

THE INCIDENCE OF INJURY AMONG WOMEN PARTICIPATING  
IN NATIONAL BASKETBALL AND TRACK AND FIELD  
AND TEXAS STATE TENNIS COMPETITION  
DURING 1969

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We hereby recommend that the thesis prepared under  
our supervision by LINDA JEAN HAMMETT  
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TENNIS COMPETITION DURING 1969

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## CHAPTER I

### INTRODUCTION

The continued development of sports competition has caused an increase in the concern for the physical well-being of the athlete. The modern idea in the larger universities is that the control of injury and the development of a team must go hand in hand. The athletic administrations realized that if sports were to be of any lasting benefit, the incidence of injury must be reduced in severity and in frequency.<sup>1</sup>

The rise of national interest contributed to the development of two major associations advocating better medical care for secondary and college athletes. The American Medical Association activated a committee on the Medical Aspects of Sports and the National Athletic Trainers Association has become active in the interest of applied sports medicine.

The National Athletic Trainers Association ( NATA ) has had the direct responsibility of defining the position of the athletic trainer. The objectives of the NATA are to advance, encourage, and improve the athletic training profession in all its phases and promote a better working relationship among those persons interested in the problems of training. The NATA strives to develop further the ability of each of its members by providing the means for the free exchange of ideas within the profession; and to enable the members to develop personal professional

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<sup>1</sup>Augustus Thorndike, Athletic Injuries (Philadelphia: Lea and Febiger, 1962), p. 15.

relationships by formal and informal means of communication. The NATA maintains a Group "E" membership in the United States Olympic Committee and an affiliate membership in the National Collegiate Athletic Association.<sup>1</sup>

The daily activities of the trainer are concerned with prevention of injury, treatment under medical direction and rehabilitation. The most important function of the trainer is the prevention of injuries. A critical phase of prevention of injuries is the physical and mental conditioning of the athlete. Conditioning decreases the likelihood of injury and increases the physical tolerance required for body contact sports.<sup>2</sup> A fatigued player is subject to a greater frequency of injury because he cannot move his body with the speed and agility to avoid injury. Therefore, an athlete with greater comeback power and endurance is less apt to be injured because he is less subject to fatigue.<sup>3</sup>

Dr. Paul Trickett has best described the professional dedication needed by a trainer.

Today's trainer must be expert in a number of areas and his technical skills must be matched by his interest and devotion. It is essential that the trainer is well-grounded in the basics of anatomy, physiology and kinesiology. He must know taping techniques, conditioning programs, rehabilitation programs, equipment, first-aid, and he, like coach and physician, must be something of a psychologist. In addition, and I feel that this is very important, he must be willing to perform without recognition or glamor. The work is not easy, the hours are long. If he makes a mistake, everybody--from press right on down to the parents--hears about it. But if he does an exceptional job in

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<sup>1</sup>Ken Rawlinson, Modern Athletic Training (Englewood Cliffs: Prentice-Hall, Inc., 1966), p. 2.

<sup>2</sup>Paul C. Trickett, Prevention and Treatment of Athletic Injuries (New York: Appleton-Century-Crofts, 1965), p. 65.

<sup>3</sup>Ibid., p. 66.

rehabilitating a boy and gets him back on the field ready to go two days before the boy might normally be expected to return, everybody is pleased, yet seldom, if ever, will you hear a word of praise directed specifically at the trainer.<sup>1</sup>

The efficiency and value of a trainer to his profession is dependent on his understanding of the precise nature of his responsibilities. An understanding must be reached between the physician and the trainer as to which injuries the doctor considers important for immediate referral and those less severe injuries which may be delayed.

It is appropriate to review the general principles and procedures for handling the various kinds of injuries that the trainer will handle during the season. The trainer must have the confidence of the team doctor. The doctor has the responsibility to leave the trainer with a definite set of instructions related to the rehabilitation program, and to determine the precise nature and areas of the responsibilities in the trainer's domain. A conflict between trainer and physician as to which one is practicing medicine and which one is carrying out the orders should not exist.<sup>2</sup>

One of the most effective methods of reducing injuries is to understand the circumstances surrounding the nature and frequency of injuries received in various sports. When the most frequent type injury is known, preventative measures can be instituted. Knowledge concerning the frequency of injuries triggers the advancement of preventative measures. Discovery of the most frequent

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<sup>1</sup>Ibid., p. 24.

<sup>2</sup>Ibid., p. 25.



injury and the body area affected in a particular activity provides for more efficient management of that injury by the trainer.<sup>1</sup>

This study is an attempt to identify two important factors, the location of the injury and the frequency of the injury, in relation to women's participation in the sports of basketball, track and field and tennis. The subject matter of this study has been limited to these two factors because of the lack of opportunity for research in the area of women's athletic injuries. Little opportunity has been provided for investigation of women's participation in sports in this country since most of the institutions providing sponsorship of athletics have been concerned solely with boys and mens participation. The research studies and literature concerning injuries among men athletes has been used as a stepping stone for development of this study. The men conducting these investigations of men athletes had the records and experiences of the male athletic trainers. Few, if any, records of women's athletic injuries have been maintained since so few women's teams have participated under recognized sponsorship for any extended period. The availability and continuity of records related to womens sports injuries has been further complicated by the lack of trainers, particularly women, who were interested in this area of research. With the renewed interest in women's competitive sports activities, the need for such research is becoming apparent. The investigator hopes that this first venture concerning the incidence of injury

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<sup>1</sup>Dr. J.W. Kyle, lecture given at Queen's University, Belfast, Ireland, March, 1966.

among women athletes will lead to further investigations in this area. As a by-product of this study, the investigator would hope that others would recognize and respond to the need for qualified women trained specifically to work with athletic injuries within womens sports programs.

#### Statement of the Problem

The proposed investigation entails the analysis of data relative to the incidences of injuries among women competitors in basketball, track and field and tennis. The data were gathered at the Womens National Amateur Athletic Union Basketball Championships at Gallup, New Mexico; the National Invitational Basketball Tournament at Amarillo, Texas; the Texas State Tennis Championships at San Antonio, Texas; and the National Intercollegiate Track and Field Championships at San Marcos, Texas, during the competitive season of 1969. Upon the basis of research pertinent to existing theories, the investigator will draw a conclusion concerning the incidence of the injuries in relation to the sport and the participants.

#### Purposes of the Study

The general purpose of this study is to collect data with respect to the incidence of injuries among a select group of highly skilled women athletes participating in basketball, track and field and tennis. The most unique purpose of this study is to contribute to the field of sports literature a first analysis of incidence of

injuries among women competitors as specified within the confines of this study. Specifically the investigator wishes to:

1. Determine the percentage of total injuries to the particular sport.
2. Determine the percentage of total injuries in relation to the total number of participants.
3. Determine the percentage of each specific injury to each specific sport.
4. Ascertain the percentage of each specific injury in relation to each specific area of the body.
5. Determine the most frequent injury in relation to the sport and the area of the body.

#### Delimitations of the Study

The study is subject to the following delimitations:

1. The availability of human sources from whom data may be collected.
2. The objectivity, reliability, and validity of the selected method of obtaining the data necessary.
3. The degree to which the participants are representative of the population from which they are drawn.
4. The availability of books, newspapers, periodicals, magazines, theses, dissertations, and other research studies related to the incidence of injuries among women participants during competitive sports.
5. The cooperation of individuals involved in ascertaining the required data.

## Definitions and Explanations of Terms

For the purposes of clarification and to promote a clear understanding of the problem, the following definitions and explanations of terms have been established for use in this study:

- A. Abrasion: The investigator accepts the following explanation by Taber who states that an abrasion is "an injury resulting from scraping away a portion of skin or of a mucous membrane."<sup>1</sup>
- B. Blister: The investigator accepts the explanation of Dorland who defines a blister as "a collection of serous fluid under the skin, frequently caused by pressure and friction."<sup>2</sup>
- C. Cartilage, Torn : The investigator accepts the explanation of Taber:
 

A strong, tough, elastic substance or non-vascular tissue forming part of the skeleton, as costal cartilages, the larynx, ears, and nostrils. It lines the bones and joints, and is bound between the vertebrae, and it facilitates the bending of the spinal column. Cartilage is not supplied with nerves and with few blood vessels. Rupture is caused by sudden and extreme force.<sup>3</sup>
- D. Contusion: The investigator accepts the definition of Taber:

An injury in which the skin is not broken,

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<sup>1</sup>Clarence Wilbur Taber, Taber's Cyclopedic Medical Dictionary (Philadelphia: F.A.Davis Company, 1946), p. A-6.

<sup>2</sup>Dr. W.A.Dorland, Dorland's Pocket Medical Dictionary (Philadelphia: W.B.Saunders Company, 1968), p. 90.

<sup>3</sup>Taber, p. C-21.

with pain, discoloration, swelling...with diffuse effusion into subcutaneous tissue, and in which the muscles increase with the fluid.<sup>1</sup>

- E. Concussion: The investigator accepts the explanation of Taber:

Impaction against an object, a common result of a blow to the head, fall on the end of the spine with transmitted force, usually causing unconsciousness, either temporary or prolonged. Return consciousness may be gradual. Patient may suddenly draw up knees and vomit. Resembles result of skull fracture.<sup>2</sup>

- F. Dislocation: The investigator accepts the definition of Dorland:

Displacement of a part. One in which the surfaces are entirely separated, one in which the joint communicates with air through a wound, one in which the displaced bone is not in the same position as when dislocated, partial dislocation, inflammatory changes have occurred, one in which the surfaces remain in partial contact, one due to deformity of the bone by disease of the joint or paralysis of the muscles, one in which the bones remain as originally displaced, one with no communication with the air through a wound, one with no inflammatory changes.<sup>3</sup>

- G. Dropped Arch: The investigator accepts the explanation of Dorland:

Formed by the inferior surfaces of the heads of the metatarsal bones of the foot, a temporary dislocation of these bones, with ligamentous damage. One of two anteroposterior arches of the foot; the medial formed by calcaneus, talus,

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<sup>1</sup> Ibid., p. C-97

<sup>2</sup> Ibid., p. C-92

<sup>3</sup> Dorland, p. 195.

navicular, cuboids, and the first three metatarsals; the lateral by the calcaneus, cuboid and forth and fifth metatarsals--a temporary dislocation with ligamentous damage.<sup>1</sup>

- H. Fracture: The investigator accepts the definition of Dorland who defines a simple fracture as "a broken bone, a sudden breaking of a bone."<sup>2</sup>
- I. Laceration: The investigator accepts the definition of Taber who defines a laceration as "a wound or irregular tear of the flesh."<sup>3</sup>
- J. Separation: The investigator accepts the definition of Taber who defines a separation as a "pulling away of a bone from a joint, because of ligamentous injury, not a tearing but a stretching injury."<sup>4</sup>
- K. Shin Splint : The investigator accepts the explanation of Thorndike:

Simple myositis, irritative myositis, located at the site of the tibialis posticus origin on the posterior and medial surface of the lower or middle third of the tibia; also, with possible involvement of the interosseus membrane.<sup>5</sup>

- L. Sprain: The investigator accepts the explanation of Taber:

To wrench a joint, the forcible wrenching of

<sup>1</sup>Ibid., p. 47.

<sup>2</sup>Ibid., p. 257

<sup>3</sup>Taber, p. L-4.

<sup>4</sup>Ibid., p. S-36.

<sup>5</sup>Augustus Thorndike, Athletic Injuries (Philadelphia: Lea and Febiger, 1962), p. 215.

a joint, with partial rupture or other injury of its attachments, and without luxation of bones. A few fibers may be torn, or tendons or ligaments at the joint may be wrenched or torn.<sup>1</sup>

- M. Strain: The investigator accepts the definition of  
Taber:

To injure by making too strong an effort or by excessive use of a part of the body so that it is injured; injury to muscles from tension due to overuse or misuse, a longitudinal separation of the muscle fibers.<sup>2</sup>

- N. Tape Rash: The investigator accepts the explanation of  
Taber:

Temporary eruption of skin, with little or no elevation, an outbreak of lesions on the skin, irritation resultant from adhesive tape. Complications may develop if not promptly treated, excessive seeping of fluid, blood blisters and scarring.<sup>3</sup>

- O. Injury: The investigator accepts the definition of  
Taber who states that an injury is a "specific impairment of body structure or function caused by an outside agent or force, which may be physical, chemical, or psychic."<sup>4</sup>

#### Survey of Related Literature

A survey of recent and previous research studies and articles indicates that the proposed study will not duplicate completed investigations. The following review of completed research was of assistance to the present investigator in the development of the study.

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<sup>1</sup>Taber, p. S-88.

<sup>2</sup>Ibid., p. S-105.

<sup>3</sup>Ibid., p. R-6.

<sup>4</sup>Ibid., p. I-25.

A. Thorndike<sup>1</sup> undertook a twenty year longitudinal study of the most serious recurrent injuries of athletes at the Harvard University, Cambridge, Massachusetts, during the inclusive dates of 1932 to 1952. The number of reported experiences with injuries totaled 7090 cases sustained during organized competitive athletics. All fractures, dislocations and injuries to any viscus were considered serious. All injuries reported were serious enough to require the athlete to refrain from one or more practice sessions or games.

Thorndike assembled all the data and presented it in the form of tables. The tables listed the classifications of injuries, the types of injuries and the frequencies of the injuries. The second table presented a listing of the complications of sprains. Both frequency in Arabic numerals and percentages were given for each category. Thorndike also examined the data by arranging the twenty year study into subgroups of five year periods.

Thorndike found that fifteen percent of the athletes who sustained fractures, dislocations and internal injuries re-entered the area of contact sports at the Harvard University. Thorndike substantiated the theory that by raising the chances of recurrent injury to the same limb, the athlete allowed the possibility of disability and loss of general control over the limb to increase beyond normal. Elbow dislocations promptly reduced, but inadequately treated in convalescence, caused myositis ossificans and serious joint dysfunctions. Shoulder dislocations permitted to recur more

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<sup>1</sup>Augustus Thorndike, M.D., "Serious Recurrent Injuries Of Athletes" Journal of School Health, XXIII (1953), pp. 73-78.



than three or four times inevitably required surgical intervention, and a dislocated shoulder previously operated on, if permitted to recur in athletic trauma, resulted in seventy per cent disability in relation to range of motion and arm motion and arm strength.

Patients who had sustained Cerebral concussions, recurring more than three times with loss of consciousness at any one time were not allowed to re-enter body-contact sports. During the twenty years involved in the Study Thorndike diagnosed three fractured skulls and 309 cases of Cerebral concussion.

Those athletes who sustained sprains had to use protective adhesive strapping, but only if there had been complete functional recovery. Athletes with recurrent dislocations were allowed to continue contact sports by using restrictive harnesses. The participation in the proper type of sport rather than the denial of all participation in sports was the recommended prescription.

The results indicated that because of the improved methods of reducing the incidence of recurrent injury in athletes, participation can be made safer. However, Thorndike reported the increase of internal injuries and stated this to be the topic of his next study; to determine the cause of this discovered increase.

B. Parrish, Dale, and Weil<sup>1</sup> developed a new report form for school accidents and to provide a code for punching and analyzing accident facts. The report form has been tested and used

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<sup>1</sup>Henry Parrish, Marjorie Dale, Janet Weil, "Development of A Report Form For Accidents," The Journal of School Health, (October, 1968), pp. 494-98.

by the Columbia Board of Education. They believe that before one can control and prevent such accidents one must know all the facts contributing to the accident.

The school accident form is printed on a five inch by eight inch Keysort card composed of one original and two carbon copies. Both copies are superimposed on the original and are made of lighter paper than the original. Of the three identical reports of a school accident, the green copy remains at the school system where the accident occurred; the blue copy is sent to the physician who treated the accident victim. After his portion of the report is completed, the physician returns his copy to the school health department. This copy is used to complete the original form and to compute the total results of a particular accident. A clerk or another member of the school health department punches, sorts, and analyzes the final form for the school.

The school accident form has three general information sections: (1) general information, (2) school accident report, (3) the physician's report. Data for the general information are obtained from the school's basic administrative records about the pupil. This section is completed by a person designated to complete accident reports in the school principal's office. The person who reported the accident is responsible for the second section; the physician who treated the patient must complete the third section.

The original copy and the blue carbon copy (the physician's

copy) are then coded and punched. An example of the coding is illustrated.

TYPE OF INJURY

- 1--No detectable injury
- 2--Fracture, open
- 3--Fracture, closed
- 4--Dislocation without fracture
- 5--Sprain or strain
- 6--Cerebral concussion
- 7--Cerebral hemorrhage
- .....
- 21--Chipped tooth
- 22--Other
- 23--Not stated

The corresponding hole is punched out of the original form and sent through a properly programed I.B.M. 1400 computer.

The investigators advocated the organization of a more active school safety committee functioning for the study of circumstances surrounding school accidents in order to recommend preventive measures and to promote school safety. The well designed accident report form and complete reporting of all accidents was essential to the epidemiological control and prevention of school accidents. Most of the accident variables needed for such a complete statement were included in the paper. The investigators believed that in some cases the variables would have to be modified to fit the needs of a particular school system.

C. Van Meter<sup>1</sup> studied the frequency and location of accidents and the types of injuries resulting from accidents which occurred in the Public Schools of Fort Worth, Texas. The study was limited to accidents which occurred in the school buildings and on the school grounds of the Public Schools of Fort Worth, Texas, and accidents involving students enrolled in the Public Schools of Fort Worth, Texas, during the academic years 1954-55 and 1955-56.

This study entailed the examination of two groups of students, those who had a record of repeated accidents and those whose records showed that they had been free of accidents. The investigation was directed toward obtaining information of a psycho-physical nature for each pupil in the study. The data from test scores and school records were statistically treated and differences between the groups noted.

The treatment of the data entailed the tabulation, computation, and construction of tables and statistical equivalents. First, the accident reports were classified according to the grade and sex of the students involved. Then data from the accident reports were tabulated for each of the twelve grades. The following locations were listed on the tabulation sheets: (1) gymnasium, (2) athletic fields, (3) school grounds, (4) classrooms, (5) vocational shops, (6) hallways, (7) cafeteria, (8) restrooms. The types of injuries listed on the tabulation sheets were (1) eye injuries, (2) lacerations, (3) fractures, (4) bruises,

<sup>1</sup>Gayle Van Meter, "The Frequency and Location Of Accidents and the Types of Injuries Resulting From Accidents in the Public Schools of Fort Worth, Texas" Unpublished Master's thesis, The Texas Woman's University, Denton, Texas, 1957.

(5) sprains, (6) strains, (7) concussion, (8) dislocations, (9) burns, (10) dental injuries, and (11) shock.

Analysis of the accident report forms from the Public Schools of Fort Worth, Texas, revealed that there were a total of 879 accidents in the two year period. Of this total, 677 accidents resulted in injury to boys and 202 accidents resulted in injury to girls. Only four accidents occurred in the school laboratories and only three in the domestic science departments; these being classified under the heading of "classroom" accidents rather than under their own headings. There were two swimming pool accidents and four dressing room accidents; these were classed under "gymnasium" instead of their separate headings. Accidents which occurred on the stairways were included in the "hallways" category.

Van Meter based the following conclusions upon an analysis of the data related to accidents which occurred in the Fort Worth, Texas Public Schools during the two year study.

1. The findings concerning the frequency of accidents by grade and location during the two-year period corresponded with the national findings as published in American Facts for the year 1955.
2. More accidents occur in areas under the supervision of the physical education department than in any other area.

3. This is substantiated by the fact that 325 of the 879 accidents occurred in the gymnasium or on the athletic field; the next largest number of accidents occurred on the school grounds with 243 accidents reported at this location.
4. A substantially large number of accidents occur on the school grounds.
5. The majority of the accidents occurring in school buildings or on school grounds result in minor injuries. This is substantiated by the fact that 449 accidents resulted in lacerations, 122 bruises, seventy-five sprains, and twenty strains.
6. More accidents occur in the vocational shops than in the classrooms. This is substantiated by the fact that 102 of the 879 accidents occurred in the vocational shops and seventy-six occurred in the classrooms.

D. Hays<sup>1</sup> indicates the purpose of her study to be two fold in nature. First, to discover the number of accident repeaters and accident free girls among pupils enrolled in physical education classes taught by the investigator at the J. P. Elder Junior High School, located in Fort Worth, Texas. Secondly, to compare the two groups as to their personality adjustment in terms of home, health, social, and emotional adjustment.

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<sup>1</sup>Margaret Dean Hays, "A Comparison of Accident Repeaters And Accident Free Girls," an unpublished Master's thesis, Graduate Division, College of Health, Physical Education, Recreation, The Texas Woman's University, Denton, Texas, 1957.

The data used in the study were gathered from human sources and documentary sources. The human sources represented 206 girls classified as seventh, eighth, and ninth graders enrolled in the above school. At the beginning of the school year, the investigator explained to the pupils enrolled in physical education classes that at the end of each month the Accident Analysis Chart would be handed to each pupil to be filled out. The Bell Adjustment Inventory was used as the personality adjustment instrument.

Forty of the 206 girls were found to be accident repeaters and 166 girls were found to be accident free. The number of accidents incurred during the school year was used to separate the two groups with less than five representing the accident free girl and over five involving a loss of time from school to represent the accident repeater girl.

Hays concluded the following findings upon the basis of her study:

1. The accident free girls possessed superior total personality adjustment at the time of the initial administration of the test.
2. The accident repeaters total personality adjustment was inferior to that of the accident free girls which may or may not have been due to their classification as accident repeaters.
3. However, since the critical ratio between the accident free and accident repeater girls was lower than the .05

level of probability, it may be stated that the total personality of the two groups was the same.

4. The accident free girl achieved the most desirable mean score for total personality adjustment obtained from the final administration of the Bell test.
5. The accident free girls and accident repeaters possessed the same degree of total personality adjustment at the time of the final administration of the Bell test.
6. The classification of pupils, accident free or accident repeater, had not influenced the total personality adjustment of the pupils.
7. The accident free girls possessed superior home adjustment at the time of the final administration of the Bell test.

E. Jones<sup>1</sup> compared accident free boys and girls and accident repeaters in the Berne-French High School, Berne, Indiana. The general purposes of the study were as follows: (1) discover the number of accident repeater and accident free boys and girls, (2) to compare the safety information possessed by accident repeaters with the safety information possessed by the accident free boys and girls, (3) to make recommendations in regard to the conduct of safety education in the high school at Berne, Indiana.

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<sup>1</sup>Norma Lou Jones, "A Comparison of the Safety Information Of One Hundred and Eighty-Four Accident Free Boys and Girls and Thirty-One Accident Repeaters in the Berne-French High School, Berne, Indiana," an unpublished thesis, The Texas Woman's University, Denton, Texas, 1958.



The data upon which the study was based were collected by the administration of the General Safety Test for High Schools. The initial and final test papers were graded and classified according to sex and frequency of accidents. A key was used to score the sixty test items. In May, 1958, when the number of accident repeaters had been ascertained, the following comparisons were made from data obtained from the General Safety Test for High Schools:

1. The initial and the final scores of accident repeater girls.
2. The initial and the final scores of the thirty-one accident repeater girls and boys.
3. The initial and the final scores of the accident repeater boys.
4. The initial and final scores of the accident free boys.
5. The initial and final scores of the accident free girls.
6. The initial and final scores of the 184 accident free boys and girls.
7. The initial and final scores of the ninety-six and the eighty-eight accident free boys and girls respectively.
8. The initial and final scores of the fourteen and seventeen accident repeater boys and girls respectively.
9. The initial and final scores of the fourteen accident repeater boys with the ninety-six accident free boys.
10. The initial and final scores of the seventeen accident

repeater girls with the eighty-eight accident free girls.

11. The initial and final scores of the thirty-one accident repeater girls and boys and the 184 accident free boys and girls.

In addition, the number of pupils having accidents, the type of accident and the location of the accident were tallied by Jones and compared. From the findings presented in her thesis, Jones made the following conclusions:

1. The information yielded by the 215 pupils taking the General Safety Test had a high degree of reliability. The actual coefficient of reliability was .86 obtained from a randomly selected sampling of 100 pupils.
2. The difference between the means for the initial and final administrations of the test were statistically significant for the girls and not for the boys.
3. The difference between the means for the boys and girls obtained from the initial administrations of the test were statistically significant for the boys and not for the girls.

#### Summary

In this chapter, the introduction to the study, the statement of the problem, the purposes of the study, the limitations of the study, definitions and explanations of terms, and a survey of previous studies have been presented. The procedures used in the development of this study are found in Chapter II.

## CHAPTER II

### PROCEDURES

The present study was developed as a result of the interest in the number of injuries sustained by highly skilled women athletes competing in the sports of basketball, tennis and track and field during the 1969 competitive season. Data were collected during the National Invitational Collegiate Basketball Tournament at Amarillo, Texas; the Womens National Amateur Athletic Union Basketball Tournament at Gallup, New Mexico; the Texas State Tennis Championships at San Antonio, Texas; and the National Intercollegiate Track and Field Championships at San Marcos, Texas. The procedures used in developing the present study are discussed in this chapter.

#### Sources of Data

The sources of data used in this study were human and documentary. The human sources of data were 105 women basketball players, thirty-two women tennis athletes and fifty-eight women track and field athletes. Faculty members of the College of Health, Physical Education and Recreation at The Texas Woman's University, Denton, Texas, provided suggestions for the development of the study. Mr. T.C. Cox, head trainer at the North Texas State University, Denton, Texas, and Mr. Jim Cody, former head trainer at the North Texas State University, Denton, Texas, currently the director of the Truett Laboratory, division of Southwest Drug Company, based in Dallas, Texas, were resource individuals for many of the

technical phases of the study. The directors of the tournaments, officials conducting the tournaments and the coaches of the teams playing in the tournaments offered valuable assistance to the investigator during the course of the investigation.

The available documentary sources of data used were professional books, reports, periodicals, bulletins, theses, research studies and dissertations pertaining to the area of scrutiny.

#### Construction of the Analysis of Injury Chart

The Analysis of Injury Chart used for the collection of data within this study was based upon the forms used previously by Thorndike and Logan in their respective studies. Thorndike's chart was devised to compile data for his twenty year longitudinal study of injuries at the Harvard University in Cambridge, Massachusetts.<sup>1</sup> The chart indicates the complications associated with sprains and the recurrent injuries of a serious nature. A current data sheet was maintained on the totals of the injuries. The chart was restricted to the complications of ankle sprains and the more serious injuries.

Logan modified Thorndike's injury chart by adding more injury classifications and by defining the areas of the body he was interested in. Logan maintained that a methodical analysis

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<sup>1</sup>Augustus Thorndike, M.D., "Serious Recurrent Injuries of Athletes", (Journal of School Health), Vol. XXIII, No.3, 1953, pp.73-78.

of injuries form be developed to aid the trainer and the team physician. Logan supplemented each athlete's medical history with a relatively detailed incidence of injury and its location on the body.

The chart forms suggested by Thorndike and Logan aided the development of the present Analysis of Injury Chart. The chart was designed to isolate the injury in relation to the specific location on the body and the particular type of the injury. There are nineteen specific anatomical locations to select from and fourteen classifications of injuries listed. Sections for the time of the injury, in relation to pre-season or season, the frequency of the injury, position or event in which the player was participating at the time of the injury, and the time lost because of the injury provide additional information. The form contains a section for the name of the athlete, the age and the college or team with which the athlete was affiliated. A copy of the Analysis of Injury Chart follows on page twenty-five.

#### Procedures for the Collection of Data

The data were gathered at four tournaments; two basketball, one tennis and one track and field. Each tournament was representative of the highest level of women's competition, either sectionally or nationally. Permission to administer the Analysis of Injury Chart was obtained from the directors of the tournaments. Teams

THE TEXAS WOMAN'S UNIVERSITY  
DENTON, TEXAS  
INCIDENCE OF INJURY  
COLLEGE

NAME

TYPE OF INJURY:

FOOT

HAND

TIME OF INJURY:

FREQUENCY OF

SECOND

POSITION AT  
OF INJURY:  
SINGLES OR  
AND  
UP OR BACK

STRAIN (MUSCLE OR

OTHER:

were selected from each meet or tournament to participate in the study. The coaches and players of the selected teams cooperated to the fullest extent in the completion of the forms.

The first tournament in which data were collected was the National Invitational Basketball Tournament at Amarillo, Texas. The four teams selected for participation in the study were: the Kansas State University, Manhattan, Kansas; the John F. Kennedy College, Wahoo, Nebraska; Hutcherson Flying Queens, Plainview, Texas; and the Ouachita Baptist University, Arkadelphia, Arkansas. Each individual completed the Analysis of Injuries Chart and returned it to the investigator after the final game of the tournament. Data were collected from the forty-six participating individuals.

The second basketball tournament was the Womens National Amateur Athletic Union Basketball Tournament at Gallup, New Mexico. The following five teams were selected for participation in the study: Raytown Piperettes, Raytown, Missouri; Teal Refrigeration, Milwaukee, Wisconsin; New York Chuckles, New York, New York; CIC Falcons, Gallup, New Mexico; and The Texas Woman's University, Denton, Texas. Each individual completed the Analysis of Injury Chart and returned it to the investigator at the end of the tournament. Data were collected from fifty-nine participating individuals.

The data were collected for the sport of tennis during the Texas State Tennis Tournament at Trinity University, San Antonio, Texas. Upon registration for the tournament each participant received the Analysis of Injury Chart. Institutions represented at the tournament were Stephen F. Austin, Nacogdoches, Texas; Lamar State College of Technology, Beaumont, Texas; Southern Methodist University, Dallas, Texas; The University of Texas, Austin, Texas; The University of Houston, Houston, Texas; Sam Houston State College, Huntsville, Texas; Wayland Baptist College, Plainview, Texas. The participants completed the charts and returned these to the investigator after the completion of the tournament.

The first National Intercollegiate Track and Field Championships at San Marcos, Texas, was the selected tournament for the collection of data in track and field. The selected teams were provided with the Analysis of Injury Chart. The teams participating in the study were Oklahoma State University, Stillwater, Oklahoma; The Texas Woman's University, Denton, Texas; Southwest Texas State College, San Marcos, Texas; Texas Technological College, Lubbock, Texas; The University of Tennessee, Knoxville, Tennessee; Florida State University, Tallahassee, Florida; Flat River Community College, Flat River, Montana; and The University of Illinois, Urbana, Illinois. The completed Analysis of Injury Charts were returned to the investigator after the completion of the track and field competition.



### Treatment of Data

The data were classified according to the respective sport in which they were collected. After arrangement according to the sport, each individual chart was tallied on a tabulation sheet. The following anatomical locations were listed on the tabulation sheet: (1) foot, (2) ankle, (3) lower leg, (4) knee, (5) upper leg, (6) hip, (7) abdominal, (8) chest, (9) shoulder, (10) upper arm, (11) elbow, (12) forearm, (13) wrist, (14) hand, (15) finger, (16) neck, and (17) head. The types of injuries listed on the tabulation sheets were (1) abrasion, (2) blister, (3) torn cartilage, (4) concussion, (5) contusion, (6) dislocation, (7) dropped arch, (8) fracture, (9) laceration, (10) separation, (11) shin splint, (12) sprain, (13) strain, (14) tape rash, and (15) other.

The percentage of injuries within each particular sport was computed based upon the rows and columns contained in the Analysis of Injury Chart. The percentage frequency for each body location of each specific injury was computed. The number of reported injuries of each sport and the number of reported injuries for the three sports were tallied.

### Summary

In this chapter, the sources of data, the construction of the Analysis of Injury Chart, the procedures for the collection of data, and the treatment of data have been presented. The tables and the results are presented in Chapter III.

### CHAPTER III

#### ANALYSIS AND INTERPRETATION OF FINDINGS

The present study was undertaken to determine the incidence of injuries among women participants during State and National competition in basketball, track and field and tennis. The data were collected through the use of an Analysis of Injury Chart. The data presented in this chapter are arranged according to the sport to which each section of data is relative.

TABLE I

THE TOTAL NUMBER OF PARTICIPANTS, TEAMS AND INJURIES  
FOR BASKETBALL, TRACK AND FIELD AND TENNIS

Sport	Number of Teams	Number of Participants	Number of Injuries
Basketball	9	105	184
Track and Field	8	58	77
Tennis	8	32	66

Table I indicates the number of teams, participants and injuries for each sport. As presented in this chart nine basketball teams comprised of 105 women athletes, eight college track and field teams with fifty-eight women athletes and eight college tennis teams comprising thirty-two women athletes participated in this study.

TABLE II  
THE INCIDENCES OF INJURIES IN RELATION TO  
THE NUMBER OF PARTICIPANTS IN BASKETBALL

Rank	Injury	Number of Injuries	Percentage Based upon the Number of Participants
1	Sprain	56	53.33 %
2	Blister	35	33.33 %
3	Abrasion	28	26.66 %
4.5	Contusion	16	15.23 %
4.5	Shin Splint	16	15.23 %
6	Strain	15	14.29 %
7	Torn Cartilage	7	6.66 %
8	Fracture	6	5.71 %
9	Dropped Arch	4	3.81 %
10	Dislocation	2	1.90 %
11.5	Laceration	1	.95 %
11.5	Separation	1	.95 %

TOTAL NUMBER OF PARTICIPANTS = 105

The incidences of injuries in basketball in relation to the number of participants are presented in Table II. Examination of the chart reveals the rank order of the frequency of injuries for each classification of injury and the percentage of this type

of injury based upon the total number of participants from whom data were collected.

The injuries classified as sprains, blisters, abrasions, contusions and shin splints were reported most frequently by the participants of the study. The largest percentage of injuries were sprains with 53.33 per cent based upon the total number of participants. One third of the injuries sustained were classified as blisters. Abrasions ranked third with slightly over one quarter of the reported injuries, precisely 26.66 per cent. Two classifications, contusions and shin splints, accounted for 15.23 per cent of the injuries.

The percentage frequency of injuries in basketball in relation to the number of injuries sustained are presented in Table III. The number of injuries within each specific classification of injury and the percentage based upon the total number of injuries is presented.

One third of the total number of injuries in the sport of basketball were classified as sprains. Blisters, and abrasions were ranked second and third in relation to sustained injuries with 18.00 per cent and 12.26 per cent respectively. Contusions and shin splints classifications accounted for 8.75 per cent of the injuries respectively.

The percentage frequency of each injury in relation to the specific body location is presented in Table IV. The largest single number of injuries sustained in one body area is listed under the classification of Blister-Foot with thirty-five injuries.

TABLE III  
THE INCIDENCES OF INJURIES IN RELATION TO  
THE NUMBER OF INJURIES IN BASKETBALL

Rank	Injury	Number of Injuries	Percentage based upon the number of Injuries
1	Sprain	56	33.24 %
2	Blister	35	18.00 %
3	Abrasion	26	12.26 %
4.5	Contusion	16	8.75 %
4.5	Shin Splint	16	8.75 %
6	Strain	15	8.01 %
7	Torn Cartilage	7	3.75 %
8	Fracture	6	3.26 %
9	Dropped Arch	4	2.12 %
10	Dislocation	2	1.02 %
11.5	Laceration	1	.42 %
11.5	Separation	1	.42 %

TOTAL NUMBER OF INJURIES = 184

TABLE IV

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ANATOMICAL LOCATION IN WHICH THE INJURY  
WAS OBSERVED IN BASKETBALL

Rank	Injury	Anatomical Area	Number of Injuries	Percentage based on each specific Injury Total	
1	Sprain	Ankle	33	59.10	%
		Finger	16	28.57	%
		Thumb	4	7.14	%
		Foot	1	1.79	%
		Knee	1	1.79	%
		Wrist	1	1.79	%
2	Blisters	Foot	35	100.00	%
3	Abrasion	Knee	21	75.00	%
		Elbow	3	10.50	%
		Forearm	2	7.00	%
		Upper Arm	1	3.60	%
		Foot	1	3.60	%
4.5	Contusion	Knee	11	69.00	%
		Shoulder	1	6.20	%
		Upper Arm	1	6.20	%
		Elbow	1	6.20	%
		Hand	1	6.20	%
		Hip	1	6.20	%
4.5	Shin Splint	Lower Leg	16	100.00	%
6	Strain	Upper Leg	7	46.68	%
		Hip	4	26.68	%
		Abdominal	1	6.66	%
		Shoulder	1	6.66	%
		Back	1	6.66	%
		Knee	1	6.66	%
7	Torn Cartilage	Knee	7	100.00	%
8	Fracture	Ankle	1	16.66	%
		Lower Leg	1	16.66	%
		Wrist	1	16.66	%
		Hand	1	16.66	%
		Neck	1	16.66	%
		Head	1	16.66	%
9	Dropped Arch	Foot	4	100.00	%
10	Dislocation	Shoulder	1	50.00	%
		Finger	1	50.00	%
11.5	Laceration	Foot	1	100.00	%
11.5	Separation	Shoulder	1	100.00	%

TOTAL NUMBER OF INJURIES = 184

The second largest frequency of specific injury occurred in the Ankle-Sprain combination with thirty-three incidences of injuries. The Lower Leg-Shin Splint injury accounted for sixteen of the 184 total injuries. Eleven injuries were identified as Contusion-Knee; seven were identified as Upper Leg-Strains, and seven as Knee-Torn Cartilage.

TABLE V  
THE INCIDENCES OF INJURIES IN RELATION TO  
THE NUMBER OF PARTICIPANTS IN TENNIS

Rank	Injury	Number of Injuries	Percentage based upon the Number of Participants
1	Blister	28	87.50 %
2	Abrasion	14	43.75 %
3	Shin Splints	12	37.50 %
4.5	Sprain	4	12.50 %
4.5	Strain	4	12.50 %
6	Tennis Elbow	2	6.25 %
7.5	Tape Rash	1	3.11 %
7.5	Contusion	1	3.11 %
TOTAL NUMBER OF PARTICIPANTS = 32			100.00% = 66 INJURIES

Table V illustrates the incidence of injuries in tennis in relation to the data collected from the thirty-two participants. The three most frequently sustained injuries were found to be blisters, abrasions and shin splints. The percentage of blisters, 87.50, was twice that of abrasions, 43.75 per cent, the second ranked injury. The classification of shin splints was the third highest ranked injury with an incidence of 37.50 per cent. The injuries classified as sprains and strains accounted for 12.50 per cent, respectively, of the injuries sustained.

TABLE VI  
THE PERCENTAGE OF INJURIES IN RELATION TO  
THE NUMBER OF INJURIES IN TENNIS

Rank	Injury	Number of Injuries	Percentage based upon the Number of Injuries
1	Blister	28	42.42 %
2	Abrasion	14	21.21 %
3	Shin Splint	12	18.18 %
4.5	Sprain	4	6.06 %
4.5	Strain	4	6.06 %
6	Tennis Elbow	2	3.03 %
7.5	Tape Rash	1	1.52 %
7.5	Contusion	1	1.52 %

TOTAL NUMBER OF INJURIES = 66

100.00 %



Eight specific classifications of injuries comprise the incidences of injuries in relation to the number of injuries in tennis. The rank, the specific injury, the number of incidences of each injury and the percentage based upon the total number of injuries reported are represented in Table VI. The highest three classifications of injuries accounted for 81.81 per cent of the total number of injuries reported in tennis. Injuries classed as sprains and strains accounted for equal percentages of 6.06 per cent.

TABLE VII  
ANATOMICAL LOCATION IN WHICH THE INJURY  
WAS OBSERVED IN TENNIS

Rank	Injury	Anatomical Location	Number of Injuries	Percentage based upon the Number of Injuries
1	Blister	Hand	13	46.42 %
		Foot	11	39.29 %
		Finger	4	14.29 %
2	Abrasion	Knee	5	35.71 %
		Elbow	4	28.57 %
		Hand	2	14.30 %
		Forearm	1	7.14 %
		Ankle	1	7.14 %
		Foot	1	7.14 %
3	Shin Splint	Lower Leg	12	100.00 %
4.5	Sprain	Ankle	4	100.00 %
4.5	Strain	Shoulder	2	50.00 %
		Upper Arm	1	25.00 %
		Neck	1	25.00 %
6	Tennis Elbow	Elbow	2	100.00 %
7.5	Tape Rash	Lower Leg	1	100.00 %
7.5	Contusion	Lower Leg	1	100.00 %

TOTAL NUMBER OF PARTICIPANTS = 32

TOTAL NUMBER OF INJURIES = 66

Table VII denotes the frequency and percentage of the location of the injury on the body as related to the specific injury classification reported in tennis. Five specific anatomical areas accounted for forty-five of the reported total of sixty-six injuries, or approximately 66.66 per cent of the total injuries. These areas of injury, in rank order, with the percentages, were as follows: (1) Hand-Blisters with 46.42 per cent of the total number of injuries classed as blisters; (2) Lower Leg-Shin Splints representing 100.00 per cent of the total incidence of injuries in this classification; (3) Foot-Blisters with 39.29 per cent of the total number of reported injuries classed under blisters; and, (4) Ankle-Sprain and Finger-Blisters accounted for an equal number of incidences. Finger-Blisters represented, however, only 14.29 per cent of the total number of blister injuries while Ankle-Sprains accounted for 100.00 per cent of the total reported injuries of the classification sprains.

Outlined in Table VIII is the incidences and percentage frequency of injuries in track and field in relation to the total number of participants from whom data were collected in track and field. The major classification of shin splints comprises slightly less than one half of the injuries in relation to the number of participants, or precisely 41.38 per cent of the fifty-eight participants. Blister injuries were second in frequency with 39.66

per cent of the total number of participants. The third and fourth ranked classifications are approximately the same with abrasions at 20.69 per cent and strains at 18.97 per cent.

TABLE VIII  
THE INCIDENCES OF INJURIES IN RELATION TO THE  
NUMBER OF PARTICIPANTS IN TRACK AND FIELD

Rank	Injury	Number of Injuries	Percentage based upon the number of participants
1	Shin Splints	24	41.38 %
2	Blister	23	39.66 %
3	Abrasion	12	20.69 %
4	Strain	11	18.97 %
5	Fracture	4	6.90 %
7	Torn Cartilage	1	1.72 %
7	Sprain	1	1.72 %
7	Dropped Arch	1	1.72 %

TOTAL NUMBER OF PARTICIPANTS = 58

The incidences of injuries in track and field in relation to the number of reported injuries is exemplified in Table IX. The first four classifications in rank order constitutes 91.20 per cent of the total reported injuries in track and field. Thirty-

one per cent of the sustained injuries were classified as shin splints. Blisters rated at 28.72 per cent was the second ranked injury in relation to the total number of reported injuries. Third and fourth rankings revealed abrasions at 15.77 per cent and strains at 14.41 per cent of the total number of injuries.

TABLE IX  
THE INCIDENCES OF INJURIES IN RELATION TO THE  
NUMBER OF INJURIES IN TRACK AND FIELD

Rank	Injury	Number of Injuries	Percentage based upon the total number of injuries
1	Shin Splints	24	31.30 %
2	Blister	23	28.72 %
3	Abrasion	12	15.77 %
4	Strain	11	14.41 %
5	Fracture	4	5.39 %
7	Torn Cartilage	1	1.47 %
7	Sprain	1	1.47 %
7	Dropped Arch	1	1.47 %

TOTAL NUMBER OF INJURIES = 77 100.00 %

TABLE X  
ANATOMICAL LOCATION IN WHICH THE INJURY  
WAS OBSERVED IN TRACK AND FIELD

Rank	Injury	Anatomical Location	Number of Injuries	Percentage based upon the number of participants
1	Shin Splint	Lower Leg	24	100.00 %
2	Blister	Foot	23	100.00 %
3	Abrasion	Knee	10	83.34 %
		Elbow	1	8.33 %
		Hand	1	8.33 %
4	Strain	Upper Leg	5	45.45 %
		Ankle	2	18.19 %
		Foot	1	9.09 %
		Knee	1	9.09 %
		Abdominal	1	9.09 %
		Elbow	1	9.09 %
5	Fracture	Lower Leg	1	25.00 %
		Foot	1	25.00 %
		Upper Arm	1	25.00 %
		Elbow	1	25.00 %
7	Torn Cartilage	Knee	1	100.00 %
7	Sprain	Ankle	1	100.00 %
7	Dropped Arch	Foot	1	100.00 %

TOTAL NUMBER OF PARTICIPANTS = 58

TOTAL NUMBER OF INJURIES = 77

Specific anatomical locations and types of injuries are presented in numerical and percentage frequency in Table X. Four distinct combinations of body location-injury combinations were revealed. The Lower Leg-Shin Splint and the Foot-Blister each displayed 100.00 per cent of the individual totals of their respective classifications. This would be expected for shin

splints since all injuries of this type are symptomatic of the lower leg. The combination of Knee-Abrasion represented 83.34 per cent of the total number of abrasion injuries. The last distinct combination was the Upper Leg-Strain resulting in 45.45 per cent of the total strain injuries.

#### Summary

Presented in Chapter III were the analysis and interpretations of the findings, and tables relevant to the examination of the data. A summary of the findings, conclusions and recommendations for further study are presented in Chapter IV.

## CHAPTER IV

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDY

The present study was undertaken to determine the incidence of injuries among women athletes in national basketball and track and field competition and in Texas state tennis competition. The data collected from the Analysis of Injury Chart encompassed pre-season and season participation during the 1969 year of competition. Upon the basis of the findings conclusions were drawn and recommendations were made for further study.

Throughout this study an endeavor was made to fulfill the following purposes:

1. To determine the percentage of each specific injury to each specific sport.
2. To determine the actual number of injuries to each specific sport.
3. To ascertain the percentage of total injuries in relation to the total number of participants.
4. To ascertain the percentage of each specific injury in relation to each anatomical area of the body.
5. To determine the most frequent injury in relation to the sport and the anatomical area of the body.

A survey of literature related to the topic of this study in the field of athletic injuries and safety revealed no investigations identical to the present study.

The procedures used in the preparation of this study are

described in Chapter II. Both human and documentary sources , comprising the athletes studied, the faculty members serving on the committee, the trainers used as resource persons, and the research literature pertaining to this area, were utilized in this study. The Analysis of Injury Chart, constructed for the collection of data, was developed as a modification of the Thorndike-Logan instruments.

The Analysis of Injury Chart used in the present investigation was constructed in order to determine the incidence of injuries among women athletes participating in national track and field and basketball competition and in Texas state women's tennis competition. The teams were selected for participation in the study in the specific sports tournaments and the charts distributed to each of the participants. The charts were completed and returned to the investigator during the competition.

The data from the administration of the instrument were tabulated and analyzed, and the findings were presented in Chapter III. Findings from the chart were summarized and conclusions drawn.

### Summary and Conclusions

#### Basketball

The 105 women participating in basketball sustained 184 injuries during the pre-season and season competition of 1969.



Eighty-eight athletes of the 105 women basketball players sustained injuries during the period investigated. Sprains, blisters, abrasions, contusions, and shin splints comprised 81 per cent of the total number of injuries. These five classifications accounted for 149 of the 184 reported injuries.

The anatomical location-frequency of injury combinations revealed the most frequent types of injuries sustained in basketball. The data indicated that blisters of the feet were the most recurrent injury with ankle sprains second in occurrence. Abrasions of the knee and shin splints ranked third and fourth in frequency. The number of actual incidences of other combinations were minimal.

From the analysis of data the investigator drew the following conclusions: (1) the five most frequent injuries in basketball were blisters of the feet, ankle sprains, knee abrasions, shin splints and knee contusions; (2) the most frequent type of injury received in basketball were sprains, blisters, abrasions and contusions; and, (3) the most vulnerable anatomical areas in basketball are the feet, the ankles, the legs and the knees.

### Tennis

The thirty-two participants in tennis competition sustained a total of sixty-six injuries. The injuries were sustained by twenty-six individuals; six reported no injuries. Approximately 82 per cent of the total number of reported injuries were accumulated within three injury classifications: blisters, abrasions

and shin splints.

Isolation of the anatomical location-frequency of injury combinations established three prominent combinations: blisters of the hand, shin splints, and blisters of the feet. These three combinations accounted for thirty-six of the sixty-six reported injuries or 81.8 per cent of the total injuries.

Upon the basis of the findings the writer drew the following conclusions: (1) the three most frequent injuries sustained in tennis were blisters of the hand, shin splints and blisters of the feet; (2) the most frequently occurring types of injuries were blisters, abrasions and shin splints; and, (3) the most vulnerable areas of the body in tennis are the hands, the legs, the feet and the ankles.

#### Track and Field

Fifty-eight participants reported a total of seventy-seven injuries with twelve individuals reporting no injuries. Shin splints, blisters, abrasions and strains accounted for 90 per cent of the total number of injuries sustained in track and field. These four classifications of injuries accounted for seventy of the reported seventy-seven injuries.

The findings obtained from the anatomical location-frequency of injury combinations revealed the following four classifications which comprised sixty-six of the seventy-seven

reported injuries: shin splints, blisters of the feet, knee abrasions and strains of the thigh.

The writer drew the following conclusions: (1) the four most frequent injuries sustained in tennis competition were shin splints, blisters of the feet, abrasions of the knee and strains of the thigh; (2) the most frequent type of injury associated with track and field were shin splints, blisters, abrasions and strains; and, (3) the anatomical areas most susceptible to injury in track and field were the feet, the lower leg, the knees and the thighs.

#### Recommendations for Further Study

The investigator submits the following recommendations for future studies:

- (1) A follow-up of this study with the same basketball teams playing under the new A.A.U.-D.G.W.S. rules.
- (2) A study of the incidence of injury in each sport in relation to the training practices of the individual teams.
- (3) A study of the precise time of the injury in relation to practices and games; for example, the first five minutes and the last five minutes.
- (4) The relationship of the types of surface used in

practice and the incidence of shin splints in track and field.

- (5) An isolation of specific injuries in relation to the individual events or positions involved in each sport.

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