The Epidemiology of Pediatric Sports and Recreational Injuries Reporting to the Emergency Department in Grand Forks, ND

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THE EPIDEMIOLOGY OF PEDIATRIC SPORTS AND RECREATIONAL INJURIES REPORTING TO THE EMERGENCY DEPARTMENT IN GRAND FORKS, ND

by

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A Scholarly Project Submitted to the Graduate Faculty of the

Department of Physical Therapy
School of Medicine

in partial fulfillment of the requirements for the degree of

Doctor of Physical Therapy

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This Scholarly Project, submitted by Erin Arndt and Sterling Hubbard in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

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Title
The Epidemiology of Pediatric Sports and Recreational Injuries Reporting to the Emergency Department in Grand Forks, ND

Department Physical Therapy

Degree Doctor of Physical Therapy

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ABSTRACT

PROBLEM: Sports and recreational injuries among youth is constantly being reviewed, and ways to prevent or decrease their incidence is an ongoing goal. The purpose of this study was to examine and provide information regarding the epidemiology of sports and recreation-related injuries in the pediatric population (ages 0-19) in the Grand Forks, ND area. This study is a continuation of a previous 10-year study; adding data retrieved within this current study would combine for 15 years of epidemiological data of those that presented to the Altru Emergency Department in Grand Forks, ND.

METHODS: This retrospective study involved examining Altru Department Emergency records included within a compiled list that was created by the Altru data department. This list used designated E-codes chosen by researchers along with the age range 0-19 years old. Following examining each record on the compiled list of potential study subjects, inclusion into the study was decided. The incident was to be included into the study if the injury fits within the established criteria: pediatric sport or recreational injury. Additional information from the incident was recorded within an Excel workbook. Following data collection, researchers combined all obtained data and analyzed results.
RESULTS: A total of 419 participants were included within this study. It was found that 51% of injuries included were recreation-related with 49% of included injuries being sport-related. The highest percentage of injuries was found in the 10-14 year old age group. It was also observed that males had a higher prevalence of injury compared to the female population. The highest prevalence of injury was found to be the head/neck, face, followed by forearm injuries. Falls were found to be the most common mechanism of injury and fractures were found to be the most common type of injury presenting to the Emergency Department.

CONCLUSION: The purpose of this study was to examine pediatric sport and recreation-related injuries presenting to the Emergency Department in Grand Forks, ND in hopes of forming a prevention strategy for minimizing injury in the future. Further research in this geographical location will need to be performed in order to able to explore trends within this research topic.
CHAPTER I

LITERATURE REVIEW

Prevalence of Injury

In the United States in 2010, the Center of Disease Control estimated more than 8.6 million children were treated at emergency rooms for injury; this number equates to an estimated 23,596 children per day seeking ED treatment, 983 children per hour, and 16 children per minute.¹ Trends in the types of injuries that present to hospital emergency departments depend on age and also gender: playground injuries tend to peak in early childhood and drop off slowly as team-sport injuries start to peak in middle teen years. Between the high level of childhood playground injuries and team-sport injuries, childhood and adolescence is characterized by bicycle injuries that are steady throughout those years.¹

As stated by Fridman et al, a sports-related injury (SRI) occurs as result of a competitive or recreational sport. Sports-related injuries can occur during organized or unorganized sports, can present to the emergency department, and are represented in a wide array of injuries among children and youth.² The number of youth participating in sports has steadily increased in the past two decades. It is reported that an estimated 30 million to 40 million youth participate in non-school related sports annually and in the 2009-10 academic year, greater
than 7.6 million adolescents participated in high school sports.\textsuperscript{3} With the increasing amount of children and youth participating in recreational activity with increasing popularity and in efforts combat of the obesity epidemic in the United States, the amount of emergency room treatment related to activity has also increased among the pediatric population.\textsuperscript{3}

Types of Injuries

The types of injuries experienced by the wide-spread pediatric age group depend on age. Overall, lower extremity injuries account for the largest proportion of emergency department visits.\textsuperscript{4} Younger children, ages 5 to 12 tend to experience more traumatic injury that is bony in nature compared to their older counterparts (13 to 17). The older age group tends to experience a larger number of overuse injuries that are more soft-tissue in nature as opposed to bony in nature. Schwebel et al\textsuperscript{1} performed a large study to assess how incidence of 39 sport and recreational injuries changed year to year, from age 1 to 18. They also compared differences found by gender. Injury incidences widely varied across the development of the child, with different activities peaking in incidence at different ages. This study oddly reports the largest number of bowling injuries occurred in young children between ages 4 to 5. Also, several hundred toddlers, between the ages of 1 and 3, were injured while taking place in activities meant for older populations, such as: “all-terrain vehicles, snowmobiles, fishing, and mopeds and minibikes.”\textsuperscript{1} Exercising and exercising equipment were among the top 5 causes of injuries in 1 year olds, 2 year olds, and 18 year olds.\textsuperscript{1} Other information reported seems more intuitive, with trampoline and
playground injuries being more prevalent in younger years of age. For 7
year olds, injuries occurring from baseball was reported as being one of the top 5
causations. Team sports (baseball, basketball, football, and soccer) were found
to be the top 4 out of 5 activities that caused injury in children from age 11 to
18.

As discussed above, older pediatric patients sustain more overuse and
soft-tissue injuries compared to younger pediatric patients; examples of soft-
tissue injuries of adolescents include meniscal and ligamentous tears; younger
children experience a significantly larger amount of fractures, physeal fractures,
and osteochondritis dissecans (OCD). While Stracciolini et al reported that
fractures were more common among the younger pediatric population (5 to 12
years), many studies report that fractures are common sports and recreational
injury throughout all ages. Schneider et al reported the incidence of
fractures presenting to emergency rooms to be 26%. As mentioned above,
injuries to the lower extremity are the most common to be seen in the emergency
department; fractures occur more in the upper extremity and are also more
common among the younger population (ages 14 and younger) compared to
pediatric patients over age 14. This information is consistent with the above
findings that younger individuals experience a larger proportion of injuries that
are bony in nature. The diagnosis for fractures accounts for a large amount of
sports-related injuries; the mechanism of this injury is likely to be collision with
another person or an object. Activities that contribute to collision, and therefore
increased sports-related injuries are football, basketball, soccer, baseball. While
those four sports are found to be the highest estimated sports-related injury, the activities of basketball, football, soccer, bicycling, and playgrounds were listed as the top 5 recreation-sport related injury for ages 1 to 18 in the years 2001-2008.9

Injury Differences by Gender

Types of injury also vary by gender. Males report to emergency rooms in large numbers than females. Nalliah et al7 reported that 76.8% of all emergency room visits are accounted for by males. Literature reports similar results.2,6 In a study performed by Fridman et al2 males reported greater numbers of injuries for 11 of the 13 sports analyzed in the study. Males are more likely to be involved in contact sports, such as football, soccer, and hockey compared to females. Males are also more likely to be involved in a team sport compared to females. Males are more likely to sustain traumatic injuries (58.3%) compared to females while females are more likely to sustain overuse (62.5%) injuries. Both genders sustain more lower extremity injuries followed by upper extremity injuries, spine, and pelvis injuries. Differences emerge between gender regarding hip and pelvis injuries: females are more likely to sustain overuse injuries (90.9%) and soft tissue injuries (75.3%) compared to males who are more likely to experience traumatic (58.3%) injuries to the hip and pelvis that are bony in nature (55.6%).4 This finding was also consistent with 5 differences between gender regarding strength, flexibility, anatomical, physiological, and biomechanical risk factors. These differences between gender may contribute to variances between types of injuries sustained by males and females.4
Risk Factors and Prevention

Smucny et al\textsuperscript{10} define single sport specialization as "intensive, year-round training in a single sport at the exclusion of other sports." They also argue that the North American culture has shifted. Sports and fitness activities have become less about "free play" and increasingly more structured, even within our school systems. Instead of encouraging core physical principles (flexibility, endurance, and balance), the culture has shifted in the development of highly specific skills, mainly sport specific skills. This has in turn transformed the idea of youth sports being a foundation to a healthy lifestyle into the idea of an elite status that is required to secure a future in professional careers or scholarships. The authors report that coaches and parents largely have had a role in this switch of culture. The media has also played a role by focusing attention on athletic prodigies who have been handsomely rewarded for their dedication to the sport at early ages, for example Tiger Woods. The NCAA reports that competing at a collegiate level directly from high school is an opportunity only 3.3\% to 6.8\% of athletes achieve. Moreover, only 0.3\% to 0.5\% of high school athletes will obtain professional status.\textsuperscript{12}

With the steadily increasing participation, competition, and intensity occurring in youth sports in the past four decades, there has been an increase in overuse injuries.\textsuperscript{5} It is speculated that these injuries can have long-term effects and may ultimately lead children and adolescents to burnout and increased risk of overuse injury, although some say definitive evidence for that correlation of relationship does not yet exist.\textsuperscript{4} A study performed by Jayanthi et al\textsuperscript{12} concludes
that the risk of injury increases with increased exposure to sport; this relationship is linear and risk of injury has been shown to significantly increase with increased exposure to sport of greater than 16 hours per week. In a separate study completed by Jayanthi et al. it was found that young athletes were at an increased risk of overuse if their ratio of organized sport to free time play was greater than 2:1 or if they participated in more hours of sport per week than was their age in years. Regarding overuse and time spent training by youth athletes, there is an independent risk of injury or overuse injury in those who specialize in one sport. This increased risk of injury may also be due to adolescent growth spurts combined with high training/playing volumes. These youth are characterized by imbalances between growth and strength, joint hypermobility, lack of lean tissue mass, and apophyseal growth plates that are less resistant to shear and tensile forces. While research on this topic of overuse and recreational/sport injury is relatively new, suggestions exist regarding efforts to decrease injury. Some include encouraging diversification in activity, searching for the root cause of injury rather than treating and having the child return to play immediately upon healing, ensuring proper fitting equipment to decrease altered biomechanics, and careful monitoring of training volume during growth spurts. 

**Concussion**

A concussion is a form of traumatic brain injury. Sports and recreational activities are becoming the most common cause of concussion injuries. It is estimated that between 1.6 and 3.8 million concussions occur yearly within the
United States. This number has fluctuated due to diagnosis terminology over the years. Traumatic brain injuries (TBIs) had been defined as a head injury with "loss of consciousness," however, this has been adapted to include head injuries that do not lose consciousness in recent years. Bryan et al. aimed to find the number of sport and recreational related concussion in a youth population between ages 1 to 18 with the use of 3 major national databases (MarketScan, National Electronic Injury Surveillance System, and National High School Sports Related Injury Surveillance System - Reporting Injury Online). The authors report that between 1.1 and 1.9 million sport or recreational concussions occur yearly. Inpatient hospitalization or emergency department visits accounted for 0.9% to 30.4% of MarketScan for concussion treatment. Based on the NEISS and MarketScan databases, there were 4 to 6 hospitalizations and between 148 to 214 emergency department visits for sports or recreational related concussions per 100,000 children in the United States annually. The RIO database reports 335,000 concussions occur yearly from 9 high school sports that were included within the study, with an estimation of nearly 400,000 concussions in all high school athletes. The authors also report that only 85,000 of these concussions were treated by a certified athletic trainer. They continue to report only between 582,000 and 635,000 of these concussions are treated by health care providers. Between 22.5% and 52.7% of all sport or recreational concussions are not being reported to any health care provider.
CHAPTER II

METHODS

Study Design

The design of this study was retrospective by using emergency department records obtained from the Altru Hospital Emergency room for pediatric injuries sustained in either a recreational or sports setting from January 2011 to June 2015. Each injury encounter was coded using the International Coding for Diseases ICD 9 codes. This study is a continuation of the thesis work completed by Tom Schuch at the University of North Dakota in 2011.

Setting Description

The emergency room records from the years 2011-2015 have been stored and filed at Altru Hospital in Grand Forks, ND. Students were only able to access these records while in the secure computer office space that only Altru employees can grant access to utilize. Students were given security badges by Altru, which gave them access to the computer space at any time. This allowed for complete confidentiality of every medical record and patient within this study. The records were maintained on the OneDrive online program in the Excel application that was approved for use by Altru security personnel. These records were password protected and only shared with the students and Mark Romanick. Results obtained from these records were also maintained on a
separate sheet of the same online Excel file. Once research was completed, the records were permanently deleted from the program.

**Sampling Procedure**

Altru Emergency Department Records were searched for inclusion using E-codes E001.0-010.9 and E826.1-917.5. The E-codes used were adjusted from the original list used in the original Thesis presented by Tom Schuch. The updated list of E-codes was given to Altru Data and a program was then created and used to filter through pertinent Emergency Department records. Once queried, the data was saved in a password protected Excel workbook. This data included Medical record number and date of each incident.

The medical record numbers and dates for each specific case were used to examine patient records in Altru's computer data base. The details of each incident, if the emergency room incident was applicable, were recorded on an online Microsoft Excel spread sheet that only the students and Mark Romanick had access to. The information recorded for each encounter included age, gender, location of injury, type of injury, admitted/not admitted, duration of stay in hospital, name of sport or recreational activity, and severity of the injury. While the month of the injury will be included, it is coded in a way that makes it unrecognizable to any person not involved within the research group. While collecting data, if there was any category of data listed above that was not found, the case was excluded from the study. Patient name, medical record number, and date of injury were not included in the collected spreadsheet data. All searches for data were performed under the supervision of Altru personnel.
Participants

Participants for this student research study included males and females ages 0-19 who had presented to Altru Emergency Department of Grand Forks, ND. Those included in the study had sustained a recreational or sport injury within the timeframe January 1, 2011 to June 30 2015. The sample of Emergency Department cases that was available for inclusion was limited to the period of time before Altru transitioned to the use of ICD 10 codes. Approval from the International Review Board from the University of North Dakota and the Altru Institutional Review Boards was required in order to begin this study.
CHAPTER III

RESULTS

Total Sample

A sample of 419 pediatric patients of the total who presented to the Altru Emergency Department in Grand Forks, ND, between January 2011 and June 2015 were analyzed as to the characteristics of their injury and their personal physical characteristics (age, gender, etc). The selected 419 Emergency Department cases were within the criteria of either a sports- or recreation-related injury.

Injuries by Age

There were a total of 419 pediatric patients in the age range 4 to 19 that were included in this study. There were no injury reports in the age range 0 to 3. The highest percentage of injuries, approximately 37.5%, occurred within the age group of 10-14 years (n=157), followed closely by the age group 15-19 years with an approximate percentage of 34.8% (n=146). Comparisons were made with age ranges as well as individual ages. Coincidentally, the age of 13 years had the highest incidence of injury with 39 total subjects (approximately 9.3%). Refer to Figure 1 for injury distribution by age. Figure 2 demonstrates number of injuries by age range.
Injuries by Gender

This study shows that males had a higher prevalence of injury compared to females. Males accounted for approximately 64.0% of injuries reported (n=268) in this study. Females accounted for approximately 36.0% (n=151). Figure 3 demonstrates injuries by gender.

Figure 3. Injuries by Gender

Injuries by Location

Anatomical locations included within this study were divided into head/neck, face, ankle, hand, leg, torso, arm, and foot. The highest prevalence of injury was to the head/neck with 22.9% total included injuries (n= 96) followed by face with 19.6% (n= 82). The third highest prevalence was forearm (n = 55). Figure 4 demonstrates pediatric injuries based on anatomical location.
Sports Versus Recreation
When categorizing sports versus recreational injuries, a definition was necessary to distinguish between the two. Sports was defined as an organized club or school sanctioned activity. Sports included football, hockey, baseball, softball, basketball, soccer, and board sports. There was also a category of “other sports” that included activities such as wrestling, cheerleading, competitive horse-riding, and bull riding. Recreational activities included any activity that did not fall under the category of an organized sport. Examples within this study include: playground, bicycle, trampoline, ATV, climbing a tree, swimming, and other less prevalent nonorganized activities. The total amount of sports injuries within this study is 207, or approximately 49.4% of total injuries. The total
amount of recreational injuries is 212, or approximately 50.1% of total injuries.

Figure 5 demonstrates these findings in a pie chart format.

Comparisons of age range and sports versus recreation were also made. The age range of 1 to 9 showed a higher prevalence of recreational injuries of approximately 24.6% (n= 103) compared to 9.5% of the age range 15 to 19 (n=40) of all subjects in the study. The number of recreational injuries declined as age increased. Conversely, the age range 15 to 19 had the highest prevalence of sports-related injuries at approximately 25.3% (n= 106) of all included subjects compared to approximately 3.1% subjects in the age range 1 to 9 (n=13). Figure 6 shows this comparison of age range and sports versus recreation.
Injuries by Environment

As previously stated, recreational activities included any activity that was not organized by a club or school. This category of recreational activities had the highest incidence of injury with approximately 26.0% of total subjects (n= 109). The second highest incidence of environment was hockey accounting for 13.1% (n=55) closely followed by basketball with 12.41% (n= 52). Figure 7 shows the distribution of injuries by environment.

Figure 7. Injuries by Environment
Injuries by Year and Month

The present study examined the years 2011-2015. The highest prevalence of injury was in the year 2014 (n= 121) followed by 2013 (n=92). When examining month of injury, the months with the highest incidence of injury were May, June, July approximate percentages of 11.0%, 11.5%, and 10.1% (n= 46, 48, 44 respectively). Figure 8 notes injuries by year and Figure 9 notes injuries by month.

![Figure 8. Injuries by Year](image-url)
Mechanism of Injury

There were 4 categories that injuries were separated into: falls, collision, hit with object, and hit by object. A collision is defined as an encounter with a person. Hit with object is defined as being struck with a ball or other object in motion. Hit by object is defined as encountering a stationary object, such as running into a tree or the boards at a hockey game. Falls accounted for the highest prevalence of mechanism of injury with approximately 52% subjects within this category (n= 214). The second highest prevalence was collisions, with approximately 25% (n=102). Figure 10 demonstrates the distribution of mechanisms of injury.
Mechanism of Injury by Gender

A comparison was made of mechanism of injury by gender. Both females and males were found to have the highest incidence of fall injuries within their gender groups with approximately 64.9% of female injuries being falls (n=98) and approximately 43.3% of male injuries being falls (n=116). Males were found to have a higher incidence of collision injuries compared to females, approximately 13.2% of female injuries being collisions versus 30.6% of male injuries consisting of collisions. Both genders were similar with “hit by object” and “hit with object.” Males were slightly higher in comparison to females for the mechanism of “hit by object” (8.8% versus 7.9%). Females were slightly higher in comparison to
males in the category "hit with object" (13.9% versus 12.7%). Males had slightly higher numbers in relation to total percentage (n=419), possibly due to higher numbers of male subjects within this study. Refer to Figure 11 for a bar graph representation of this data.

![Figure 11. Mechanism of Injury by Gender](image)

**Type of Injury**

Categories used in distinguishing type of injury are as follows: fracture, laceration, dislocation, closed head injury, soft tissue, and sprain/strain. In this study, it was found that fractures constituted approximately 33.4% of total injuries within the study (n= 140). The second highest type of injury was a laceration, accounting for approximately 24.3% of total injuries included (n= 102). Figure 12 shows the distribution of types of injuries prevalent in this study.
Figure 12. Types of Injuries
CHAPTER IV
DISCUSSION

Prevalence of Injury

According to the literature, participation in youth recreation and sports activities has increased throughout the years. With an increase in youth participating in recreational and sports activities, there are many injuries that present to Emergency Departments around the country. We examined the Grand Forks area Emergency Department for sports and recreational injuries among pediatric patients in the Grand Forks, ND area.

Our current study concurs with a study performed by Schwebel and Brezausek that recreational injuries, such as playgrounds, trampolines, etc, were more common in the 0 to 9 year-old populations. Additionally, it was found that as age population grew in age, fewer recreational injuries were found, and more injuries were related to organized sports as noted in our results. While we had similar findings with sports versus recreation related to age range, this study had a low frequency of bicycle injuries. Bicycle injuries accounted for approximately 9.5%, while Schwebel and Brezausek reported steady bicycle injuries throughout all age ranges. We are unable to conclude with our data if bicycle injuries remain steady throughout all ages at least in this population. Due to our geographical location in the upper Midwest, the population of youth in this
area may be more likely to experience hockey-related injuries as compared to other areas in which hockey is not as popular in youth sports.

**Type of Injury**

Fractures were found to be the most common type of injury with this study followed by laceration and closed head injury. This finding is similar to what was reported by Gottschalk and Andrish\(^3\), as they reported fractures being the most prevalent type of injury throughout all age groups. They noted that fractures were more common in the lower extremity and within the younger population. Similar to Gottschalk and Andrish\(^3\), data within this study concluded that fractures are more common within the younger age group of 1 to 9 year olds compared to the age groups 10 to 14 year olds and 15 to 19 year olds (see results).

Overuse injuries are a current topic within the medical world with increasing prevalence of specialization and intensity within athletics.\(^5\) Youth participation in sports has increased steadily throughout the last two decades.\(^3\) It was stated in the literature that many injuries may be influenced or induced by overuse. According to Gottshalk and Stracciolini\(^3,5\), overuse injuries are more common among the adolescent population whereas injuries bony in nature are more common within the age group 5 to 12 years old. With an increase in sports-related injuries in the older age groups (ages 15 to 19) and more recreational injuries combined with more fractures in younger age groups (ages 1-9), it could be hypothesized that there are potentially more overuse injuries in older age groups compared to younger ages groups. We are unable to exactly decipher with our data whether overuse had an impact in each injury or not. It
can be noted that an individual may be more likely to present to the emergency department following a traumatic injury as compared to a progressive overuse injury. It is essential to understand the importance of decreasing risk of overuse injury among youth that includes increasing diversification, ensuring proper fitting equipment, monitoring of training volume or time, and searching for the cause of the injury rather than just treating the injury itself.

Schwebel\textsuperscript{1} notes that team sports including baseball, football, and soccer were found to be the top 4 out of 5 activities that can cause injury in children from age 11 to 18. Within this study, it was found that sport injuries were of the highest prevalence within the age group 15 to 19 years old, as noted within the Prevalence section of the discussion. With the exception of "other recreational injuries," hockey, basketball, and football were the most common mechanism for injuries listed most prevalent to least prevalent. Soccer and board sports such as skateboarding had the lowest prevalence of injury. It is interesting to note that while there are large differences between age groups of sports versus recreation, the overall categorization within the whole study is close to even (51% sports versus 49% recreation).

Gender

Our current study agrees with Nilliah et al\textsuperscript{7} that there were more males that reported to the Altru Emergency Department within the years 2011-2015 due to recreational or sport injuries compared to females. Results in this study concluded that falls accounted for the greatest occurrence of injury for both males and females. Results from this study also state that males have at least 4
times significantly greater frequency of collisions compared to females (n=20 Females, n=82 Males). This finding is consistent with the research done by Fridman et al\(^2\) stating that males are more likely to have an injury that is traumatic in nature, such as a collision. As previously noted in the results section, collisions are the second highest mechanism of injury for males. This finding differs from females, who have a slightly higher incidence of being “hit with object” compared to collision (see Results).

Location of Injury

Literature notes that lower extremity is the most commonly injured body part.\(^4\) This study differs from the literature stating that injuries were more likely to occur in the head/neck followed by face and forearm. Please refer to results and limitations for further discussion of location of injury.

The results of this study show that the most prevalent areas of injury are the head/neck followed by the face, as detailed in the results section. It was then noted in our results as well as multiple studies in literature that fractures were the most common type of injury as previously noted. We thought that these results were interesting due to the fact that there are minimal fractures to the head/neck and face even though these areas of the body are the most prevalent areas of injury. A majority of fractures that presented to the Altru Emergency Department were of the arm, forearm, and leg as opposed to the head/neck and face. We hypothesize that these results exist because all closed head injuries occur in the body area of head/neck and many lacerations and soft tissue injuries are also found in the area of the head/neck. When combining these types of injuries to
body area, they became categorized into a majority of head/neck and face injuries, making these areas the most commonly injured within this study.

Limitations

Time constraint for current study may have influenced results of this study. An estimated 3,500 Emergency Department records were initially compiled by the Altru data department and listed to be potentially included within the study. With this time constraint approximately 1,500 records were examined and determined to be included or not be included within the study. Of these 1,500 records examined, 419 records were included within our sample. However, when examining the 1,500 records, large portions of the records yielded the same location of injury location for consecutive subjects. For example, (chin, chin, chin, ankle, leg, hand, hand, hand, hand, hand, hand, hand, hand, hand, etc.) This grouping of body area throughout the list of subjects may have influenced the incidence of an injury location included within the study or could potentially misrepresent the reality of injury data in this Emergency Department. Completion of all 3,500 records may yield a different or similar result.

Consistency of determination of inclusion of subjects into the study between two researchers can also present as a limitation to this study. While we did have criteria for inclusion, individual differences in interpretation to the event or mechanism of injury could possibly alter data. Another limitation to the study was having two researchers determining mechanism of injury (fall, collision, hit by object, hit with object). These mechanisms of injury are strictly defined; however, consistency may have varied by between two researchers or between
different years in which study was conducted. Another possible limitation would be consistently documenting descriptor terms in the Excel results document for ease of use of the sorting feature on Excel. An example of this would be one researcher documenting a body area as “Left 4th ring finger” versus “L hand.” While each researcher is documenting the same category (location of injury) this makes sorting the data more challenging when compiling results due to this descriptor inconsistency.
CHAPTER V
CONCLUSION

The purpose of this study was to examine pediatric sport and recreation-related injuries presenting to the Emergency Department in Grand Forks, ND in hopes of forming a prevention strategy for minimizing injury in the future. Within this study, the highest prevalence of injury was among youth 10 to 14 years of age with males accounting for 64% of injuries within this study. The most commonly injured area was the head/neck and face followed by the forearm. The distribution of sports and recreation-related injuries was close to equal (49.5% sports injuries, 50.1% recreational injuries). The most common type of injury was a fracture and the most common mechanism of injury was falls.

As noted above in the literature review and discussion, our study agrees with results found by other researchers, such as differences between gender, mechanism, and type of injury. There are also differences between results found in this study and throughout literature. For example, Gottschalk et al., found the highest prevalence of injury was to the lower extremity. However, within the current study, head/neck and face injuries were found to be the most prevalent. As noted previously within the limitations, this may be due to many factors.
Further research in this geographical location (Grand Forks, ND) will need to be performed to be able to explore trends within this research topic.
REFERENCES


