A REGIONAL ASSESSMENT OF CHEERLEADING INJURY FREQUENCY, DISTRIBUTION AND ASSOCIATED FACTORS

By

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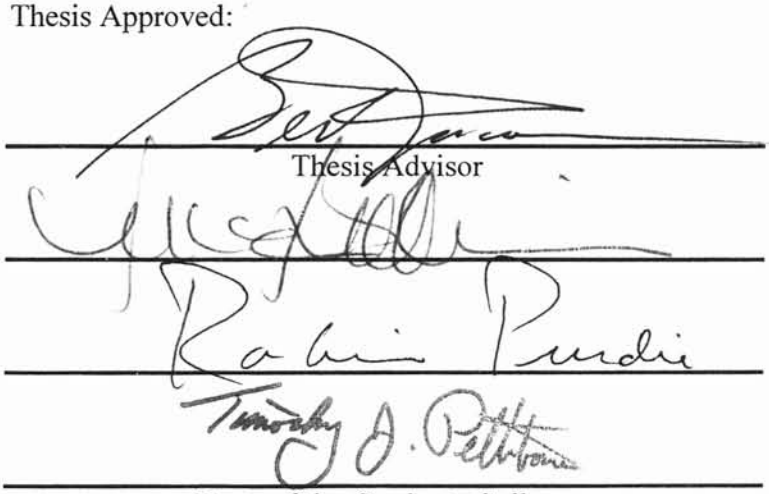

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CHAPTER I

INTRODUCTION

Cheerleading in the United States has evolved over the years from a simple chanting, arm-waving activity into a serious, competitive sport. The basic roots of cheerleading can be traced back to ancient history. Spectators cheered for runners in races held during the first ever Olympic games in ancient Greece (10). Cheerleading began to take the form we recognize today in the late 1800's. Thomas Peebler led a group of 6 men in a yell at a Princeton football game in the late 1800's, soon to follow was the first pep club at Princeton in 1865 (10, 30). In 1884 Mr. Peebler took his yell to the University of Minnesota (MU) campus (30). In 1898 a cheerleader and first year medical student at MU named Johnny Campbell jumped out in front of the crowd and led a cheer, and cheerleading as we know it today began to take shape (10, 30). Cheerleading progressed and grew throughout the 1900's with innovations and improvements coming regularly. Women became active in cheerleading in the 1920's and the MU squad began to incorporate gymnastics and tumbling into their routines (30). In the 1940's, when men went off to fight in World War II, cheerleading became a female dominated activity, and has remained upwards of 90% female ever since (10, 30). In the late 1940's Lawrence "Hurkie" Hurkimer organized the first cheerleading camps and started the National Cheerleading Association (NCA). He also invented the very popular cheerleader jump that bears his name, "the hurkie" (10, 30). As cheerleading grew, the pompon was introduced in its current version in the 1960's by Fred Gastoff and the Baltimore Colts organized the first professional cheerleading squad (30). In 1976 the Dallas Cowboys Cheerleaders performed during Super Bowl X and popularized the "dancing

cheerleaders", and in the 1980's universal standards were set and safety guidelines outlawed many dangerous tumbles and pyramids (30). Some famous cheerleaders include: Kirk Douglas, Teri Hatcher, Samuel L. Jackson, Dwight D. Eisenhower, Reba McEntire, Cybil Sheppard, Jimmy Stewart, Meryl Streep, and Raquel Welch (30). Modern cheerleading had begun to boom and blossom into the athletic display it now embodies. Today's cheerleaders perform choreographed routines featuring intricate stunts combined with flying and catching. They build complex pyramids and use advanced gymnastic tumbling maneuvers during performances. Stunting involves more than one person (partners or groups) and each is involved in the maneuver by either holding another cheerleader off the ground, or providing support for those performing the lift. Examples of stunting include extensions, liberties, and heel stretches. Flying and catching involves a base-which remains in contact with the ground at all times, and a flyer who is thrown off the ground to perform the maneuver and then caught by the bases. Gymnastics tumbling maneuvers include back flips, and round off back handsprings. Collegiate cheerleaders utilize partner stunting and more advanced tumbling, which further increases the incidence of injury. The majority of the participants in cheerleading are teenage girls. These girls are taught how to flip, tumble, throw and catch each other, all while performing short, quick dance routines to fast-paced music on unsafe surfaces, or under poor conditions. These athletes also perform without pads, and in many cases, without proper safety devices. The increase in difficulty of cheerleading routines could lead to an increase in cheerleading injuries.

The most common type of injury is a ligament sprain and the most common injury site is the ankle (22). Extensive studies by Mueller (15) have shown injury rates of 0.31

injuries per 100 participants among the 53, 738 cheerleaders who participated in the Universal Cheerleading Association's summer camps. In a separate study conducted over an entire school year (15), Mueller found injury rates to be 13.3 per 100 collegiate cheerleaders, and 3.3 per 100 high school cheerleaders. Axe and associates (4, 15) revealed that cheerleaders miss more days of practice and competition on average (28.8 days) per injury than any other sport.

Background

While cheerleading injuries have only recently been brought to the forefront, other sports have a long record of injuries dating back 20 years or more. Sports such as football, basketball and hockey have extensive, detailed histories and continue to get the majority of attention when it comes to reporting sports injuries. One such database is the National Center for Catastrophic Sports Injury Research maintained by the National Collegiate Athletic Association (NCAA) in association with the University of North Carolina at Chapel Hill. The NCAA also controls the Injury Surveillance System (ISS) which tracks injuries in selected collegiate sports. The respective World Wide Web addresses for these databases are as follows: www.unc.edu/depts/nccsi/ for the NCCSI, and www.ncaa.org/sports_sciences/injury_surveillance/injury_summary.html for the ISS. The ISS database will be discussed in a few paragraphs. Numerous studies have been performed outlining the injuries, and circumstances surrounding the injuries, of the above mentioned sports, as well as many others to be mentioned later.

Injury records are maintained differently on both the national and local level. Most sports have their own injury report system, and most local schools set their own protocol on how to deal with athletic injuries. At the high school level, the athletic

trainer records most injuries as they encounter and treat them. Hospital records can be used to check for injuries, but records do not account for unreported injuries or minor scrapes and contusions.

The National Athletic Trainers Association (NATA), in cooperation with athletic trainers across the country, participated in an injury surveillance system used to record injuries to high school athletes over a 3-year span. The World Wide Web address for this study is www.nata.org/publications/press_releases/resultsof3yearstudy.html. Participants in the NATA injury study were high school athletes on the varsity sports roster of the following sports: football, wrestling, baseball, field hockey, softball, girls' volleyball, boys' and girls' basketball, or boys' and girls' soccer (26, 27).

A total of 246 athletic trainers were selected to participate in the study because they (a) worked directly with high school sports programs on a daily basis, (b) fell within a geographic distribution among the 50 states, and (c) fit a broad representation from different size schools (26, 27).

For this study only reportable injuries were counted. A reportable injury was defined as:

a) Any injury that causes cessation of participation in the current game or practice and prevents the player's return to that session.

b) Any injury that causes cessation of a player's customary participation on the day following the day of onset.

c) Any fracture that occurs, even though the athlete does not miss any regularly scheduled session.

d) Any dental injury, including fillings, luxations, and fractures.

e) Any mild brain injury that requires cessation of a player's participation for observation before returning, either in the current session, or the next session (27).

The NCAA uses a different system for recording its injury rates and information but with a similar arrangement. The NCAA ISS was developed in 1982 to provide current and reliable data on injury trends in intercollegiate athletics (24). The ISS uses yearly data collected from the colleges that participated in each sport in the system. The data is then reviewed by the NCAA Committee on Competitive Safeguards and Medical Aspects of Sports to spot trends and reduce injury rates through suggested changes in rules, protective equipment or coaching techniques.

Participation in the ISS is voluntary and limited to the NCAA member institutions. The participants are selected from the population of schools sponsoring a given sport. Selections are random within the constraints of having a minimum 10 percent representation of each NCAA division (I, II and III) and region (East, South, Midwest, West). The system does not identify every injury that occurs at NCAA institutions in a particular sport. Rather, by using the above criteria, it collects a sampling that is representative of a national cross section of NCAA institutions (24).

To fully understand the ISS, a few parts must be defined. The ISS uses only reportable injuries. A reportable injury is defined as one that:

1. Occurs as a result of participation in an organized intercollegiate practice or game;
2. Requires medical attention by a team athletic trainer or physician, and
3. Results in restriction of the student-athlete's participation or performance for one or more days beyond the day of injury (24).

The ISS uses athlete exposures (A-E) as its unit of risk. An A-E is defined as one athlete participating in one practice or contest where he or she is exposed to the possibility of athletics injury (24). The majority of previous studies in the field of cheerleading injuries recorded injury rates based on 1000 A-E. Standardized values such as these make comparisons between studies easier to understand and explain.

An injury rate is the ratio of the number of injuries in a particular category to the number of A-E in that category. In the ISS, this value is expressed as injuries per 1,000 A-E (24). For example, if there are 10 fractures found in a particular sport, and the total number of exposures to injury for this particular sport is 10,000, this sport would have an injury rate of 1 injury per 1000 A-E for fractures.

Currently the ISS monitors16 sports: spring football, football, men's gymnastics, women's gymnastics, wrestling, men's soccer, women's soccer, men's basketball, women's basketball, women's volleyball, field hockey, men's lacrosse, women's lacrosse, women's softball, ice hockey, and baseball (24).

As mentioned earlier, several articles and studies have been written about these sports, their injury modes and rates. A sampling of these studies has been used to gain a perspective on how cheerleading injury modes and rates compare to the sports on the ISS and to reported high school injuries. For the purposes of comparison, all injury rates are reported per 1000 A-E unless otherwise stated.

Concerning injuries, football is widely considered the most dangerous sport. High school football has an injury rate of around 8.1 total injuries with smaller rates for more specific injuries such as concussions which are 0.59 (26, 27). According to a separate study by Powell and Barber (27), most high school football injuries occur during

practice. The most frequent injury site is the lower extremity with the most frequent type of injury being a ligament sprain.

College football is divided into different seasons for injury reporting, spring and regular season. Spring football has a total injury rate of 9.8 with a practice rate of 9.4 and a game rate of 21.4 (24). According to the ISS, spring football practice constitutes 92% of total injuries, while spring football games make up the final 8% (24). Regular season football has a total injury rate of 6.5 with a practice rate of 4.2 and a game rate of 36.1 (24). The ISS reports a practice injury percentage of 58%, with a game percentage of 42% (24).

Gymnastics is divided into men's and women's within the high school and college divisions. Injury information is limited at the high school level. Like cheerleading, gymnastics injuries are not as well documented at this stage. College gymnastics, however, has been the subject of more studies than high school gymnastics. Injury sites, types, and occurrences are fairly similar for both men's and women's gymnastics. The most common injury site for both sports is the lower extremity, with sprains/strains being the most common injury type (19). Both men's and women's studies have shown the majority of injuries (about 80%) occur during practice, while the remaining 20% occur during competitions (24). Injury rates differ slightly between genders, with male total injuries at 5.5 and females at 9.3 (24). This trend continues for both practice and competition rates with male practice injury rates at 4.7 and competition rates at 15.7 (24). Females practice injury rates are 8.1 with competition rates of 20.8 (24).

High school and collegiate wrestling have fairly similar injury numbers in some categories and differ in others. Both high school and college wrestlers suffer most of

their injuries during practice (67%) with the remaining third occurring in matches or meets (24, 27). Wrestling also differs from other sports in that the majority of injuries for the high school level are to the shoulder and arm area as opposed to the lower extremity (27). Injury rates for the high school level are 5.6 for total injuries and 0.25 for concussions (26, 27). As has been the case, sprains constitute the highest percentage (28.6%) of total injuries (27). For collegiate wrestlers, total injury rates are 9.6 with practice rates of 7.2 and match rates of 30.6 (17, 24). Knee injuries and sprains return as the most common sites and types of injuries respectively (17). These findings continue the injury trend seen in all the sports thus far.

Men's and women's soccer and basketball have been the subject of extensive injury studies. While a majority of the focus for these sports has been on comparing knee injury rates, total injuries are more relevant. Men's high school soccer total injury rates are 4.6, and 20.23/1000 player hours (8, 27). The ankle is still considered the most often injured area, while sprains remain the most common injury type (8, 18, 25, 27). Game injury percentages vary between 55-60% while practice ranges vary between 40-45% depending on which study is used (18, 25, 27).

Collegiate injury rates for the men's soccer programs are fairly similar to each other throughout most studies. Total injury rates fall around 8.1 with practice rates of 4.8 and game rates of 20.2 (24). The percentages of injury occurrences are similar to those from high school in that 44-47% of the injuries occur in practice while 53-56% occur in games (18, 24). This is a reversal from the sports mentioned earlier in that the majority of injuries occur during games, not practices.

Women's high school soccer injury rates are 5.3 and 20.57/1000 player hours (8, 27). Ankle/foot injuries, and ligament sprains remain the most common injury site and type, with game injury percentages coming in the range of 55-60% and practice injury percentages at 40-45% (8, 18, 25, 27).

Women's soccer programs at the collegiate level have a total injury rate of 8.6 with practice rates of 5.8 and game rates of 17.3 (24). Percentages of injuries in practices versus games are almost identical with practices at 52% and games at 48% (18, 24). This continues the trend seen in men's collegiate soccer, but goes against the trend seen in the other sports mentioned earlier.

Men's high school basketball has a total injury rate of 4.8 and 28.3/100 players (25, 27). Ankle/foot injuries and ligament sprains each make up the highest percentage of injuries in their respective categories (18, 25, 27). Practices make up the majority of injury occurrences with 58%, while games have the remaining 42% (25, 27).

Men's collegiate basketball has a total injury rate 5.7 with practice rates of 4.6 and game rates of 10.1 (24). In keeping with the injury trends we have seen in most studies thus far, practice injury percentages far outweigh game injury percentages 64% - 36% (24).

Women's high school basketball has a total injury rate of 4.4 and 28.7/100 players (25, 27). Again, ankle injuries and sprains are the top percentages in the injury site and type categories respectively (18, 25, 27). Practice injuries again outweighed game injuries 53.2% - 46.8% (25, 27).

Women's collegiate basketball has a total injury rate of 5.6 with practice rates of 4.4 and game rates of 9.4 (24). Practice injury percentages of 62% again are quite a bit higher than the game percentages of 38% (24).

Women's high school volleyball is a relatively low risk sport. Total injury rates were 1.7, 14.9/100 players and only 0.02 for concussions (26, 27). Like most of the sports mentioned, the most common injury site was the ankle, and the most common type was the ligament sprain (18, 27). Practice sessions constituted just over 2/3 of the injuries (68.8%) as compared with games (31.2%) (27)

Women's collegiate volleyball was a little more high risk than high school. Total injury rates of 4.8, practice rates of 4.6 and game rates of 5.2 support these findings (24). But, as in high school, the majority of the injuries (65%) occurred in practice and 35% occurred in games (24).

High school field hockey has total injury rates of 3.7 and 15.8/100 players, with concussion rates of only 0.09 (26, 27). Ankle injuries and ligament sprains/general trauma (bruises, abrasions) are at the top of the list percentage wise, while practices again far outdistance games in injury percentages 63.5% - 36.5% (22, 27).

College field hockey has a total injury rate of 5.3 with practice rates of 4.1 and game rates of 9.4 (24). The practice to game injury percentage is a little lower than that of the high school group, but at 59% - 41%, there is still a noticeable difference (24).

Men's and women's lacrosse is not a major sport in most high schools. Injury data for the high school level is limited. However, on the collegiate level, men's lacrosse has a total injury rate of 5.7 with a practice rate of 3.8 and a game rate of 15.7 (24). Women's lacrosse has a total injury rate of 4.2 with a practice rate of 3.5 and a game rate

of 7.2 (24). The injury percentages for the men are 56% for practice and 44% for games (24). The women differ quite a bit in this category with 68% injuries in practice and 32% in games (24).

Women's high school softball has a total injury rate of 3.5 and an injury rate of 16.7/100 players. The concussion injury rate was 0.10 (25, 26, 27). Practice and game injury rates are similar to the other studies with 56% of injuries coming in practice and 44% in games (25, 27). Softball is different in the site and type of injury. The most common injury site is the forearm/wrist/hand, and the most common type of injury is a strain (25, 27)

Women's collegiate softball has a total injury rate of 3.9 with practice rates of 3.3 and game rates of 4.9 (24). Injury percentages are 53% for practices and 47% for games (24).

Like lacrosse, very few studies are available on high school ice hockey injuries. Most available data are specific case studies and not relevant to this study. More data is available for collegiate hockey. Men's hockey has a collegiate injury rate total of 5.7 with a practice total of 2.3 and a game total of 16.9 (24). In a departure from most of the other sports, except soccer, hockey has a practice injury percentage of 32% and a game percentage of 68% (24). Knee injuries and contusions are considered the most common sites and types of injuries (18).

High school baseball has total injury rates of 2.8 and 13.2/100 players. The injury rate for concussions was 0.05 (25, 26, 27). Like softball, the most common injury site was the forearm/wrist/hand and the most common type of injury was a strain (25, 27).

Practice and game injury percentages were nearly identical with practices comprising 49.4% of injuries and games 50.6% (25, 27).

Collegiate baseball has a total injury rate of 3.4, the lowest of the ISS sports. Practice rates were 2.2 and game rates were 6.2 (24). Unlike high school baseball, collegiate baseball has a more significant difference between practice and game injury percentages. The practice percentage was 45% while the game percentage was 55% (24).

This has been a basic overview of the major sports tracked by both the NCAA and high school trainers and administrators. Table 1 compares the injury rates, injury sites and injury modes of these sports with the data found in previous studies (4, 15).

SPORT	INJURY RATES / 1000 A-E	INJURY RATES / 100 PLAYERS	MOST COMMON INJURY SITE	MOST COMMON INJURY MODE
CHEERLEADING (SUMMER CAMP)	0.26	0.31	ANKLE	SPRAIN
CHEERLEADING (COLLEGE)	0.67	13.3	ANKLE	SPRAIN
CHEERLEADING (HIGH SCHOOL)	0.17	3.3	ANKLE	SPRAIN
SPRING FOOTBALL (COLLEGE)	9.8	NA	NA	NA
REGULAR SEASON FOOTBALL (COLLEGE)	6.5	NA	NA	NA
FOOTBALL (HIGH SCHOOL)	8.1	NA	LOWER EXTR	SPRAIN
MEN'S GYMNASTICS (COLLEGE)	5.5	NA	LOWER EXTR	SPRAIN
WOMEN'S GYMNASICS (COLLEGE)	9.3	NA	LOWER EXTR	SPRAIN
WRESTLING (HIGH SCHOOL)	5.6	NA	SHOULDER/ARM	SPRAIN
WRESTLING (COLLEGE)	9.6	NA	KNEE	SPRAIN
MEN'S SOCCER (HIGH SCHOOL)	4.6	NA	ANKLE	SPRAIN
WOMEN'S SOCCER (HIGH SCHOOL)	5.3	NA	ANKLE/FOOT	SPRAIN
MEN'S SOCCER (COLLEGE)	8.1	NA	NA	NA
WOMEN'S SOCCER (COLLEGE)	8.6	NA	NA	NA
MEN'S BASKETBALL (HIGH SCHOOL)	4.8	28.3	ANKLE/FOOT	SPRAIN
WOMEN'S BASKETBALL (HIGH SCHOOL)	4.4	28.7	ANKLE	SPRAIN

MEN'S BASKETBALL (COLLEGE)	5.7	NA	NA	NA
WOMEN'S BASKETBALL (COLLEGE)	5.6	NA	NA	NA
VOLLEYBALL (HIGH SCHOOL)	1.7	14.9	ANKLE	SPRAIN
VOLLEYBALL (COLLEGE)	4.8	NA	NA	NA
FIELD HOCKEY (HIGH SCHOOL)	3.7	15.8	ANKLE	SPRAIN
FIELD HOCKEY (COLLEGE)	5.3	NA	NA	NA
MEN'S LACROSSE (COLLEGE)	5.7	NA	NA	NA
WOMEN'S LACROSSE (COLLEGE)	4.2	NA	NA	NA
SOFTBALL (HIGH SCHOOL)	3.5	16.7	FOREARM/HAND	STRAIN
SOFTBALL (COLLEGE)	3.9	NA	NA	NA
ICE HOCKEY (COLLEGE)	5.7	NA	KNEE	BRUISE
BASEBALL (HIGH SCHOOL)	2.8	13.2	FOREARM/HAND	STRAIN
BASEBALL (COLLEGE)	3.4	NA	NA	NA

Injury data from these sports will be compared with historical data on cheerleading injuries to find any similarities or differences in injury rates. These findings will then be compared to the data from this current study to find information which could warrant further research concerning cheerleading injuries. Data will be statistically run using the Statistical Packages for Social Sciences (SPSS). Data sets will be analyzed using descriptive statistics, Analysis of Variance (ANOVA) with a Newman-Keuls Post-hoc test, and Spearman Rho Correlations.

Problem

The primary problem when dealing with research of this type is the lack of available literature. With the vast majority of studies focusing on the "major" high school and college sports, cheerleading has been largely ignored. Without the respect other school sports have, cheerleading will continue to be somewhat overlooked in

regards to injury rates. Studies are beginning to become available, but the relatively small amounts of information that currently exist makes comparisons between sports difficult.

Purpose

The purpose of this study was to document the frequency, severity and sites of the most common cheerleading injuries and the factors that most contribute to them. These findings may help to further broaden the understanding of the risk involved in cheerleading and to possibly gain more attention for injury prevention guidelines.

Assumptions

It was assumed that:

1. the sample population is representative of the high school cheerleader of the Midwestern United States.
2. the survey was completed honestly.
3. all questions on the survey were worded to be congruent with the education level of the intended participants.

Limitations

The limitations of this study were:

1. the cheerleader's understanding of the directions and questions on the survey.
2. the cooperation of the schools chosen to participate in the survey.
3. the accuracy of the information provided by the participants.

Delimitations

The delimitations of this study were:

1. the limited number of questions on the survey.

2. the number of surveys sent to each school.
3. the number of schools selected.
4. the regional distribution of selected schools.
5. the size of each selected school.

Hypotheses

HYPOTHESIS 1: There will be no difference among states in the number of years subjects have participated in cheerleading.

HYPOTHESIS 2: There will be no difference among states in the number of yearly injuries experienced by cheerleaders.

HYPOTHESIS 3: There will be no difference among states in the number of annual cheerleading practice days.

HYPOTHESIS 4: There will be no difference among states in the length of practice periods.

HYPOTHESIS 5: There will be no difference among states in the delivery of nutrition information to cheerleading participants.

HYPOTHESIS 6: There will be no difference among states in the use of endurance training in cheerleading practices.

HYPOTHESIS 7: There will be no difference among states in the use of weight training in cheerleading practices.

HYPOTHESIS 8: There will be no significant relationship between the number of injuries per year and the use of weight training in cheerleading practices.

HYPOTHESIS 9: There will be no significant relationship between the number of participation days missed from cheerleading due to injury and the number of cheerleading practice days per year.

HYPOTHESIS 10: There will be no significant relationship between the number of days missed from cheerleading due to injury and the length of cheerleading practices.

HYPOTHESIS 11: There will be no significant relationship between the number of cheerleading practices and the number of cheerleading injuries treated by a physician.

HYPOTHESIS 12: There will be no significant relationship between the number of cheerleading practice days per year and the number of cheerleading injuries that required surgery.

HYPOTHESIS 13: There will be no significant relationship between the number of years of participation in cheerleading and the participant ever being injured while cheerleading.

HYPOTHESIS 14: There will be no significant relationship between the number of years of participation in cheerleading and the number of cheerleading injuries sustained during the previous year.

HYPOTHESIS 15: There will be no significant relationship between the number of years of participation in cheerleading and the number of lifetime injuries suffered due to cheerleading.

HYPOTHESIS 16: There will be no significant relationship between the number of cheerleading practices per year and the total number of injuries per year suffered from participating in cheerleading.

HYPOTHESIS 17: There will be no significant relationship between the lengths of cheerleading practices and the total number of injuries per year suffered from participating in cheerleading.

HYPOTHESIS 18: There will be no significant relationship between the total number of injuries suffered from participating in cheerleading and the use of weight training in practices.

HYPOTHESIS 19: There will be no significant relationship between the total number of injuries suffered from participating in cheerleading and the use of endurance training in practices.

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter will outline literature related to the background knowledge of cheerleader specific injuries as well as other pertinent and relevant injury information. Also covered in this chapter is literature relating to the inherent and gender specific risks involved in this sport and the safety guidelines that are already in place to protect these athletes.

Injury Knowledge

Cheerleading injuries have increased during the last several years. Increased participation is thought to be one reason (6, 7, 23). Increased difficulty of stunts and routines is another reason (6, 7, 23). It is this last reason that has prompted studies into safety guidelines and identifying causative factors for the increase in injuries. As stated earlier, information regarding specific cheerleading injuries is fairly limited. What is known are the factors and mechanisms behind a few frequent cheerleading injuries and also injuries in other related sports which can help shed light on possible causes of cheerleading injuries. Injuries include slight sprains, muscle and ligament damage, paralysis and death. While the latter is extremely rare, it can happen. One study showed no deaths resulting from cheerleading from 1980-1985, while another discussed several cases of paralysis and death due to cheerleading during a 17 year span from 1982-1999 (7, 23). The first study also noted that half of all cheerleading injuries were strains and sprains (7). Like most other sports and as mentioned previously, most injuries occur in

the lower extremities, specifically the ankle, with sprains being the most common (7, 13, 15). Of course these are not the only injuries involved in this sport.

Cheerleading also has sport and type specific injuries. Some of these include wrist injuries, voice injuries, dysphonia (altered or labored speech, hoarseness), nerve damage in hands and wrists, and knee injuries (9, 11, 12, 15, 28, 29).

Many known and speculated causes exist for these injuries and the rates at which they occur. Some attribute injuries to lack of experience, training, and good coaching in proper techniques and safety (6, 12, 15, 23). Others say that an increase in skill level and experience causes more injuries due to the increased difficulty of routines and greater practice lengths, which increase exposure to injury (13, 19, 28). A general lack of adequate facilities and safety devices is also a main concern in the area of injuries.

While some of these possible causes could be attributed to the comparatively miniscule budgets provided cheerleading programs from their institutions, blame can also be dispensed upon a lack of education in the needs of cheerleading squads. One study polled several Division I schools fielding at least six varsity teams and found their average cheerleading budget was only $4900.00, of which about 20% was supplemented with outside fundraising (13). Along with a smaller budget comes a lack of compensation for coaches and sponsors of cheerleading teams (13). This could attribute to the lack of qualified coaches and proper training mentioned earlier. With no real incentive to coach cheerleading, quality coaches might look elsewhere for jobs in other sports. Coaches with experience are more able to aptly teach proper spotting, tumbling, or stunting techniques and may also be trained in safety and first-aid techniques as well.

Without proper experience or knowledge the risk of injury could be increased which could raise the occurrences of severe accidents.

With this in mind, some injuries cannot be prevented and will occur even with proper safety and spotting techniques in place. When these injuries do occur, cheerleading has the highest incidence of prolonged absence from performing. Studies have estimated that cheerleaders average just less than 29 days of their athletic season missed due to injury (4, 15). This can be due to several factors. One reason is that cheerleading injuries can be extremely severe. One small group of major injuries involving extended time loss can greatly affect the average numbers for time missed. Also contributing to extended time missed is the fact that a cheerleader must have full use of their entire body to perform tasks involved in their routines (4, 15). Unlike other sports where a non-dominant arm or leg can be compensated for, cheerleading requires all limbs to be completely healed in order to safely perform and execute the necessary routines (15). The severity of the injury could result in substantial time losses from their respective sports.

Another possible reason for increased injuries might be the year-round season cheerleaders face. While other sports have an "off season" which allows for recuperation from injuries suffered over the course of a season, cheerleaders move from one sport to the next. For example, when football season ends, cheerleaders move straight to basketball, to spring sports, tryouts, competitions, summer camps, then back to football without a break to recover from injuries. This leads to overuse injuries such as stress fractures, plantar fascitis, patellofemoral joint injuries, tendonitis, and iliotibial band inflammation (16).

Considering the injuries cheerleaders suffer, and the fact that some occur even with safety guidelines in place, certain factors should be addressed. Other factors include the inherent risk of cheerleading itself, and the gender differences between males and females with regards to susceptibility to injury.

Inherent Risks of Cheerleading

In the case Aaris vs. Las Virgenes Unified School District, the courts ruled that modern cheerleading carries with it an inherent risk of injury and cheerleaders accept these risks when they begin participating in the sport (5). If cheerleaders are to be viewed as athletes, then they must adhere to the same assumption of risk athletes from other sports must abide by (5). Aside from the injuries such as ankle sprains and muscle pulls that have been discussed so far, cheerleading has a number of injury types more closely associated with the sport itself. Injuries such as hand and wrist problems, voice damage, gymnastics and dance injuries, back and spinal cord injuries, knee injuries, acute and chronic dysphonia, and eating disorders are a few such examples (9, 11, 12, 19, 28, 29). These injuries are inherent and assumed risks cheerleaders would face by virtue of participation. Additionally equipment and techniques used in cheerleading can cause injury, which would make use of these a known, inherent risk. Equipment and techniques such as mini-trampolines, pyramids, tumbling, and stunting would qualify as examples of this group (6, 7, 12, 14, 21). For example, vigorous hand clapping and blunt trauma to the palm (from tumbling or catching) may cause damage to the Palmar Digital Nerves, which are affected during finger extension (28). Also, avulsion of the ischial tuberosity due to pulling of the hamstrings and adductor thigh muscles, and pressure on

the palmar branch of the ulnar nerve from holding another cheerleader above the head using the palm of the hand are other more specific examples of inherent risks (11, 29).

Eating disorders, which were mentioned earlier, could be considered an indirect risk of cheerleading. Cheerleaders are highly encouraged and in some cases required to keep a weight and body image somewhat smaller than the average adolescent or young adult (12). The pressures to maintain this weight and body image can lead to an eating disorder. Studies have shown eating disorders to be present and, in some cases, significant in adolescent females of the general population. The pressures of cheerleading only increase the chances of a girl developing an eating disorder to meet the demands placed upon her (12). Some signs and symptoms of eating disorders are preoccupation with food and or weight, self-report of purging after eating, abnormal eating behavior, malnutrition, and changing physical appearance. Early detection of these and other signs is vital to minimize the effects of the disorder (12). Besides inherent risk, gender also plays an important role in injuries.

Gender Differences in Injury Rates

Many factors are involved in athletic injuries. The difference between genders is one of these factors. Besides the obvious anatomical differences, the sports themselves differ in both style and strategy. The style of play in most male sports is generally categorized as being faster and more physical than that of the female sports. This would lead one to think that the injury rates for males would be higher than those for females in comparable sports, and in some types and sites of injuries they are. Where female injuries begin to rise is when other gender differences are discussed. For the purpose of this paper, these differences will be addressed. Both extrinsic and intrinsic factors play a

role in the increased injuries among female athletes. Extrinsic factors include: coaching differences, conditioning, malnutrition, body movement, strength, skill, playing surface, and heat (3, 7, 8, 16, 19, 25). The way these factors affect injuries varies.

Coaching differences can impart a lack of knowledge which might result in less skill and conditioning than other better coached athletes. Poor conditioning and decreased skill can contribute to increased injuries (3, 6, 7, 16, 19).

Malnutrition can cause many disruptions in the body including injuries. Not receiving the proper energy levels in food can affect all facets of sport and adversely affect the body's ability to deal with the stresses from sports. Malnutrition can lead to poor conditioning, which leads to increased injuries, especially overuse injuries such as stress fractures (15, 16). With these problems the body is often unable to heal itself and subsequently is more susceptible to injury.

The difference in strength and musculature between males and females is well documented. The comparatively smaller muscle mass in females allows for more injuries due to the decreased support and stability provided by the muscles (3, 16, 25). For example, the vastus medialis obliquus is a major stabilizer for lateral patellar movement. If this muscle is not conditioned, the chances for injury increase (16).

Heat, while an extrinsic factor, is better defined by the intrinsic processes that make it a problem for female athletes. These processes will be subsequently discussed.

Intrinsic factors affecting injury include: ligament laxity, body alignment, femoral notch differences, and endogenous hormones (3, 8, 16, 25). Ligament laxity, body alignment and femoral notch differences can be combined to better explain the mode of injury. Knee injuries are the most common and reported differences between

male and female athletes. The alignment of the female lower body differs greatly from the male. The female body is wider in the hips, which causes the Q angle (the angle of insertion of the femur to the knee joint) to be increased thus putting more lateral force on the knee making it more susceptible to injury (3, 16). Besides the increased forces applied from the above cited example, the ligaments themselves have more laxity than those found in males (3, 16). Combined with decreased musculature, this laxity leaves the knee more vulnerable and unstable due to the lack of supportive tissue around it (3, 16). Lastly, the smaller femoral notch in females also decreases the size of the anterior cruciate ligament (ACL) and further decreases structural support for the knee (3, 16, 25). Not surprisingly, females have a much higher rate of knee injuries than males. Patello-Femoral injuries such as "jumper's knee" and patellar tracking problems are some examples of injuries that are more prevalent in females than males (16). Non-contact injuries are also higher due to the inherent instability of the female knee. Specifically, injury rates for the ACL in female athletes are anywhere from 2-4 times higher than their male counterparts in comparable sports such as soccer and basketball (3, 25).

Hormones can affect all parts of the female body and any imbalance or change to the homeostatic state of the body can affect performance and injury. Heat injuries, like those mentioned earlier, are affected by hormones and possibly the menstrual cycle of each female athlete (8, 16). Females are more susceptible to heat illness than males and one study states that hormones could be a major factor in this problem (8). Menstrual cycle irregularities affect how the body reacts to stress. Amenorrhea, irregular menstrual cycles, can affect bone density and other systems and leave the body weakened and more susceptible to stress injuries due to an impaired ability to heal itself (16). While not

every injury can be prevented, several guidelines have been set up to make cheerleading a safer activity for all participants.

Safety Guidelines for Cheerleading

Guidelines and regulations have been set up by several organizations and conferences to better protect individuals who choose to participate in cheerleading. Appendix A (1, 2) outlines several guidelines set forth a noted cheerleading organization.

Summary

While detailed injury data on cheerleading is not substantial, information is available and lays a firm groundwork for future studies. It appears ankle and knee injuries are the most common, while sprains and strains are the most common modes of injury (7, 13, 15). The range of injuries suffered by cheerleaders includes sprains, knee injuries, fractures, spinal injuries and death (4, 7, 9, 11-13, 15 16, 19, 20, 23, 28, 29). Many reasons such as inadequate education, lack of funding, poor supervision, decreased skill and technique, unsatisfactory facilities and equipment, and poor health screening have been theorized as explanations for cheerleading injuries. However, most literature centers on the inherent risks involved in participating in cheerleading and the gender differences that make female athletes more susceptible to injury than males (3, 5, 6, 12-14, 23).

Courts have stated that modern cheerleading carries an "inherent risk" of injury and that participants voluntarily assume that risk (5). Inherent risks involved in cheering include hoarseness, nerve damage in the extremities, eating disorders, permanent spinal injury and death (3, 7, 9, 11-13, 15, 16, 19, 21, 23, 28, 29). Participants should be aware of potential risks and ready to accept the consequences of participation.

Female athletics are often different from that of the males through style of play, and in some cases rules, which affect the injury rates of participants. Intrinsic differences truly differentiate the injury susceptibility of males and females in sport. Anatomical differences in ligament laxity, body shape and bone structures combine to raise the probability of injury in female athletes (3, 16, 25). Another important component includes hormonal differences and the affect on body systems, bone density, muscle mass and support structures of the body (3, 8, 16, 25). Disruption of the body's homeostasis decreases the ability to heal itself and increases the chance of injuries such as stress fractures, heat illness and knee damage (3, 8, 15, 16).

Guidelines are in place to help protect cheerleaders as they participate in both practices and performances. Several sources and organizations have rules and guidelines available for use. Overall governing bodies such as the American Association of Cheerleading Coaches and Advisors (AACCA), National Cheerleading Association (NCA), Universal Cheerleaders Association (UCA), and National Collegiate Athletic Association (NCAA) have set up rules which transcend all levels of cheerleading, and must be followed by any participant who wishes to compete in events sanctioned by these groups. In addition, levels such as school conferences, school districts, and individual schools may also have guidelines in place more specific to their locations, resources and participation (6, 13-15, 21, 23). Appendix A lists several rules and guidelines created for the safety of cheerleaders.

CHAPTER III

METHODS AND MATERIALS

Subjects

The participant group for this study was comprised of 407 cheerleaders from the largest high school classes in the states of Oklahoma and Kansas, and a random selection of 50 high schools from Texas. Participants were asked to complete and return a survey sent to the Cheerleading Sponsor of each school. At the time the study was initiated, both Kansas and Oklahoma had 32 schools in their largest class. Texas had 232 schools in its largest class, so a random sampling of 50 schools from this state was used to determine who would receive surveys.

Instrument

The instrument used in this study was a one-page survey containing 27 questions of both open-ended and multiple-choice varieties (see Appendix B). In the spring of 2000 a test-retest was performed with a correlation factor of 0.898. The survey took approximately 5 minutes to complete. Subjects were asked questions pertaining to demographic information for themselves and their school, injury histories, safety devices used during workouts, and information regarding their practices (Appendix B).

Design

A total of 1560 surveys were mailed to the 114 regionally selected schools. Each school received a packet containing 15 surveys, instructions, and a coach's survey. Three

states including Kansas, Oklahoma, and Texas were chosen because of their similarity in geographical location and prevalence of cheerleading in area high schools. The surveys were sent to schools in the highest class of each state. Class indicates schools with the highest enrollment numbers as of the 2000-2001 school year. In the states of Kansas and Oklahoma, 6A represents the largest class while in Texas 5A represents the largest class. Kansas and Oklahoma have 32 schools in their largest class and each of these schools was included in the study. Random selections of 50 schools from Texas' large class were used to bring the total to 114 participating schools. The surveys were mailed to the cheerleading sponsor or coach from each school. The enclosed instruction letter directed the coaches to distribute the surveys to their squads, collect when completed and mail them back to Oklahoma State University (OSU) in the provided return envelope. Participants were instructed to fill out the survey as honestly as possible and to not put their name or any other identifying markings on the surveys. Approximately 500 surveys (32.1%) were completed and returned from the selected schools, of which 407 surveys (26.2%) were deemed usable for the study. The state-by-state breakdown of returned surveys went as follows: Kansas returned 63 surveys (15.7%), Oklahoma returned 104 surveys (25.4%), and Texas returned 240 surveys (58.9%). Those surveys deemed unusable were either incorrectly completed or illegible, and therefore could not be included in the data. Correctly completed surveys comprised the basis for this study. The Internal Review Board at OSU approved the survey form and method of collection for use in this study (Appendix C).

Statistical Processes

Data were transcribed from individual questionnaires and entered on a spreadsheet, which was subsequently copied, into the Statistical Packages for Social Sciences (SPSS) package. The data were analyzed using three methods. Descriptive statistics were used to determine magnitude for selected variables such as injury distribution, practice days, practice duration, injury frequency and training. Selected variable means were compared using Analysis of Variance (ANOVA) in conjunction with a Newman-Keuls Post-hoc test to determine probabilities of specific variable combinations. Correlations between selected variables were determined by Spearman Rho analysis. Level of significance was established as $p<0.05$.

CHAPTER IV

RESULTS

The average age of the participants who completed surveys ranged from 14-18 years old with a mean age of 16.3 years old (SD=2.6). The average years of experience as a cheerleader was 4.1 years (SD=2.6) with 47.7% having between 1-3 years experience, 35.2% having 4-6 years experience, 11.3% having between 7-9 years experience, and 5.8% having less than one year of experience.

Of those cheerleaders who with 5 years of experience or more, 69.7% reported sustaining one or more career injuries. The number of injuries ranged from 0-50 (mean = 3.9, SE = 4.4). Of these, 49% suffered 1-2 injuries, 23.2% suffered 3-4 injuries, and 27.7% suffered 5+ injuries. The average number of injuries suffered by each participant over the last year was 1.7 (SD=1.9). A total of 55 participants suffered no injuries (20.4%), 161 suffered 1-2 injuries (59.9%), 37 suffered 3-4 injuries (13.8%), and 16 suffered 5+ injuries (5.9%). The average number of practices or performances missed last year due to these injuries was 1.5 days (SD=3.2) per participant. A total of 144 cheerleaders missed no practices or performances, 65 missed 1-2 (25.1%), 26 missed 3-4 (10%), and 24 missed 5+ (9.3%). Of those cheerleaders injured during participation, 78.6% were treated by a physician for their injuries with 12.23% of those requiring surgery.

The most serious injuries by percentages were to the back (26%), ankle (24%), wrist/hand/finger (11.4%), face/chin/lip/teeth (11.4%), and shoulder (10.2%). The most

frequent injuries by rank were to the ankle (24.7%), wrist (18.5%), back (16.2%), knee (10.9%), face/chin/lip/teeth (7.4%), and head/neck (6.8%).

The phase of cheerleading where the most serious injuries occurred was, by rank, stunting (33.3%), flying (29.2%), and basing (18.5%). The phase where the most frequent injuries occurred was, by rank, stunting (50%), tumbling (23.7%), and basing (15.2%). The most dangerous phase of each routine was, by rank, stunting (80.5%), and tumbling (15.4%).

The most common sites for cheerleading practices were the gym/basketball floor (46.6%), the school (27.3%), other (8.7%), cheer room (6.4%), and cafeteria/commons (5.7%). Safety measures present when practicing/performing included spots (58.6%), mats (27.4%), and trainers (4.8%). When asked about additions to their practices, 100% of the participating cheerleaders listed stretching, 68% listed endurance training, 25% listed nutrition information, and 24% listed weight training as usual parts of their practices. In all, 93.6% of cheerleading related injuries occurred during practices.

The average number of days per year cheerleaders practiced or performed was 230 days (SD=81.2) with a range of 120-365 days per year. A total of 17.8% of the participants practiced between 120-179 days per year, 38.9% practiced between 180-269 days, and 43.3% practiced 270 days or more per year. The average length of practice was 122 minutes (SD=42.8) with a range of 45-300 minutes. A total of 9.5% practiced between 0-59 minutes, 24.3% practiced between 60-89 minutes, 39.2% practiced between 90-119 minutes, 11.4% practiced between 120-179 minutes, and 15.6% practiced 180+ minutes per day.

Review of Null Hypotheses

Hypothesis 1: There will be no significant difference among states in the number of years subjects have participated in cheerleading. This hypothesis was rejected because participants from Oklahoma reported significantly ($p<0.05$) more participation years than participants from both Kansas and Texas. Table 2 illustrates the mean number of years of participation for each state and the probability values for each state-to-state comparison.

Hypothesis 2: There will be no difference among states in the number of yearly injuries experienced by cheerleaders. This hypothesis failed to be rejected because no significant difference was found between states with regard to injuries suffered by the cheerleaders. Table 2 illustrates the mean number of injuries for each state and the probability values for state-to-state comparison

Hypothesis 3: There will be no difference among states in the number of annual cheerleading practices days. This hypothesis was rejected because the state of Oklahoma reported significantly ($p<0.05$) more cheerleading practice days than the state of Kansas. Table 2 illustrates the mean number of practice days for each state and the probability values for each state-to-state comparison.

Hypothesis 4: There will be no difference among states in the length of practice sessions. This hypothesis was rejected because the state of Kansas reported significantly ($p<0.05$) longer practices than those in both Oklahoma and Texas. Table 2 illustrates the mean length of practice for each state and the probability values for each state-to-state comparison.

Hypothesis 5: There will be no difference among states in the cheerleading participants' reception of nutrition information. This hypothesis was rejected because the

state of Texas reported a significantly ($p<0.05$) higher reception of nutrition information than the state of Kansas. Table 2 illustrates the differences in information delivery and the probability values of each state-to-state comparison.

Hypothesis 6: There will be no difference among states in the use of endurance training for cheerleading participants. This hypothesis failed to be rejected because no significant difference was found between states with regard to the use of endurance training. Table 2 illustrates the differences in endurance training and the probability values of each state-to-state comparison.

Hypothesis 7: There will be no difference among states in the inclusion of weight training during cheerleading practices. This hypothesis was rejected because the state of Texas reported a significantly ($p<0.05$) higher rate of weight training than was reported by both Kansas and Oklahoma. Table 2 illustrates the differences in weight training and the probability values of each state-to-state comparison.

TABLE 2 – ANOVA with Newman-Kuels Post-hoc Test

Hypothesis 1

	KANSAS = 3.68	OKLAHOMA = 4.95	TEXAS = 3.92
KANSAS		0.0016	0.0508
OKLAHOMA			0.005

Hypothesis 2

	KANSAS = 1.29	OKLAHOMA = 1.53	TEXAS = 1.90
KANSAS		0.464	0.158
OKLAHOMA			0.271

Hypothesis 3

	KANSAS = 195.8	OKLAHOMA = 251.4	TEXAS = 229.1
KANSAS		0.022	0.109
OKLAHOMA			0.215

Hypothesis 4

	KANSAS = 96.9	OKLAHOMA = 118.9	TEXAS = 130.4
KANSAS		0.002	0.00003
OKLAHOMA			0.114

Hypothesis 5

	KANSAS = 1.89	OKLAHOMA = 1.81	TEXAS = 1.68
KANSAS		0.301	0.015
OKLAHOMA			0.081

Hypothesis 6

	KANSAS = 1.35	OKLAHOMA = 1.28	TEXAS = 1.32
KANSAS		0.665	0.743
OKLAHOMA			0.594

Hypothesis 7

	KANSAS = 1.84	OKLAHOMA = 1.89	TEXAS = 1.66
KANSAS		0.442	0.019
OKLAHOMA			0.005

Stretching was not included in Table 2 because 100% of the cheerleaders noted it was part of their everyday practices. Use of statistical data in this situation might be considered redundant.

Hypothesis 8: There will be no significant relationship between the number of injuries per year and the use of weight training in cheerleading practices. This hypothesis failed to be rejected because no significant relationship was found between these two variables. Table 3 illustrates the correlation and probability values for the variables.

Hypothesis 9: There will be no significant relationship between number of participation days missed from cheerleading due to injury and the number of cheerleading practice days per year. This hypothesis failed to be rejected because no significant relationship was found between these two variables. Table 3 illustrates the correlation and probability values for the variables.

Hypothesis 10: There will be no significant relationship between the number of days missed from cheerleading due to injury and the length of cheerleading practices. This hypothesis failed to be rejected because no significant relationship was found between these two variables. Table 3 illustrates the correlation and probability values for the variables.

Hypothesis 11: There will be no significant relationship between the number of cheerleading practices and the number of cheerleading injuries treated by a physician. This hypothesis was rejected because a significant ($R=0.270$; $p<0.05$) relationship was found between the two variables. Table 3 illustrates the correlation and probability values for the variables.

Hypothesis 12: There will be no significant relationship between the number of cheerleading practices and the number of cheerleading injuries that required surgery. This hypothesis was rejected because a significant ($R=0.264$; $p<0.05$) relationship was found between the two variables. Table 3 illustrates the correlation and probability values for the variables.

Hypothesis 13: There will be no significant relationship between the number of years of participation in cheerleading and the participant ever being injured. This hypothesis was rejected because a significant ($R=0.323$; $p<0.05$) relationship was found between the two variables. Table 3 illustrates the correlation and probability values for the variables.

Hypothesis 14: There will be no significant relationship between the number of years of participation in cheerleading and the number of cheerleading injuries sustained during the previous year. This hypothesis failed to be rejected because no significant

relationship was found between the two variables. Table 3 illustrates the correlation and probability values for the variables.

Hypothesis 15: There will be no significant relationship between the number of years of participation in cheerleading and the number of lifetime cheerleading injuries. This hypothesis was rejected because a significant ($R=0.220$; $p<0.05$) relationship was found between the two variables. Table 3 illustrates the correlation and probability values for the variables.

Hypothesis 16: There will be no significant relationship between the number of cheerleading practices per year and the total number of injuries per year suffered from cheerleading participation. This hypothesis failed to be rejected because no significant relationship was found between the two variables. Table 3 illustrates the correlation and probability values for the variables.

Hypothesis 17: There will be no significant relationship between the lengths of cheerleading practices and the total number of injuries per year suffered from cheerleading participation. This hypothesis was rejected because a significant ($R=0.238$; $p<0.05$) relationship was found between the two variables. Table 3 illustrates the correlation and probability values for the variables.

Hypothesis 18: There will be no significant relationship between the total number of injuries suffered from cheerleading participation and the use of weight training in practices. This hypothesis failed to be rejected because no significant relationship was found between the two variables. Table 3 illustrates the correlation and probability values for the variables.

Hypothesis 19: There will be no significant relationship between the total number of injuries suffered from cheerleading participation and the use of endurance training in practices. This hypothesis failed to be rejected because no significant relationship was found between the two variables. Table 3 illustrates the correlation and probability values for the variables.

TABLE 3 – Spearman Rho Correlations

VARIABLES	R	P
HYPOTHESIS 8: Number of Injuries per year vs. Use of Weight Training	0.071	0.31 ns
HYPOTHESIS 9: Number of Days Missed Per Year vs. Number of Practice Days Per Year	0.421	0.71 ns
HYPOTHESIS 10: Number of Days Missed Per Year vs. Length of Practice	0.117	0.07 ns
HYPOTHESIS 11: Number of Practice Days Per Year vs. MD Treatment for Injuries	0.270	<0.05
HYPOTHESIS 12: Number of Practice Days Per Year vs. Surgery for Injuries	0.264	<0.05
HYPOTHESIS 13: Number of Years of Participation vs. Ever Been Injured	0.323	<0.05
HYPOTHESIS 14: Number of Years of Participation vs. Number of Injuries in the Last Year	0.043	Ns
HYPOTHESIS 15: Number of Years of Participation vs. Number of Lifetime Injuries	0.220	<0.05
HYPOTHESIS 16: Number of Practice Days Per Year vs. Number of Injuries Per Year	0.114	Ns
HYPOTHESIS 17: Length of Practice vs. Number of Injuries Per Year	0.238	<0.05
HYPOTHESIS 18: Number of Injuries Per Year vs. Use of Weight Training	0.092	Ns
HYPOTHESIS 19: Number of Injuries Per Year vs. Use of Endurance Training	0.111	Ns

CHAPTER V

CONCLUSIONS

This study differs from most of the previous studies in that not all of the information sought and/or obtained dealt with specific injuries. Background information on how and why some of these injuries occurred was an important component to the overall study. Understanding why injuries occur and not just that they occur, could make prevention become feasible.

Studies on cheerleading include those about safety guidelines, injuries sustained while participating in cheerleading, and cheerleading's rank among other sports in its injury rates and severity.

As has been stated previously, studies on cheerleading injuries are rare. For comparison purposes, the results from two previous studies on cheerleading injuries (4, 15) will be compared. One study (4) is about the ranking of cheerleading injuries with other sports to see how injury rates compare. The other study (15) involves information concerning cheerleading injuries, patterns, and prevention. The following paragraphs will outline the similarities and differences between studies, while also isolating pertinent comparisons and findings.

This current study had 407 respondents from 114 high schools in Kansas, Oklahoma, and Texas. The previous study conducted from June 1989 to June 1990 and published in June 1991 (4) had 619 respondents from a sports clinic in Delaware. The previous study published in September 1997 (15) did not provide respondent numbers or demographic information on participants. Previous studies (4, 15) collected data on most common injury sites, most common injury types, time missed due to injury, and most

dangerous facets of cheerleading. The current study collected data on all of the topics listed above except the most common type of injury. The current study also collected data on a few other topics not covered in the past studies (4, 15). These include experience, physician treatment of injuries, most serious injuries, what facet of cheerleading causes them the most serious injuries and which causes the most common injuries, what safety measures are present, whether or not stretching, weight training, endurance training, and nutrition information were included in practices, average number of practice days per year, average length of each practice session, where practices are held, and the percent of injuries occurring in practice.

In the current study, the five most common injury sites were ankle, wrist, back, knee, and lip/teeth/chin/face, in descending order. These findings compare favorably with previous study (15), which had ankle, knee, hand, back, and shoulder and wrist, in descending order. The ankle is the most common injury site in both studies. The data from these studies confirms what has been widely regarded, that the ankle is the most commonly injured site in sports (22). With the many tumbling and stunting maneuvers performed in any given cheerleading routine, it is no surprise that the wrist, back, and knee also rank high on injury lists. These body parts, along with the ankle, are instrumental in the proper execution of any routine. All of the sites mentioned above help absorb the energy and impact of each stunt and, as a consequence, become more susceptible to injury through constant micro-trauma.

The current study did not focus on the specific type of injuries cheerleading participants suffer. While this concept was not directly addressed, it can be implied

through previous studies (4,15, 22) that sprains/strains are the most common injury in the vast majority of competitive sports.

Once any participating cheerleader suffered an injury, recovery time needed to be evaluated. To fully participate in a typical cheerleading routine, each participant needs to be at 100% and have full use of all body parts, which would require a longer absence to fully recover from injuries. The current study looked at practice/performance time missed due to injuries (in days) and found it differed from previous studies. Both studies (4,15) sited average days lost to injury at 28.8 days. This differs greatly from the 1.5 days (SD=3.2) found in the current study. While such a difference seems prominent, a partial explanation might be found in the words of previous study (4) in which low numbers of participants missed high numbers of days, which will skew data and alter final statistics. In other words, there were only five cheerleaders in previous study (4) so a long-term or season ending injury to one participant makes the average seem higher than it should be. The current study questioned over 400 cheerleaders, with a majority (80.7%) missing less than two days of practices/performances. These findings might actually be closer to a national average. This in no way belittles the severity of cheerleading injuries, but keeps the rates from appearing over-inflated.

Once injury types and sites have been addressed, the causes of injuries should be studied. The current study lists the most dangerous facets of a cheerleading routine as stunting (80.5%), and tumbling (15.4%). In previous studies (15) it has been sited that most cheerleading injuries occur during gymnastics maneuvers and partner stunts. According to this study, 67% of injuries occurred from gymnastics maneuvers and 16% from partner stunts. Parallels can be drawn between these two studies as both agree that

stunting and tumbling are the most dangerous parts of cheerleading routines. Many factors contribute to injuries. Experience, conditioning, and technique are contributing factors in several types of injuries, and even more so in stunting and tumbling. Deficiencies in any of these areas can lead to an injury, or an increased chance of injury. Table 4 compares values from a past study (15) to corresponding values from the current study.

TABLE 4 – Comparisons Between Current and Past Cheerleading Studies

	CURRENT STUDY	PAST STUDY - HUTCHINSON
TOP 5 MOST COMMON INJURY SITES	ANKLE, WRIST, BACK KNEE, LIP/FACE/CHIN	ANKLE, KNEE, HAND, BACK, SHOULDER/WRIST
AVERAGE RECOVERY TIME (IN DAYS)	1.5 DAYS (SD=3.2)	28.8 DAYS
MOST DANGEROUS FACETS OF CHEERLEADING ROUTINES	STUNTING, TUMBLING	GYMNASTICS EXERCISES (TUMBLING), PARTNER STUNTS

The experience of a cheerleader can influence the number of injuries he/she suffers in that generally, the more experienced they are, the more difficult their stunts will be. As cheerleaders mature, practice, and excel they are expected to progressively master more difficult stunts and routines. As previous study (15) states, experienced cheerleaders are more apt to attempt stunts that pose increased risks. Contrarily, more experienced athletes know how to care for their bodies, and can often times prevent smaller, more trivial injuries through better conditioning, and general expertise. The current study found the average number of years of participation to vary between the states with Oklahoma having the most average experience followed by Texas and Kansas respectively.

While some small contusions, minor sprains, and occasional strains can go unnoticed or unreported, most injuries are reported in some way, and treatment is

outlined. In the case of a more severe injury, a physician may be seen to assess and treat the injury. In the current study ¾ of the participants who suffered an injury sought treatment from a physician with 1/10 of those requiring surgery. Simply stated, almost one out of every ten cheerleaders who sees a physician regarding injury treatment requires surgery. That is a fairly high percentage, which would indicate a high probability of severe injury. If other sports, or facets of daily life carried such consequences, changes would have been increasingly imminent. However, cheerleading is a fairly new sport from an injury research standpoint and the guidelines have not yet completely caught up to the advancements being made in technique and difficulty.

The current study found the most seriously injured area (back) to differ from the most commonly injured one (ankle). Along the same lines, the current study found stunting, flying (being lifted thrown into the air), and basing (catching or holding a flyer), in that order, to be the main facets of the cheerleading routine that led to participants suffering their most serious injuries. Facets of the routine contributing to suffering the most common injuries were stunting, tumbling, an basing (in that order). This can be explained through experience and conditioning. As stated earlier, more experience tends to lead to more difficult stunts such as throwing and catching, which are harder to perform, and could lead to more serious injuries. Stunting is one of the first areas to show an increase in difficulty as experience level rises. As participants mature and gain strength, the more difficult stunts such as basket tosses are implemented into routines. Mishaps in these more dangerous stunts can lead to more serious injuries. By the same token, a lesser experienced cheerleader may not have the same knowledge or conditioning as a more experienced cheerleader. Repetitious movement such as

practicing stunts or tumbling runs could lead to repeated minor injuries especially if techniques have not been perfected and movements are done incorrectly.

Safety measures and devices for cheerleading competitions and practices are greatly debated in most studies on cheerleading injuries. Having safety measures in place for practices or performances could decrease cheerleading injuries as a whole. The current study found the top three safety measures used by schools are spotters, mats, and athletic trainers. Proper safety practices are the best way to prevent injury and only a 1/2 of the participants in this study use mats on a regular basis for their practices and performances. Safety guidelines are in place in several states and national cheerleading organizations often have their own rules and regulations, however, compliance lacks on many levels of cheerleading participation.

Another injury prevention technique, body conditioning, is not as widely practiced as it needs to be. The current study found that while 100% of the participants said they stretch with each practice, only 2/3 reported any kind of endurance training and only ¼ reported weight training or nutrition information as part of their practices. The benefits of a fit, well-conditioned body have been widely publicized. Incorporating all of these conditioning techniques into each practice session (or even just a few practices per week) could help reduce injuries by strengthening and conditioning the cheerleaders' bodies to better handle the year-round rigors of participation in this sport.

The number of practices and performances a cheerleader goes through can affect their chances for injury. The more exposure to potential injury causing incidents, the more likely an injury will occur. The current study found practice lengths lasting an average of 60-120 minutes 270 days or more of each year. With that much exposure and

little recuperation time (the season is year round) injuries are bound to happen. They may become more severe or problematic if sites are repeatedly injured and not given enough time to adequately heal. Proper knowledge of injury care and prevention is necessary to minimize the affects of repeated injury. If a coach or sponsor knows the risks of returning from an injury too soon, and can convey those to the participant, proper treatment can be given and further injury may be avoided. Having coaches or sponsors attend first aid or injury care and prevention seminars is a good way to decrease repeated injuries.

The study also found that cheerleaders seem to practice wherever they can find room. A few examples include gym floors, cafeterias, commons areas, outside areas, and in some cases in an actual cheerleading room. Findings in this study were that 93.6% of all injuries were suffered in practice. Proper practice facilities with adequate safety devices are essential to any sport and cheerleading is no different. Cheerleaders must be able to perform on many types of surfaces and in all kinds of environments. Practices should be more controlled and safer to decrease possible injuies. As stated above, 93.6% of all injuries occur in practices and most might have been able to be avoided with proper safety devices and techniques.

A long season, repetitive practices, difficult routines, improper safety techniques, inadequate conditioning, and experience level all play a part in the myriad of injures suffered by cheerleaders today. Only through more study can better preventative guidelines and practices be found and implemented.

Recommendations

In light of this current study and the two previous studies (4, 15) used for comparison, injuries are a fact in any sport, especially one with as much technical skill, precision, timing, and explosiveness as cheerleading. One area for improvement is in the prevention of injuries. Other sports have governing bodies, strict rules, and specific protective equipment for their participants. Only now are guidelines for injury prevention in cheerleading being taken seriously and implemented. A more comprehensive plan of prevention, intervention, and implementation of specific guidelines and protective practices and equipment, undertaken by a governing body for this specific sport will go a long way in improving safety standards and cutting injuries in cheerleading. By cutting back on state-to-state laws and creating more standardized guidelines and precautions for practices and performances, more schools will be able to implement standard plans to decrease injuries.

In a more controllable area, the knowledge and training for cheerleading coaches and sponsors needs improvement. By hiring staff with more background in cheerleading and gymnastics techniques, and teaching the importance of total body conditioning, the cheerleading squad might learn better tips for taking care of their bodies and conditioning themselves for the long season ahead, while also getting better instruction on techniques. By learning the correct way to perform a stunt or tumbling run, injuries due to poor form or execution can be decreased or avoided.

Recommendations for Further Research

The data contained in this study and other previous studies have laid the groundwork for research, however some recommendations for further research are warranted. More research is needed in the following areas: are the rates of physician treatment and surgery as high in other parts of the country; what kinds of safety measures are used during practices and performances from schools all across the country, not just in the Midwest; do other schools incorporate endurance training, weight training, and nutrition into their cheerleading practices; is cheerleading as popular in other parts of the country, is it as competitive; is a nationwide safety guidelines policy feasible for high school cheerleading; does a smaller budget, or lack of financial help from their district or state affect total injury rates of participants; and is there a difference in injury rates between high schools of varying sizes.

CITED REFERENCES

1. *2000-2001 AACCA Cheerleading Safety Guidelines (College Age Level).* American Association of Cheerleading Coaches and Advisors (AACCA). Retrieved February 28, 2001, from the World Wide Web: http://www.aacca.org/aacca/0001cogl.html

2. *2000-20001 AACCA Cheerleading Safety Guidelines (High School Age and Younger).* American Association of Cheerleading Coaches and Advisors (AACCA). Retrieved February 28, 2001, from the World Wide Web: http://www.aacca.org/aacca/00-01hsgl.html

3. Arendt, E., Randall, D. Knee Injury Patterns Among Men and Women in Collegiate Basketball and Soccer. Am J of Sports Med. 23(6): 694-701. 1995.

4. Axe, M., Newcomb, W., Warner, D. Sports Injuries and Adolescent Athletes. Del Med J 63(6): 359-363. 1991.

5. Biedzynski, K. (1999, April) Sis Bah Boom! A cheerleader falls, as does a resulting cheerleading lawsuit. Athletic Business, pp. 28, 30.

6. Cantu, R.C., Mueller, F.O. Cheerleading [Editorial]. Clinical Journal of Sport Medicine 4(2): 75-76. 1994.

7. DeBenedette, V. Are Cheerleaders Athletes? The Physician and Sportsmedicine. 15(9): 214-217, 220. 1987.

8. Elias, S.R. 10-Year Trend in USA Cup Soccer Injuries: 1988-1997. Med. Sci. Sports Exerc. 33(3): 359-367. 2001.

9. Fort, G.G., Fort, F.G. Cheerleading as a Cause of Splenic Rupture. Am J of Emergency Med. 17(4): 432-433. 1999.

10. *History of Cheerleading*. Geocities.com. Retrieved June 18, 2002, from the World Wide Web: www.geocities.com/colosseum/8339/history.html

11. Goodman, C.E. Unusual Nerve Injuries in Recreational Activities. Am J of Sports Med. 11(4): 224-227. 1983.

12. Gottlieb, A. Cheerleaders Are Athletes Too. Pediatric Nursing 20(6): 630-633. 1994.

13. Hage, P. Cheerleading: New Problems in a Changing Sport. The Physician and Sportsmedicine. 9(2): 140-145. 1981.

14. Herbert, D.L. Cheerleading Injury Rates, Litigation and Rule Change Trends. Sports, Parks and Recreation Law Reporter. 7(3): 38-42. 1993.

15. Hutchinson, M.R. Cheerleading Injuries: Patterns, Prevention, Case Reports. The Physician and Sportsmedicine. 25(9): 83-96 1997.

16. Hutchinson, M.R., Ireland, M.L. Knee Injuries in Female Athletes. Sports Med. 19(4): 288-302. 1995.

17. Jarrett, G.J., Orwin, J.F., Dick, R.W. Injuries in Collegiate Wrestling. Am J of Sports Med. 26(5): 674-680. 1998.

18. Kujala, U.M., Taimela, S., Antti-Poika, I., Orava, S., Tuominen, R., Myllynen, P. Acute Injuries in Soccer, Ice Hockey, Volleyball, Basketball, Judo, and Karate: Analysis of National Registry Data. BMJ. 311: 1465-1468. 1995.

19. McAuley, E., Hudash, G., Shields, K., Albright, J.P., Garrick, J., Requa, R., Wallace, R. Injuries in Women's Gymnastics, The state of the art. Am J of Sports Med. 15(6): S124-S131. 1987.

20. Miller, J. Chiropractic Care for the Child Athlete. I.C.P.A. Newsletter. http://www.icpa4kids.com/pediatric_chiropractic_articles_chiropractic_care_for_the_child_athlete.html September/October. 1998

21. Murphy, P. Cheerleading Not As Safe As It Once Was. The Physician and Sportsmedicine. 13(11): 39-40. 1985.

22. Murtaugh, K. Injury Patterns Among Female Field Hockey Players. Med. Sci. Sports Exerc. 33(2): 201-207. 2001.

23. *National Center for Catastrophic Sport Injury Research.* National Center for Catastrophic Sports Injury (NCCSI): Seventeenth Annual Report. Retrieved from the World Wide Web, January 23, 2001: http://www.unc.edu/depts/nccsi/report15.html

24. *All Sports Injury Summary.* National Collegiate Athletic Association (NCAA). Retrieved from the World Wide Web, May 22, 2001: http://www.ncaa.org/sports_science/injury_surveillance/injury_summary

25. Powell, J.W., Barber-Foss, K.D. Sex-Related Injury Patterns Among Selected High School Sports. Am. J of Sports Med. 28(3): 385-391. 2000.

26. Powell, J.W., Barber-Foss, K.D. Traumatic Brain Injury in High School Athletes. JAMA. 282(10): 958-963. 1999.

27. Powell, J.W., Barber-Foss, K.D. Injury Patterns in Selected High School Sports: A Review of the 1995-1997 Seasons. Journal of Athletic Training. 34(3): 277-284. 1999.

28. Shields, R.W. Jr., Jacobs, I.B. Median Palmar Digital Neuropathy in a Cheerleader. Arch Phys Med Rehabil. 67: 824-826. 1986.

29. Tehranzadeh, J., Labosky, D.A., Gabriele, O.F. Ganglion Cysts and Tear of Triangular Fibrocartilages of Both Wrists in a Cheerleader. Am. J of Sports Med. 11(5): 357-359. 1983.

30. *The History of Cheerleading*. The University of Wisconsin – River Falls. Retrieved June 16, 2002, from the World Wide Web: www.uwrf.edu/uca/history.html.

2000-2001 AACCA Cheerleading Safety Guidelines

(High School Age and Younger)

SPECIFIC SAFETY REGULATIONS

Partner Stunts / Pyramids

1. All pyramids and partner stunts are limited to two persons high. "Two high" is defined as the base (bottom person) having at least one foot on the ground.
2. The top person in a partner stunt, pyramid or transition may not be in an inverted (head below the waist) position, with the exception of a double based forward suspended roll.
3. Suspended splits in a transition are allowed provided there are a total of 4 bases that support the top person; at least three of the bases must support under the legs of the top person, and the fourth base may support under the legs or make contact with the hands of the top person. The top person must have hand contact with the bases.
4. Partner stunts and pyramids higher than shoulder stand level must have a continuous spotter for each person over shoulder stand level.
5. When one person is bracing another (including over lapping of arms), one of the individuals must be at shoulder height or below. (Exception: Extensions may brace other extensions.)
6. If a person in a partner stunt or pyramid is used as a brace for an extended stunt, that brace must not be supporting a majority of the top person's weight. (To demonstrate this, the foot of the top person's braced leg must be at or above the knee of their supporting leg.)
7. Triple-base straddle lifts must have an additional spotter for the head and shoulders of the top person.
8. Hanging pyramids must have a continuous spotter for each shoulder stand involved in suspending another person.
9. All vaults are prohibited.
10. Basket tosses, toe pitch tosses, or similar tosses are limited to no more than four tossers and must be dismounted to a cradle position by two of the original bases, plus an additional spotter at the head and shoulder area. These tosses may not be directed so that the bases must move to catch the top person.
11. Partner stunts, pyramids or participants may not pass over, under or through other partner stunts or pyramids.
12. Bird partner stunts must have a continuous spotter at the head and shoulder of the top person.
13. Free falling flips or swan dives from any type of toss, partner stunt or pyramid are prohibited.
14. Double based forward suspended rolls are allowed as long as the bases have their feet on the ground, and the top person and the bases maintain hand-to-hand contact throughout the skill.
15. Backward suspended rolls and single based suspended rolls are prohibited.
16. Cradle dismounts from shoulder stand level and above must use a spotter in addition to the number of bases required for the stunt. Exception: A "chair" does not require an additional spotter. (A cradle is defined as a dismount from a partner stunt or pyramid in which the top person is caught in a face-up, piked position before being placed on the floor or remounting into another stunt or pyramid.)

17. Cradle dismounts which involve a jump twist, or other gymnastic skills require a spotter in addition to the original base(s).
18. All backward dismounts from partner stunts or pyramids must use three catchers. The execution of any gymnastic skill (i.e., jump, twist, etc.) during a backward dismount is prohibited.
19. Twists greater than two rotations in stunts, tosses or dismounts are prohibited. (Exception: Double full cradles to the front from side facing stunts such as Arabesques and Scorpions are legal.)
20. Knee drops are prohibited.
21. Tension rolls and tension drops are prohibited.
22. Helicopter tosses are prohibited.
23. Single based split catches are prohibited.
24. Toe pitch and leg pitch flips are prohibited.
25. The use of mini-trampolines, springboards, or any other height-increasing apparatus is prohibited.
26. Tosses that land in stunts (i.e. toss to hands, basket toss to elevator, etc.) are allowed; however, they cannot significantly exceed the height of the intended stunt. Tosses cannot land in a loading position for another stunt. (Exception: Single base tosses without assistance from another person are allowed into a loading position.)

Tumbling/Gymnastics/Jumps

1. Dive rolls are prohibited. (A dive roll is defined as a forward roll where your feet leave the ground before your hands reach the ground.)
2. Flips greater than one rotation are prohibited.
3. Twists greater than two rotations are prohibited.
4. A forward three-quarter flip to the seat or knees is prohibited.
5. The use of mini-trampolines, springboards, or any other height increasing apparatus is prohibited.
6. Participants may not tumble under or through partner stunts, pyramids, or over or under individuals.
7. Participants may not land in a partner stunt or in a catching position from an aerial tumbling skill. (Example : A back flip from a tumbling pass into a cradle is prohibited, however, rebounding from a back handspring into a cradle is allowed.)
8. Landings for all jumps must bear weight on at least one foot. (Example: A toe touch jump or kick to a hurdler position, to the seat, knees, or landing with both feet back, or to a push-up position are prohibited.)
9. High kicks to a hurdler position are prohibited.
10. Any type of hurdler position or the position with both feet back (sitting, landing or lying) is prohibited with the exception of a "Z" sit.

GENERAL SAFETY GUIDELINES

1. Cheerleading squads should be placed under the direction of a knowledgeable advisor or coach.
2. The cheerleading coach or another knowledgeable designated school representative should be in attendance at all practices and functions.
3. All cheerleaders should receive proper training before attempting any form of cheerleading gymnastics (tumbling, partner stunts, pyramids and jumps).
4. All partner stunts should be mastered according the "Partner Stunt Progressions" section of the *AACCA Cheerleader Safety Manual.*

5. All practice sessions should be held in a location suitable for the activities of cheerleaders (i.e., use of tumbling mats where available away from excessive noise and distractions, etc.).
6. Training in proper spotting techniques should be mandatory for all squads attempting cheerleading gymnastics.
7. Jewelry, accessories and apparel should be conducive to safe performance.
8. Warm-up exercises and stretching should precede all practice sessions, pep rallies, games, competitions, and other physical activity.
9. All cheerleading squads should develop a conditioning and strength building program.
10. The cheering surface, location, lighting, and weather conditions should be taken into consideration before engaging in physical activity.
11. Advisors/coaches should recognize the entire squad's particular ability level and limit the squad's activities accordingly.

Copies of these guidelines should be distributed to all squad members and any administrators involved with the cheerleading program. All guidelines should be understood and accepted by all parties involved in the cheerleading program including advisors, coaches, assistants, squad members, parents, and administrators.

Note: The above safety guidelines are general in nature and are not intended to cover all circumstances. All cheerleading gymnastics including, tumbling, partner stunts, pyramids and jumps should be carefully reviewed and supervised by a qualified adult advisor or coach.

2000-2001 AACCA Cheerleading Safety Guidelines
(College Age Level)

SPECIFIC SAFETY GUIDELINES

Partner Stunts, Pyramids, and Tosses

1. All partner stunts, pyramids, and basket tosses shalt be reviewed and approved by the coach prior to execution. "Hands on" spotting is required until new stunts are mastered.
2. In all pyramids there must be at least two spotters designated for each person who is above "two high" and whose base does not have at least one foot on the ground. One of the spotters must be in the back and the other can be at the side or in front of the pyramid to spot the front of the pyramid. This spotter can move to the back to catch the cradle. The spotters must assist the top person when dismounting.
3. Pyramids over "two high" should be limited to appropriate surfaces.
4. Cradles from pyramids over "two high" must use at least two catchers.
5. A forward three-quarter roll dismount off of pyramids must use at least two catchers.
6. Toe touch dismounts off of pyramids two body lengths high or above must use at least three catchers.
7. Basket tosses or similar tosses may only be performed from ground level and shall be cradled by three catchers (the original two bases and a spotter at the head and shoulder area). These tosses may not be directed so that the bases must move to catch the top person.
8. An additional spotter that assists in the dismount is required for the following:

    1. Twisting dismounts with more than a 360-degree rotation,
    2. Flip dismounts to a cradle from shoulder height partner stunts.
    3. Stunts which use only one arm of the base for support.

RESTRICTIONS

1. The use of mini-trampolines, springboards, or any height increasing apparatus is prohibited.
2. Pyramids higher than two and one-half body lengths are prohibited. Pyramid height is measured by body lengths. For example, a shoulder stand is two body lengths, a chair is one and one-half body lengths, an extension on top of a thigh stand is three body lengths high and therefore, is prohibited.
3. Single based split catches are prohibited.
4. Full twist dismounts from a chair are prohibited.
5. Flips into and from partner stunts as well as straddle catches are prohibited, with the exception of the following: basket tosses or similar tosses, front flip dismounts from shoulder level to a cradle, back flip dismounts from shoulder level double base stunts to a cradle. Flips must land in a cradle to the original bases, and must have an additional spotter.

6. All flips from pyramids are prohibited except a forward three quarter roll dismount, which will be allowed as long as at least two catchers are used.
7. Front, back, and side tension drops are prohibited.
8. Toe pitch, leg pitch or walk-in and "smoosh" front and back flips are prohibited.
9. All flips with two rotations or greater from any type of toss are prohibited.
10. Twisting skills greater than two rotations from partner stunts, pyramids or from tosses are prohibited. (Exception: Double full cradles to the front from side facing stunts such as Arabesques and Scorpions are legal.)
11. Basket tosses or similar tosses must be performed from ground level and must be cradled by the same bases that originally tossed the top person and an additional spotter. You may not jump, flip or dive over, under or through partner stunts, pyramids, or individuals from basket tosses, partner stunts or other tosses from hands.
12. Participants may not jump, flip or dive over, under or through partner stunts, pyramids, or individuals from basket tosses, partner stunts or other tosses from hands.
13. The top person in a partner stunt, pyramid, or transition cannot dismount or be tossed to purposely land or be caught in an inverted body position.

Tumbling

1. All tumbling activities should be reviewed and approved by the advisor/coach prior to execution.
2. Tumbling skills must use at least one spotter until performance consistency is demonstrated.
3. A clear, accurate communication between performer and spotter must be established prior to attempting a skill.
4. New tumbling skills should be mastered on a mat whenever possible. If a mat is not available, "over spotting" should be employed. New tumbling skills should not be learned on inappropriate surfaces.
5. Tumbling skills performed over, under, or through partner stunts, pyramids, or individuals are prohibited.
6. Somersaults greater than one rotation are prohibited.
7. Twists greater than two rotations are prohibited.
8. Dive rolls are prohibited. (A dive roll is defined as a forward roll wherein the performer is airborne prior to the completion of the forward roll).

Specific Football Guidelines

1. Pyramids over two body lengths should not be performed outdoors unless they are performed on appropriate surfaces.
2. Pyramids over two body lengths should be performed only during pre-game, time-outs, quarter breaks or half-time activities in order to avoid the potential of interference from players, game officials, spectators, etc. on the sidelines during the actual game.
3. Tumbling should only be performed on appropriate surfaces.

Specific Basketball Guidelines

1. Pyramids over two body lengths performed indoors must have spotters in front and back of the pyramid for each person over "two persons" high.
2. Pyramids over two high should be performed only during pre-game, time-outs, or half-time activities.
3. Flips from partner stunts or basket tosses should not be performed indoors without the use of cushioned mats.
4. Basket tosses should be performed only during pre-game, time-outs, or half-time activities and should be performed in a space which insures that no incidental traffic could interfere with the toss.

GENERAL GUIDELINES

1. Cheerleading squads should be placed under the direction of a qualified and knowledgeable advisor or coach.
2. All practice sessions should be supervised by the coach and held in a location suitable for the activities of cheerleaders (i.e., use of appropriate mats, away from excessive noise and distractions, etc.).
3. Advisors/coaches should recognize a squad's particular ability level and should limit the squad's activities accordingly. "Ability level" refers to the squad's talents as a whole and individuals should not be pressed to perform activities until safely perfected.
4. All cheerleaders should receive proper training before attempting any form of cheerleading gymnastics (tumbling, partner stunts, pyramids and jumps).
5. Professional training in proper spotting techniques should be mandatory for all squads.
6. All cheerleading squads should adopt a comprehensive conditioning and strength building program.
7. A structured stretching exercise and flexibility routine should precede and follow all practice sessions, game activities, pep rallies, etc.
8. Tumbling, partner stunts, pyramids and jumps should be limited to appropriate surfaces.
9. As a general rule, all programs should qualify cheerleaders according to accepted teaching progressions. Appropriate spotting should be used until all performers demonstrate mastery of the skill.

Note: The above safety guidelines are general in nature and are not intended to cover all circumstances. All cheerleading gymnastics including tumbling, partner stunts, pyramids and jumps should be carefully reviewed and supervised by a qualified adult advisor or coach.

The American Association of Cheerleading Coaches and Advisors makes no warranties or representations, either expressed or implied, that the above guidelines will prevent injuries to individual participants.

If you have any questions regarding the legality of a specific skill, contact us at 800-533-6583. For the latest safety updates, visit us on the web at "http://www.aacca.org".

American Association of Cheerleading Coaches and Advisors

OSU

By completing this questionnaire you have agreed to voluntarily participate in a study conducted by Dr. Bert Jacobson of Oklahoma State University. By not placing your name on this form all information will be anonymous.

1. STATE YOU LIVE IN? _____ 2. AGE _____

3. SCHOOL CLASS SIZE (Circle) 5A, 4A, 3A, 2A, 1A, other
4. YEARS AS A CHEERLEADER? _____YRS.

5, HAVE YOU EVER BEEN INJURED WHILE PARTICIPATING IN CHEERLEADING? ____ YES _____ NO (if NO, stop and return)

6.ABOUT HOW MANY INJURIES DID YOU HAVE LAST YEAR FROM CHEERING? _____

7. ABOUT HOW MANY **LIFETIME TOTAL** INJURIES HAVE YOU HAD FROM CHEERLEADING? _____

8. ABOUT HOW MANY PRACTICES OR GAMES DID YOU MISS LAST YEAR DUE TO INJURIES? _____

9. HAVE YOU EVER BEEN TREATED BY A PHYSICIAN FOR YOUR INJURIES? _____ YES _____ NO

10. DID ANY OF YOUR INJURIES NEED SURGERY? ____ YES ____ NO

11. WHAT WAS YOUR MOST SERIOUS INJURY?

_____

RANK (MOST TO LEAST) YOUR INJURIES. (i.e., KNEE, ANKLE, WRIST) FROM CHEERING

	RANK	INJURED AREA	NUMBER OF TIMES
12.	1		
13.	2		
14.	3		

15. MY MOST SERIOUS INJURY HAPPENED WHEN I (explain)

_____

16. MY MOST FPEQUENT INJURY HAPPENS WHEN I

_____

17. THE MOST DANGEROUS PART OF OUR ROUTINE IS:

_____

18. WHAT SAFETY MEASURES ARE PRESENT WHEN PRACTICING?

_____

19. WHAT SAFETY MEASURES ARE PRESENT WHEN PERFORMING?

_____

DOES YOUR ORGANIZED PRACTICE INCLUDE: (Circle answer)

20. YES NO -------- STRETCHING
21. YES NO -------- WEIGHT TPAMNG
22. YES NO -------- ENDURANCE TRAINING
23. YES NO -------- NUTPMON INFORMATION

24. HOW MANY DAYS PER YEAR DO YOU PRACTICE OR PERFORM?

_____

25. HOW LONG IS YOUR USUAL PRACTICE SESSION?
_____ HOURS/MINUTES

26. WHERE DO YOU USUALLY PRACTICE?

_____

27. ESTIMATE WHAT PERCENT OF YOUR INJURIES OCCURRED IN PRACTICE _____ % PERFORMANCE _____ %

PLEASE RETURN THIS FORM TO YOUR COACH NOW.
THANK YOU FOR YOUR PARTICIPATION

OSU

Oklahoma State University
Institutional Review Board

Protocol Expires: 3/6/02

Date: Wednesday, March 07, 2001 IRB Application No ED00178

Proposal Title: MODE AND FREQUENCY OF CHEERLEADING INJURIES

Principal
Investigator(s):

Mandy Sinclair
101 Colvin Center
Stillwater, OK 74078

Bert Jacobson
101 Colvin Center
Stillwater, OK 74078

Reviewed
and Expedited (Spec Pop) **Continuation**
Approval Status Recommended by Reviewer(s) : Approved

Signature:

Carol Olson, Director of University Research Compilan

Wednesday, March 07, 2001
Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.