

UNIVERSITY OF CENTRAL OKLAHOMA
W. ROGER WEBB FORENSIC SCIENCE INSTITUTE

A COMPARATIVE INVESTIGATION OF EQUINE-RELATED AND
BOVINE-RELATED HUMAN FATALITIES IN OKLAHOMA

A THESIS
SUBMITTED TO THE GRADUATE FACULTY
in partial fulfillment of the requirements for the
Degree of
MASTER OF SCIENCE

By
KAYLAN SHAE PETERSON
Edmond, Oklahoma
2023

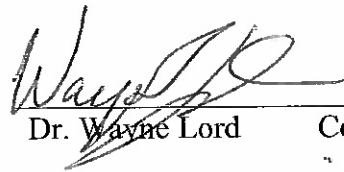
**A COMPARATIVE INVESTIGATION OF EQUINE-RELATED AND
BOVINE-RELATED HUMAN FATALITIES IN OKLAHOMA**

BY: KAYLAN SHAE PETERSON

A THESIS APPROVED FOR THE
W. ROGER WEBB FORENSIC SCIENCE INSTITUTE

MAY 2023

BY




Dr. Wayne Lord Committee Chairperson



Dr. Ross Miller Committee Member



Dr. Mark McCoy Committee Member



Mr. Timothy Dwyer Committee Member



Mrs. Amber Fortney Committee Member



Dr. Sean Laverty Committee Member

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

© Copyright by KAYLAN SHAE PETERSON 2023
All Rights Reserved.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Acknowledgements

A very special person made a one-off statement in my undergraduate career that has stuck with me and given me purpose throughout my toughest days. He said, “You have to appreciate reality.” To him, it was a casual remark. To me, it was a new life motto. You have to appreciate the reality of where you are now, appreciate how hard you’ve worked to get here, and appreciate how far it will take you. My journey through graduate school and through this thesis process has definitely shown me how far hard work can take me. I’ve been given so many opportunities to collaborate with, speak to, and learn from so many wonderful people. To everyone who has supported me throughout this entire graduate school process: Thank you!

I owe a particularly vast thank you to the W. Roger Webb Forensic Science Institute and all of the amazing faculty and staff within the FSI. This program has been a place where I have felt both challenged and welcomed since I moved to Oklahoma in 2016. I have been given the opportunity to learn and grow under the guidance of so many amazing people to whom I extend the sincerest gratitude. My time as a student at the FSI have been some of the most formative years of my life.

I also owe a grand thank you to the Oklahoma Office of the Chief Medical Examiner for allowing me to conduct my research using their database. Many unnamed individuals in the OCME Tulsa office took the time to assist me in compiling the data I needed for this research. Thank you to all at the OCME who helped make this thesis research possible.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

To Director Dr. Dwight Adams:

I first met you in 2015 when I came to tour UCO. At the time, UCO was my first of many college tours and I wasn't quite sure what I wanted to be when I grew up. After meeting you and learning about the FSI, my mind was made up; I was going to be a Broncho and I was going to become a forensic scientist. Taking Forensics 101 with you was one of the greatest, most influential landmarks in my college career. All of the stories you told us about your extensive career experiences sparked my fascination for many disciplines within forensic science, and I can't thank you enough for being my first and strongest inspiration at UCO. Thank you for being a prime example of how to be a kind, open-minded, and influential leader. Thank you for always being someone I can look to for guidance and inspiration.

To Assistant Director Dr. James Creecy:

On so many occasions, you have challenged me to go outside of my comfort zone to think boldly and work diligently. Before taking Professional Issues and Graduate Seminar, I had a very hard time taking constructive criticism. I have always been loud and outgoing, but I always struggled with accepting critiques. Thank you for giving me the space to grow comfortable in being myself while challenging me to grow as an open-minded academic. You have guided me to stand behind what I know is true while teaching me to feel calm in uneasy situations. One of the greatest take-aways from all of the things you have taught me is to feel comfortable saying "I don't know". There is always more to learn, and I thank you for helping me feel secure in standing tall while staying humble.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

To Dr. Wayne Lord:

When I took your courses in the undergraduate program, I knew without a doubt that I wanted to seek you out as my thesis committee chair when I started the graduate program. You helped me create a project that I am wildly passionate about; one that, even after working on it for countless exhausting hours, I'm still eager to talk about. Thank you for all of the guidance you offered me throughout my time here at the FSI. You have played one of the most intricate roles in helping me become the person I am today!

To Dr. Ross Miller:

There is a common theory in crime scene reconstruction that says, "Nothing just happens." I'm convinced more and more each day that this is true. One small decision to volunteer for the OK-IAI conference started laying the path for us to get to work on some really incredible things. Without you, without your overwhelming generosity and willingness to go out of your way for someone you barely knew, I wouldn't have been able to create such an amazing and insightful project. You have helped me with my thesis research, guided me through numerous other graduate school projects, and greatly contributed to the passion I have for pathology and medicolegal death investigations. Thank you for jumping into this project and playing so many key roles during my graduate school career. As I've said to you before, I truly believe I could not have been as successful with this whole experience had it not been for you.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

To Dr. Mark McCoy:

Without your help and guidance with my thesis beginning in Research Methods, there would have been no solid platform for this thesis to stand on. Not only did you help me guide me in determining the best way to conduct my research, but you also helped me understand why I wouldn't conduct it a different way. Thank you for assisting me in laying the foundation for this project and for helping me see it through.

To Timothy Dwyer:

It was your initial excitement and insight into horse and cow related deaths that got me really excited to work on this project. Your hands-on experience with cases like the ones in this study really jumpstarted this research. I truly appreciate all of your input and guidance with my thesis, and with graduate school in general. Thank you for letting me bounce ideas off of you, both for this thesis and other projects. And, of course, I can't thank you enough for the light-hearted conversation and comic relief in times of high stress!

To Amber Fortney:

I knew we would hit it off the moment I found out you're a horse lover, too. It was your great ideas in the first few committee meetings that helped me lay the beginning foundation for this project. I sincerely appreciate all of the time you have taken to painstakingly comb through my thesis in efforts to help me turn out the best document (and hopefully future publications) possible. Thank you for being one of the most reliable sources of feedback and encouragement I've had throughout this entire process.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

To Dr. Sean Lavery:

When I reached out to you about getting your help with the statistical side of this project, I expressed to you that I'm not the most mathematically inclined individual. Little did I know, you remembered me from when I took your Bio-Calculus class in 2017 and assured me that I was more than capable of comprehending the statistical analysis associated with this project. I can't express enough how much I appreciate you going out of your way on many occasions (especially over holiday breaks and after hours) to work on this project. Words can be manipulated, but numbers don't lie. Thank you for guiding me in putting numerical truth behind the story my research was trying to tell.

To Steven Dunn:

When I took General Psychology in 2018, I had no clue that the weirdo standing in front of the class in mismatching cardigan, khakis, novelty socks, and Birkenstocks would become one of my biggest allies. In the past five years, you have been more than just my mentor; it would take another thesis-length document to just summarize all of the ways you have guided me. Without you, I don't think I would've made it through undergrad, much less triumph through grad school. Thank you for seeing something in me that I didn't see in myself. Thank you for being my advocate, my challenger, and my friend. Thank you for teaching me to appreciate reality.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

To Hunter:

Somehow you got roped into loving this chaotic, crazy horse girl/forensics nerd. You have stuck with me at my lowest and cheered me on at my highest. You have loved me through some of the biggest struggles of my life and you have stood by my side supporting me through some of my greatest achievements. Thank you for always being my partner through this amazing journey.

To my grandparents, aunts, and uncles:

Throughout my entire life, I have always had my family by my side. For as long as I can remember, there has been a running joke about my posse of family who came to every PTA meeting, volleyball game, band concert, and fundraising event. My posse is a group of amazing people who have loved me and cheered me on through every part of my life. Thank you all for being exactly what I needed, exactly when I needed it. I have learned so many things about life, love, and family by watching all of you. You all have seen me transition from being a curly-haired little girl to being a Master's level graduate; I hope I have made you all proud.

To my parents:

Most importantly, I owe the biggest thank you to my earliest and loudest cheerleaders. Thank you both for guiding me and loving me through my biggest mistakes and greatest accomplishments. Since the day I was born, you have both lived your lives for my betterment. I'm forever grateful for the way the both of you have always supported me and for everything you have done to help me build an adventurous, fruitful, wonderful life. I know that neither of you have ever wavered in your believing in me. You both have instilled in me that life is not about winning or

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

getting an A; life is about doing the absolute best you can do and being proud of it. I have no doubt that the love and support you both have shown me is relentless. I am proud of the person you both have helped me become, and I am proud to be your daughter.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

THESIS ABSTRACT

University of Central Oklahoma

Edmond, Oklahoma

NAME: Kaylan Shae Peterson

TITLE OF THESIS: A Comparative Investigation of Equine-Related and Bovine-Related Human Fatalities in Oklahoma

DIRECTOR OF THESIS: Wayne D. Lord, Ph.D.

PAGES: 73

ABSTRACT: Since the late 1990s, there have been a growing number of research efforts evaluating the patterns associated with equine-related injuries. Most of the data collected focuses on demographics, cause of injury, and sustained injuries of the individuals studied. There is a copious amount of published research discussing rates of injury and safety concerns in both equine and bovine activities. However, there is an impressive lack of research concerning mortality. This study identified patterns in the demographics, causes of sustained injury, location of injury, cause of death, and injury characteristics in equine-related fatalities in comparison to bovine-related fatalities in Oklahoma.

Data for this study was collected by examining cases from the years 2000-2022 from the Oklahoma Office of the Chief Medical Examiner case database. Of the total cases, 80% of the decedents were male. A large majority of the equine-related fatality cases involved males under 18 years of age and between 60-69 years of age with sustained injuries of the head, neck, and thoracic regions. A significant portion of the equine-related fatality decedents were in a mounted position during the incident that led

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

to their demise. The most documented equine-related injuries were inflicted by being kicked or a result of blunt force trauma upon impact with a hard surface. A majority of the bovine-related fatality cases involved males of the ages 60-69 and 70-79, with sustained injuries of the head, neck, and thoracic regions while being unmounted. These bovine-related injuries were most often inflicted by being butted, trampled, or resulted from blunt force trauma upon impact. Of the total cases examined, approximately 42% of the causes of death were Blunt Force Trauma of the Head/Neck and about 32% were Multiple Blunt Force Injuries. Given the lack of autopsies performed in the cases examined, mechanism of death was not readily apparent for analysis. However, 10 cases included lists of specific fatal injuries observed. These fatal injuries documented assisted the descriptive patterns identified in the study and their implications.

The findings in this study are consistent with previous research, where a higher frequency of children in equine-related cases and a higher frequency of elder adults in bovine-related cases was reported. There was also a similarity between current literature and the findings in this study, where equine-related cases most often occurred while mounted and bovine-related cases most often occurred while unmounted. In both equine- and bovine-related cases, injuries to the head/neck region and thoracic cavity were most prevalent, as reflected in the other studies.

The findings suggest that there is high vulnerability of the head, neck, and chest in both equine-related and bovine-related activities. This implies the need for the development of and adherence to safety protocols and the acceptance of the use of safety equipment in both equine- and bovine-related activities. The use of protective riding vests and ASTM/SEI certified helmets may significantly decrease the number of

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

serious and/or fatal injuries sustained in equine-related and bovine-related accidents. An increase in awareness and education concerning the risks associated with and safe handling practices of equine and bovine species may also mitigate serious and/or fatal injuries. The results also have potential applications to the mediation of the possible adverse consequences against the animals involved.

Future research could determine whether other jurisdictions outside of Oklahoma experience similar patterns with equine- and bovine-related fatalities. A more detailed understanding of these patterns could inform safety protocol research, presenting public education and alternative approaches to preventative health measures targeted at decreasing equine- and bovine-related fatalities.

KEY WORDS: *equine, bovine, fatalities, death, injury, injuries sustained, mechanism, cause of death, safety, public health, Oklahoma*

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Table of Contents

Acknowledgements	iv
THESIS ABSTRACT.....	xi
Table of Contents	xiv
Table of Figures.....	xvii
CHAPTER I.....	1
Introduction	1
CHAPTER II.....	4
Literature Review	4
Demographics.....	4
Individual’s Position and Cause of Sustained Injury	6
Location of Injury.....	8
Blunt Force Trauma.....	9
Cause of Death	10
Mechanism of Death.....	11
Review of <i>Horse-Related Fatalities in the Province of Alberta, 1975-1990</i>	12
Review of <i>Fatalities Caused by Cattle – Four States, 2003-2008</i>	13
References	14
CHAPTER III.....	18
Methods	18
Purpose Statement	18
Research Questions	18
Null Hypothesis.....	18

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Research Design	19
Case Sample	19
Data Collection	19
Data Analysis	21
Case Security and Data Confidentiality	21
Results	22
Equine-Related Fatalities.....	22
Bovine-Related Fatalities	30
Comparison of Equine- and Bovine-Related Fatality Patterns.....	38
CHAPTER IV.....	47
Discussion.....	47
Limitations.....	57
References	59
CHAPTER V	62
Summary of Conclusions	62
Future Research	63
CHAPTER VI.....	65
Author's Note	65
APPENDIX A: Auxiliary Tables	67
Age and Gender (Equine v. Bovine)	67
Compiled Age and Gender (Equine v. Bovine).....	67
Gender and Decedent Position (Equine v. Bovine).....	67
Age and Decedent Position (Equine v. Bovine).....	67

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Gender and Cause of Sustained Injury (Equine v. Bovine).....	68
Age and Cause of Sustained Injury (Equine v. Bovine).....	68
Gender and Location of Injury (Equine v. Bovine).....	69
Age and Location of Injury (Equine v. Bovine).....	69
Decedent Position and Location of Injury (Equine v. Bovine)	69
Gender and Cause of Death (Equine v. Bovine)	70
Gender and Species (BFT from Impact Present).....	70
Gender and Species (BFT from Impact Absent)	70
Compiled Age and Species (BFT from Impact Present)	70
Compiled Age and Species (BFT from Impact Absent)	71
Compiled Age and Gender (BFT from Impact Present)	71
Compiled Age and Gender (BFT from Impact Absent).....	71
APPENDIX B: Horse and Cattle Safety Pamphlet	72

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Table of Figures

<i>Figure 1 - Patterned injury on a male decedent, age 19-29,.....</i>	<i>25</i>
<i>Figure 2 - Female decedent, age 60-69, with blunt force.....</i>	<i>25</i>
<i>Figure 3 - Decedent Position and Cause of Sustained Injury (Equine).....</i>	<i>26</i>
<i>Figure 4 - Male decedent, age 0-18, with blunt force injuries to the head/neck.....</i>	<i>27</i>
<i>Figure 5 - Significant subgaleal hemorrhage in female decedent, age 0-18,.....</i>	<i>29</i>
<i>Figure 6 - Male decedent, age 19-29, with injury to the.....</i>	<i>31</i>
<i>Figure 7 - Multiple blunt force injuries in male decedent,.....</i>	<i>33</i>
<i>Figure 8 - Decedent Position and Cause of Sustained Injury (Bovine).....</i>	<i>34</i>
<i>Figure 9 - Depressed skull fracture in male decedent, age 19-29,.....</i>	<i>35</i>
<i>Figure 10 - Injuries to the head/neck in female decedent, age 70-79, after being attacked by a bull.....</i>	<i>35</i>
<i>Figure 11 - Injuries to lower extremities on female decedent, age 70-79, after being attacked by a bull.....</i>	<i>35</i>
<i>Figure 12 - Multiple blunt force injuries on male decedent, age 50-59,.....</i>	<i>37</i>
<i>Figure 13 - Fractured T6 vertebrae in female decedent,.....</i>	<i>37</i>
<i>Figure 14 - Gender (Equine v. Bovine).....</i>	<i>38</i>
<i>Figure 15 - Decedent Position (Equine v. Bovine).....</i>	<i>39</i>
<i>Figure 16 - Age (Equine v. Bovine).....</i>	<i>39</i>
<i>Figure 17 - Female decedent, age 0-18, with patterned injury.....</i>	<i>40</i>
<i>Figure 18 - Cause of Sustained Injury (Equine v. Bovine).....</i>	<i>41</i>
<i>Figure 19 - Photograph taken at scene where male decedent,.....</i>	<i>42</i>
<i>Figure 20 - Anterior view of male decedent, age 60-69, who.....</i>	<i>42</i>
<i>Figure 21 - Posterior view of male decedent, age 60-69, who.....</i>	<i>42</i>
<i>Figure 22 - Location of Injury (Equine v. Bovine).....</i>	<i>43</i>
<i>Figure 23 - Cause of Death (Equine v. Bovine).....</i>	<i>44</i>
<i>Figure 24 - Compiled Age and Decedent Position (BFT from Impact Present).....</i>	<i>46</i>
<i>Figure 25 - Compiled Age and Decedent Position (BFT from Impact Absent).....</i>	<i>46</i>

CHAPTER I

Introduction

Since the late 1990s, there have been a growing number of research efforts evaluating equine-related injury patterns. Most of the data collected focuses on demographics, cause of injury, and sustained injuries of the studied individuals. Age and gender were the most documented demographics. The analysis of the cause of injury included injuries sustained while mounted and unmounted, identified by whether the injury resulted from falls while riding the horse or from handling and other non-riding exercises (Carmichael, 2014; Northey, 2003; Spitz, 2020). Of the sustained injuries discussed, a majority were identified as injuries to the head and neck, chest, and extremities (Carmichael, 2014; Guyton, et al., 2013; Moss, Wan, & Whitlock, 2002; Northey, 2003).

Though there is a copious amount of published research discussing rates of injury and safety concerns in both equine and bovine industries, there is an impressive lack of research concerning mortality in these industries. Very few studies solely focus on equine- or bovine-related fatalities. The most recent study was published in 1993, discussing equine-related fatalities in Alberta, Canada from 1975-1990 (Aronson & Tough).

In non-fatal equine-related incidences, a large majority of the sample populations consisted of females within the age range of 10-38. The greatest portion of injuries were sustained from falling or being thrown from a horse, which were all considered mounted injuries. While injuries to the upper extremities were often identified, injuries to the head and neck region were most frequent. In a pool of four research studies, with 6,404 individuals assessed, 23 equine-related fatalities were identified (Carmichael, et al., 2014, Guyton, et al., 2013; Moss, Wan, & Whitlock, 2002; Northey, 2003). Of these fatalities, only three mechanisms of death

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

were identified; two of the fatalities resulted from intracranial hemorrhage, while one was attributed to hemorrhagic shock secondary to a pelvic fracture (Guyton, 2013).

In comparison to studies on equine-related injuries, there is an abundance of research discussing the prevalence of bovine-related injuries. In non-fatal bovine-related incidences, the subject pool was predominantly males ranging from 30-50 years of age (Casey, 1997; Wheeler, 2019). Injuries to the upper and lower extremities were documented most frequently, with injuries to the thoracic and abdominal regions following secondarily (Casey et al., 1997; Karbeyaz et al., 2013; Wheeler, 2019). Most injuries were sustained from being kicked. Per contra, in the studies that analyzed bull riding, the most common cause of injury resulted from being thrown from a bull (Watts, Meisel, & Densie, 2013). In two research studies with 4,040 individuals assessed, 184 bovine-related fatalities were identified. Only one study discussed the mechanisms of death: hemopneumothorax and lung injury from trauma to the thoracic cavity (Fraser, McIntyre, & Westgarth, 2016; Karbeyaz et al., 2013).

There was substantive availability of information concerning bovine-related fatalities; however, the same cannot be found for equine-related research. This could be attributed to the considerably large number of bovine-related fatalities worldwide, understanding that bovine-related activities were inherently more populous than that of equine-related activities.

This study identified patterns in the demographics, causes of injury, injuries sustained, and documented fatal injuries in equine-related fatalities in comparison to bovine-related fatalities. While this study examined all domesticated equine species (horses, zebras, and asses), a considerable majority were classified as horses. The demographics considered in this study included the gender and age of the decedents. The decedent position section addressed trauma sustained while either mounted or unmounted, identifying whether the decedent's death resulted

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

from being ejected off an equine/bovine species or from handling and other non-riding activities. The causes of sustained injury identified the specific events resulting in injury and death, including but not limited to being crushed, kicked, and/or trampled. While this study also considered auxiliary placements of injury, the location of injuries was categorized into five anatomical regions: head/neck region, thoracic region, abdominal region, upper extremities, and lower extremities. The fatal injuries documented and associated mechanisms of death in both equine- and bovine-related fatalities were compared based on a preliminary review and analysis of the data.

CHAPTER II

Literature Review

Demographics

The United States Equestrian Federation (2021) reported that 85% of individuals who participate in equine-related activities (hereafter referred to as equestrians) were female. Similarly, the American Horse Publication's 2018 Equine Industry Survey also reported that over three-quarters of equestrians were female. It is also documented by the leading US equestrian organizations, such as the National Snaffle Bit Association (NSBA, 2020) and the Professional Rodeo Cowboys Association (PRCA, 2021) that a large majority of equestrians were female. Taking into consideration demographic statistics from the United States Hunter Jumper Association (USHJA, 2019), the United States Dressage Federation (USDF, 2021), the United States Eventing Association (USEA, 2020), the National Snaffle Bit Association (NSBA, 2020), the National Reining Horse Association (NRHA, 2021), and the National Barrel Horse Association (NBHA, 2019), the average equestrian is between 35 and 55 years of age.

The recorded data concerning the majority gender of equestrians parallels the findings of the most common gender involved in equine-related injuries. A sizable portion of the sampled equestrian incidences involved females (Guyton, et al., 2013; Moss, Wan, & Whitlock, 2002; Northey, 2003). However, the recorded data concerning the average age of equestrians does not coincide with the findings of the most common age range of individuals injured during equine-related activities. One study of over 5,500 individuals between 1993 and 2001 found that the average person involved in an equine-related incident resulting in injury were of or between the ages 10 and 19 (Northey, 2003). More recent studies have shown that the average age of persons

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

injured during equestrian activities is 37-38 years of age (Carmichael, et al., 2014; Guyton, et al., 2013).

Contrary to the above findings, a study concerning equine-related fatalities conducted in 1992, reported that 53% of the decedents were male. Of the 205 cases observed, the average age of decedents was 33.5 years old, with a range from 7-68 years of age (U.S. Centers for Disease Control and Prevention, 1992).

The mean age of equestrians injured in equine-related activities was skewed in comparison to the average age of active equestrians in the United States. The average age of individuals injured in equestrian sports was on the low end of the general age of equestrians (Carmichael, et al., 2014; Guyton, et al., 2013, NBHA, 2019; NRHA, 2021; NSBA, 2020; USDF, 2021; USEA, 2020; USHJA, 2019).

The American Farm Bureau Foundation for Agriculture identifies farming as a male-dominated profession, with only 36% of farms in the United States operated by women. The bovine industry, established as one of the top three largest farm productions in the United States, is majority male. Competitors in bull riding events were also predominantly male (PRCA, 2021). There is no reliable data discussing the average age of individuals involved in bovine-related activities.

The recorded data concerning the majority gender of persons involved in bovine-related activities matches the findings of the most common gender involved in bovine-related injuries. A research article published in 2019 states that a large majority of individuals who experience bovine-related trauma were males younger than 50 years of age (Wheeler, 2019). More specifically, workers injured by bulls were generally between the ages of 30 and 50 years of age (Casey, et al., 1997).

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

These statistical findings correspond to study findings suggesting that most individuals who were involved in bovine-related activities and who have suffered from bovine-related injuries were predominantly male.

Individual's Position and Cause of Sustained Injury

The individual's position in equine- and bovine-related injuries and deaths were often classified under two categories. Though they were defined slightly differently throughout various works, the underlying categorization of these factors can be condensed into determining whether the individual who sustained the injury was working with the animal on the ground or was injured after coming off the animal while riding.

While some studies only classified the individual's position into two broad categories, others expanded their findings into subcategories. Kiss et al. (2008) classified the individual's position as riding injuries and handling injuries. The study also divided the riding injuries into two subcategories: falling from the horse and falling with the horse. The handling injuries were also sectioned into several causes of sustained injury, focusing on kicks, bites, collisions, trappings, and other instances (Kiss, 2008). This same study found that approximately 77% of injuries were sustained from incidents while riding. Following this, roughly 10% of injuries occurred while handling, and resulted from kicks, then bites, collisions, trampling, and others (Kiss, 2008).

Moss et al. (2002) disregarded the individual's position altogether and identified five, "mechanism[s] of injury," being falls, kicks, bites, "being trodden on," and injuries while handling the horse. Falling resulted in almost 80% of the injuries documented, while roughly 11% resulted from being kicked, and the remaining 9% bites, "being trodden on," and handling.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

On the contrary, Carmichael et al. (2014) grouped all causes of sustained injury into two distinguishable groups, identifying the individual's position as trauma sustained to, "mounted and unmounted equestrians," where the injuries resulted from falling from a mounted position or from handling the horse in an unmounted position. Though causes of sustained injury were not descriptively identified in the research methods, the results did discuss injuries from being kicked. Over 50% of the documented injuries occurred from falling while mounted, while the remaining 46% resulted from injuries while unmounted. Of this 45%, approximately 20% resulted from being kicked by the horse (Carmichael et al., 2014).

In a study conducted by the U.S. Centers for Disease Control and Prevention in 1992, 32 horseback-riding associated fatalities were analyzed. This study did not separate the individual's position and cause of sustained injury but combined them. The study found that approximately 80% of the decedents were mounted at the time of death, while the decedents in the remaining known cases were either trampled or kicked.

The individual's position and causes of sustained injury categories in bovine-related injury studies reflect similar accounts as the equine-related subcategories, focusing on specific types of contact with a bovine species. Casey et al. (1997) studied being kicked, knocked down, mauled, tossed, crushed, and head-butted as the causes of injury. Of these causes of injury, nearly 41% of the injuries resulted from being head-butted, while being tossed and crushed accounted for around 16% of the injuries individually (Casey et al., 1997).

In a study comparing injuries from all large animals, 55% of the individuals were injured by horses and 43% by cows or bulls. Norwood et al. (2000) discussed several, "mechanisms of injury." The study found the mechanisms of injury to be species-specific, where majority of the horse-related injuries resulted from falling off the horse, majority of the injuries associated with

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

bulls occurred via trampling, and majority of the injuries from cows were caused by being kicked.

In a large majority of bovine-related injury studies, mounted injuries were not discussed.

Location of Injury

Location of injury in equine- and bovine-related trauma and deaths were often categorized by body region, with only marginal variation in the body region groupings. Northey (2003) categorized the body regions of sustained injuries into arm fractures and dislocations, head injuries, leg fractures and dislocations, neck and trunk fractures and dislocations, and a category for other injury sites. Northey (2003) found that approximately 33% of the documented injuries occurred in the upper extremities and approximately 25% of the injuries were in the head region.

Swanberg et al. (2016) documented the injury sites into more specific categories, breaking down the body regions into specific anatomical structures such as the wrist and hand, shoulder, head, chest and torso, hip, and knee. Of these injury locations, the study found that approximately 25% of the injuries sustained occurred in the wrist or hand, closely followed by the foot or ankle at 18%, and injuries to the back as 12% (Swanberg et al., 2016).

Norwood et al. (2000) categorized the body regions into brain/craniofacial injuries, torso injuries, upper extremities, and lower extremities. Of these, brain/craniofacial injuries were most predominant in equine-related injuries, while torso injuries were most common in bovine-related injuries. Injuries to multiple regions of the body occurred in 32% of the cases studied (Norwood et al., 2000).

A study conducted by the U.S. Centers for Disease Control and Prevention in 1992 identified the locations of sustained injury in horseback-riding fatalities. The study discussed

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

locations of injury as head injuries, internal chest injuries, and abdominal injuries. The 1992 study identified 67% of the cases sustaining injuries to the head, 30% to the internal chest or abdomen, and one case where the rider drowned (U.S. Centers for Disease Control and Prevention). The U.S. Centers for Disease Control and Prevention also published a study discussing cattle-caused fatalities in 2009. The study only discussed injuries to the head and chest.

Blunt Force Trauma

In the context of analyzing equine- and bovine-related fatalities, it is important to understand the concept of blunt force trauma. As defined by Spitz and Fisher (2020), blunt force trauma is any “injury caused by blunt force tears, shears, and crushes.” These injuries can occur in one of two ways: when a blunt object makes forceful contact with an individual, or when an individual makes forceful contact with a blunt object. There were three basic categories of blunt force trauma defined: 1) contusions, 2) abrasions, and 3) lacerations (Spitz & Fisher, 2020).

Contusions, commonly known as bruises, occur when there is presence of hemorrhage in the skin, tissues, or organs. These injuries occur by forceful contact with a blunt force, such as the ground or an animal’s hoof. These types of blows crush tissues and rupture blood vessels beneath the skin, but do not break the skin. Contusions are visible due to the pooling of blood under the skin’s surface. Contusions may also be patterned, indicating the size, shape, and location of the impact (Spitz & Fisher, 2020). In cases of equine and bovine kicks, the distinct pattern of the animal’s hoof may be present.

Abrasions occur when an injury to the superficial layers of the skin are scraped away, leaving “tissue paper-like, wrinkled, whitish-gray flaps of epidermis” visible (Spitz & Fisher, 2020). These types of superficial injuries can indicate the direction of impact. Abrasions may

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

also be called grazes, scratches, or brush burns. Abrasions often have little to no bleeding, as they do not involve the dermis or underlying tissues. Abrasions, like contusions, can be patterned, indicating the size, shape, and location of impact (Spitz & Fisher, 2020).

Lacerations are produced by forceful impact with a blunt object that tears through the skin and underlying tissues. These injuries are characterized by ragged edges, contusions and abrasions around the edges of the laceration, and tissue bridging within the wound. Tissue bridging is indicated by the presence of soft tissues, such as nerves and blood vessels, visible across the base of the injury. Tears in skeletal tissue, most known as bone fractures, are also forms of lacerations (Spitz & Fisher, 2020).

Both contusions and lacerations can be present on the skin's surface and on internal organs. Contusions and lacerations of the internal organs are often indicative of an excessive amount of blunt force. "A severe blunt impact may cause minimal external evidence of injury; however, internal injuries may be catastrophic," (Spitz & Fisher, 2020). Therefore, the cause and mechanism of death in equine- and bovine-related fatalities may not be readily apparent without internal examination.

Cause of Death

Cause of death is defined as, "the disease or injury responsible for initiating the lethal sequence of events that results in death," (Dudley, 2017).

In a 1990 review of medical examiner records across 27 states, 205 deaths associated with horseback riding accidents were identified. Of these 205 deaths, over 60% attributed cause of death to head injuries (Centers for Disease Control and Prevention, 1990).

Moss et al. (2002) briefly discusses one fatal equine-related incident resulting from a fall, where the decedent suffered from a traumatic subdural hematoma and pulmonary contusion. In

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Guyton et al. (2003), three fatalities were discussed, identifying the cause of death in two of the three cases as intracranial hemorrhaging secondary to falling off a horse. Head injuries were briefly noted by Meredith et al. (2018) as being the most frequent cause of death in horse-related fatalities, though no statistics were presented to support this claim. Carmichael et al. (2014) discussed three deaths that occurred in Kentucky, where the causes of death were all in unmounted handling of horses. One fatality was from a kick to the thoracic region, one a kick to the head, and one a fatal head injury from a fall (Carmichael et al., 2014).

Similar to equine-related fatalities, “there is limited information available regarding deaths related to contact with cattle,” (Watts et al., 2013). According to Watts et al. (2013), the top three causes of death in bovine-related fatalities were identified as gored, followed by trampled, then crushed, then kicked. These fatalities were all due to blunt force trauma to the head or thoracic regions (Watts et al., 2013). It was also found that of the 287 cases involving bulls, 149 cases were fatal. Of these 149 fatalities, a large majority were caused by trampling or crushing (Fraser-Williams et al., 2016).

Mechanism of Death

Mechanism of death is defined as, “altered physiology and biochemistry whereby the cause exerts its lethal effect,” (Dudley, 2017). Mechanism of death is not regularly included on death certificates but is commonly explained in full autopsy reports (Oklahoma Child Death Review Board, 2014; Office of the Chief Medical Examiner, 2019).

According to the US Centers for Disease Control and Prevention (1992), “total injury-related morbidity and mortality associated with horseback riding in the United States is unknown.” Only one article pertaining to equine-related injury discussed mechanism of death in a horse-related fatality; the decedent suffered from hemorrhagic shock after a pelvic fracture

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

(Guyton et al., 2013). There was no evidence of discussion of mechanism of death in bovine-related fatalities in any current research publications.

Review of Horse-Related Fatalities in the Province of Alberta, 1975-1990

The most recent study focused solely on equine-related fatalities was published in 1993. The purpose of this study was to identify the magnitude of horse-related fatalities in Alberta, Canada, and illustrate the need for improved safety and training protocols (Aronson & Tough, 1993).

The descriptive study reviewed 38 incidences of equine-related fatality in Alberta, Canada from 1975-1990. The study found that a vast majority, over 65%, of the cases occurred while the decedent was riding a horse. A slight majority (55.3%) of the cases were male, with females representing 44.7% of the decedent population. Over 50% of the decedents were age 21 and older, and nearly 20% were of children 5 years of age or younger. Nearly 60% of the deaths resulted from head injuries. Of the 38 cases analyzed, only one decedent was wearing an approved helmet. There was no discussion of injuries to the neck or cervical spine (Aronson & Tough, 1993).

Unlike the above-mentioned research on equine-related injuries, *Horse-Related Fatalities in the Province of Alberta, 1975-1990* investigated the time of year that the incidences occurred, as well as victim accompaniment. Exactly 63% of the cases analyzed in the study occurred in the summer months, between June and September. About 60% of the incidences occurred while the decedent was accompanied by another individual at the time of the fatal accident (Aronson & Tough, 1993).

Aronson and Tough (1993) found that in 19 of the cases, exactly 50%, the cause of death was confirmed via autopsy. In one case, cause of death was determined through inference after

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

review of the investigation notes. The remaining 18 cases determined cause of death through an external examination only.

Review of Fatalities Caused by Cattle – Four States, 2003-2008

The most recent study solely focused on bovine-related fatalities was published in 2009 by the U.S. Centers for Disease Control and Prevention. The study identified 21 deaths associated with, “occupational fatalities caused by cattle,” and discussed several demographics, as well as the relative activities associated with the fatal event. Only one decedent was female, with 20 of the 21 decedents being male. Of the total decedents, the median age was 65 years, with a range from 8 to 86 years of age. The most common activity involved the decedent being in an enclosed space with an animal. Moving and sorting the animal(s) was the second most common activity. The remaining activities included loading cattle, feeding, and working in an open pasture.

The study identified two distinct categories of bovine: bulls and cows, finding that 10 of the cases involved attacks by bulls, six involved attacks by cows, and five had multiple cattle involvement. In just over 75% of the cases, reports of the incidences show that the animal, “purposefully struck the victim,” (U.S. Centers for Disease Control and Prevention, 2009). The remaining cases resulted from accidental crushing. Only one case did not involve blunt force trauma to the head and/or chest. In this case, the decedent accidentally injected himself with a lethal dose of livestock antibiotic.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

References

- American Farm Bureau Foundation for Agriculture. (2019). Fast facts about agriculture & food. *Food and Farm Facts*.
- AQHA. (2020). AQHA facts. *American Quarter Horse Association*.
- Aronson, H., & Tough, S.C. (1993). Horse-related fatalities in the province of Alberta, 1975-1990. *The American Journal of Forensic Medicine and Pathology*, 14(1), 28-30.
- Carmichael, S. P., Davenport, D. L., Kearney, P. A., & Bernard, A. C. (2014). On and off the horse: Mechanisms and patterns of injury in mounted and unmounted equestrians. *NIH Public Access: Injury*, 45(9), 1479-1483. <https://doi.org/10.1016/j.injury.2014.03.016>
- Casey, G., Grant, A., Roerig, D. S., Boyd, J., Hill, M., London, M., Gelberg, K., Hallman, E., & Pollock, J. (1997). Farm worker injuries associated with bulls. *AAOHN Journal*, 48(8), 393-396.
- Dudley, M. (2017). Cause, mechanism, and manner of death. *Forensic Medicolegal Injury and Death Investigation*, 21-28. CRC Press.
- Fraser-Williams, A. P., McIntyre, K. M., & Westgarth, C. (2016). Are cattle dangerous to walkers? A scoping review. *Injury Prevention*, 22(6), 437-441. <http://dx.doi.org/10.1136/injuryprev-2015-041784>
- Guyton, K., Houchen-Wise, E., Peck, E., & Mayberry, J. (2013). Equestrian injury is costly, disabling, and frequently preventable: The imperative for improved safety awareness. *The American Surgeon*, 79(1), 76-83.
- Karbeyaz, K., Ayranci, U., Balci, Y., & Gunduz, T. (2013). Cattle-caused fatalities in a province of western Turkey: 1996-2010 autopsy results. *Journal of Forensic Sciences*, 58(3), 697.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

- Kiss, K., Swatek, P., Lenart, I., Mayr, J., Schmidt, B., Pinter, A., & Hollwarth, E. (2008). Analysis of horse-related injuries in children. *Pediatric Surgery international*, 24(1), 1165-1169. <https://doi.org/10.1007/s00383-008-2214-9>
- Martini, F. H. (2015). *Martini's Atlas of the Human Body*. Pearson Education, Inc.
- Meredith, L., Ekman, R., & Thomson, R. (2018). Horse-related incidents and factors for predicting injuries to the head. *BMJ Open Sport & Exercise Medicine*, 4(1). <https://doi.org/10.1136/bmjsem-2018-000398>
- Moss, P.S., Wan, A., & Whitlock, M.R. (2002) A changing pattern of injuries to horse riders. *Emergency Medicine Journal*, 19(5), 412-414. <https://doi.org/10.1136/emj.19.5.412>
- NBHA. (2019). 2020 media planner. *Barrel Horse News*.
- Northey, G. (2003). Equestrian injuries in New Zealand, 1993-2001: knowledge and experience. *The New Zealand Medical Journal*, 116(1182), 1-8.
- Norwood et al. (2000). Mechanisms and patterns of injuries related to large animals. *The Journal of Trauma: Injury, Infection, and Critical Care*, 48(4), 740-744.
- NRHA. (2021). 2021 media kit: Reach reiners worldwide. *Reiner*.
- NSBA. (2020). *NSBA: The Way to Go*.
- Oklahoma Child Death Review Board. (2015). *The Oklahoma Child Death Review Board 2014 Annual Report*.
- Office of the Chief Medical Examiner. (2019). *Office of the Chief Medical Examiner Annual Report, 2018*.
- PRCA. (2021). About the Professional Rodeo Cowboys Association. *The Official Membership Site of the Professional Rodeo Cowboys Association*.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

- Spitz, W. U., & Fisher, R. S. (2020). Blunt force injury. *Medicolegal Investigation of Death: Guidelines for the Application of Pathology to Crime Investigation* (pp. 57-106). Charles C Thomas Publisher, LTD.
- Stowe, C. J. (2018). Results from the 2018 AHP Equine Industry Survey. *2018 American Horse Publications*.
- Swanberg, J. E., Clouser, J. M., Bush, A., & Westneat, S. (2016). From the horse worker's mouth: A detailed account of injuries experienced by Latino horse workers. *J Immigrant Minority Health, 18*(1), 513-521. <https://doi.org/10.1007/s10903-015-0302-1>
- Thomas, K. E., Amnest, J. L., Gilchrist, J., & Bixby-Hammett, D. M. (2006). Non-fatal horse related injuries treated in emergency departments in the United States, 2001-2003. *British Journal of Sports Medicine, 40*(7). <https://dx.doi.org/10.1136/bjism.2006.025858>
- U.S. Bureau of Labor Statistics. (2020). Number and rate of fatal work injuries, by industry sector. *Census of Fatal Occupational Injuries Summary, 2019*.
- U.S. Centers for Disease Control and Prevention. (1990). Current trends: Injuries associated with horseback riding – United States, 1987 and 1988. *Morbidity and Mortality Weekly Report (MMWR), 39*(20), 329-332.
- U.S. Centers for Disease Control and Prevention. (1992). Alcohol use and horseback-riding-associated fatalities – North Carolina, 1979-1989. *Morbidity and Mortality Weekly Report (MMWR), 41*(19), 341-342.
- U.S. Centers for Disease Control and Prevention. (2009). Fatalities caused by cattle – four states, 2003-2008. *Morbidity and Mortality Weekly Report (MMWR), 58*(29), 800-804.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

U.S. Department of Justice. (2011). Death investigations: A guide for the scene investigator.

Office of Justice Programs, National Institute of Justice. Washington, DC. Retrieved from <https://www.ncjrs.gov/pdffiles/167568.pdf>

USDF. (2021). *United States Dressage Federation 2022 Media Kit*.

USEA. (2020). *United States Eventing Association 2021 Media Kit*.

USEF. (2021). *US Equestrian Media Kit 2022*.

USHJA. (2019). In stride 2020 media kit. *The Magazine of the United States Hunter Jumpers Association*.

Watts, M., Meisel, E. M., & Densie, I. K. (2013). Cattle-related trauma, injuries, and deaths.

Trauma, 16(1), 3-8.

Wheeler, J. A. (2019). Cattle related trauma: Are we underestimating its severity? *Australasian*

Medical Journal, 12(4), 123-130. <https://doi.org/10.21767/AMJ.2019.3588>

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

CHAPTER III

Methods

Purpose Statement

The purpose of this research is to identify patterns in demographics, decedent position, causes of sustained injury, location of injury, cause of death, and mechanism of death in equine-related fatalities in comparison to bovine-related fatalities.

Research Questions

1. What are the discernable patterns in demographics, decedent position, causes of sustained injury, location of injury, cause of death, and mechanisms of death in equine-related fatalities in Oklahoma?
2. What are the discernable patterns in demographics, decedent position, causes of sustained injury, location of injury, cause of death, and mechanisms of death bovine-related fatalities in Oklahoma?
3. Are the discernable patterns in demographics, decedent position, causes of sustained injury, location of injury, cause of death, and mechanisms of death different between equine-related fatalities and bovine-related fatalities in Oklahoma?

Null Hypothesis

There will be no statistical difference between any demographic, decedent position, cause of injury, injury sustained, or mechanism of death data point for equine-related fatalities. There will be no statistical difference between any demographic, decedent position, cause of injury, injury sustained, or mechanism of death data point for bovine-related fatalities. There will also be no discernable patterns within equine-related deaths in comparison to bovine-related deaths.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Research Design

This research followed a nonexperimental explanatory qualitative case study approach. Pre-existing data were compiled to compare and contrast equine- and bovine-related fatalities by gathering information from numerous cases into one data set.^{1,2}

This study separated cases into mounted or unmounted injuries leading to death and defining them as decedent position. The study also included categories for cause of sustained injury, including blunt force trauma from impact, being butted, crushed, dragged, gored, kicked, stepped on, trampled, other, and unknown. All causes of sustained injury in the study were considered blunt force trauma. The locations of sustained injuries were grouped into the following regions: head and neck region, thoracic cavity, abdominal cavity, upper extremities, and lower extremities.

Case Sample

The case sample included all documented equine- and bovine-related fatalities from the Oklahoma Office of the Chief Medical Examiner (OCME) database of cases. The population size encompassed all equine- and bovine-related fatality cases in the OCME case database. This study consisted of 71 total cases, including 45 equine-related fatality cases and 26 bovine-related fatality cases. A total of 71 cases for evaluation constituted the largest sample size of cases collected from Oklahoma.

Data Collection

A standardized survey was developed on Qualtrics, an online survey platform used to build and distribute surveys to respondents and gather information.²¹ The survey was utilized to document case data information collected from the case database of the Office of the Chief

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Medical Examiner of Oklahoma. The researcher filled out an individual survey for each appropriate case from 2000 to 2022.

The survey consisted of the following queries:

- What year did the case become assigned to the agency?
- Was the demise of the decedent equine-related or bovine-related?
 - Yes or No
 - Select “Equine-related” or “Bovine-related”
- Demographic questions about the decedent.
 - Gender (Male or Female)
 - Age at death (formatted in a range)
- Questions regarding cause of injury.
 - Did the decedent die from an injuring after falling off of the horse or from working on the ground? (mounted, unmounted, or unknown)
 - Were the injuries caused by any or several of the following?
 - Kicked, bitten, trampled, crushed, stepped on, butted, gored, dragged, blunt force trauma from impact, or unknown
- Questions regarding the location of sustained injuries.
 - Head and Neck region, Thoracic Cavity, Abdominal Cavity, Upper Extremities, Lower Extremities
- Question regarding the cause of death (fill in the blank as written on the death certificate)
- Question regarding the mechanism of death (fill in the blank as written in the autopsy notes)

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Data Analysis

The respondents' entries were categorized and charted to determine possible trends in the equine- and bovine-related fatalities reported. The categorizations were as follows:

- Demographics
 - Male or Female
 - Age Range
- Decedent Position
 - Mounted, Unmounted, or Unknown
- Cause of Sustained Injury
 - Kicked, Bitten, Trampled, Crushed, Butted, Gored, Dragged, Blunt Force Trauma from Impact, and/or Unknown
- Location of Sustained Injuries
 - Head and Neck Region, Thoracic Cavity, Abdominal Cavity, Upper Extremities, and/or Lower Extremities
- Cause of Death
 - Open-ended response
- Mechanism of Death
 - Open-ended response

Once all responses were collected and categorized, trends in the collected data were analyzed. Responses were entered into R, a software program for, “statistical computing and graphics.”¹⁷ The table command of R was used to cross-tabulate the data into contingency tables. Chi-square tests were utilized on appropriate datasets to determine if the differences between the observed data and the expected data were due to chance, or if there was a statistically significant predictability between the variables.

Case Security and Data Confidentiality

The identifying information for the individuals in the case data collected were only viewed by the researcher and were stored on a secure server. No other individuals were allowed access to the identifying information collected. Both printed and electronic individually identifying information were deleted and permanently disposed of upon completion of the study.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Results

Equine-Related Fatalities

Of the 71 cases collected from the Office of the Chief Medical Examiner of Oklahoma's case database, 45 cases were of equine-related fatalities. Approximately 73% of the equine-related fatality cases were male individuals. Thirty-two of these cases involved mounted injuries leading to death, while 11 involved unmounted injuries, and two unknown. Of the equine-related fatalities, the most predominant age groups involved those in the age range of 0-18 and 60-69, where roughly 27% of the cases were juveniles and 22% ages 60-69. In the breakdown of age, 12 cases were of individuals ages 0-18, four cases ages 19-29, five cases ages 30-39, seven cases ages 40-49, five cases ages 50-59, 10 cases ages 60-69, one case ages 70-79, and one case ages 80 and older.

When analyzing the cause of sustained injuries in equine-related fatalities, it is noteworthy that each case included one or more cause of sustained injury. Of the 45 equine-related fatality cases, 36 contributed one cause of sustained injury, while nine contributed two causes of sustained injury. Roughly 49% of the cases involved blunt force trauma injuries from impact with either the ground or a hard surface, such as a wall. The second most abundant cause of sustained injury was due to being kicked, accounting for 27% of the causes of injury. After this, eight of the equine-related fatality cases involved being crushed, while five involved being dragged, three being trampled, two being stepped on, and one unknown. There were no entries for being butted or gored in the equine-related cases.

In the location of injury categories, it is noteworthy that each case included one or more locations of injury. Of the 45 equine-related fatality cases, 31 contributed one location of injury, six cases contributed two locations of injury, three cases contributed three locations of injury,

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

two cases contributed four locations of injury, and three cases contributed five locations of injury. Of these cases, over 60% sustained injuries to the head and neck region, with 23 cases involving injuries to the thoracic cavity, 11 to the abdominal cavity, eight to the upper extremities, and five to the lower extremities.

With the determination of cause of death (COD), 22 of the cases documented COD as Blunt Force Trauma of the Head/Neck, while 11 cases documented COD as Multiple Blunt Force Injuries. After these, eight cases documented Blunt Force Trauma of the Chest and three cases documented Blunt Force Trauma of the Abdomen as COD. Only one of the cases documented a non-blunt-force-related COD as Drowning, where the individual sustained mounted injuries and remained unconscious in the water.

Cross-tabulation of gender and age in equine-related fatalities showed that in the male fatalities, seven were of the ages 0-18, four were of the ages 19-29, three were of the ages 30-39, five were of the ages 40-49, four were of the ages 50-59, nine were of the ages 60-69, and one was of the age range of 80 and up. There were no male equine-related fatalities documented in the age range of 70-79. Of the female equine-related fatalities, five were of the ages 0-18, two were of the ages 30-39, two were of the ages 40-49, one was of the age 50-59, one was of the age 60-69, and one was of the age 70-79. There were no female equine-related fatalities reported in the age ranges 19-29 or 80 and up (see Appendix A).

When analyzing the gender of the equine-related fatalities in comparison to decedent position, it was found that 23 of the 33 male fatalities resulted from injuries sustained while mounted, eight of the male fatalities resulted from injuries sustained while unmounted, and in two of the male fatalities the decedent positions were unknown. It was found that nine of the 12

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

female fatalities resulted from injuries sustained while mounted, while three of the female fatalities resulted from injuries sustained while unmounted (see Appendix A).

Cross-tabulation of the decedent position variables and age in equine-related fatalities showed 10 mounted and two unmounted fatalities in the 0-18 age range. The fatalities in the 19-29 age range reported two mounted, one unmounted, and one unknown position. In the 30-39 age range, four mounted fatalities and one unmounted fatality were documented. In the 40-49 age range, six mounted and one unmounted fatality were documented. In the 50-59 age range, four mounted and one unmounted fatalities were documented. The fatalities in the 60-69 age range reported five mounted, four unmounted, and one unknown position. In the 70-79 age range, there was one unmounted fatality, with no reported mounted fatalities. In the 80 and up age range, there was one mounted fatality, with no reported unmounted fatalities (see Appendix A).

Analysis of gender in relation to cause of sustained injury for equine-related fatalities showed that 17 of the male decedents experienced blunt force trauma from impact. In eight of the male equine-related cases, the individual was kicked (Fig. 1). There were five cases that reported the decedent was crushed, four dragged, and three trampled. One case reported the individual was stepped on, one other (drowning), and one unknown. Of the female equine-related fatalities, five experienced blunt force trauma from impact. In four of the female equine-related cases, the individual was kicked. There were three female cases that reported the decedent was crushed, one that the decedent was dragged, and one that the decedent was stepped on (see Appendix A).

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

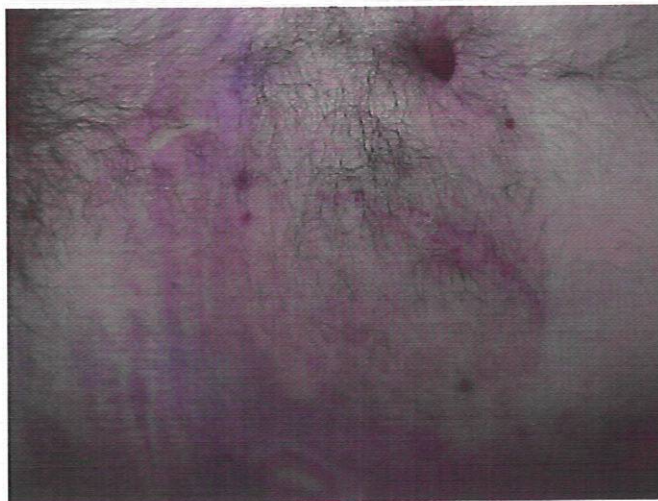


Figure 1 - Patterned injury on a male decedent, age 19-29, after being kicked in the abdomen by a horse.

Upon evaluation of age compared to cause of sustained injury in equine-related fatalities, it was found that blunt force trauma from impact was the most prevalent cause of sustained injury in ages 0-18, 30-39, 40-49, 50-59, and 80 and up. For the age range of 19-29, being crushed and kicked were equally prevalent. For the age range of 60-69, both blunt force trauma from impact and kicked (Fig. 2) were equally prevalent. For the age range of 70-79, kicked was the most prevalent cause of sustained injury (see Appendix A).

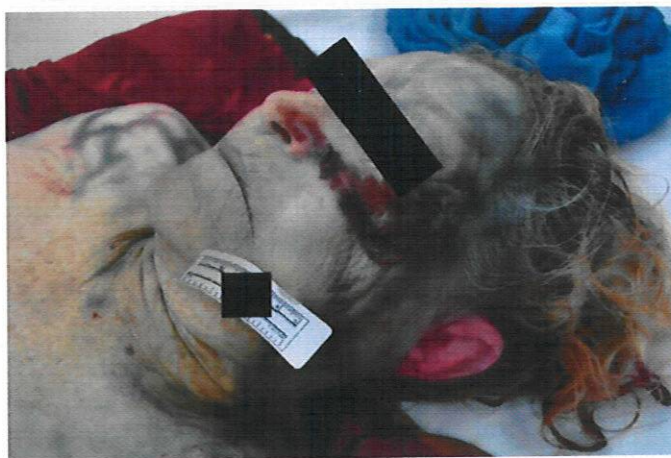
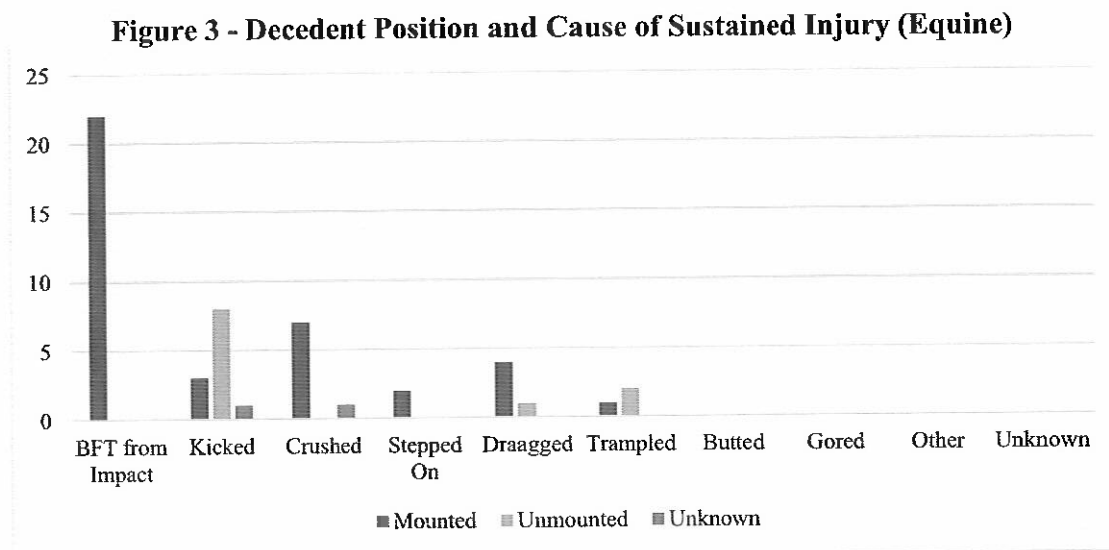


Figure 2 - Female decedent, age 60-69, with blunt force injury to the head after being kicked by a horse.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

In comparison of decedent position and cause of sustained injury in equine-related fatalities, a large quantity (22 of the cases) involved blunt force trauma from impact, where the decedent met their demise from a mounted position. The remaining mounted cases consisted of seven individuals being crushed, four being dragged, three being kicked, two being stepped on, and one being trampled. Of the individuals who sustained fatal trauma from an unmounted position, the majority (eight) sustained injuries from being kicked. The remaining unmounted cases consisted of two individuals being trampled and one individual being dragged (Fig. 3).



In comparison of gender and location of sustained injuries for equine-related fatalities, roughly 58% of the male cases involved injuries to the head and neck region. Nearly 52% of the male cases reported injuries to the thoracic cavity (Fig. 4). Approximately 27% of the male cases reported injuries to the abdominal cavity, while approximately 15% reported injuries to the upper extremities and less than 1% reported injuries to the lower extremities. Of the female cases, exactly 75% reported injuries to the head and neck region, while exactly 50% reported injuries to the thoracic cavity. Nearly 17% of the female cases documented injuries to the abdominal cavity,

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

while 25% reported upper extremity and roughly 17% reported lower extremity injuries (see Appendix A).



Figure 4 - Male decedent, age 0-18, with blunt force injuries to the head/neck region and thoracic cavity after being dragged by a horse.

Cross-tabulation of age and location of sustained injuries showed that the most common location of injury for all of the age ranges was the head and neck region, except in the 30-39 range where the thoracic cavity was most prevalent and in 70-79 where injuries to the thoracic cavity, abdominal cavity, and upper extremities were equally distributed (see Appendix A).

Evaluation of the location of injury in relation to decedent position of the equine-related fatality cases showed that of the 32 mounted cases, nearly 66% of the individuals sustained injuries to the head and neck region, while 50% sustained injuries to the thoracic cavity. Exactly 25% of the mounted equine-related cases involved injuries to the abdominal cavity, and 5 of the 32 showed injuries to the upper and lower extremities. Of the 13 unmounted equine-related fatality cases, approximately 46% involved injuries to the head and neck region, and approximately 46% cases involved injuries to the thoracic cavity. Roughly 15% of the unmounted cases resulted in injuries to the abdominal cavity, and 23% resulted in injuries to the

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

upper extremities. None of the unmounted equine-related fatality cases reported injuries to the lower extremities (see Appendix A).

Upon comparison of gender and cause of death (COD), evaluation showed that Blunt Force Trauma of the Head/Neck were the most prevalent documentations for both male and female, with Multiple Blunt Force Injuries being the second-most abundant documentation for both genders. The majority of the equine-related decedents sustained acute injury with a minimal agonal period. This was due to the nature of the cause of sustained injury, where one singular injury led to an immediate or almost immediate death. This was inferred based on the fact that a significant portion of the decedents were found dead on the scene or did not remain alive long enough to receive any sort of medical intervention.

Of the male equine-related fatality cases, 15 were documented as Blunt Force Trauma of the Head/Neck, seven were documented as Blunt Force Trauma of the Chest, three as Blunt Force Trauma of the Abdomen, seven as Multiple Blunt Force Injuries, and one as Drowning. Of the female equine-related fatality cases, seven were documented as Blunt Force Trauma of the Head/Neck, one was documented as Blunt Force Trauma of the Chest, and four as Multiple Blunt Force Injuries. There were no documentations of females with the COD as Blunt Force Trauma of the Abdomen (see Appendix A).

In only eight of the equine-related fatalities were specific fatal injuries discussed. In one case, nasal fracture, left zygomatic arch fracture, left side maxilla fracture, and brain edema were noted with cause of death listed as Blunt Force Trauma of the Head/Neck. Another case with the cause of death as Blunt Force Trauma of the Head/Neck identified the fatal injuries as subgaleal and subcutaneous hemorrhages of the left head, left subdural hemorrhage, and diffuse subarachnoid hemorrhage (Fig. 5). Another equine-related fatality case listed multiple basilar

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

skull fractures and atloanto-occipital subluxation with spinal cord transection as the fatal injuries with Blunt Force Trauma of the Head/Neck as the cause of death. One case identified the fatal injuries as skull fractures, hemorrhage of the left putamen, marked cerebral edema with uncal herniation, and subarachnoid hemorrhage in a Blunt Force Trauma of the Head/Neck death. In a case where Blunt Force Trauma of the Chest was the classified cause of death, spleen laceration and hemoperitoneum, left hemothorax, and cardiomegaly with significant coronary atherosclerosis was noted. In a case where Blunt Force Trauma of the Abdomen was the classified cause of death, peritonitis due to small bowel rupture was noted. In one case of Multiple Blunt Force Injuries, the fatal injuries were determined to be a right temporal bleed, bleeding of the brain stem, and bilateral pulmonary contusions. In another case of Multiple Blunt Force Injuries, the fatal injuries were determined to be bilateral pneumothorax and cervical spine fracture.



Figure 5 - Significant subgaleal hemorrhage in female decedent, age 0-18, after being kicked in the head/neck by a horse.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Bovine-Related Fatalities

Of the 71 cases collected from the Office of the Chief Medical Examiner of Oklahoma's case database, 26 cases were of bovine-related fatalities. Approximately 92% of the bovine-related fatality cases were male individuals. Of the 26 bovine-related cases, 85% involved unmounted injuries leading to death, while four involved mounted injuries. The most predominant age groups involved those in the age range of 60-69 and 70-79, where roughly 73% of the cases were of the ages 60 and older. In the breakdown of age, one of the cases were of individuals ages 0-18, three cases ages 19-29, seven cases ages 60-69, seven cases ages 70-79, 5 cases ages 80 and up, and no reported cases in the ages of 30-39 or 40-49.

When analyzing the causes of sustained injury in bovine-related fatalities, it is noteworthy that each case included one or more cause(s) of sustained injury. Of the 26 bovine-related fatality cases, 16 contributed one cause of sustained injury, seven contributed two causes of injury, one contributed three causes of sustained injury, and two reported unknown causes of injury. Roughly 27% of the cases involved blunt force trauma injuries from impact with either the ground or a hard surface, such as a wall. Similarly, roughly 27% of the cases involved being butted. The second most abundant cause of sustained injury was due to being trampled. After this, five of the bovine-related fatality cases involved being stepped on (Fig. 6), while three involved being kicked, three being crushed, three being gored, and two unknown. There were no entries for being dragged in the bovine-related cases.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES



Figure 6 - Male decedent, age 19-29, with injury to the neck after being stepped on by a bull.

As previously mentioned, it is noteworthy that each case included one or more location(s) of injury. Of the 26 bovine-related fatality cases, 11 contributed one location of injury, six cases contributed two locations of injury, three cases contributed three locations of injury, four cases contributed four locations of injury, and two cases contributed five locations of injury. Of these cases, over 69% sustained injuries to the thoracic cavity, with nine cases involving injuries to the abdominal cavity, seven to the head and neck region, seven to the upper extremities, and six to the lower extremities.

In the bovine-related fatalities analyzed, 12 of the cases documented COD as Multiple Blunt Force Injuries, while eight cases documented COD as Blunt Force Trauma of the Head/Neck. After these, five cases documented Blunt Force Trauma of the Chest and one case documented Blunt Force Trauma of the Abdomen as COD.

Cross-tabulation of gender and age in bovine-related fatalities showed that in the male fatalities, one was of the age 0-18, seven were of the ages 19-29, three were of the ages 50-59, 6 were of the ages 60-69, six were of the ages 70-79, and five were of the ages 80 and up. There

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

were no male bovine-related cases reported for the age ranges 30-39 or 40-49. Of the female bovine-related fatalities, one was of the age 60-69 and one was of the age 70-79. There were no female bovine-related cases reported for the age ranges 0-18, 19-29, 30-39, 40-49, or 50-59 (see Appendix A).

When analyzing the gender of the bovine-related fatality decedents in comparison to their position, it was found that four of the 24 male fatalities resulted from injuries sustained while mounted, and 20 of the male fatalities from injuries while unmounted. It was also found that the two documented female fatalities resulted from injuries sustained while unmounted (see Appendix A).

Cross-tabulation of the decedent position variables and age in bovine-related fatalities showed one unmounted fatality in the 0-18 age range, with no reported unmounted fatalities. The fatalities in the 19-29 age range included three mounted, with no reported unmounted. In the 50-59 age range, three unmounted fatalities were reported, with no reported mounted. There were seven observed unmounted fatalities in both the 60-69 and 70-79 age ranges, with no mounted fatalities reported in either age range. Of the decedents 80 years of age and older, five cases reported as unmounted, with zero mounted fatalities. There were no bovine-related fatality cases reported in the age ranges 30-39 or 40-49 (see Appendix A).

Analysis of gender in relation to cause of sustained injury for bovine-related fatalities showed that seven of the male decedents experienced blunt force trauma from impact. In seven of the male bovine-related cases, the individual was butted. There were five cases that reported the decedent was trampled, four stepped on, three crushed, three gored, and three kicked. One male case reported unknown cause of sustained injury. Of the two female bovine-related

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

fatalities, one decedent was trampled, and the others' cause of sustained injury was reported as unknown (see Appendix A).

When comparing age to cause of sustained injury in bovine-related fatalities, blunt force trauma from impact was the most prevalent cause of sustained injury in ages 0-18, 19-29, and 80 and up, where blunt force trauma from impact and being stepped on were equally prevalent for the 0-18 age range and blunt force trauma from impact and being kicked were equally prevalent for the 80 and up range. For the age range of 50-59, being butted was the most reported cause of sustained injury. For the age range of 60-69, being butted and trampled were the most prevalent and equally documented. For the age range of 70-79, being trampled and unknown were the most prevalent and equally documented (Fig. 7). Of the 80 and up age range, blunt force trauma from impact. For the age range of 70-79, being kicked was the most prevalent cause of sustained injury (see Appendix A).



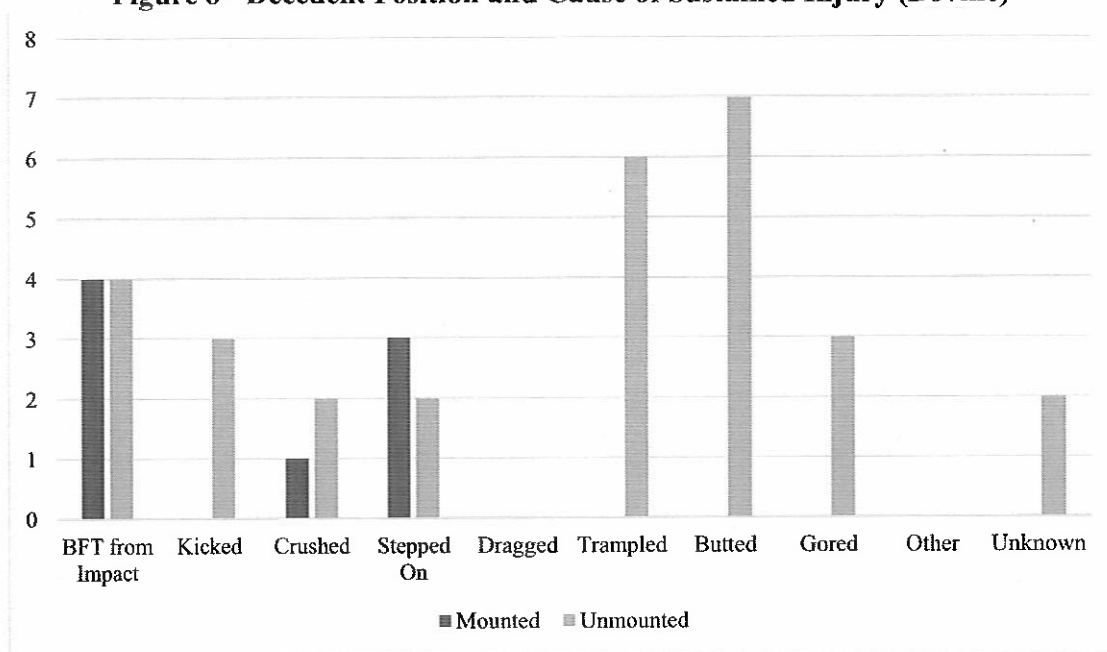
Figure 7 - Multiple blunt force injuries in male decedent, age 70-79, after being attacked by a bull.

In comparison of decedent position and cause of sustained injury in bovine-related fatalities, three of the four mounted cases involved injuries sustained by blunt force trauma from

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

impact, while two of the four included injuries sustained from being stepped on. The remaining mounted case involved the individual being crushed. A majority of the sustained injuries from the unmounted position involved being butted (seven) or trampled (six). The remaining cases included four individuals sustaining blunt force trauma from impact with a hard surface, such as the ground or a wall, while three cases involved the individual being kicked, three involving being gored, three involving being stepped on, two involving being crushed, and two unknown (Fig. 8).

Figure 8 - Decedent Position and Cause of Sustained Injury (Bovine)



In comparison of gender and location of sustained injuries for bovine-related fatalities, roughly 67% of the male cases involved injuries to the head and neck region (Fig. 9). Nearly 71% of the male cases reported injuries to the thoracic cavity. Approximately 29% of the male cases reported injuries to the abdominal cavity, while approximately 21% reported injuries to the upper extremities and approximately 17% reported injuries to the lower extremities. Of the female cases, exactly 50% reported injuries to the head and neck region, while 100% reported

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

injuries to the thoracic cavity, abdominal cavity, upper extremities, and lower extremities (see Appendix A; Fig. 10 & 11).



Figure 9 - Depressed skull fracture in male decedent, age 19-29, after being thrown from a bull and stepped on.



Figure 10 - Injuries to the head/neck in female decedent, age 70-79, after being attacked by a bull.

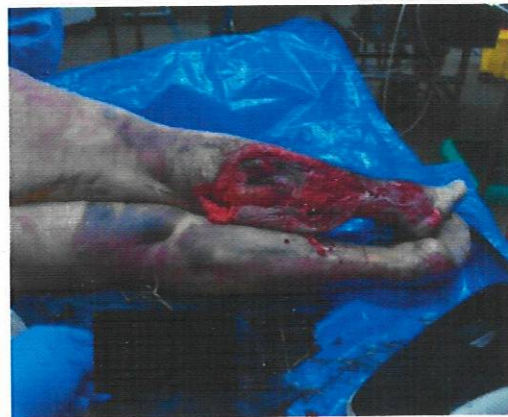


Figure 11 - Injuries to lower extremities on female decedent, age 70-79, after being attacked by a bull.

Cross-tabulation of age and location of sustained injuries showed that the most common location of injury for all the age ranges was the thoracic region, except in the 19-29 range where the head and neck region was most prevalent. Of these, in the 50-59 and 70-79 age ranges, the head and neck region were equally as prevalent as the thoracic cavity (see Appendix A).

Evaluation of the location of injury in relation to decedent position of the bovine-related fatality cases showed that of the four mounted cases, 75% of the individuals sustained injuries to

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

the head and neck region, while 25% sustained injuries to the thoracic cavity. Injuries to the thoracic cavity, upper extremities, and lower extremities were seen in 25% of the mounted bovine-related cases. Of the 22 unmounted bovine-related fatality cases, nearly 64% involved injuries to the head and neck region, and approximately 77% cases involved injuries to the thoracic cavity. Roughly 41% of the unmounted cases resulted in injuries to the abdominal cavity. Approximately 27% resulted in injuries to the upper extremities and nearly 23% resulted in lower extremity injuries (see Appendix A).

Upon comparison of gender and cause of death (COD), evaluation showed that Multiple Blunt Force Injuries were the most prevalent in male bovine-related fatalities, with Blunt Force Trauma of the Head/Neck being the second-most abundant. The majority of the bovine-related decedents sustained sub-acute injury with a more extended agonal period. This is due to the general nature of the cause of sustained injury, where several injuries occurred but did not lead to immediate death. This was inferred based on the fact that a significant portion of the decedents remained alive long enough to receive medical interventions prior to their passing.

For the two female bovine-related fatalities, one was reported as Blunt Force Trauma of the Chest, and the other Multiple Blunt Force Injuries. Of the male bovine-related fatality cases, eight were documented as Blunt Force Trauma of the Head/Neck, four were documented as Blunt Force Trauma of the Chest, one as Blunt Force Trauma of the Abdomen, and 11 as Multiple Blunt Force Injuries. Of the female bovine-related fatality cases, one was documented as Blunt Force Trauma of the Chest, and one as Multiple Blunt Force Injuries (Fig. 12). There were no documentations of females with the COD as Blunt Force Trauma of the Head/Neck or Blunt Force Trauma of the Abdomen (see Appendix A).

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES



Figure 12 - Multiple blunt force injuries on male decedent, age 50-59, after being butted and trampled by a bull.

In only two bovine-related fatality cases were specific fatal injuries discussed. In one case, posterior bilateral chest wall fractures associated with significant intercostal injuries and a T6 vertebrae fracture were noted, categorizing the cause of death as Blunt Force Trauma of the Chest (Fig. 13). In another case where the cause of death was determined as Multiple Blunt Force Injuries, the fatal injury was determined to be anoxic encephalopathy with infarction.

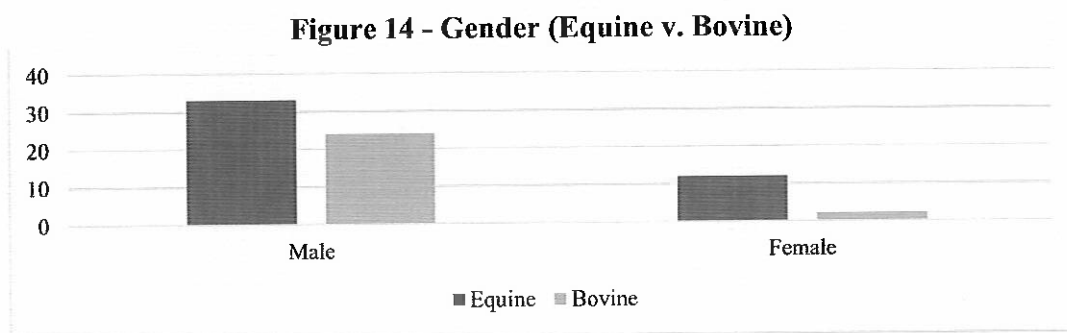


Figure 13 - Fractured T6 vertebrae in female decedent, age 70-79, after being attacked by a bull.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Comparison of Equine- and Bovine-Related Fatality Patterns

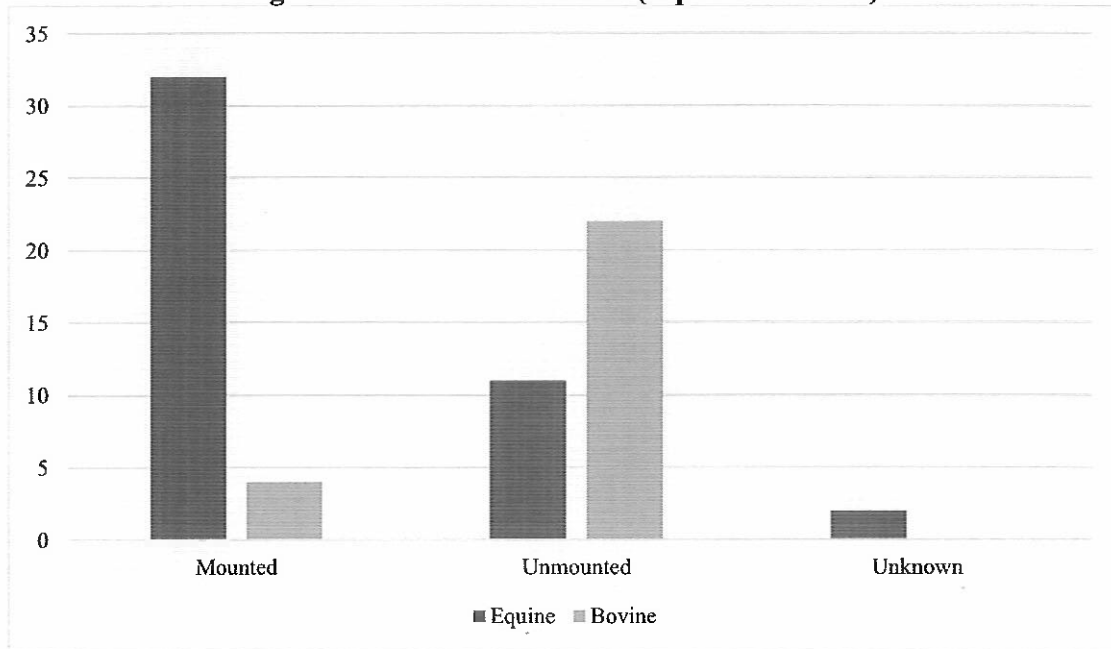
In both equine- and bovine-related fatalities, male decedents were more prevalent. Data showed that over 70% of the cases in both groups involved males. At a significance level of .10, given the relatively small sample size, demonstrated that the recorded data showed a statistically significant relationship when predicting gender in both equine- and bovine-related fatalities. However, at a significance level of .05, the data is statistically insignificant ($p=0.052877$) (Fig. 14).



In consideration of decedent position for both equine- and bovine-related fatalities, a chi-square test determined that there was a statistical significance .05 significance level between a case being equine- or bovine-related and whether the individual was mounted or unmounted ($p=0.00000589$). For the equine-related cases, over 74% of the individuals were mounted, while nearly 85% of the bovine-related cases were unmounted (Fig. 15).

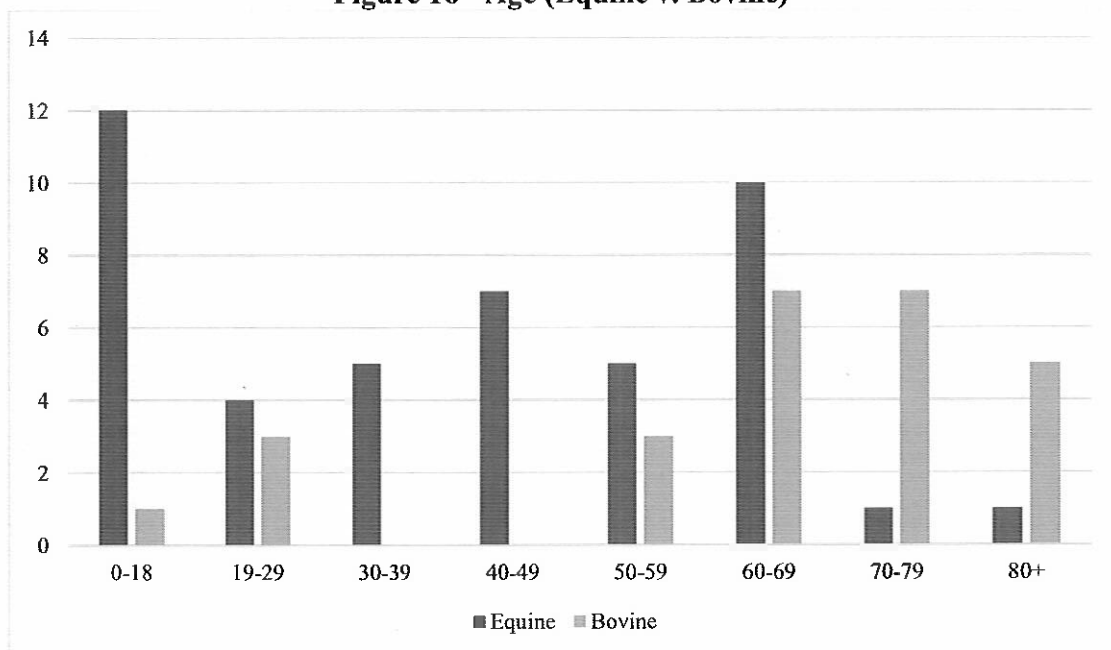
EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Figure 15 - Decedent Position (Equine v. Bovine)



Given the small sample size and low actual values for majority of the entries, statistical analysis of age as a determining factor in equine- and bovine-related fatalities would not show reliable results (Fig. 16).

Figure 16 - Age (Equine v. Bovine)



EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Data was compiled to compare age and gender for equine- and bovine-related fatalities. Of the equine-related fatalities, it was found that a majority of the male cases were in the age ranges of 0-18 and 60-69, where in the female cases the most abundant age range was 0-18 (Fig. 17). In comparison, majority of the male bovine-related fatalities were in the 60-69, 70-79, and 80 and up age ranges, where the two observed female cases were in the 60-69 and 70-79 age ranges. These findings suggest that most of the equine-related cases were of males between the ages of 0-50, while a majority of the bovine-related cases were of males ages 60 and older. Compiling the ages into juvenile versus adult cases, a total of 13 juvenile cases were reported, while 58 adult cases were documented. It was found that a majority of both equine and bovine cases occurred in males over the age of 18, where 26 equine adult male and 23 bovine adult male cases were observed (see Appendix A).



Figure 17 - Female decedent, age 0-18, with partially patterned injury to the head/neck after being kicked by a horse.

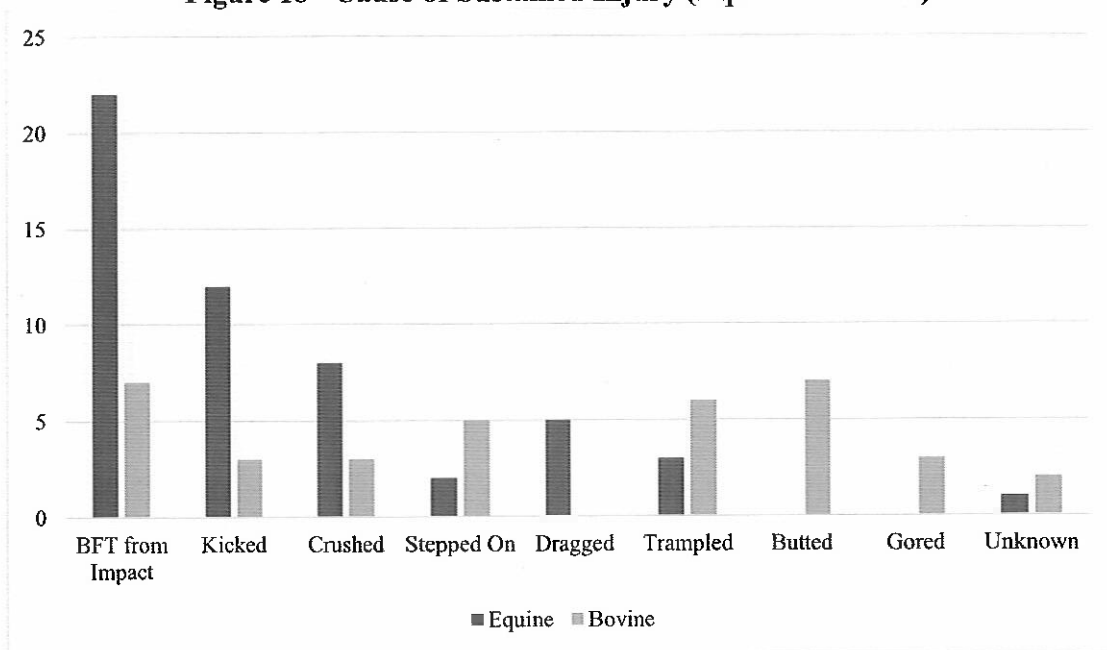
Comparison of gender and decedent position in equine- and bovine-related cases suggest that a majority of the equine-related cases involved mounted males under the age of 18, while majority of the bovine-related cases involved unmounted males over the age of 60. Findings

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

from the equine-related fatalities showed that over 50% of the cases were males who were injured while mounted, while 77% of the bovine-related cases were unmounted males. Of the mounted equine-related fatalities, the 0-18 age range was the most populated. Of the unmounted bovine-related cases, majority of the decedents were of the ages 60 and older (see Appendix A).

Given the small sample size and low actual values for the majority of the entries, statistical analysis of equine- or bovine-relation as a determining factor for cause of sustained injury did not demonstrate significant results. However, descriptive pattern analysis of the data suggested that injuries sustained by being dragged were more likely to occur with equine-related incidents (Fig. 19), while being butted and/or gored were more likely to occur with bovine-related incidents (Fig. 20 & 21). Blunt force trauma from impact is likely to occur in both equine- and bovine-related incidents (Fig. 18).

Figure 18 - Cause of Sustained Injury (Equine v. Bovine)



EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES



Figure 19 - Photograph taken at scene where male decedent, age 0-18, was dragged by a horse.



Figure 20 - Anterior view of male decedent, age 60-69, after being butted and gored by a bull.

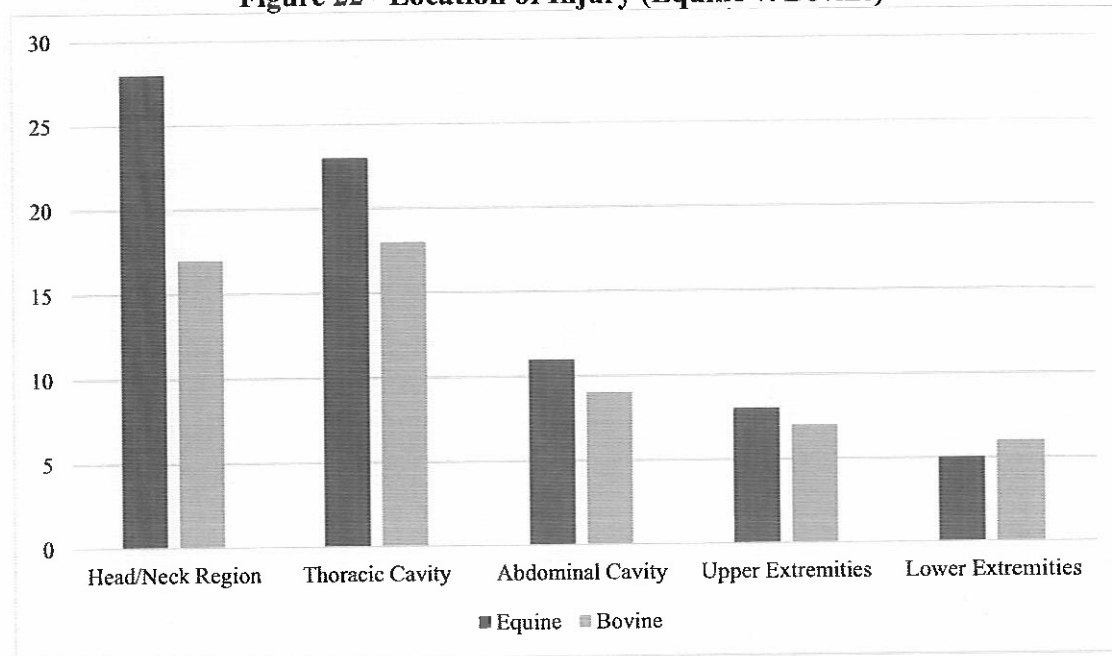


Figure 21 - Posterior view of male decedent, age 60-69, after being butted and gored by a bull.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

In comparison of location of injury between equine-related and bovine-related fatalities, analysis demonstrates that there is no statistical significance in using location of injury as a determination for species relation in the fatalities ($p = .874058$) (Fig. 22).

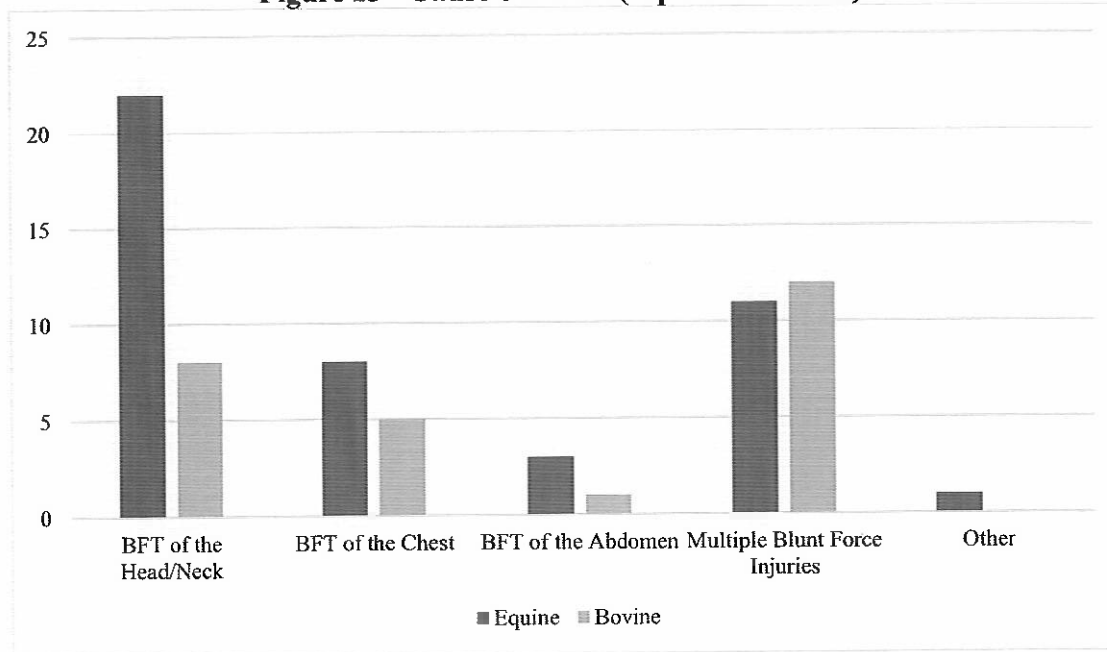
Figure 22 - Location of Injury (Equine v. Bovine)



Determination of cause of death cannot be used as a predictor for relation between equine- and bovine-related fatalities. Statistical analysis shows a p -value of 0.3417, where there is no statistically significant difference between the cause of death observed and its relation to equine- or bovine-related fatalities (Fig. 23).

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Figure 23 - Cause of Death (Equine v. Bovine)



In comparison of gender and presence of blunt force trauma from impact, five female and 17 male equine-related fatalities were documented. For bovine-related fatalities, seven male and zero female cases were reported having blunt force trauma from impact. In chi-square analysis, these values were statistically insignificant at .05 significance level ($p=0.1656$). In comparison of gender and absence of blunt force trauma from impact, seven female and 14 male equine-related fatalities were reported. For bovine-related fatalities, two female and 17 male cases were documented having no blunt force trauma from impact. Chi-square testing indicated that these values were statistically insignificant at .05 significance level ($p=0.84532$) (see Appendix A).

Age and the presence or absence of blunt force trauma was analyzed by compiling the age ranges into juvenile (0-18), adult (19-59), and elder adult (60+). In comparison of age and presence of blunt force trauma from impact, six juveniles, 10 adults, and six elder adults were documented. For bovine-related fatalities, one juvenile, 13 adults, and nine elder adults were reported. In chi-square tests, these values were statistically insignificant at .05 significance level

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

($p=0.6392$). In comparison of age and absence of blunt force trauma from impact, six juvenile, 10 adult, and five elder adults were reported. For bovine-related fatalities, zero juveniles, three adults, and 16 elder adults were documented. Chi-square analysis indicated that these values were not statistically significant at .05 significance level ($p=0.1997$) (see Appendix A).

Data for both equine-related and bovine-related fatalities were combined to evaluate age and gender in relation to the presence or absence of blunt force trauma from impact. Results showed that two juvenile females, three adult females, and zero elder adult females experienced blunt force trauma from impact. Blunt force trauma from impact was noted in cases of five juvenile males, 10 adult males, and nine elder adult males. Chi-square analysis of these findings indicate a lack of statistical significance at .05 significance level ($p=0.2488$). The involvement of blunt force trauma from impact was not noted in three female juvenile, two female adult, and four female elder adult cases. Blunt force trauma from impact was also not noted in three male juvenile cases, 11 male adult cases, and 17 male elder adult cases. Chi-square analysis of these findings were not significant at .05 significance level ($p= 0.2098$) (see Appendix A).

Data for both equine-related and bovine-related fatalities were combined to evaluate age and decedent position in relation to the presence or absence of blunt force trauma from impact. Results showed that seven mounted juveniles, 12 mounted adults, and six mounted elder adults experienced blunt force trauma from impact. Blunt force trauma from impact was noted in one case of an unmounted adult and three cases of unmounted elder adults. Chi-square testing indicated that these values were statistically insignificant at .05 significance level ($p=0.1099$) (Fig. 24). The involvement of blunt force trauma from impact was not noted in four mounted juvenile and seven mounted adult cases. Blunt force trauma from impact was also not noted in two unmounted juvenile, six unmounted adult and 21 unmounted elder adult cases. Analysis with

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

a chi-square test indicated statistical significance at .05 significance level ($p=0.0001928$) (Fig. 25).

Figure 24 - Compiled Age and Decedent Position (BFT from Impact Present)

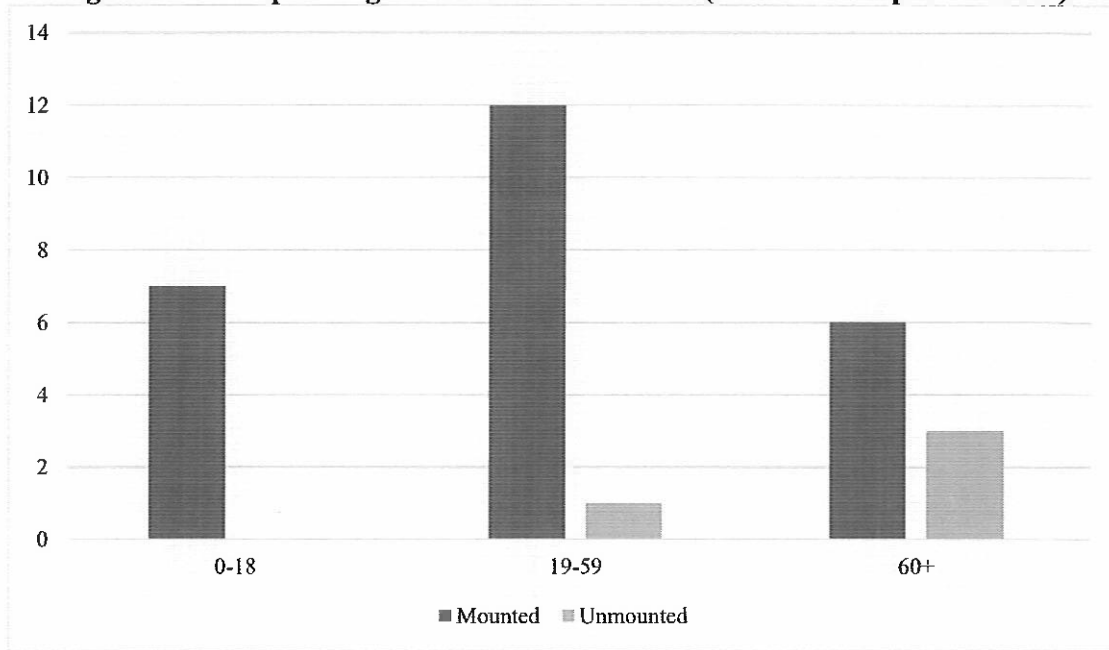
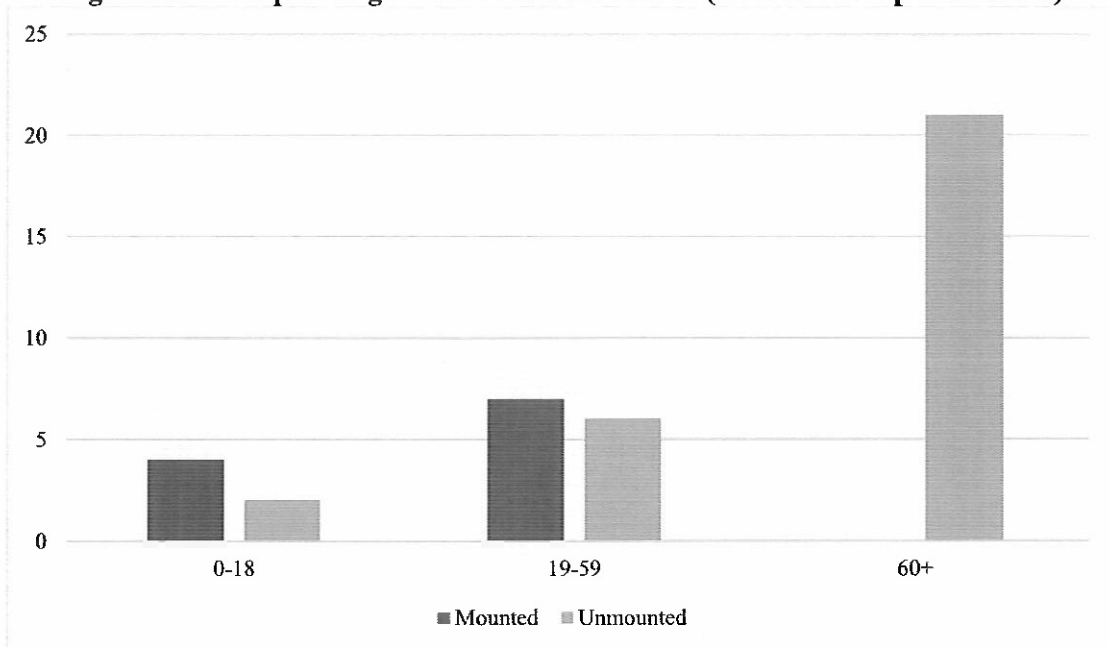


Figure 25 - Compiled Age and Decedent Position (BFT from Impact Absent)



CHAPTER IV

Discussion

The cases observed in this study fell under the jurisdiction of the Office of the Chief Medical Examiner (OCME) for one of two reasons: Oklahoma law requires that unnatural or unusual deaths be reported to the OCME for investigation, and/or the bodies of those who are to be cremated must be investigated by OCME.¹⁴ The fatalities included in this study fell under the jurisdiction of the OCME due to the decedents having met their demise outside the realm of natural causes. When entering a new case into the Office of the Chief Medical Examiner of Oklahoma's database, the investigator or pathologist must indicate the "Type of Death" for each fatality. The options, as listed, are while in penal incarceration; after unexplained coma; during therapeutic procedure; death possible threat to public safety; unattended during fatal illness; under suspicious circumstances; and violent, unusual, or unnatural. All of the recorded 71 equine- and bovine-related fatality cases were categorized as *violent, unusual, or unnatural*.

Due to the descriptive nature of this study, with low case sub-category values present in the data collected, the results for chi-square tests for most of the contingency tables lacked statistical significance at the .05 level. However, informative descriptive patterns were inferred in addition to the utilization of statistical analysis. Case-based studies and descriptive research are important for identifying patterns and trends that provide information for medicolegal death investigation, public health, and preventative medicine research.

In the equine-related cases observed in this study, a majority of the decedents were male. These findings were consistent with earlier studies concerning equine-related fatalities, where most of the documented decedents were male.^{2,20} However, gender findings in equine-related fatalities contrasted the findings of documentation by the leading U.S. equestrian organizations,

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

where majority of individuals involved in a broad array of equestrian activities are female.^{12,16,18,26} The findings in this study also contradicted the findings historically reported in equine-related injury studies. A sizable portion of the sampled equestrian incidences resulting in documented injuries involved females.^{6,7,9}

Taking into consideration demographic statistics from enrollment in prominent equestrian organizations, the average equestrian is between the ages of 35 and 55.^{8,11,12,24,25,28} However, the majority age of decedents in equine-related fatalities were either juveniles under the age of 18 or were elder adults between the ages of 60 and 69. This discrepancy between ages supports the notion that children and elder adults are either at higher risk for mortal injury, or are not practicing effective safety precautions. These findings suggest a need for an increase in vigilance towards safe horse handling and riding practices with an acknowledgement of the safety risks equine-related activities pose on higher-risk pediatric and elder adult individuals.

A majority of the equine-related decedents were mounted during the event that led to their demise. This finding is indicative of the general nature of equine-related activities, where the typical objective is to ride the horse. Activities such as jumping, dressage, eventing, reining, and barrel racing are inherently dangerous sports.^{8,11,24,25,28} The frequent involvement of equestrians in these risky mounted activities supports the findings of this study.

Of the causes of sustained injury documented in equine-related fatalities, the most prevalent injury was due to blunt force trauma from impact with a hard surface. In this study, blunt force trauma associated with mounted injuries was most often documented. Inferences demonstrated that majority of these fatalities resulted from the individual being ejected from the horse and hitting the ground or a hard surface, such as an arena wall. It is not surprising that most of the decedents suffered trauma from impacts, given the size and power exhibited by most

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

horses. The second most common injury resulted from being kicked while unmounted. Horses have exceptional peripheral vision but cannot see directly in front or directly behind themselves. Given that horses are prey animals, and humans predatory, horses use their hind limbs as a means for self-defense. Put in a situation where they are irritated or startled, horses will kick. Most everyone has heard the saying, “Don’t stand behind a horse,” or, “Don’t walk up behind a horse.” Understanding the generalized nature of horses and their reactions to threatening stimuli explains the large number of kicks noted in this study.

Injuries to the head and neck region, followed by the thoracic region, were most frequently found in the equine-related fatality cases. These findings were consistent with literature reviewed, where a significant majority of injuries were allocated to the head (regardless of each studies classification of anatomical regions).^{10,20} For all equine-related fatalities noted in this study, Blunt Force Trauma of the Head/Neck was the primary cause of death. The prevalence of head injuries implies the need for increased safety precautions when interacting with the equine species. In only one study was the use of safety equipment discussed, and the use of helmets was a documented factor.²

The American Society for Testing and Materials (ASTM) sets equipment standards for many different articles of safety equipment. The ASTM has set guidelines for helmets suitable for horseback riding. In conjunction, the Safety Equipment Institute (SEI) is a private laboratory that focuses on testing helmets to ensure the product meets ASTM standards. The American Medical Equestrian Association reports that ASTM/SEI approved helmets can reduce severe head injuries by roughly 50%.²³ Requirements for the use of ASTM/SEI approved helmets in competition are heavily outlined and upheld by many U.S. equestrian organization.^{13,24,25,28} A majority of the English style riding discipline organizations require ASTM/SEI approved

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

helmets. However, many of the Western style riding discipline organizations do not require ASTM/SEI approved helmets.^{11,13,16} There is a common stigma within the Western discipline equestrian community that wearing a helmet is not trendy and makes the rider seem inexperienced or inept. For the cases used in this study, there was no available information regarding the presence or absence of safety equipment. However, in viewing photographs associated with each case, those that included on-scene photographs did not show any signs of safety equipment being utilized. Given the logical assumption that the activities associated with the cases in this study involved Western style riding, this stigma may play a key role in the severity of the head injuries noted. Overall, findings in this study lend significant support for the increased use of ASTM/SEI certified helmets in all riding activities, particularly those of Western nature. A transformation in social dynamics where the use of ASTM/SEI certified helmets became the standard model in all riding disciplines could serve to decrease the number of fatal equine-related incidences.

Only one U.S. equestrian organization requires the use of protective vests. The *U.S. Equestrian Federation Rules for Eventing* handbook requires all riders to wear protective vests while warming-up for and during all Cross-Country events.²⁷ For all other disciplines, vests are permitted but not required. In some organizations, vests are only permitted in certain competition classes.¹³ As with the use of helmets in Western disciplines, there is a stigma hinting at the relative disapproval of status for those who wear protective vests in all equestrian disciplines (excluding Eventing). The overall lack of acceptance and/or encouragement of the use of safety vests could lend evidence to the high number of thoracic cavity injuries found in this study. Again, as with the use of helmets, a shift in societal acceptance of the use of protective vests while riding could significantly decrease the number of fatal equine-related thoracic injuries.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

In the bovine-related fatality cases observed in this study, a majority of the decedents were male. These findings were consistent with earlier studies investigating bovine-related fatalities, where most of the documented decedents were male.²¹ The gender finding in bovine-related fatalities was consistent with documented involvement in bovine-related activities and research investigating bovine-related injuries, where a majority of individuals documented were male.^{1,16,29}

In the bovine-related fatalities observed in this study, a vast majority of victims were senior adults 60 years of age or older. This contrasts significantly with the recorded bovine-related injuries, where individuals injured by cattle were generally between the ages of 30 and 50 years of age.^{4,29} These findings suggest that elder ranchers and farmers may have a reluctance towards asking for or accepting help, where they may view this as giving up on their livelihood. These elder individuals may also have reduced agility and reaction responses, rendering them unable to move quick enough to get out of the way of danger, which may be the reason for the results demonstrated in this study.

A majority of the bovine-related decedents were unmounted during the event that led to their demise. Though some individuals ride bulls for sport, the typical objective of bovine-related activities is to raise and sell cattle. With bovine industries standing as one of the top three largest farm productions in the U.S, the findings in this study were indicative of the general nature of bovine-related activities.^{1,16} Handling of cattle, such as feeding, sorting, and loading into trailers, were the most common activities involved in previous studies concerning bovine-related fatalities.²¹ This lends understanding to the findings in this study, where the decedents noted in Oklahoma were typically injured in cases where they were in a confined space with a large, heavy, and active animal.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Of the causes of sustained injury documented in bovine-related fatalities, the most common injury was due to blunt force trauma from impact with a hard surface. In bovine-related fatalities, the blunt force trauma from impact was most associated with unmounted decedent's positioning. The second most common injury was due to being butted. A majority of the fatalities identified in this study resulted from individuals being butted and thrown into a hard surface, such as a wall or gate. It is not surprising that majority of the decedents suffered trauma from impact, given the size and power most cattle exhibit. Given that cattle are prey animals, and humans predatory, cows use their powerful heads to defend themselves. When cattle are put into situations where they feel trapped and threatened, they often attempt to overcome anyone or anything in their way to escape. Understanding the generalized nature of cattle and their reactions to perceived threats explains the findings in this study.

The Professional Rodeo Cowboys Association (PRCA) does not require the use of any protective equipment. The use of helmets and vests is optional, but not mandatory in any mounted rodeo event.¹⁵ Similar to equestrian activities, the lack of requirements for the use of safety vests and helmets could contribute to the frequent occurrence of head and thoracic injuries found in this study. Mandating the use of protective equipment could decrease the number of mounted bovine-related fatalities.

This study found several points of similarity between equine- and bovine-related fatalities. In both species-related sets of data, there was a significant representation of male decedents. In comparison of decedent position and cause of sustained injury, mounted cases in both equine- and bovine-related fatalities experienced blunt force trauma from impact. These findings indicate that both equine and bovine human interactions pose substantial risks for injury and fatality while riding.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

There were several findings of interest illustrating contrast between equine- and bovine-related fatalities in this study. The data showed that decedent position in fatalities during equine-related activities predominantly occurred while mounted, and fatalities during bovine-related activities were most prevalent while unmounted. Chi-square testing demonstrated the predictability of decedent position as a predictor for species relation, where the differences in the findings proved to be statistically significant with a p -value of 0.00000589 at .05 significance level.

Only in equine-related fatalities was being dragged a contributing cause of sustained injury. Only in bovine-related fatalities was being butted or gored a contributing cause of sustained injury. The presence of these causes of sustained injury can be attributed to the overall nature of the species-specific activities and/or species-specific behaviors. Given the majority of bovine-related fatalities were unmounted, the likelihood of a dragging incident occurring around cattle was impractical. In addition, given that horses generally do not defend themselves by using their head, the absence of butted or gored trauma can be associated with the overall nature of equine species. In a theoretical case where both horses and cattle are present in the vicinity of an unwitnessed fatal incident, these findings could help with determination of which species-interaction most likely inflicted the fatal trauma.

Statistical significance was only found in one other chi-square test in this study. Testing was conducted specifically comparing compiled age to decedent position without the presence of blunt force trauma from impact. In this analysis, four mounted juvenile, seven mounted adult, two unmounted juvenile, six unmounted adult and 21 unmounted elder adult cases were identified. With a p -value of 0.0001928, using compiled age categories as a means for predicting decedent position is statistically supported.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

A majority of the decedents researched in this study did not undergo autopsy, therefore only 10 of the cases discussed specific fatal injuries. Because of this, categorical analysis of mechanism of death was not applicable. However, there were descriptive patterns in the fatal injuries reported in comparison to the findings of locations of injury and cause of death in both equine- and bovine-related fatalities.

There is a hierarchical diagnostic progression based on what the medical examiner observes during their external examination of the decedent. If the external exam shows evidence of obvious lethality of the injuries observed, often times there is no autopsy performed. If the external exam shows a general area of injury with a less obvious sign of lethality, a limited internal exam may be performed by only examining the underlying critical organs in the area indicated by the visible external injury. When the external exam lacks any evidence of lethal injury, a full internal exam is performed to determine the lethal injury or injuries.

The National Association of Medical Examiners (NAME) outlines the requirements for when a forensic autopsy shall be performed as the following:

- B3.1 the death is unknown or suspected to have been caused by apparent criminal violent.
- B3.2 the death is unexpected and unexplained in an infant or child.
- B3.3 the death is associated with police action.
- B3.4 the death is associated with police action.
- B3.5 the death is due to acute workplace injury.
- B3.6 the death is caused by an apparent electrocution.
- B3.7 the death is by apparent intoxication by alcohol, drugs, or poison.
- B3.8 the death is caused by unwitnessed or suspected drowning.
- B3.9 the body is unidentified, and the autopsy may aid in identification.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

B3.10 the body is skeletonized.

B3.11 the body is charred.

B3.12 the forensic pathologist deems a forensic autopsy is necessary to determine cause or manner of death, or document injuries/disease, or collect evidence.

B3.13 the deceased is involved in a motor vehicle incident and an autopsy is necessary to document injuries and/or determine cause of death.¹⁸

Determination of the reasoning for the performance of autopsy is outside of the scope of this study. However, one can assume that a majority of equine- and bovine-related fatalities would not fall into any of the above-mentioned categories, as a chief part of these cases were inferred to be accidental.

For the equine-related fatalities with cause of death as Blunt Force Trauma of the Head/Neck, the following fatal injuries were recorded: multiple basilar skull fractures, atlanto-occipital subluxation with spinal cord transection; nasal fracture, left zygomatic arch fracture, left side maxilla fracture, and brain edema; subgaleal and subcutaneous hemorrhage of the left head, left subdural hemorrhage, and diffuse subarachnoid hemorrhage. These fatal injuries and associated causes of death can be directly compared to the significant number of head and neck region locations of injury. For the equine-related fatality with cause of death as Blunt Force Trauma of the Chest, the fatal injuries were noted as a spleen laceration and hemoperitoneum, left hemothorax, and cardiomegaly with significant atherosclerosis. These fatal injuries and associated causes of death correlate with the second-most prevalent location of injury: the thoracic cavity. For the equine-related fatalities with cause of death as Multiple Blunt Force Injuries, the following fatal injuries were recorded: right temporal bleed, brain stem bleed, and bilateral pulmonary contusions; bilateral pneumothorax and cervical spine fracture. Of these

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Multiple Blunt Force Injury cases, injuries to both the head/neck region and thoracic cavity were directly associated with the documented fatal injuries.

For the bovine-related fatalities, one case with the cause of death as Blunt Force Trauma of the Chest listed posterior bilateral chest wall fractures associated with significant intercostal injuries and a T6 vertebrae fracture as the fatal injuries. The other bovine-related case listed cause of death as Multiple Blunt Force Injuries, where anoxic encephalopathy with infarction were determined as the fatal injuries. Both bovine-related cases directly correlate with the majority representation of head/neck region and thoracic cavity as locations of injury.

The findings demonstrating a direct correlation between locations of injury, cause of death, and documented fatal injuries in the fatalities examined implicate the need for the increased use of protective vests and ASTM/SEI certified helmets.

The role of intoxication or impairment of the decedent in the previously discussed incidences was unknown. There are strict guidelines set in place for the administration of medications and/or drugs to the livestock used in competition. The Professional Rodeo Cowboys Association states that, “no stimulants or hypnotics may be given to any animal used for contest purposes.”¹⁵ Likewise, the National Snaffle Bit Association requires that no devices, drugs, or medications be administered to the animals that affect their appearance or performance. These animals are subject to mandated and random drug testing throughout the competition process.¹³ However, there are no rules, guidelines, or inhibitions regarding the use of drugs and/or alcohol for competition exhibitors.

There is a need for increasing awareness of how to safely handle horses and cattle to decrease injuries and fatalities. One means for increasing education could be conducted by publishing and distributing safety pamphlets to individuals involved in activities using livestock.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

These pamphlets could include horse and cattle facts, common signs of the animal feeling angry or threatened, common methods of defense, and recommendations for safe handling practices (see Appendix B). The distribution of these pamphlets could occur at livestock events, riding lessons, sale barns, and/or by large animal veterinarians. Increasing education on horse and cattle behaviors and safe handling practices could decrease negative stigmas and increase the acceptance of the use of protective equipment.

The results in this study also have potential applications to the mediation of possible adverse consequences taken against the animals involved. There are no laws or regulations set in place for the detainment or euthanasia of livestock involved in the demise of a human, but inferences can be made regarding the likelihood that animals responsible for human fatality will be sent to sale barns or slaughter. These animals are at risk for being discarded to kill pens, where they will be purchased, euthanized, and used for things such as animal feed or glue. Along with concerns for the human counterparts, the findings in this study hold significant implications for the protection of livestock and animal welfare concerns.

Limitations

The limitations of this study were predominantly associated with sample size. Due to the small sample size and low actual values for the majority of the data sub-categories, statistical analysis of many of the contingency tables was either not feasible or produced unreliable results. Also, most of the decedents did not undergo autopsy, as they did not fit the autopsy criteria outlined by the National Association of Medical Examiners *Forensic Autopsy Performance Standards* (2016). Because of this, a majority of the cases did not include information on specific fatal injuries. Along with this, determination of mechanism of death was not readily apparent. Given that mechanism of death was one of the considerations in the research questions for this

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

study, this lack of information resulted in significant limitations in statistically analyzing mechanism of death patterns and trends.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

References

1. American Farm Bureau Foundation for Agriculture. (2019). Fast facts about agriculture & food. *Food and Farm Facts*.
2. Aronson, H., & Tough, S.C. (1993). Horse-related fatalities in the province of Alberta, 1975-1990. *The American Journal of Forensic Medicine and Pathology*, 14(1), 28-30.
3. Business Research Methodology. (2022). *Case Studies*.
4. Casey, G., Grant, A., Roerig, D. S., Boyd, J., Hill, M., London, M., Gelberg, K., Hallman, E., & Pollock, J. (1997). Farm worker injuries associated with bulls. *AAOHN Journal*, 48(8), 393-396.
5. Gliner, J. A., Morgan, G. A., & Leech, N. L. (2017). *Research Methods in Applied Settings* (3rd ed.). Routledge. ISGN: 978-1-138-85297-6
6. Guyton, K., Houchen-Wise, E., Peck, E., & Mayberry, J. (2013). Equestrian injury is costly, disabling, and frequently preventable: The imperative for improved safety awareness. *The American Surgeon*, 79(1), 76-83.
7. Moss, P.S., Wan, A., & Whitlock, M.R. (2002) A changing pattern of injuries to horse riders. *Emergency Medicine Journal*, 19(5), 412-414. <https://doi.org/10.1136/emj.19.5.412>
8. NBHA. (2019). 2020 media planner. *Barrel Horse News*.
9. Northey, G. (2003). Equestrian injuries in New Zealand, 1993-2001: knowledge and experience. *The New Zealand Medical Journal*, 116(1182), 1-8.
10. Norwood et al. (2000). Mechanisms and patterns of injuries related to large animals. *The Journal of Trauma: Injury, Infection, and Critical Care*, 48(4), 740-744.
11. NRHA. (2021). 2021 media kit: Reach reiners worldwide. *Reiner*.
12. NSBA. (2020). *NSBA: The Way to Go*.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

13. NSBA. (2023). *NSBA 2023 Official Handbook*.
14. Office of the Chief Medical Examiner. (2023). *Introduction to Medical Examiner's Office*.
15. PRCA. (2019). *Articles of Incorporation, Bylaws, and Rules*.
16. PRCA. (2021). About the Professional Rodeo Cowboys Association. *The Official Membership Site of the Professional Rodeo Cowboys Association*.
17. R Project. (2022). *The R Project for Statistical Computing*.
18. Stowe, C. J. (2018). Results from the 2018 AHP Equine Industry Survey. *2018 American Horse Publications*.
19. The National Association of Medical Examiners. (2016). *Forensic Autopsy Performance Standards*.
20. U.S. Centers for Disease Control and Prevention. (1992). Alcohol use and horseback-riding-associated fatalities – North Carolina, 1979-1989. *Morbidity and Mortality Weekly Report (MMWR)*, 41(19), 341-342.
21. U.S. Centers for Disease Control and Prevention. (2009). Fatalities caused by cattle – four states, 2003-2008. *Morbidity and Mortality Weekly Report (MMWR)*, 58(29), 800-804.
22. University of Central Oklahoma Service Desk. (2022). *Qualtrics Service Request*.
23. University of Wisconsin-Madison. (2020). Riding helmet safety: Helmet facts – Here's why you need your ASTM/SEI approved helmet for every ride...*Dane County 4-H Youth Development*.
24. USDF. (2021). *United States Dressage Federation 2022 Media Kit*.
25. USEA. (2020). *United States Eventing Association 2021 Media Kit*.
26. USEF. (2021). *US Equestrian Media Kit 2022*.
27. USEF. (2023). *United States Equestrian Federation Rules for Eventing*.

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

28. USHJA. (2019). In stride 2020 media kit. *The Magazine of the United States Hunter Jumpers Association*.
29. Wheeler, J. A. (2019). Cattle related trauma: Are we underestimating its severity? *Australasian Medical Journal*, 12(4), 123-130. <https://doi.org/10.21767/AMJ.2019.3588>

CHAPTER V

Summary of Conclusions

The findings suggest that there are distinct similarities in the most prominent gender, cause of sustained injury, and location(s) of injury for both equine- and bovine-related fatalities. Blunt force trauma from impact located in the head/neck region and thoracic cavity of male decedents was most often documented in this study.

For equine-related fatalities, a significant portion of the cases involved mounted decedent juveniles and elder adults. Only in equine-related fatalities were there reports of being kicked. In bovine-related fatalities, the majority of cases involved unmounted elder adults. Only in bovine-related fatalities were there reports of being butted or gored.

For both equine- and bovine-related fatalities, the fatal injuries documented directly correlated with the location of injury and cause of death. The available autopsy reports examined showed significant trauma to the head/neck region and thoracic cavity, where Blunt Force Trauma of the Head/Neck, Blunt Force Trauma of the Chest, and Multiple Blunt Force Injuries were most often documented causes of death.

The study findings rejected the null hypothesis and indicated that there are several discernable patterns within equine-related fatalities, within bovine-related fatalities, and between fatalities of both equine-and bovine-relation.

This study lends significant evidence to the need for increased safety precautions in both equine and bovine activities. Use of safety equipment, such as ASTM/SEI certified helmets and protective vests, could decrease the number of fatal equine- and bovine-related incidences. This study also gives testimony to the need for an eradication of the negative stigma associated with

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

the use of protective equipment. Safety precautions and increased assistance to vulnerable populations (juveniles and elder adults) should become top priorities.

Future Research

Future research could be conducted outside of Oklahoma to investigate whether other jurisdictions experience the same discernable patterns within equine-related and bovine-related fatalities as was found in this study. With the sample size limitations of this study, gathering of larger sample sizes may produce more substantial statistical evidence of relationship.

The impact or role of intoxication in the cases observed in this study was unknown. Future research into the involvement of drug/alcohol impairment in equine- and bovine-related fatalities is warranted. Research into the efficacy of the safety equipment discussed could be conducted to increase the understanding of their impacts on decreasing injuries and fatalities. A study could be conducted using a target and a control group, where one group utilizes safety equipment and one does not. In this hypothetical study, both groups would participate in the same activities over some period of time. Injuries and injury severity for both groups would be documented and analyzed to determine patterns and trends associated with the presence or absence of safety equipment.

Future research could also be conducted to determine the efficacy of establishing education-based programs for safe handling practices of livestock. The formalization and distribution of such programs, like the safety pamphlet discussed in this research, may increase the understanding of how to safely handle the targeted large animals, thus leading to a decrease in injuries and fatalities.

Further determination of the above-mentioned patterns could justify the need for extensive safety protocol research as discussed in the above literature review. These

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

determinations could introduce innovative and novel approaches to identifying where increased safety measures, education, and substance-use guidelines could decrease the number of equine- and bovine-related fatalities.

CHAPTER VI

Author's Note

I was introduced to horseback riding when I was very little. Since the day I stepped foot in a barn, I have been obsessed with horses. Fast forward many years, I am currently living out my childhood dreams as a horse trainer and horseback riding instructor while completing my graduate degree in hopes of becoming a medicolegal death investigator. When I was deciding what to research for my thesis topic, I was asked by my thesis committee chair, "What is something, other than forensics, that you can talk about for hours without getting bored?" To that I answered very quickly, "Horses." My committee chair smiled and said, "Figure out how to turn that into a research project." And so, *A Comparative Investigation of Equine-Related and Bovine-Related Human Fatalities in Oklahoma* was born.

Throughout my years of personal experience, I have made observations about the most common ways people get injured while working with horses. To my surprise, my research indicates that my personal experiences may be widely applicable. When teaching anyone how to be safe around horses, the first thing you teach them is, "Never walk behind a horse." As it turns out, being kicked is one of the leading causes of injury in equine-related fatalities in Oklahoma. When teaching anyone how to ride, I harp on the importance of wearing a helmet. For personal safety reasons and to set a good example for my students, I always wear a helmet when I ride. I always tell my students and/or their parents, "You can replace a helmet, but you can't replace a head." And as it turns out, injuries to the head and neck are the leading location of injury in equine-related fatalities in Oklahoma.

I hold this research project very close to my heart, as I'm extremely proud of the relationships I have built, efforts I have put in, and progress I have made as an academic

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

throughout the graduate school process. I am excited that I was able to merge my two greatest passions in life into one successful research project, of which I am more sad than excited for it to be completed.

The main takeaway from this research is that the key to success is staying away from the front end of cattle, the back end of horses, and protect your head from hitting hard surfaces!

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

APPENDIX A: Auxiliary Tables

Age and Gender (Equine v. Bovine)

	0-18		19-29		30-39		40-49		50-59		60-69		70-79		80+	
	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>
<i>Male</i>	7	1	4	3	3	0	5	0	4	3	9	6	0	6	1	5
<i>Female</i>	5	0	0	0	2	0	2	0	1	0	1	1	1	1	0	0

Compiled Age and Gender (Equine v. Bovine)

	0-18		19+	
	<i>Equine</i>	<i>Bovine</i>	<i>Equine</i>	<i>Bovine</i>
<i>Male</i>	7	1	26	23
<i>Female</i>	5	0	7	2

Gender and Decedent Position (Equine v. Bovine)

	<i>Male</i>		<i>Female</i>	
	<i>Equine</i>	<i>Bovine</i>	<i>Equine</i>	<i>Bovine</i>
<i>Mounted</i>	23	4	9	0
<i>Unmounted</i>	8	20	3	2
<i>Unknown</i>	2	0	0	0

Age and Decedent Position (Equine v. Bovine)

	0-18		19-29		30-39		40-49		50-59		60-69		70-79		80+	
	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>
<i>Mounted</i>	10	1	2	3	4	0	6	0	4	0	5	0	0	0	1	0
<i>Unmounted</i>	2	0	1	0	1	0	1	0	1	3	4	7	1	7	0	5
<i>Unknown</i>	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Gender and Cause of Sustained Injury (Equine v. Bovine)

	<i>Male</i>		<i>Female</i>	
	<i>Equine</i>	<i>Bovine</i>	<i>Equine</i>	<i>Bovine</i>
<i>BFT from Impact</i>	17	7	5	0
<i>Butted</i>	0	7	0	0
<i>Crushed</i>	5	3	3	0
<i>Dragged</i>	4	0	1	0
<i>Gored</i>	0	3	0	0
<i>Kicked</i>	8	3	4	0
<i>Stepped On</i>	1	4	1	0
<i>Trampled</i>	3	5	0	1
<i>Other</i>	1	0	0	0
<i>Unknown</i>	1	1	0	1

Age and Cause of Sustained Injury (Equine v. Bovine)

	<i>0-18</i>		<i>19-29</i>		<i>30-39</i>		<i>40-49</i>		<i>50-59</i>		<i>60-69</i>		<i>70-79</i>		<i>80+</i>	
	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>
<i>BFT from Impact</i>	6	1	0	2	3	0	4	0	3	1	5	1	0	0	1	2
<i>Butted</i>	0	0	0	0	0	0	0	0	0	3	0	2	0	1	0	1
<i>Crushed</i>	2	0	2	1	0	0	2	0	1	1	1	1	0	0	0	0
<i>Dragged</i>	2	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0
<i>Gored</i>	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1
<i>Kicked</i>	2	0	2	1	2	0	0	0	0	0	5	1	1	0	0	2
<i>Stepped On</i>	2	1	0	2	0	0	0	0	0	0	0	1	0	1	0	0
<i>Trampled</i>	1	0	0	0	0	0	1	0	1	1	0	2	0	2	0	1
<i>Other</i>	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
<i>Unknown</i>	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Gender and Location of Injury (Equine v. Bovine)

	<i>Male</i>		<i>Female</i>	
	<i>Equine</i>	<i>Bovine</i>	<i>Equine</i>	<i>Bovine</i>
<i>Head/Neck Region</i>	19	16	9	1
<i>Thoracic Cavity</i>	17	17	6	2
<i>Abdominal Cavity</i>	9	7	2	2
<i>Upper Extremities</i>	5	5	3	2
<i>Lower Extremities</i>	3	4	2	2

Age and Location of Injury (Equine v. Bovine)

	<i>0-18</i>		<i>19-29</i>		<i>30-39</i>		<i>40-49</i>		<i>50-59</i>		<i>60-69</i>		<i>70-79</i>		<i>80+</i>	
	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>	<i>Eq</i>	<i>Bo</i>
<i>Head/Neck Region</i>	8	0	2	3	2	0	4	0	5	2	6	3	0	5	1	4
<i>Thoracic Cavity</i>	7	1	1	0	3	0	4	0	3	2	4	5	1	5	0	6
<i>Abdominal Cavity</i>	4	0	2	0	0	0	3	0	0	1	1	4	1	4	0	0
<i>Upper Extremities</i>	3	0	0	1	0	0	3	0	1	1	0	2	1	1	0	2
<i>Lower Extremities</i>	3	0	0	1	0	0	2	0	0	0	0	3	0	1	0	1

Decedent Position and Location of Injury (Equine v. Bovine)

	<i>Mounted</i>		<i>Unmounted</i>		<i>Unknown</i>	
	<i>Equine</i>	<i>Bovine</i>	<i>Equine</i>	<i>Bovine</i>	<i>Equine</i>	<i>Bovine</i>
<i>Head/Neck Region</i>	21	3	6	14	1	0
<i>Thoracic Cavity</i>	16	1	6	17	1	0
<i>Abdominal Cavity</i>	8	0	2	9	1	0
<i>Upper Extremities</i>	5	1	3	6	0	0
<i>Lower Extremities</i>	5	1	0	5	0	0

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Gender and Cause of Death (Equine v. Bovine)

	<i>Male</i>		<i>Female</i>	
	<i>Equine</i>	<i>Bovine</i>	<i>Equine</i>	<i>Bovine</i>
<i>BFT of the Head/Neck</i>	15	8	7	0
<i>BFT of the Chest</i>	7	4	1	1
<i>BFT of the Abdomen</i>	3	1	0	0
<i>Multiple Blunt Force Injuries</i>	7	11	4	1
<i>Other</i>	1	0	0	0

Gender and Species (BFT from Impact Present)

	<i>Female</i>	<i>Male</i>	<i>Total</i>
<i>Equine</i>	5	17	22
<i>Bovine</i>	0	7	7
<i>Total</i>	5	24	29

Gender and Species (BFT from Impact Absent)

	<i>Female</i>	<i>Male</i>	<i>Total</i>
<i>Equine</i>	7	14	21
<i>Bovine</i>	2	17	19
<i>Total</i>	9	31	40

Compiled Age and Species (BFT from Impact Present)

	<i>0-18</i>	<i>19-59</i>	<i>60+</i>	<i>Total</i>
<i>Equine</i>	6	10	6	22
<i>Bovine</i>	1	3	3	7
<i>Total</i>	7	13	9	29

EQUINE-RELATED AND BOVINE-RELATED HUMAN FATALITIES

Compiled Age and Species (BFT from Impact Absent)

	<i>0-18</i>	<i>19-59</i>	<i>60+</i>	<i>Total</i>
<i>Equine</i>	6	10	5	21
<i>Bovine</i>	0	3	16	19
<i>Total</i>	6	13	21	40

Compiled Age and Gender (BFT from Impact Present)

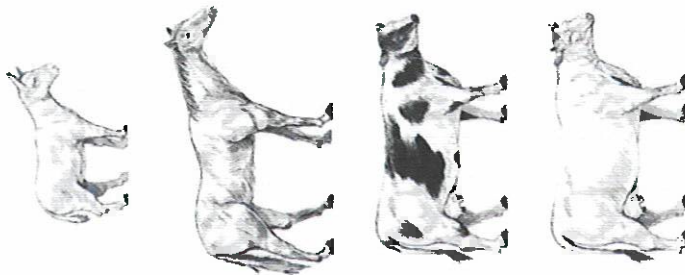
	<i>Female</i>	<i>Male</i>	<i>Total</i>
<i>0-18</i>	2	5	7
<i>19-59</i>	3	10	13
<i>60+</i>	0	9	9
<i>Total</i>	5	24	29

Compiled Age and Gender (BFT from Impact Absent)

	<i>Female</i>	<i>Male</i>	<i>Total</i>
<i>0-18</i>	3	3	6
<i>19-59</i>	2	11	13
<i>60+</i>	4	17	21
<i>Total</i>	9	31	40

APPENDIX B: Horse and Cattle Safety Pamphlet

Horse and Cattle Safety Pamphlet



Resources

Freeman, D.W. (n.a.). Horses and kids: Safety on the ground. *OSU Oklahoma Cooperative Extension Service: 4-H Youth Development*. Retrieved from <https://4h.okstate.edu/projects/animal-science-companion-animals/site-files/docs/horse-files/safety-on-the-ground.pdf>

Hines, K. (2017). Training horses safely. *Oklahoma State University*. Retrieved from <https://extension.okstate.edu/fact-sheets/training-horses-safely.html>

Hubert, J.H., Huhnke, R.L., Horp, S.L. (2017). Cattle handling safety in working facilities. *Oklahoma State University*. Retrieved from <https://extension.okstate.edu/fact-sheets/cattle-handling-safety-in-working-facilities.html>

Pamphlet Creator

Kaylan Peterson
(214) 793-9682
kpeterson14@uco.edu

The University of Central Oklahoma
The W. Roger Webb Forensic Science Institute
Thesis Defense Visual Aid

Horses and cattle are prey animals. This means that they react with fight-or-flight behaviors when they feel threatened.

Horses

- Weight**
- ❖ 950-1500 pounds
- Uses**
- ❖ Sport
- ❖ Breeding
- ❖ Animal assisted therapy
- ❖ Companions for leisure
- Vision:**
- ❖ 200° field of vision
- ❖ Horses can see anywhere except directly behind them.

Cattle

- Weight**
- ❖ Males - 1000-4000 pounds
- ❖ Females - 800-2400 pounds
- Uses**
- ❖ Sport
- ❖ Consumption
 - Beef and dairy products
- ❖ Companions for leisure
- Vision**
- ❖ 300° field of vision
- ❖ Cattle can see anywhere except directly behind them

<p>Common Signs of Anger or Feeling Threatened</p> <p><u>Horses</u></p> <ul style="list-style-type: none"> ❖ Pinned-back ears ❖ Rapid tail movement ❖ Cocking a hind leg ❖ Stamping/pawing ❖ Whites of eyes visible ❖ Tension in face and body <p><u>Cattle</u></p> <ul style="list-style-type: none"> ❖ Raised ears ❖ Rapid tail movement ❖ Erratic movements ❖ Stamping/pawing ❖ Turning sideways ❖ Snorting or chuffing 	<p>Recommendations for Safety</p> <ul style="list-style-type: none"> ❖ Utilize safety equipment such as helmets and protective vests! ❖ Always ride or handle horses or cattle with a well-educated and responsible instructor first! ❖ Never leave a child unattended with a large animal! ❖ Follow the <i>buddy system</i>. Never handle or interact with horses or cattle alone! ❖ Don't antagonize any animal, especially one that's roughly 10-times bigger than the average human! 	<p>Recommendations for Safety</p> <ul style="list-style-type: none"> ❖ Know the general behaviors and common signs of anger or feeling threatened! ❖ Don't be in confined or enclosed spaces with horses or cattle without a safe and quick way to get out! ❖ Follow your natural instinct...if you feel nervous, the animal will feel nervous! ❖ Don't put yourself in a situation where you're making the animal feel threatened! ❖ Never interact with large animals while under the influence of any mind-altering substance!
<p>Common Methods of Defense</p> <p><u>Horses</u></p> <ul style="list-style-type: none"> ❖ Striking and/or lunging ❖ Kicking ❖ Running away <p><u>Cattle</u></p> <ul style="list-style-type: none"> ❖ Headbutting ❖ Kicking ❖ Trampling 		