, and accompaniment. Whether the injury occurred while riding or on the ground was included instead of type of interaction with horses because these two variables were highly correlated, so only one could be included in the model. Both variables were significantly associated with the exposures of ownership, location, and accompaniment, but only whether the injury occurred while riding or on the ground was significantly associated with the outcome of receiving emergency or medical treatment.

This model was also controlled for severity because the aim of my research question was to find out if these factors that the person has more control over (ownership, location, and accompaniment) influence the receipt of emergency or medical treatment when controlling for severity of injury, which the person does not have control over. Use of safety equipment was also found to be a confounder that should be controlled for because it was significantly associated with the exposures of ownership, location, and accompaniment and the outcome of receiving emergency and medical treatment. The

variables of receipt of emotional and informational support from friends or family, a professional in the equine industry, or a healthcare professional were also considered as potential confounders. These variables were significantly associated with the outcome of receiving emergency or medical treatment, but they were not significantly associated with the exposures (ownership, location, and accompaniment). Furthermore, when included in the model they did not change the odds ratio estimate by 10% so they were not included as confounders in the final model.

The improving behaviors following the injury model was adjusted for age, sex, and type of interaction. As above, age and years of experience are highly correlated, so only one of the variables could be included in the model. Age was more significantly associated with the outcome of improving behaviors so it was included instead of years of experience. Receiving medical treatment was also found to be significantly associated with the exposures of receipt of emotional and/or informational support from friends/family, a professional in the equine industry, and/or a health care professional and outcome of improving behaviors so that it could have been treated as a confounder. However, I felt that it could be the causal pathway; therefore I performed mediation analysis on this variable. I also considered the variables of severity and accompaniment as confounders as they were significantly associated with the exposures of receiving support. However, they were not significantly associated with the outcome of improving behaviors and when included did not change the odds ratio by 10% so they were not included in the final model.

Statistical Analysis

First I compared the two populations of those who had never been injured and those who had ever been injured by socio-demographic variables (sex and age), equine interaction characteristics (years of experience with horses and type of interaction with horses), and safety characteristics (frequency of wearing a helmet, if always use at least 3 safety measures, frequency of wearing safety equipment, frequency of having another person present or carrying a cell phone, frequency of using safety equipment on the horse, and frequency of using safety equipment in the saddle). For each population, the prevalence for each variable was determined and odds ratios were calculated for the odds of injury by performing simple logistic regression.

Next, I restricted the analysis to those who had ever been injured and compared injury characteristics of the adults who had been injured during the past 12 months and adults who had been injured more than 12 months ago. I calculated the prevalence for each of the socio-demographic, equine interaction, and safety variables and conducted simple logistic regression to determine the odds of injury within the past 12 months. I also performed chi-square tests to compare the prevalence of all the injury characteristic variables between the two populations to find out which ones were significantly different.

The dichotomous variables of ‘emergency’ and ‘medical_trt’ were evaluated by socio-demographic characteristics (age and sex), equine interaction characteristics (year of equine experience, type of interaction with horses), injury characteristics (type of injury, severity), and situational characteristics of when the injury occurred (ownership status of the horse, location, and accompaniment). The prevalence, by frequency tables, and odds, by simple logistic regression, of receiving each type of treatment was

calculated for each independent variable. In the multivariate logistic regression models, the main independent variables of interest were ownership, location where the injury occurred, and accompaniment. The models were adjusted for sex, years of experience, if the injury occurred while riding or on the ground, severity of injury, and safety (as described above).

For the sub-analysis on severe injuries, categories of injury had to be combined because of cells with counts of zero. There were zero cases of severe lacerations or other injuries that did not receive any professional medical treatment. The prevalence of receiving each type of treatment among those with severe injuries by the socio-demographic, equine interaction, and injury characteristic variables was determined using frequency tables, and the odds ratios were determined by performing simple logistic regression.

The dichotomous variable of 'improved' was evaluated by socio-demographic characteristics (age and sex), equine interaction characteristics (year of equine experience, type of interaction with horses), injury characteristics (type of injury, severity), receipt of medical treatment, and receipt of social support. The prevalence, by frequency tables, and odds, by simple logistic regression, of improving was calculated for each independent variable. The multivariate logistic regression model was adjusted for age, sex, and type of interaction (as described above).

Further analysis was performed on the summary measures of total emotional and total informational support received and the outcome of improving safety behaviors. The prevalence, by frequency tables, and crude odds, by simple logistic regression, of improving were calculated for both variables. Two multivariate models were run, the first

one adjusted for age, sex, and type of interaction, and the second one adjusted for those variables plus total emotional support received (in the total informational support model) and total informational support received (in the total emotional support model). While the variables of total emotional and total informational support were highly correlated, I was curious to see if when I controlled for the other type of support, one type of support would stand out as more significant.

Mediation analysis was performed for variables that qualified as confounders but I thought were in the causal pathway between exposure and outcome. For the mediation analysis, I tested for a significant association between the predictor variable and the outcome, the predictor variable and the mediator, and the mediator and the outcome. If a variable is a mediator all of those interactions will be significant. When the mediator is included in the model with the predictor and the outcome, the association between the predictor and the outcome will no longer be significant or will have reduced significance. In the model for improving behaviors, I felt that receiving medical treatment could be in the causal pathway because the support could push the person to receiving treatment and the person must receive medical treatment in order to receive support from a healthcare professional.

Power analysis was conducted prior to collecting the data in order to calculate the needed sample size. Sample size estimates were calculated using SAS 9.2. The Proc power procedure for two sample t tests, chi-square tests, and logistic regression was used because these were the statistical tests used in analysis. The needed sample size that had been calculated was 700 for achieving a power of 80%. Since a final analytical sample of 908 was achieved, power of 80% was achieved. The models for informational support

from friends/family and improving behaviors, informational support from a professional in the equine industry and improving behaviors, ownership and receiving emergency or medical treatment, accompaniment and receiving emergency or medical treatment, and location and receiving emergency or medical treatment achieved powers of 99.9%.

Chapter 3: Results

Description of Study Population: All Respondents

A total of 951 survey responses were collected from July 1st, 2010 to September 1st, 2010. After cleaning the data, the final analytical sample consisted of 908 responses. This final sample was determined by responses to the 4 basic socio-demographic and equine interaction questions. Those with missing responses for age, sex, years of experience with horses, type of interaction with horses, and having ever been injured were deleted. Additionally, responses with out of range values for age (those under 18) and responses with years of experience that exceeded the maximum age were deleted.

Table 1 shows the socio-demographic and equine interaction characteristics of the study sample. The majority of the sample reported having ever been injured, 93.7%, with 37.3% of these having been injured in the past 12 months. The majority of the respondents were female (94.2%) between the ages of 35 and 64 (73.6%), had more than 15 years of experience with horses (79.3%), and reported the primary type of interaction with horses as some type of riding (72.4%). Although not shown, the specific types of riding that were most common were pleasure/trail riding (29.2%), hunter/jumper (14.3%), and dressage (13.7%). The use of safety measures was common, with almost two-thirds (62.6%) reporting always using at least three safety measures. Specifically, wearing a helmet, wearing some other form of safety equipment (gloves, safety vest, footwear), and having another person present or carrying a cell phone were the most commonly practiced safety measures (87.3%, 95.5%, and 83.5% practiced those safety measures always or most of the time). The safety measures that were least commonly used were

safety equipment being used on the saddle (safety stirrups, grab strap); with only 42.1% reporting that they use those types of safety equipment always or most of the time.

Characteristics of Adults Ever Injured

Table 2 shows the association between socio-demographic and equine interaction characteristics and having ever been injured (n=851). The odds of injury for females were 2.45 times the odds of injury for males (OR=2.45, 95% CI=1.05-5.71), with 94.2% of females reporting ever being injured compared to 86.8% of males reporting ever being injured. Age was not significantly associated with having ever been injured, but years of experience with horses was. The odds of injury for adults with more the 15 years of experience were 3.05 times the odds of injury for adults with fewer than 15 years of experience (OR=3.05, 95% CI=1.75-5.30).

The results for the usage of safety equipment were opposite of what I expected to find. I expected that those who used the safety measures more frequently would be less likely to be injured. However, I found that the odds of injury for adults who used fewer safety measures (≤2) were significantly lower than the odds of injury for adults who used more safety measures (≥3) (OR=0.52, 95% CI=0.30-0.88). The odds of injury for adults who wore a helmet occasionally/never were significantly lower than the odds of injury for adults who wore a helmet always/most of the time (OR=0.23, 95% CI=0.11-0.48). The only safety category that showed the trend that I expected was having another person present or carrying a cell phone. Although not significant, the odds of injury for adults who had another person present or carried a cell phone occasionally/never were 2.30 times the odds of injury for adults who had another person present or carried a cell phone always/most of the time (OR=2.30, 95% CI=0.31-17.19).

Characteristics of Adults Injured Within the Past 12 Months

Table 3 compares the socio-demographic and equine interaction characteristics of adults who have been injured within the past 12 months (n=317) and adults who have been injured more than 12 months ago (n=526). The odds of being injured within the past 12 months are also presented in table 3. The odds of being injured within the past 12 months for adults age 65 and older were significantly lower than the odds of being injured within the past 12 months for adults age 18-24 (OR=0.42, 95%CI=0.19-0.96). When looking at years of experience, the odds of injury within the past 12 months for adults with 15 or more years of experience were significantly lower than the odds of injury within the past 12 months for adults with 1-15 years of experience (OR=0.55, 95% CI=0.39-0.77). None of the safety measures were significantly associated with injury within the past 12 months; however, the odds of injury for those who wore a helmet, wore other safety equipment, or had another person present or carried a cell phone occasionally/never were higher than the odds of injury for those who practiced those safety measures always/most of the time.

Injury Characteristics

The characteristics of the injuries that were reported are shown in Table 3. The table compares the injury characteristics of those who had been injured within the past 12 months (n=317) and more than 12 months ago (n=526). Almost half (44.8%) of adults who had been injured more than 12 months ago had received emergency treatment for the injury, compared to 37.2% of adults who had been injured within the past 12 months ($p<.0001$). Those reporting being injured more than 12 months ago were significantly more likely to report the type of injury being a fracture or broken bone (p=0.0005), while

those reporting an injury within the past 12 months were significantly more likely to report the type of injury being a contusion or abrasion (p=0.007), or a sprain or strain (p=0.05). The injuries occurring more than 12 months ago were also significantly more likely (p=0.007) to have occurred while riding (69.2%), while the injuries occurring within the past 12 months were significantly more likely (p=0.0001) to have occurred on the ground (40.9%).

Receipt of Emergency and Medical Treatment among those Ever Injured

Almost half of those who had been injured (48.2%) had received emergency treatment for their injury. Of those who had received emergency treatment, 16.5% were hospitalized. Receipt of medical treatment included receiving emergency treatment with or without hospitalization (48.2%), visit to a physician (32.1%), visit to a physical therapist (16.9%), visit to a chiropractor (10.5%), and visit to a mental/psychological therapist (0.8%). Table 4 shows the association of predictors for receiving emergency or professional medical treatment among those who had ever been injured, including in the past 12 months (n=851).

When looking at the socio-demographic characteristics, there was no significant difference in receipt of emergency or medical treatment by sex or age. The odds of receiving emergency or medical treatment for adults whose injury occurred when riding were 2.25 and 2.48 (respectively) times the odds of receiving emergency or medical treatment for adults whose injury occurred on the ground (OR=2.25, 95% CI=1.66-3.04; OR=2.48, 95% CI=1.83-3.36). The odds of receiving medical treatment for those who always used two or fewer safety measures were 0.71 times the odds of receiving medical treatment for those who always used three or more safety measures (OR=0.71, 95%

CI=0.53-0.95). The odds of receiving emergency or medical treatment for adults with fracture/broken bone, head injury, laceration, or other type of injury (e.g., dislocations) were higher than the odds of receiving emergency or medical treatment for adults with contusions or abrasions. The odds of receiving medical treatment for those with a sprain or strain were 2.53 times the odds of receiving medical treatment for those with a contusion or abrasion (OR=2.54, 95% CI= 1.63-3.94), but the odds of receiving emergency treatment for adults with a sprain or strain were not significantly higher than adults with a contusion or abrasion.

Table 4 also shows the crude odds ratios for the main independent predictor variables of receiving emergency or medical treatment. The odds of receiving emergency or medical treatment for injuries that occurred at a competition or show were significantly higher than the odds of receiving emergency or medical treatment for injuries that occurred at home (OR=1.97, 95% CI=1.09-3.58; OR=3.08, 95% CI=1.48-6.40, respectively). The odds of receiving emergency treatment for injuries that occurred when someone else was present were 1.43 times the odds of receiving emergency treatment for injuries that occurred when the participant was alone (OR=1.43, 95% CI=1.05-1.95).

Predictors of Receiving Emergency and Medical Treatment

The main independent variables that I wanted to consider as predictors of receiving emergency or medical treatment were ownership status of the horse, location where the injury occurred, and accompaniment. I treated these three variables as the predictor variables because I see them as factors that the person can have more control over. The person does not have control over the type of injury or severity, so I wanted to see if any of these other factors were significant after controlling for severity of injury. Sex, years

of experience, if the injury occurred while riding or on the ground, and safety were also adjusted for. Table 5 shows the adjusted models.

From table 5, you can see that ownership status of the horse remained insignificant in the adjusted models. Additionally, the injury occurring at a competition or show and accompaniment was no longer significantly associated with receiving emergency treatment. But, the odds of receiving medical treatment for injuries that occurred at a competition or show were still significantly higher than the odds of receiving medical treatment for injuries that occurred at home (OR=2.42, 95% CI=1.08-5.44). Although not shown, to investigate this further, I performed separate analyses on mild injuries (n=423) and severe injuries (n=386). I found that the location of a competition or show was significantly associated with receiving emergency and medical treatment among those with mild injuries, but not severe injuries. The odds of receiving emergency and medical treatment for those with mild injuries occurring at a competition or show were 2.62 and 3.22 times the odds of receiving emergency or medical treatment for those with mild injuries that occurred at home (OR=2.62, 95% CI=1.05-6.56; OR=3.22, 95% CI=1.23-8.42). Ownership and accompaniment were not significant in either of these analyses.

Sub-Analysis on Severe Injuries

There were 386 injuries that were classified as severe and 423 injuries classified as mild. I decided to do a sub-analysis on the severe injuries because 28.2% of those who classified their injuries as severe did not receive emergency treatment and 12.2% did not receive any other professional medical treatment. I was interested to see how those with severe injuries who did not receive treatment differed from those who did receive treatment. As seen in table 6, although not significant, the odds of receiving emergency

or medical treatment for females with severe injuries were 1.73 and 1.34 times the odds of receiving emergency or medical treatment for males with severe injuries (OR=1.73, 95% CI=0.75-3.98; OR=1.34, 95% CI=0.44-4.08). Adults with severe injuries whose primary type of interaction was riding and whose injury occurred while riding were more likely to receive both emergency and medical treatment than those whose primary type of interaction with horses was on the ground and were on the ground when the injury occurred.

Although not shown, 20.4% of contusions or abrasions were classified as severe, 80.2% of fractures/broken bones, 51.7% of sprains or strains, 43.2% of head injuries, 24.5% of lacerations, and 50% of other type of injuries (e.g., dislocations). In table 6, some of the injury categories had to be combined because of cells with no responses. For example, 100% of those with severe lacerations received medical treatment, so laceration was combined with fracture/broken bone. The odds of receiving emergency or medical treatment for adults with severe fracture/broken bones or lacerations were 4.84 and 4.64 times the odds of receiving emergency or medical treatment for adults with severe contusions or abrasions (OR=4.84, 95%CI=2.55-9.18; OR=4.64, 95%CI=2.08-10.36). The odds of receiving emergency or medical treatment for adults with severe head injuries were 9.00 and 6.65 times the odds of receiving emergency or medical treatment for adults with severe contusions or abrasions (OR=9.00, 95%CI=2.81-28.78; OR=6.65, 95%CI=1.42-31.19).

Ownership of the horse, location where the injury occurred, and accompaniment were not significantly associated with receipt of emergency or medical treatment among those with severe injuries.

Characteristics of those who Improved Safety Behaviors following the Injury

Sixty-six percent (65.7%) of those who had ever been injured improved their safety behaviors following their injury. Table 7 shows the analysis of characteristics that were associated with improving safety behaviors following the injury. The odds of improving safety behaviors following the injury for adults 50-64 years of age were 2.19 times the odds of improving safety behaviors following the injury for 18-24 year olds (OR=2.19, 95% CI=1.29-3.73). The odds of improving safety behaviors following the injury for those who received medical treatment for the injury were 1.51 times the odds of improving safety behaviors following the injury for those who did not receive medical treatment (OR=1.51, 95% CI=1.12-2.03). Table 7 also shows the crude analysis for the main independent variables of interest, which are receipt of emotional and informational support from family or friends, a professional in the equine industry, and a healthcare professional. Almost all of the categories of support were significant, with those who strongly agreed or agreed that they received that type of support from that source having higher odds of improving their safety behaviors than those who strongly disagreed/disagreed that they received the support. The two categories that were not significant were receipt of emotional support from family or friends and receipt of emotional support a professional in the equine industry.

Predictors of Improving Safety Behaviors

A multivariate model was performed in order to see, when controlling for other significant variables, which categories of support were significant predictors of improving behaviors (table 8). The model was adjusted for the type of interaction, age,

and sex. Age was included instead of years of experience because those variables were highly correlated and age was significantly associated with improving behaviors while years of experience was not (table 7). Receiving medical treatment was significantly associated with improving one's behaviors (table 7), but it was not adjusted for in the model because I thought it was in the causal pathway. Separate mediation analysis was done and it was found that receiving medical treatment was a partial mediator within the pathway between emotional support from healthcare providers and improving behaviors.

As can be seen from table 8, all categories of support were significant for those who strongly agreed/agreed that they received support except for receipt of emotional support from a professional in the equine industry. Receipt of emotional support from friends or family was not significant in the bivariate analysis (table 7) but it was in the multivariate model. The category of support with the highest odds associated with improving behaviors was receipt of informational support from family or friends (OR=3.02, 95% CI: 1.98-4.60).

The results of the mediation analysis indicated that medical treatment was a partial mediator in the relationship between receipt of emotional support from a healthcare professional and improving behaviors. This is because the model with the mediator had reduced significance compared to the model with just the predictor of receiving emotional support from a healthcare professional. There was no mediation for the predictors of receipt of emotional support from friends/family or a professional in the equine industry because these variables were not significantly associated with the outcome of improving behaviors. There was also no mediation for the predictors of receipt of informational support from friends/family, a professional in the equine

industry, or a healthcare professional because these variables were not significantly associated with the mediator of medical treatment.

Total Support Measures

In order to look more closely at exactly which type of support was more important I performed the analysis shown in table 9. Each type of support was significant in the crude model and in the model adjusting for age, type of interaction, and sex. However, you can see that the odds ratios for receiving informational support were higher than those for emotional support, so I decided to run another model in which I controlled for the other type of support. These two variables, total emotional support received and total informational support received, were highly correlated so this is not an accurate model to be used for prediction purposes. However, I was interested to see what would happen when I controlled for the other type of support. The result was that only informational support was significant.

Respondents' Perception of Safety Information

Table 10 shows the descriptive statistics on the variables providing information on how respondents' perceptions on the safety information provided in the equine industry and reasons for their safety habits. The majority of respondents (84.2%) felt that enough safety information is provided already in the horse industry. When asked about why they do not always use all of the safety measures cited above, the main reasons were not believing it is necessary (53.4%), it is not available (24.1%), it is uncomfortable (14.6%), and it interferes with range of motion (13.1%). When asked about appropriate sources of safety information, the main sources indicated were professionals in the equine industry

(87.4%), horse magazines (67.3%), and 4-H clubs, pony clubs, and other horse organizations (66.0%).

Although not shown, analysis was performed to compare perceptions regarding whether enough safety information is provided in the equine industry by previous injury. Eighty-five percent (85.3%) of those who had ever been injured strongly agreed/agreed that enough safety is provided and 67.3% of those who had never been injured strongly agreed/agreed that enough safety information is provided ($p=0.001$). Also not shown, perceptions regarding whether enough safety information is provided in the equine industry varied according to years of experience, with 86.1% of those with at least 15 years of experience strongly agreeing or agreeing that enough safety information is provided compared to 76.4% of those with fewer than 15 years of experience ($p=0.005$).

Chapter 4: Discussion

The vast majority of respondents (93.7%) reported having ever been injured as a result of horse-related activities. Other surveys of people engaging in horse-related activities have found a similarly high prevalence of horse-related injury, with Mayberry et al. (2007) reporting 81%. With this high prevalence of injury, studies like this are needed to identify the high risk subpopulations to target for prevention strategies (7). This study is also important because it identifies characteristics of safety practices among people engaging in horse-related activities and factors that are associated with improving outcome following injury.

The high risk population in MD and VA that was identified in this study was female pleasure riders of any age with more than 15 years of experience. Females had higher odds of injury than males, and the highest percentage of the injured were pleasure riders. However, this could be a result of the fact that pleasure riding was the most common type of interaction. Injury rate did vary by type of interaction, with pleasure riders having an injury rate of 92.1% and eventers having an injury rate of 97.5%, hunter/jumper riders having an injury rate of 93.9%, and foxhunters having an injury rate of 100%. Those with more years of experience were more likely to have ever been injured but less likely to have been injured within the past 12 months. The literature suggests this exact relationship between experience and injury. Studies have reported that there is an increased incidence of injury for beginner and novice riders (up to eight times higher), but professionals have the highest career risk of injury (34). This suggests that risk of

injury increases with greater number of years working with horses, but inexperience also plays a role in increasing injury incidence among beginners.

I had hypothesized that 35-49 year olds would be the most commonly injured based on the literature indicating that injuries peaked across this age group (7). I also thought that those who are younger may be competing more and riding in areas where they are required to wear safety equipment and the eldest age group usually has increased safety awareness. I did not find age to be significantly associated with injury, but a higher percentage of those in the 25-34 and 50-65+ year old age groups were injured than those in the 35-49 year old age group. This could be explained by the fact that I had formed my prediction off of how likely I thought each age group would be to follow safety measures. However, my data showed that following safety measures was not associated with a lower likelihood of injury.

I had anticipated that those who used safety equipment and followed safety measures more frequently would be less likely to be injured. The literature is consistent in reporting that safety measures, especially wearing a helmet, are effective in preventing and reducing the severity of injury (14, 21, 28). There was a marked decrease in head injuries following the United States Pony Club's adoption of compulsory headgear guidelines (14), and many studies have found lowered injury severity scores for those wearing helmets (28). However, I found that those who used safety equipment and followed safety measures less frequently were less likely to be injured than those who followed them more frequently. A similar finding has been reported, with Christey et al. (1994) finding that safety training was not associated with a decreased risk of injury.

These findings should not, however, lead to the conclusion that safety measures are not necessary. The results presented here could be due to the fact that those who use safety measures less often are involved in less risky activities and/or they work with horses less often, and those who use safety equipment and follow safety measures more often are involved in more risky activities. The data support this conclusion, as those who followed safety measures more were significantly more likely to be dressage and eventer riders, and those who followed safety measures less were significantly more likely to be western riders or primary care takers. Using safety equipment such as helmets, boots, and break-away halters and following safety measures such as matching the skill level of the horse and rider and teaching first-aid at horse facilities are still viewed as the best methods to significantly reduce horse-related injuries (10).

Receiving emergency and medical treatment can help people recover more completely from their injury. Type and severity of injury were very strong predictors of receiving emergency and medical treatment. However, many who sustained severe injuries did not receive emergency or medical treatment. Public health messages need to emphasize the importance of seeking medical treatment for injuries, especially for severe injuries. Also significantly associated with receiving emergency or medical treatment was if the injury occurred while riding or on the ground. This could be a result of the type of injuries sustained by riding accidents versus those occurring on the ground. Injuries occurring while riding were significantly more likely to be fractures or broken bones, sprains or strains, and head injuries. This could be a result of the height from which you are falling and the momentum that you have on impact.

However, those factors are not modifiable by the participant; you cannot control how severe your injury is. The present study has identified actions that the person can take before the injury occurs, such as not engaging in horse-related activities alone, to increase their chances of receiving needed medical care in the event of an injury. When looking at location of where the injury occurred, those who were injured at boarding or lesson stables were not significantly more likely to receive medical or emergency treatment than those whose injury occurred at home. However, adults whose injury occurred at a competition or show had significantly higher odds of receiving emergency or medical treatment. The liability requirements at the show grounds could be responsible for this finding, as well as the presence of emergency medical services at shows making access to medical treatment easier (11). Boarding or lesson stables can improve their response to injuries by instituting liability requirements similar to those at competitions or shows.

Research has indicated that there is a need for psychosocial support following horse-related injuries (8). This research has focused on the support being provided by therapists and physicians in a medical setting (8). Friends and family and professionals in the equine industry can be better equipped to provide to this needed support to people with horse-related injuries since these individuals may have more knowledge about horse activities. Receiving informational support from family or friends or a professional in the equine industry had higher odds of improving behaviors than receiving informational support from healthcare professionals.

This study identified why receiving social support is important. It was found to be strongly associated with improving behaviors following the injury, which can aid in preventing future injury. Almost all of those who have suffered a horse-related injury

continue to participate in horse-related activities (22), but they do not always learn from their mistakes. Studies have found that recidivism, or returning to the same unsafe practices as before the injury, is common, with rates of 37-47% being reported (8, 13, 22). Receipt of emotional and informational support from friends or family, a professional in the equine industry, and healthcare professionals was found to be associated with higher odds or improving their behaviors following the injury than those who did not receive this kind of support.

It was surprising to find that the only category of support that was not significant in the multivariate model was receipt of emotional support by a professional in the equine industry. The reason could be that some respondents probably considered themselves equine industry professionals, and would be less likely to receive support from other professionals. Another reason could be that the majority of respondents were pleasure and trail riders who may not interact with professionals in the equine industry such as instructors or trainers on a consistent basis. It was not surprising that the receipt of informational support was more significant than emotional support, because informational support can actually offer tangible ways in which the recipient can improve their behaviors.

There are some very important findings to be taken from this study. One is the identification of a high risk population among people involved in horse-related activities in the MD and VA region. This provides a target population for intervention strategies to focus on. The importance of not engaging in horse-related activities alone should also be conveyed because the data presented here indicate that those who were accompanied when the injury occurred were more likely to receive emergency and medical treatment.

Finally, the provision of informational and emotional support from friends or family, healthcare professionals, or professionals in the equine industry has the potential to significantly improve safety practices among equine enthusiasts who have suffered an injury.

Limitations

The main limitations of this study are a result of the cross-sectional design and the use of a web-based data collection instrument. The cross-sectional design only provides a snapshot of the study population at one point in time. The use of a convenience sample is also a limitation because the responses were obtained from any individual who voluntarily decided to take part in the survey rather than selecting respondents from the entire population using a probability sampling method. This could have resulted in selection bias in that those who had experienced an injury were more likely to complete the survey. The title of the survey and the fact that the advertisements pictured horse-related injuries could have also made those who have been injured more likely to respond. The survey will have limited generalizability as a result of the study population being limited to adults in MD and VA. Those under the age of 18 were excluded from the study because of ethical issues requiring receipt of parental consent, and many people under 18 engage in horse-related activities.

There are also some limitations associated with the survey itself. Using a web-based survey mode is a limitation because web-based surveys have a low response rate in general and the mode excludes individuals who do not have access to the internet. The response rate could not be calculated because I could not determine how many people were exposed to the survey and chose to take it or not. The survey questions also did not

identify what safety measures were being used at the time of injury. The way that severity of the injury was ascertained in the survey may not have been the most accurate. Severity was determined by how many days the respondent indicated they were limited in their normal daily activities (choices of 0-7 days, 8-21 days, and more than 21 days) and people may have different perceptions regarding what qualifies as limited daily activities.

Due to these limitations, the high prevalence of injuries and other results of this study should not be interpreted as reflective of the injury experience of the entire population of adults who interact with horses, or used to assign risk for insurance purposes. Study findings can be used to identify ways that the outcomes from horse-related injuries can be improved and ways to increase the adherence to safety measures.

Strengths

There are also many strengths to this study as well. One strength is that I am very knowledgeable on this subject so I could use my experience to predict and interpret the results and construct a questionnaire to capture realistic variables. I also gained support from VirginiaEquestrian.com, the Virginia Horse Council, the Equiery magazine, the Virginia Horse Journal, and the Horse Show Times to help achieve broad dissemination. This broad dissemination and the incentive that was offered helped me achieve and surpass my desired sample size. There is also a large population of adults engaged in horse-related activities in MD and VA, which provided a large study base. More responses than the needed samples size were collected, so high power was achieved.

The survey was open to all people involved in horse-related activities who had suffered any type of injury. This allowed me to capture more complete data on all horse-related injuries, because most studies of horse-related injuries have been conducted in

hospital settings, so they only capture those injuries receiving medical treatment. In constructing the questionnaire, I also used several standardized questions that have been used in previous studies on horse-related injuries (see appendix). Content validity was achieved through sharing the draft questionnaire with other equestrians, trainers, and people in the horse industry and incorporating their feedback. While the cross-sectional design does impose limitations as listed above, it is the most appropriate design for determining the prevalence of horse-related injuries.

Feedback from Respondents

Six respondents provided suggestions for improving the survey questionnaire. One respondent noted that the question on the use of safety equipment was vague: "When working with horses, please indicate the frequency with which you practice the following safety measures," with the choices listed. She was unsure whether the term 'working with horses' meant when riding or handling in general. She suggested that there be two separate questions on the use of safety equipment, one when riding and one when handling horses on the ground.

Another respondent noted that using proper safety equipment is only part of the solution to being safer around horses because in some instances the safety equipment will not be able to prevent the injury or reduce the severity. She thought that more emphasis needed to be placed on training our horses to be safe and confident mounts, because that is the only way to truly reduce the rate of injury. A similar comment from another respondent was that more education is needed on horse behavior and training of the horse and rider to be safer. This is also a very valid point, and is reflective in the results. Those

who used safety equipment and wore a helmet were more likely to be injured than those who did not.

Another suggestion was to add a question to capture the zip code of the respondent so that responses could be compared geographically. For instance, injuries occurring in Maryland and Virginia and in different parts of each state could be compared.

Public Health Implications

The results of this survey provide important implications for public health. The population to target for injury reducing interventions was identified: female pleasure riders with more than 15 years of experience. People might assume that we should target those engaged in what we perceive as the highest risk equine activities, such as eventing. However, the findings here suggest that pleasure riders need to be targeted. In addition, education on safety and ways to avoid injury should not only focus on beginner and inexperienced riders. Prevention strategies should also focus on continuing education for more experienced riders.

There were significant findings concerning the location where the injury occurred. Competition or shows represented the only location that was significantly associated with receiving medical treatment. However, the majority of studies have found that most injuries occur during recreational riding at home or at a farm or stable as opposed to in competition setting (i.e., shows) (7, 17, 21, 29). For example, one study found that one-third of injuries occurred during riding lessons (16). Therefore, further research needs to be done to determine why injuries occurring at boarding or lesson stables are not significantly more likely to receive treatment than injuries occurring at home and how we

can improve this. Interventions need to target boarding and lesson stables to help them form an injury response plan that includes seeking medical treatment.

The main outcomes of receiving emergency or medical treatment and improving one's safety behaviors are very important for public health. Receiving professional medical treatment could decrease the likelihood of experiencing permanent disabilities as a result of the injury. Studies have indicated that up to 55% of people experience physical disability and 40% experience mental disability as a result of horse-related injuries (8, 13). Improving behaviors after an injury is also an important outcome because future injuries can be prevented if people learn from what happened and improve their behaviors to become safer. This study identified that receipt of social support from friends or family, a professional in the equine industry, or healthcare professionals is associated with higher odds of improving behaviors.

Not only was the high risk population that needs to be targeted identified, but this study also identified how they need to be targeted. While previous studies have indicated that education on safety equipment usage is needed, they have not indicated what this education needs to focus on or from where it should be delivered (24). It was found in this study that most of the respondents (84.2%) felt that enough safety information was provided in the equine industry. However, the most cited reason for not always using safety measures was that the respondent did not feel that they were necessary. This implies that the safety information provided needs to focus more on relaying the message of the necessity of following safety measures: how can the safety equipment help prevent injury or reduce the severity of injury and what is the importance of following other safety measures such as not engaging in horse-related activities alone. The most

appropriate channel for the delivery of this information was found to be from professionals in the equine industry, 4-H clubs, pony clubs, or other equestrian organizations, and horse magazines. Interventions to deliver safety information focusing on the necessity and importance through these sources could lead to improvement in safety equipment use, and help reduce the occurrence and severity of horse-related injuries.

Tables

Table 1. Sample Socio-demographic and Equine Interaction Characteristics (n=908)

	Number	Percentage (%)
Sex		
Male	53	5.8
Female	855	94.2
Age in years		
18-24	75	8.3
25-34	117	12.9
35-49	284	31.3
50-64	384	42.3
≥65	48	5.3
Range 18-73		
Mean 46.3		
Years of Equine Experience		
1-15	188	20.7
≥15	720	79.3
Range 1-65		
Mean 29.6		
Primary Type of Interaction with Horses		
Riding[1]	657	72.4
Ground[2]	166	18.3
Other[3]	85	9.4
Always use ≥ 3 safety measures[4]	568	62.6
Always use ≤ 2 safety measures	340	37.4
Frequency of wearing a helmet		
Always/Most of the time	764	87.3
Sometimes	49	5.6
Occasionally/Never	62	7.1
Frequency of wearing other safety equipment [5]		
Always/most of the time	839	95.5
Sometimes	27	3.1
Occasionally/Never	13	1.5
Frequency of having another person present or carrying a cell phone		
Always/most of the time	736	83.5
Sometimes	111	12.6

Occasionally/Never	34	3.9
Frequency of using safety equipment on the horse[6]		
Always/most of the time	646	74.0
Sometimes	117	13.4
Occasionally/Never	110	12.6
Frequency of using safety equipment on saddle[7]		
Always/most of the time	365	42.1
Sometimes	120	13.8
Occasionally/Never	383	44.1
Ever injured[8] in horse-related activities		
Yes	851	93.7
No	57	6.3
Injured in the past 12 months in horse-related activities		
Yes	317	37.3
No	526	61.8
No response/can't remember	8	0.9

All categories may not add up to 908 because of missing responses.

[1] Riding includes: pleasure/trail, dressage, hunter/jumper, eventer, foxhunter, and western

[2]Ground includes: stable manager, groom/stable hand, primary care taker, veterinarian, and farrier

[3]Other includes: categories in which it could not be determined whether the primary interaction was riding or on the ground: instructor/trainer, and other (e.g., driving)

[4]Safety measures includes: helmet, safety vest, gloves, footwear, having another person present, carrying a cell phone, using safety equipment on the horse (e.g., break-away halter, chain lead rope), and using safety equipment on the saddle (e.g., safety stirrups, grab strap)

[5]Safety equipment that you wear includes: gloves, footwear with a heel and hard toe, and safety vest.

[6]Safety equipment on the horse includes: using a break-away halter and chain lead rope

[7]Safety equipment on the saddle includes: using safety stirrups and grab strap

[8]Injury includes any type of injury sustained while working around horses (e.g., contusion (bruise) or abrasion, fracture or broken bone, sprain or strain, head injury, laceration, or other)

Table 2. Association between socio-demographic, equine interaction, and safety measure characteristics and having ever been injured

	% Never Injured (n=57)	% Ever Injured (n=851)	Unadjusted Odds Ratio Point Estimate and 95% CI
Sex			
Male	13.2	86.8	1 (reference)
Female	5.8	94.2	2.45 (1.05-5.71)
Age in years			
18-24	8.0	92.0	1 (reference)
25-34	4.3	95.7	1.95 (0.57-6.63)
35-49	7.4	92.6	1.09 (0.42-2.80)
50-64	5.7	94.3	1.43 (0.56-3.66)
65+	6.2	93.8	1.30 (0.31-5.48)
Range	19-71 years	18-73 years	
Mean	45.2 years	46.4 years	
Years of Equine Experience			
1-15	12.8	87.2	1 (reference)
≥15	4.6	95.4	3.05 (1.75-5.30)
Range	2-65 years	1-65 years	
Mean	22.0 years	30.1 years	
Primary Type of Interaction with Horses			
Riding[1]	5.5	94.5	1.59 (0.84-3.02)
Ground[2]	8.4	91.6	1 (reference)
Other[3]	8.2	91.8	1.03 (0.40-2.65)
Always use ≥ 3 safety measures[4]	4.7	95.3	1 (reference)
Always use ≤ 2 safety measures	8.8	91.2	0.52 (0.30-0.88)
Frequency of wearing a helmet			
Always/Most of the time	4.7	95.3	1 (reference)
Sometimes	12.2	87.8	0.35 (0.14-0.89)
Occasionally/Never	17.7	82.3	0.23 (0.11-0.48)
Frequency of wearing other safety equipment[5]			

Always/most of the time	6.0	94.0	1 (reference)
Sometimes	7.4	92.6	0.79 (0.18-3.44)
Occasionally/Never	15.4	84.6	0.35 (0.08-1.62)
Frequency of having another person present or carrying a cell phone			
Always/most of the time	6.5	93.5	1 (reference)
Sometimes	5.4	94.6	1.22 (0.51-2.92)
Occasionally/Never	2.9	97.1	2.30 (0.31-17.19)
Frequency of using safety equipment on the horse[6]			
Always/most of the time	5.4	94.6	1 (reference)
Sometimes	7.7	92.3	0.69 (0.32-1.47)
Occasionally/Never	8.2	91.8	0.64 (0.30-1.38)
Frequency of using safety equipment on saddle[7]			
Always/most of the time	4.9	95.1	1 (reference)
Sometimes	5.0	95.0	0.99 (0.38-2.54)
Occasionally/Never	7.6	92.4	0.63 (0.35-1.16)

[1] Riding includes: pleasure/trail, dressage, hunter/jumper, eventer, foxhunter, and western

[2]Ground includes: stable manager, groom/stable hand, primary care taker, veterinarian, and farrier

[3]Other includes: categories in which it could not be determined whether the primary interaction was riding or on the ground: instructor/trainer, and other (e.g., driving)

[4]Safety measures includes: helmet, safety vest, gloves, footwear, having another person present, carrying a cell phone, using safety equipment on the horse (e.g., break-away halter, chain lead rope), and using safety equipment on the saddle (e.g., safety stirrups, grab strap)

[5]Safety equipment that you wear includes: gloves, footwear with a heel and hard toe, and safety vest.

[6]Safety equipment on the horse includes: using a break-away halter and chain lead rope

[7]Safety equipment on the saddle includes: using safety stirrups and grab strap

Table 3. Association between socio-demographic, equine interaction, and safety measure characteristics and having been injured within the past 12 months

	% Injured more than 12 months ago (n=526)*	% Injured within the past 12 months (n=317)*	Unadjusted Odds Ratio Point Estimate and 95% CI
Sex			
Male	71.7	28.3	1 (reference)
Female	61.9	38.1	1.57 (0.81-3.02)
Age in years			
18-24	53.7	46.3	1 (reference)
25-34	56.4	43.6	0.90 (0.49-1.66)
35-49	61.1	38.9	0.74 (0.43-1.27)
50-64	65.5	34.5	0.61 (0.36-1.04)
65+	73.3	26.7	0.42 (0.19-0.96)
Range	18-73 years	18-73 years	
Mean	47.5 years	44.6 years	
Years of Equine Experience			
1-15	50.6	49.4	1 (reference)
≥15	65.2	34.8	0.55 (0.39-0.77)
Range	4-63 years	1-65 years	
Mean	31.6 years	27.8 years	
Primary Type of Interaction with Horses			
Riding[1]	61.7	38.3	0.99 (0.69-1.43)
Ground[2]	61.6	38.4	1 (reference)
Other[3]	69.2	30.8	0.71 (0.40-1.28)
Always use ≥ 3 safety measures[4]	60.2	39.8	1 (reference)
Always use ≤ 2 safety measures	66.2	33.8	0.77 (0.58-1.04)
Frequency of wearing a helmet			
Always/Most of the time	61.1	38.9	1 (reference)
Sometimes	74.4	25.6	0.54 (0.27-1.09)
Occasionally/Never	58.8	41.2	1.10 (0.62-1.96)
Frequency of wearing other safety equipment[5]			

Always/most of the time	61.8	38.2	1 (reference)
Sometimes	64.0	36.0	0.91 (0.40-2.08)
Occasionally/Never	60.0	40.0	1.08 (0.30-3.85)
Frequency of having another person present or carrying a cell phone			
Always/most of the time	61.6	38.4	1 (reference)
Sometimes	66.7	33.3	0.80 (0.52-1.24)
Occasionally/Never	48.5	51.5	1.71 (0.85-3.44)
Frequency of using safety equipment on the horse[6]			
Always/most of the time	60.3	39.7	1 (reference)
Sometimes	70.1	29.9	0.65 (0.42-1.01)
Occasionally/Never	62.4	37.6	0.92 (0.59-1.41)
Frequency of using safety equipment on saddle[7]			
Always/most of the time	61.2	38.8	1 (reference)
Sometimes	65.5	34.5	0.83 (0.53-1.30)
Occasionally/Never	61.0	39.0	1.01 (0.74-1.37)

*n's do not add up to 851 because of missing responses for being injured in the past 12 months

[1] Riding includes: pleasure/trail, dressage, hunter/jumper, eventer, foxhunter, and western

[2]Ground includes: stable manager, groom/stable hand, primary care taker, veterinarian, and farrier

[3]Other includes: categories in which it could not be determined whether the primary interaction was riding or on the ground: instructor/trainer, and other (e.g., driving)

[4]Safety measures includes: helmet, safety vest, gloves, footwear, having another person present, carrying a cell phone, using safety equipment on the horse (e.g., break-away halter, chain lead rope), and using safety equipment on the saddle (e.g., safety stirrups, grab strap)

[5]Safety equipment that you wear includes: gloves, footwear with a heel and hard toe, and safety vest.

[6]Safety equipment on the horse includes: using a break-away halter and chain lead rope

[7]Safety equipment on the saddle includes: using safety stirrups and grab strap

Table 4. Injury characteristics among those ever injured by whether they have been injured during the past 12 months

	Injured more than 12 months ago (n=526)†		Injured during past 12 months (n=317) †	
	Number	Percentage (%)	Number	Percentage (%)
Received Emergency Treatment				
Yes	275	44.8*	116	37.2*
No	223	55.2*	196	62.8*
Visit to regular physician				
Yes	178	33.8	94	29.7
No	348	66.2	223	70.3
Visit to physical therapist				
Yes	97	18.4	46	14.5
No	429	81.6	271	85.5
Visit to mental/psychological therapist				
Yes	5	1.0	2	0.6
No	521	99.0	315	99.4
Visit to chiropractor				
Yes	50	9.5	38	12.0
No	476	90.5	279	88.0
Outcome after Injury				
Improved safety behaviors	339	68.3	194	62.0
Did not improve	157	31.7	119	38.0
Type of Injury				
Contusion or abrasion	152	30.3*	120	38.6*
Fracture or broken bone	186	37.1*	76	24.4*
Sprain or strain	64	12.8*	54	17.4*
Head injury, concussion, or traumatic brain injury	64	12.8	33	10.6
Laceration	25	5.0	23	7.4
Other[1]	11	2.2	5	1.6
Severity				

Mild	247	49.9	172	55.7
Severe	248	50.1	137	44.3
Situation in which injury occurred				
Riding	346	69.2*	179	57.2*
Ground	145	29.0*	128	40.9*
Other[2]	9	1.8	6	1.9
How the riding injuries occurred				
Thrown/fall	285	82.4	154	86.0
Crushed by falling horse	29	8.4*	6	3.4*
Drug (foot caught in stirrup)	3	0.9	0	0
Other[3]	29	8.4	19	10.6
How the ground injuries occurred				
Kicked	29	20.1	21	16.4
Trampled	9	6.3	10	7.8
Struck	3	2.1	4	3.1
Stepped on	55	38.2	35	27.3
Bitten	12	8.3	10	7.8
Other[4]	36	25.0*	48	37.5*

†n's do not add up to 851 because of missing responses for being injured in the past 12 months

*Indicates a significant difference between the two proportions at the 0.05 significance level

[1]Other types of injury that were reported by respondents include: whiplash; orthopedic injuries such as tearing a rotator cuff, separated shoulder, and dislocated pelvis; herniated disc in the back; and torn ligament.

[2]The option for other situation in which the injury occurred did not allow participants to fill in the type of situation, but the example given was driving the horse.

[3]Other ways in which riding injuries occurred that were reported by respondents include: being hit in the face by the horse's neck, spraining a finger on the reins; not being fit for riding and tearing a muscle; getting a sprain when trying to stay on the horse (did not fall off).

[4]Other ways in which ground injuries occurred that were reported by respondents include: being head butted, the horse jerking your arm and pulling away; being crushed between the horse and the wall/a gate, heavy lifting while doing barn chores.

Table 5. Association between having received emergency treatment or medical treatment[1] and socio-demographic, equine interaction, and injury characteristics among those who have ever been injured (n=851)

	Emergency Treatment		Medical Treatment[1]	
	% Receiving Emergency Treatment (n = 393)	Unadjusted OR Point estimate and 95% CI	% Receiving Medical Treatment (n = 535)	Unadjusted OR Point estimate and 95% CI
Gender				
Male	47.7	1 (reference)	56.6	1 (reference)
Female	48.3	1.02 (0.56-1.88)	59.1	0.90 (0.48-1.67)
Age in years				
18-24	49.3	1 (reference)	57.3	1 (reference)
25-34	44.4	0.82 (0.45-1.52)	53.9	0.78 (0.42-1.44)
35-49	47.2	0.92 (0.54-1.58)	58.8	1.05 (0.61-1.82)
50-64	47.8	0.94 (0.56-1.59)	59.9	1.05 (0.62-1.79)
≥ 65	65.1	1.92 (0.87-4.23)	66.7	1.49 (0.66-3.34)
Years of Equine Experience				
1-15	42.0	1 (reference)	50.5	1 (reference)
≥15	49.7	1.36 (0.96-1.94)	61.1	1.29 (0.92-1.83)
Primary type of interaction with horses				
Riding[2]	49.2	1.42 (0.99-2.05)	59.5	1.11 (0.77-1.60)
Ground[3]	40.5	1 (reference)	55.4	1 (reference)
Other[4]	55.4	1.82 (1.04-3.20)	61.2	1.30 (0.74-2.31)
Situation in which the injury occurred				
When Riding	54.7	2.25 (1.66-3.04)	72.2	2.48 (1.83-3.36)
On the Ground	34.9	1 (reference)	51.1	1 (reference)
Other[5]	57.1	2.48 (0.84-7.37)	62.5	1.60 (0.56-4.51)

Always use ≥ 3 safety measures[4]	49.6	1 (reference)	65.8	1 (reference)
Always use ≤ 2 safety measures	45.6	0.85 (0.64-1.14)	57.7	0.71 (0.53-0.95)
Type of injury				
Contusion or abrasion	22.5	1 (reference)	36.9	1 (reference)
Fracture or broken bone	73.9	9.72 (6.53-14.46)	88.2	12.82 (8.19-20.06)
Sprain or strain	27.7	1.32 (0.81-2.16)	59.7	2.53 (1.63-3.94)
Head injury, concussion, or traumatic brain injury	75.5	10.63 (6.13-18.42)	84.5	9.36 (5.13-17.11)
Laceration	51.0	3.59 (1.91-6.72)	61.2	2.71 (1.45-5.05)
Other[6]	50.0	3.44 (1.24-9.55)	93.8	25.69 (3.34-197.35)
Severity of injury				
Mild[7]	26.7	1 (reference)	44.0	1 (reference)
Severe[8]	71.4	6.84 (5.02-9.33)	87.8	9.19 (6.41-13.18)
Main Independent Variables				
Ownership status of horse				
Owned by you or a family member	46.8	1 (reference)	63.6	1 (reference)
Not Owned by you or a family member	51.9	1.22 (0.91-1.65)	67.9	1.21 (0.88-1.66)
Location where injury occurred				
Home	43.2	1 (reference)	59.4	1 (reference)
Boarding/ lesson	48.5	1.24 (0.89-1.73)	63.3	1.18 (0.85-1.66)

stable				
Competition/ show	60.0	1.97 (1.09-3.58)	81.8	3.08 (1.48-6.40)
Trail/open field	50.9	1.36 (0.92-2.02)	69.4	1.55 (1.03-2.35)
Other[9]	54.6	1.58 (0.47-5.31)	90.9	6.85 (0.86-54.35)
Accompaniment				
Alone	42.0	1 (reference)	59.9	1 (reference)
Someone else present	50.9	1.43 (1.05-1.95)	67.2	1.37 (1.00-1.87)

[1]Professional medical treatment includes: emergency treatment with or without hospitalization, visit to a physician, visit to a chiropractor, visit to a physical therapist, or visit to a mental/psychological therapist.

[2]Riding includes: pleasure/trail, dressage, hunter/jumper, eventer, foxhunter, and western

[3]Ground includes: stable manager, groom/stable hand, primary care taker, veterinarian, and farrier

[4]Other includes: categories in which it could not be determined whether the primary interaction was riding or on the ground: instructor/trainer, and other (e.g., driving)

[5]The option for other situation in which the injury occurred did not allow participants to fill in the type of situation, but the example given was driving the horse.

[6]Other types of injury that were reported by respondents include: whiplash; orthopedic injuries such as tearing a rotator cuff, separated shoulder, and dislocated pelvis; herniated disc in the back; and torn ligament.

[7]Mild injuries were those in which the participant was limited in their daily activities for 0-7 days.

[8]Severe injuries were those in which the participants were limited in their daily activities for more than 8 days.

[9]Other location includes: neighbor's/friend's barn, vet clinic, paddock, training/race track, and on the trailer.

Table 6. Multivariate model of the association between receiving emergency and medical treatment and ownership status of horse, location, and accompaniment among those who have ever been injured (n=851)

	Emergency Treatment Adjusted Odds Ratio* Point Estimate and 95% CI	Medical Treatment[1] Adjusted Odds Ratio* Point Estimate and 95% CI
Ownership status of horse		
Owned by you or a family member	1 (reference)	1 (reference)
Not Owned by you or a family member	1.10 (0.78-1.56)	1.08 (0.75-1.57)
Location where injury occurred		
Home	1 (reference)	1 (reference)
Boarding/ lesson stable	1.20 (0.81-1.77)	1.07 (0.71-1.60)
Competition/ show	1.58 (0.80-3.12)	2.42 (1.08-5.44)
Trail/open field	0.97 (0.60-1.56)	1.05 (0.63-1.73)
Other[2]	0.86 (0.23-3.26)	5.47 (0.56-53.20)
Accompaniment		
Alone	1 (reference)	1 (reference)
Someone else present	1.27 (0.89-1.81)	1.17 (0.81-1.70)

*Adjusted for sex, years of experience, if the injury occurred while riding or on the ground, severity of the injury, and safety (frequency of using >=3 safety measures)

[1]Medical treatment includes: emergency treatment with or without hospitalization, visit to a physician, visit to a chiropractor, visit to a physical therapist, or visit to a mental/psychological therapist.

[2]Other location includes: neighbor's/friend's barn, vet clinic, paddock, training/race track, and on the trailer.

Table 7. Association between socio-demographic, equine interaction, and injury characteristics and receipt of emergency and medical treatment among the severe injuries (n=386)

	Emergency Treatment		Medical Treatment[1]	
	% received emergency treatment (n=272)	Unadjusted Odds Ratio Point Estimate and 95% CI	% received medical treatment (n=339)	Unadjusted Odds Ratio Point Estimate and 95% CI
Sex				
Male	60.0	1 (reference)	84.6	1 (reference)
Female	72.2	1.73 (0.75-3.98)	88.1	1.34 (0.44-4.08)
Age				
18-24	84.0	1 (reference)	92.0	1 (reference)
25-34	65.2	0.36 (0.10-1.22)	87.0	0.58 (0.11-3.11)
35-49	69.7	0.44 (0.14-1.36)	88.6	0.68 (0.14-3.18)
50-64	70.3	0.45 (0.15-1.38)	86.3	0.55 (0.12-2.48)
65+	87.0	1.27 (0.25-9.40)	91.7	0.96 (0.12-7.40)
Type of interaction				
Riding[2]	73.0	1.50 (0.86-2.62)	89.4	1.89 (0.92-3.85)
Ground[3]	64.3	1 (reference)	81.7	1 (reference)
Other[4]	73.2	1.52 (0.65-3.53)	88.1	1.66 (0.55-5.04)
Years of experience				
<15	68.7	1 (reference)	83.6	1 (reference)
≥15	72.0	1.17 (0.66-2.08)	88.7	1.54 (0.74-3.22)
Situation in which injury occurred				
Riding	73.7	1.62 (0.98-2.67)	89.6	1.75 (0.91-3.39)
Ground	63.4	1 (reference)	83.2	1 (reference)
Other[5]	66.7	1.15 (0.20-6.63)	71.4	0.51 (0.09-2.84)
Type of injury				
Contusion or abrasion	50.0	1 (reference)	74.6	1 (reference)

Fracture/broken bone or laceration	82.9	4.84 (2.55-9.18)	93.2	4.64 (2.08-10.36)
Head injury, concussion, or traumatic brain injury	90.0	9.00 (2.81-28.78)	95.1	6.65 (1.42-31.19)
Sprain/strain or other[1]	41.2	0.70 (0.34-1.44)	76.5	1.11 (0.49-2.54)
Ownership				
Owned by you or family member	70.5	1 (reference)	87.8	1 (reference)
Not owned by you or family member	73.6	1.17 (0.73-1.88)	87.9	1.01 (0.53-1.93)
Location where injury occurred				
Home	69.6	1 (reference)	86.5	1 (reference)
Boarding/ lesson stable	71.6	1.10 (0.64-1.91)	86.5	1.00 (0.48-2.07)
Competition/ show	70.0	1.02 (0.42-2.48)	90.0	1.40 (0.37-5.24)
Trail/open field	74.4	1.27 (0.67-2.42)	90.9	1.56 (0.62-3.90)
Other[7]	62.5	0.73 (0.16-3.24)	87.5	1.09 (0.12-9.53)
Accompaniment				
Alone	67.4	1 (reference)	86.9	1 (reference)
Someone else present	72.8	1.30 (0.79-2.13)	88.2	1.13 (0.57-2.23)

[1]Professional medical treatment includes: emergency treatment with or without hospitalization, visit to a physician, visit to a chiropractor, visit to a physical therapist, or visit to a mental/psychological therapist.

[2]Riding includes: pleasure/trail, dressage, hunter/jumper, eventer, foxhunter, and western

[3]Ground includes: stable manager, groom/stable hand, primary care taker, veterinarian, and farrier

[4]Other includes: categories in which it could not be determined whether the primary interaction was riding or on the ground: instructor/trainer, and other (e.g., driving)

[5]The option for other situation in which the injury occurred did not allow participants to fill in the type of situation, but the example given was driving the horse.

[6]Other types of injury that were reported by respondents include: whiplash; orthopedic injuries such as tearing a rotator cuff, separated shoulder, and dislocated pelvis; herniated disc in the back; and torn ligament.

[7]Other location includes: neighbor's/friend's barn, vet clinic, paddock, training/race track, and on the trailer.

Table 8. Association between having improved safety behaviors and socio-demographic, equine interaction, injury characteristics, and receipt of social support among those who have ever been injured (n=851)

	% Improved Safety Behaviors (n=535)*	% Did Not Improve Safety Behaviors (n=279)*	Unadjusted OR Point Estimate and 95% CI
Gender			
Male	58.1	41.9	1 (reference)
Female	66.2	33.8	1.41 (0.75-2.63)
Age in years			
18-24	54.4	45.6	1 (reference)
25-34	48.6	51.4	0.79 (0.43-1.46)
35-49	65.9	34.1	1.62 (0.94-2.79)
50-64	72.3	27.7	2.19 (1.29-3.73)
≥65	72.1	27.9	2.16 (0.95-4.91)
Years of Experience			
1-15	66.0	34.0	1 (reference)
≥15	65.7	34.3	0.98 (0.68-1.42)
Primary Type of Interaction with Horses			
Riding[1]	62.1	37.9	1.28 (0.88-1.87)
Ground[2]	67.7	32.3	1 (reference)
Other[3]	56.8	43.2	0.80 (0.45-1.42)
Received Medical Treatment			
Yes	69.0	31.0	1.51 (1.12-2.03)
No	59.7	40.3	1 (reference)
Main Independent Variables			
Receipt of emotional support from family/friends			
Strongly agree/agree	69.2	30.8	1.71 (0.99-2.95)
Neutral	54.5	45.5	0.91 (0.49-1.68)
Strongly disagree/ disagree	56.9	43.1	1 (reference)
Receipt of emotional support from professional in the horse industry			
Strongly agree/agree	67.4	32.6	1.10 (0.71-1.72)
Neutral	63.3	36.7	0.92 (0.58-1.47)
Strongly disagree/ disagree	65.1	34.9	1 (reference)

Receipt of emotional support from a health care professional			
Strongly agree/agree	72.3	27.7	1.80 (1.19-2.71)
Neutral	60.1	39.9	1.04 (0.69-1.57)
Strongly disagree/ disagree	59.3	40.7	1 (reference)
Receipt of informational support from family/friends			
Strongly agree/agree	80.3	19.7	2.90 (1.92-4.36)
Neutral	60.8	39.2	1.10 (0.79-1.54)
Strongly disagree/ disagree	58.5	41.5	1 (reference)
Receipt of informational support from professional in the horse industry			
Strongly agree/agree	76.8	23.2	2.37 (1.61-3.49)
Neutral	62.6	37.4	1.20 (0.85-1.69)
Strongly disagree/ disagree	58.3	41.7	1 (reference)
Receipt of informational support from a health care professional			
Strongly agree/agree	73.5	26.5	1.74 (1.15-2.64)
Neutral	65.5	34.5	1.19 (0.86-1.64)
Strongly disagree/ disagree	61.5	38.5	1 (reference)

*n's do not add up to 851 because of missing responses for the outcome of improving safety behaviors.

[1]Riding includes: pleasure/trail, dressage, hunter/jumper, eventer, foxhunter, and western

[2]Ground includes: stable manager, groom/stable hand, primary care taker, veterinarian, and farrier

[3]Other includes: categories in which it could not be determined whether the primary interaction was riding or on the ground: instructor/trainer, and other (e.g., driving)

[4]Other types of injury that were reported by respondents include: whiplash; orthopedic injuries such as tearing a rotator cuff, separated shoulder, and dislocated pelvis; herniated disc in the back; and torn ligament.

[5]Mild injuries were those in which the participant was limited in their daily activities for 0-7 days.

[6]Severe injuries were those in which the participants were limited in their daily activities for more than 8 days.

Table 9. Multivariate model of the association between receipt of informational and emotional support from friends/family, a professional in the equine industry, and a healthcare professional and improving safety behaviors among those who have ever been injured (n=851)

	Adjusted Odds Ratio* Point estimate and 95% CI
Receipt of emotional support from family/friends	
Strongly agree/agree	1.78 (1.01-3.12)
Neutral	0.94 (0.50-1.77)
Strongly disagree/disagree	1 (reference)
Receipt of emotional support from professional in the horse industry	
Strongly agree/agree	1.12 (0.71-1.76)
Neutral	0.98 (0.61-1.59)
Strongly disagree/disagree	1 (reference)
Receipt of emotional support from a health care professional	
Strongly agree/agree	1.77 (1.17-2.69)
Neutral	1.13 (0.74-1.73)
Strongly disagree/disagree	1 (reference)
Receipt of informational support from family/friends	
Strongly agree/agree	3.02 (1.98-4.60)
Neutral	1.14 (0.81-1.61)
Strongly disagree/disagree	1 (reference)
Receipt of informational support from professional in the horse industry	
Strongly agree/agree	2.49 (1.67-3.72)
Neutral	1.27 (0.89-1.80)
Strongly disagree/disagree	1 (reference)
Receipt of informational support from a health care professional	
Strongly agree/agree	1.78 (1.16-2.73)
Neutral	1.23 (0.89-1.72)
Strongly disagree/disagree	1 (reference)

*Adjusted for type of interaction, age, and sex

Table 10. Receipt of emotional and informational support from any source[1] as predictors for improving one's safety behaviors among those who have ever been injured (n=851).

	% Improved Safety Behaviors (n= 535)*	% Did Not Improve Safety Behaviors (n=279)*	Unadjusted OR Point estimate and 95% confidence interval	Model 1* Point estimate and 95% CI	Model 2** Point estimate and 95% CI
Receipt of emotional support					
None	52.9	47.1	1 (reference)	1 (reference)	1 (reference)
One Source	67.1	32.9	1.81 (1.15-2.87)	1.77 (1.10-2.84)	1.46 (0.90-2.38)
Two Sources	66.0	34.0	1.72 (1.14-2.61)	1.82 (1.18-2.80)	1.33 (0.85-2.10)
Three Sources	72.0	28.0	2.29 (1.51-3.46)	2.13 (1.39-3.26)	1.44 (0.90-2.31)
Receipt of informational support					
None	56.9	43.1	1 (reference)	1 (reference)	1 (reference)
One Source	77.9	22.1	2.67 (1.75-4.08)	2.99 (1.93-4.64)	2.80 (1.80-4.38)
Two Sources	77.4	22.6	2.59 (1.51-4.46)	2.77 (1.58-4.86)	2.59 (1.46-4.61)
Three Sources	76.8	23.2	2.51 (1.56-4.03)	2.47 (1.52-4.04)	2.23 (1.30-3.81)

*n's do not add up to 851 because of missing responses for the outcome of improved behaviors

[1]Sources of emotional and informational support include: friends/family, professional in the equine industry, and professional in the healthcare industry.

*Adjusted for age, type of interaction, and sex

**Adjusted for age, type of interaction, and sex. The model for total emotional support is also controlled for total informational support and the model for total informational support is also controlled for total emotional support.

Table 11. Respondents' perceptions on safety information, reasons why they do not always follow safety measures, and sources where more safety information is desired

	Percentage (%) of All Respondents (n=908)
I feel that enough Safety Information is provided in the equine industry	
Strongly agree/Agree	84.2
Neutral	8.9
Strongly disagree/Disagree	7.0
Reasons for which do not always use all of the safety measures*	
It is not available	24.1
Interferes with range of motion	13.1
Don't believe it is necessary	53.4
Not educated on its importance	6.3
Uncomfortable	14.6
Peer pressure	0.6
Fashion	1.7
Other[1]	10.1
Source where more safety information is desired*	
Professional in the equine industry	87.4
Professional in the healthcare industry	13.1
4-H clubs, pony clubs, other organizations	66.0
Horse magazines	67.3
Educational videos	26.7
Community seminars	30.1
Other[2]	7.4

*Percentages do not add up to 100% because the respondents could choose more than 1 answer.

[1]Other reasons includes: expense of equipment/can't afford it, doesn't fit, in a hurry

[2]Other sources includes: at horse shows, in tack shops, web sites and internet sources, extension agents, friends/peers, education programs in school (collegiate programs)

Appendices

Appendix A: Survey on Horse-Related Injuries and Safety Practices in MD and VA

Section 1: Introduction and Consent

The University of Maryland College Park School of Public Health, VirginiaEquestrian.com, Equiery Magazine and Virginia Horse Council are conducting a survey to better understand the use of safety practices and horse-related injuries among adults in Maryland and Virginia who interact with horses. We would like to hear from anyone who has any type of interaction with horses. You do not need to have suffered a horse-related injury to participate in this survey. ALL injuries of any kind and severity are to be included in this survey, not just those that required medical attention. Benefits of participating in the survey include providing information that will be used to inform the horse industry about ways to improve safety around horses and improve outcome after horse-related injury.

By clicking yes below, you are giving consent to participate in the survey and agreeing that you are at least 18 years of age. We plan to share what we learn from you in news articles posted on VirginiaEquestrian.com and in the Equiery magazine. As an incentive to participate, we are raffling off a $50 GIFT CERTIFICATE from DOVER SADDLERY. If you are interested in participating in the raffle, instructions on how to do so are at the end of the survey questionnaire. If you have any questions, you can contact Lisa Bethune at bethune.lisa08@gmail.com or 571-271-2815. Thank you for your time and attention. We greatly appreciate your participation.

By clicking yes below, I agree to participate.

Yes

Section 2: General Information

1. Age at your last birthday (in years):

2. Sex: Male
Female

3. Please indicate the number of years you have been involved with horses:

4. Which best describes the primary type of interaction you usually have with horses:
(Choose only one)
Pleasure rider/Trail rider
Dressage rider
Hunter/Jumper rider
Eventer
Foxhunter
Western rider
Instructor/Trainer
Stable manager
Groom/stable worker
Primary care taker
Veterinarian
Farrier

5. Have you EVER had ANY injury as a result of horse-related activities?
Yes
No
Don't remember

Section 3: Injury Occurrence

1. Within the PAST 12 MONTHS, have you had ANY injuries as a result of horse-related activities?
   Yes
   No
   Don’t remember

Section 4: Injury Characteristics

1. Which of the following best describes the type of injury?

2. Please indicate the ownership status of the horse that was involved in the injury:
   Owned by you or a family member
   Not owned by you or a family member

3. Where did the injury occur?

4. Please indicate whether or not another person was present when the injury occurred:
   I was alone
   Someone else was present

5. To the best of your knowledge, did the horse involved in the injury have any health problems? (e.g., EPM, Lyme Disease, etc...)
   Yes
   No
   Don't know

6. Did you receive emergency treatment as a result of the injury?
   Yes, WITH hospitalization
   Yes, WITHOUT hospitalization
   No
   Prefer not to answer

7. Did you receive any other treatment for the injury? (Check all that apply)
   No other treatment
   Visit to a regular physician
   Visit to a chiropractor
   Visit to a physical therapist
   Visit to a mental/psychological therapist
   Treatment at home from a family member
   Self-treatment at home
   Prefer not to answer

8. For how many days were you limited in your normal daily activities as a result of the injury?
   0-7 days
   8-21 days
   More than 21 days

9. Following the injury, I received EMOTIONAL support (i.e., encouragement, comfort, sympathy) from: (Indicate strongly agree, agree, neutral, disagree, strongly disagree)

Friends of family
Professional in the equine industry (e.g., instructor, trainer)
Healthcare professional (e.g., doctor, nurse, therapist)

10. Following the injury, I received INFORMATIONAL support (i.e., guidance and advice on how to improve my safety behaviors when working around horses) from: (Indicate strongly agree, agree, neutral, disagree, strongly disagree)
Friends of family
Professional in the equine industry (e.g., instructor, trainer)
Healthcare professional (e.g., doctor, nurse, therapist)

11. Have you improved your safety behaviors when handling, riding, or working with horses as a result of the injury?
Yes
No
I no longer work with horses

12. When the injury occurred where you:
Riding the horse
On the ground
Other situation (e.g., driving the horse)

Section 5: Riding Injury

1. How did the injury occur?
    Thrown/fell off horse
    Crushed by falling horse
    Foot got caught in stirrup and dragged by horse
    Injury occurred some other way (please specify)

Section 6: Injury from the Ground

1. How did the injury occur?
    Kicked by horse
    Trampled by bolting horse
    Struck by rearing horse
    Stepped on by horse
    Bitten by horse
    Injury occurred some other way (please specify)

Section 7: Safety Information

1. When working with horses, please indicate the frequency with which you practice the following safety measures: (Indicate always, most of the time, sometimes, occasionally, never)

Wear a helmet
Wear a body protector/safety vest
Wear gloves
Wear footwear with a heel and hard toe (e.g., paddock boots)
Have another person present
Carry a cell phone
Use safety equipment on the horse (e.g., break-away halter, chain lead rope)
Use safety measures on your saddle (e.g., safety stirrups, grab strap)

2. If you do not always practice all of the above safety measures, please indicate the reasons for which you do not: (Check all that apply)

Fashion
Peer pressure
Uncomfortable
Interferes with range of motion
It is not available
I don't believe it is necessary
I have not been education on the importance of practicing that safety measure
Other reason (please specify):

3. Concerning safety information that is provided in the horse industry: (Indicate strongly agree, agree, neutral, disagree, strongly disagree)

I feel that I have received enough education on safety when engaged in horse-related activities and that enough safety information is readily available in the horse industry

4. Where do you think the most effective or appropriate source of horse related safety information would be? (Check all that apply)

Professional in the equine industry (e.g., instructor, trainer, veterinarian)
Professional in the healthcare industry (e.g., physician, nurse)
4-H clubs, pony clubs, other equestrian organizations
Horse magazines
Community seminars
Educational videos
Other source (please specify):

Section 8: Thank You

Thank you for completing the survey! Your responses are very important to us. When you hit the 'Done' button below you will automatically be taken to the page to enter into the raffle for the gift certificate. You will be asked to enter your email address so that the winner can be contacted. Your survey responses will not be able to be linked to your email address.
Thank you!

Appendix B: Survey advertisements

Below is the advertisement that appeared on Equiery.com, in the Virginia Horse Journal e-newsletter, and on VirginiaEquestrian.com. This advertisement was also sent out in an 'e-blast' by the Equiery, appeared in the print issue of the Equiery magazine, and was emailed to members of the Virginia Horse Council. The advertisement also appeared in the Horse Show Times newspaper along with a story about the principal investigator and why this survey was being conducted.

Please Participate in University of Maryland Equine-Related Injury Study

[The Equiery, The Virginia Horse Journal, VirginiaEquestrian.com, The Virginia Horse Council, The Horse Show Times] is supporting a University of Maryland School of Public Health study on horse-related injuries and safety practices among people who interact with horses in Maryland and Virginia.

The goal of this survey is to characterize the injuries that are most commonly occurring in this population and to identify ways in which safety practices can be improved to reduce the occurrence of injury and improve the outcome after injury.

We are asking all [Equiery, Virginia Horse Journal, VirginiaEquestrian.com, Horse Show Times readers or Virginia Horse Council members] to participate in this survey, regardless of whether or not you have suffered a horse-related injury.

Everyone who completes the survey will be able to enter into a drawing to win a $50 gift certificate to Dover Saddlery! The survey should take about 5 minutes to complete. Your responses are very important to us and the results of the survey will be shared in a future issue of [The Equiery, The Virginia Horse Journal, The Horse Show Times]. You must be at least 18 years of age in order to participate.

Click here to take the survey and enter into the drawing.

Appendix C: Riding Safely Survey

This survey was conducted by Pat Evans at Utah State University. Only those who have suffered a horse-related injury were to complete this survey and only those 18 years of age or older could participate.

1. Please indicate your gender. (Circle the correct response)
   Male Female

2. Please indicate your age:

3. Indicate the Country/Region or State in which you reside. _____

4. Check all that describe your exposure to the horse industry:
   Professional trainer — Riding instructor
   Professional competitor — Riding school client
   Amateur competitor — Groom
   Horse owner for pleasure riding — Jockey
   Service to equine industry; e.g., vet, farrier, saddler, etc.
   Center manager; e.g., livery yard, riding school, trekking center, etc.
   Other (please specify):_____

5. Indicate all below that relate to your horse experience:
   Hacking — Hunting
   Competing — Polo
   Training young stock — Endurance riding
   Driving — Ground work only (e.g., lunging)
   Breeding — Polocrosse
   Service related (e.g., vet, farrier, saddler)
   Racing (including point-to-point)
   Other (please specify):_____

6. If you have competition experience, indicate type of experience you have. (Circle all correct responses)
   Western classes — Hunter trials
   Ridden showing — Team chasing
   In-hand showing — Eventing
   Dressage — Driving
   Show Jumping
   Other (please specify):_____

7. Indicate the breeds of horses with which you have worked. (Circle all correct responses)
   Quarter horse — Paints

Arabs	Warmbloods
Thoroughbreds	Cob
Heavy horse	Light horse
Pony	
Other (please specify):_____	

8. Your riding styles include:

Western	Side saddle
English	Race horses
Driving	
Other (please specify):_____	

9. Rate yourself on your experience of the above styles.

	Novice	Intermediate	Advanced	Never done this style
Western				
English				
Dressage				
Driving				
Side saddle				
Other (please specify):_____				

10. Your horse experience includes working with: Check all that apply.

Older, well broken horses	Stallions
Young, unbroken horses	Race horses
Young, green broken horses	
Other (please specify):_____	

11. Your recent (last 3 years) horse experience include working with: Check all that apply.

Older, well broken horses	Stallions
Young, unbroken horses	Race horses
Young, green broken horses	
Other (please specify):_____	

12. Indicate the number of years involved with horses.

1-2 years	3-5 years
6-9 years	10-15 years
16-20 years	More than 20 years

13. Please indicate the number of horses you come in contact with on a daily basis.

Do not have daily contact	7-10 horses
1 horse	11-15 horses
2-3 horses	16-20 horses
4-6 horses	More than 20 horses

14. Indicate overall your current (last 3 years) involvement with horses.

	Care of horses, i.e., feeding, handling, turnout
Daily care	
Care of horse(s) 4 or more times a week	
Care of horse(s) 1-3 time per week	
Not responsible for care of horse(s)	
Other (please specify):_____	

15. Indicate your average level of riding involvement.

	Ride Daily	Ride 3-4 days a week	Ride 1-2 days a week
Teenage years			
20-30 years of age			
30-40 years of age			
40-50 years of age			
50-60 years of age			
60 or more years of age			
Other (please specify):_____			

16. Have you had formal riding instruction? Yes No

17. If you have had formal riding instruction, indicate type and length of instruction below.

	Less than a year	1-3 years	3-5 years	More than 5 years
Western				
English				
Other (different style of riding and information about style):_____				

18. Please indicate if you have sustained injuries due to horse related activities.

Yes No

19. Indicate the types of horse related injuries which you have incurred. If you have had more than one injury to a site or other injuries not listed please indicate those in the 'other' box.

	Injury type	Horse aspect
1-	Cut;	1- working on the ground w/ horse;
2-	Bruise;	2- riding school horse;
3-	Sprain;	3- riding personal horse;
4-	Torn muscle/ligament;	4-riding someone else's horse;
5-	Broken bone;	5- training personal horse;
6-	Concussion;	6- training client horse;
7-	Organ damage;	7- driving;
8-	Lost teeth;	8- service; veterinarian or farrier;
9-	Broken nose;	9- race horse industry;
10-	Dislocated joint;	10- driving
11-	Stitches;	

12- Loss of fingers or toes

	Type of horse	Style of riding
1-	(Weanling-3 years old) unbroken horse;	1- western;
2-	(2-3 years) green broken horse;	2- English;
3-	(3-5 years) broken horse;	3- driving;
4-	Older broken horse (5 years or more);	4- racing
5-	Older, not well broken or green broken horse	5-side-saddle

Age at time of injury	Injury type	Horse aspect	Type of horse	Style of riding
Foot				
Ankle				
Knee				
Lower leg				
Upper leg				
Hip				
Ribs				
Back/spine				
Head				
Neck				
Face				
Hand				
Wrist				
Elbow				
Lower arm				
Upper arm				
Shoulder				
Collar bone				
Internal damage				

If you have had other injuries or if an area has been injured more than once please list below and give details.

_____

20. Have previous horse related injuries resulted in: Check all that apply.

Doctor's Surgery visits	Hospital casualty visits
Hospital stays	Days of missed work
Days of missed school	Rehabilitation
Did not seek medical attention but might have been appropriate	
Dental Treatment	

21. Have injuries resulted in any type of surgery? Yes No
    If yes, please explain: _____

22. If injuries resulted in missed school or work, indicate total number of days missed throughout your years of horse activity.

	School days missed	Work days missed
1-2 days		
3-4 days		
5-6 days		
7-8 days		
9-10 days		
More than 10 days		

23. Do you ride with safety equipment or with someone else?

	Always	Most of the time	Sometimes	Occasionally	Never
Riding hat					
Body protector					
Proper riding boots					
Ride with someone else					
Other (please specify):_____					

24. If you use safety equipment please indicate when you use that safety equipment.
    _____

25. If you chose not to use all or some safety equipment during your involvement with horses please tell us at what time, or for what activities, you choose not to wear all or some safety equipment, specify which items you choose not to use.
    _____

26. Given your equestrians experience what are the four most important factors to improve horse related safety? For example, equine training, rider experience with multiple horses, type of activity, use of safety equipment at all time on horseback, choosing horse appropriate for rider level, riding instruction, understanding equine natural behavior, evaluation of tack before use for weaknesses or proper fit, etc.
    _____

Thank you for our assistance with this survey.

Retrieved from: http://www.ridingsafely.net/equine_injuries_survey_2008.html

Accessed: December 14, 2009

Appendix D: Brown University Equestrian Injury Survey

1. What is your gender? Male Female

2. What is your age? ____

3. Which choice best describes the type of interaction you primarily have with horses?

Hacking	Show Jumping
Veterinarian	Polo
Farrier	Eventing
Dressage	Driving
Fox hunting	Show hunters
Breeding	Racing
Endurance riding	Other:_____

4. Have you had any formal riding instruction? Yes No

5. Do you have competition experience? Yes No

6. If so, has it been at a professional level? Yes No

7. How many years have you been working with horses? ____

8. On average, how many hours a week do you spend working with horses? ____

9. With which type(s) of horses have you spent time working with?
   Older, well broken horses
   Young, unbroken horses
   Green horses
   Stallions

10. Have you had any injuries or infections? (if not please to question 16)
    Yes No

11. If so, please indicate below the type of injuries and/or infections you have sustained (rashes, cuts, bruises, sprains, muscle/ligament tears, broken bones, tooth injuries, loss of digits, dislocations, concussions, etc.) where it occurred on your body and what you were doing at the time (hacking, competing, vet work, etc.) Please use the back of this page if you need more space.
    Injury type
    Location on your body

What you were doing

12. Did any of the injuries or infections require surgery or hospitalization?
    Yes No

13. If so, please explain: (again, feel free to use the back of this page for additional space)

14. Did you miss work or school? Yes No
    If so, how much? ____

15. Did you miss time working with horses? Yes No
    If so, how much? ____

16. Do you use safety equipment or ride with someone else? Yes No

17. If so, how often do you use or do the following? (Always, most times, sometimes, occasionally, never)
    Helmet
    Safety vest
    Proper riding boots
    Ride with someone else
    Other_____

Thank you

Retrieved from:
http://groups.google.com/group/uk.rec.equestrian/browse_thread/thread/a8b4ba7685c8b339/2854c16ae45b2ebe?hl=en&ie=UTF-8&q=Brown+University+Equestrian+Injury+Survey&pli=1

Accessed: December 14, 2009

Appendix E: Mayberry et al. Survey

Survey: Horse Safety Study

A. Demographic Information:

1. Age: _____

2. Sex: _____

B. Riding Skills:

3. How long have you been riding horses? _____ Years

4. How many hours per month do you ride? _____ Hours

5. How would you categorize your riding skill level? [Please check only one]

- ❑ Beginner/Novice
- ❑ Intermediate
- ❑ Advanced
- ❑ Instructor or Professional

6. In which discipline[s] do you participate? [Please check all that apply]

- ❑ Barrel Racing
- ❑ Cutting
- ❑ Dressage
- ❑ Driving
- ❑ Gaming
- ❑ Hunting or Jumping
- ❑ Police Work
- ❑ Race or Speed Work
- ❑ Rodeo
- ❑ Roping
- ❑ Schooling
- ❑ Team Penning
- ❑ Trail Riding
- ❑ Western Pleasure

C. Injury Assessment:

7. Have you even been injured as a result of riding or contact with a horse?

- ❑ Yes [Please answer <u>all</u> of the following questions]

- ❑ No [Please skip ahead to Section D]

8. What was the cause of your accident?
   - ❑ Unsafe horse
   - ❑ Green horse
   - ❑ Unsafe footing or riding conditions
   - ❑ Inexperience as a rider
   - ❑ Horse spooked

9. What was the nature of your injury or injuries? [Please check all that apply]
   Face and scalp injury

   - ❑ Neck injury
   - ❑ Brain injury
   - ❑ Spinal cord injury
   - ❑ Broken arm or leg
   - ❑ Cut or bruise on your arm or leg
   - ❑ Broken rib or a cut or bruise to your chest area
   - ❑ Abdominal injury [this includes injuries to your internal organs like your liver, spleen, or bowel]
   - ❑ Broken pelvis
   - ❑ Other Injury: [describe]

   _____
   ____

10. Did you seek medical care?
    - ❑ Yes [Please answer all questions]
    - ❑ No [*Please skip ahead to section D*]

11. Did you require hospitalization?
    - ❑ Yes
    - ❑ No

12. Did you require surgery?
    - ❑ Yes
    - ❑ No

13. Do you have a permanent disability from any of your injuries?
    - ❑ Yes
    - ❑ No

14. What were the circumstances surrounding your injury? [Please check all that apply]

- ❑ Fall from horse
- ❑ Thrown or bucked from horse
- ❑ Kicked by horse
- ❑ Horse hit by auto
- ❑ Horse ran into a 2nd horse
- ❑ Rider caught in rope or stirrup and dragged
- ❑ Horse reared, striking rider
- ❑ Trampled by horse
- ❑ Other [Please describe]:

  _____
  _____
  _____

D. Rider Safety:

15. What type[s] of protective gear do you wear when you ride? [Please check all that apply]
    - ❑ None
    - ❑ Helmet
    - ❑ Boots [riding or paddock boots with heels]
    - ❑ Vest
    - ❑ Other: [describe]

16. If you do NOT wear protective gear while engaging in horse-related activities, please tell us why not? [Check the most important reason to you]:
    - ❑ Fashion
    - ❑ Discomfort
    - ❑ Interferes with riding
    - ❑ Protective gear is not available
    - ❑ Other: [please explain]

    _____
    _____
    _____

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