ATHLETIC INJURIES AND HIGH SCHOOL PHYSICAL EDUCATION TEACHERS

By

Darlene Beeusaert

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ATHLETIC INJURIES AND HIGH SCHOOL PHYSICAL EDUCATION TEACHERS

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DARLENE BEEUSAERT

A Thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF SCIENCE

ABSTRACT

Athletic Injuries and High School Physical Education Teachers

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The rising incidence and cost of athletic injuries among high school athletes raises concern about the ability of the physical education teacher to effectively and efficiently manage these injuries. All 380 senior high physical education teachers in Manitoba's public high schools were identified in this mail survey, a return rate of 50.3% was achieved.

Teacher knowledge of athletic injury management was evaluated by the Sports Trauma Management Inventory (STMI) (Carey and Shute, 1982). Subjects provided information concerning related independent variables (gender, first aid training experience, physical education teaching experience, educational background, and location of school) and the incidence of athletic injuries.

The average score achieved on the STMI was 47.1% (sd=12). The average number of injuries that occurred in classes taught by respondents was 4.05, while the average number of interschool sports injuries was 3.23. A significant ANOVA was found among three levels of educational background and two categories of location. Significant interactions were found between location and educational background and educational background and gender.

The percentage of respondents who failed to achieve the pass criterion on the STMI was similar to related research. Comparison of injury rates to related research was difficult due to differences in data collection, injury definition and sample methodology.

The findings highlight the discrepancy between the responsibilities and the preparedness of the sample, a preference for physical education teachers with Bachelor of Physical Education degrees, a preference for sport specific training in athletic injury management, and the importance of regular updating and continuing education. Recommendations include the establishment of a reliable injury data collection system, and a standardized system of continuing education for physical education teachers, as well as amendments to the Education Administration Act in Manitoba.

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Chapter 1

INTRODUCTION

The large number of students involved in high school athletics coupled with the rising incidence of athletic injuries and lack of professional preparation raises concern as to the ability of physical education teachers to competently manage athletic injuries.

In 1987, Statistics Canada reported that 1.2 million injuries occurred as a result of sports participation (Millar & Adams, 1991). This represented 23% of all accidents, second only to motor vehicle accidents. de Loes (1990) indicated that the mean length of sick leave for sports injured persons in Sweden was 21.5 days. The authors further explained that "the overall cost per injury was $335.00" (American currency) (p. 71). They compared this to similar research in two other Scandinavian centers in which the total cost of injury was $372.00 and $470.00 respectively (American currency). If the figure of $335 per injury were related to the million sports injuries that may occur each year, the cost would be formidable. Prichett (1980) reported that the average cost per football injury in the U.S. in 1977 was $177.95. The author also stated that this cost had quadrupled from 1966 to 1977 and that in the last year alone (1976-1977) the cost had risen 18.7% (Pritchett, 1980). If this percent rise in cost was held constant over the last sixteen years, today's cost of injury would pose a tremendous burden on the health care system.

Injuries incurred during participation in sport activities are so frequent that they are commonly assumed to be "part of the game". A recent study using Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) data collected from 37,169 records of children from across Canada, aged 5-19 who were treated for injury, indicated that 60% of sport injuries occurred in 10-14 year olds. The data also showed that the male to female injury ratio was 2.2:1,

sprain and strains were the most common injury (32%), while fractures were the second most common (20.6%) type of injuries. Males were hurt most often playing ice hockey (17.4%); females while playing basketball (16.3%). The authors caution that there is an under representation of the most severely injured patients because they often bypass the usual emergency room administrative procedures, including the completion of a CHIRPP form. As well, older teenagers are also underrepresented because they often attend general, rather than pediatric hospitals, where the data collection had taken place. (Ellison & Mackenzie, 1993).

According to the Campbell's Survey on Well-being in Canada (Stephens & Craig, 1990), "approximately 9% of Canadians missed work or school as a result of a sports injury during the year prior to the survey. Since the rate of injury was so much higher among youth, the majority of this loss would be in school days (p. 33). The authors reported that 17% of females and 34% of males aged 15-19 had incurred a sports injury in the previous 12 months. This resulted in a loss of one or more school days for 68% of females and 53% of males (Stephens & Craig).

"In Manitoba, there were 330 hospitalizations for sports-related injuries in 1991. Eightly-one percent of these injuries occurred in males. Individuals between the ages of 10 and 20 comprise the largest number of sports-related hospitalizations" (The Injury Prevention and Control Coalition, 1994). Injuries that occur in public high schools in Manitoba are supposed to be reported to the General Accident Insurance Company. Year after year, the volume of serious injuries resulting from participation in high school athletics has been increasing (MAST claims, 1984-1990). In Manitoba, between 1984-1987, there were one to two serious injuries a year as a result of participation in athletics. In 1986, for example, a student sustained a depressed skull fracture as a result of being hit

by a shot put. Similarly, in 1987, another student sustained an injury to his arm on the parallel bars that required surgery. The total number of injuries in 1985-1987 doubled from those reported in 1984. In 1984, one student reported suffering a physical education related injury. In 1985-1987 two students each year reported a physical education related injury to the school division's insurance company. In 1988, however, the number of physical activity injuries sustained by students jumped to four (MAST Claims, 1984-1990). Initial indications for 1992 show that this statistic may well be 20 times that seen only a few years ago (K. Thomas, personal communication, September 18, 1992; Manitoba Association of School Trustees, Risk Management Officer). In fact, 1994 records showed that there were 40 athletic injury incidents that involved the legal system in Manitoba (K. Thomas, personal communication, May 15, 1995). It is important to note that the cases reported here only represent those that have been challenged in a liability suit against the school board. One can only speculate the number of injuries that are not legally challenged, possibly a much higher number.

It is important to realize that there are a great many high school students involved in interschool athletics and physical education classes. The Manitoba High School Athletic Association reported that 35,000 or 57 % of the entire high school student body was involved in interscholastic athletics in Manitoba in 1992 (C. Lasuik, personal communication, September, 18, 1992). There is little information describing the number of students that participate in intramurals or physical education classes. It is likely that both of these programs involve a higher percentage of the entire student population. There are 178 high schools in Manitoba with enrollments ranging between 25 and 1500. Projections for the 1992-1993 school year estimated an enrollment of 61,400 in Manitoba public high schools (Manitoba Department of Education, 1992). The number of

interscholastic sports teams that a school may field is quite varied. A single school however, may organize up to 22 separate sports teams.

Concurrent with the rapid increase in frequency of athletic injuries, is the increase in the dollar value of liability settlements associated with each incident. In 1986, the liability claims sought against school divisions in Manitoba ranged from $250.00 to $5000.00 (MAST claims, 1984-1990). In 1990, a range between $500.00 and $35,000.00 was awarded in similar liability claims against these same school divisions.

This increase far exceeds any increase that may have resulted from inflation. According to Statistics Canada, the Consumer Price Index for 1986 was equal to 100. In 1990, it was equal to 119.5 (Statistics Canada, 1992). This means that the $5000.00 mentioned in 1986 would only have increased to $5975.00 in 1990 if inflation were the only influence on the dollar value of each claim. The dramatic increase in claim value is, therefore, due to much more than inflation.

Not only are there more claims being brought against school divisions, but they are also involving larger sums of money. The result is a rapidly increasing amount of money payable by the school divisions' insurance company. This could result in higher insurance premiums for school divisions, ultimately adding to the tax burden required to fund public education.

This increase in the number of liability claims against school divisions may be occurring for a variety of reasons. Students and their parents may be more comfortable with the idea that they can sue school divisions in the event of an accident. This tendency is enhanced by increased media advertisements as well as the belief that large pay-offs are easy to attain (Agro, 1981). "The once common doctrine that an athlete assumes the risk of the sport in which he or she competes almost disappeared in the 1970's" (Lubell, 1989, p. 240). Today

"injured athletes consider litigation to be an appropriate remedy for an injury that occurred during play" (Lubell, p. 240).

One reason for the increasing number of injuries sustained by students may be that teachers have increasing demands on their time, larger classes to teach, and as a result students receive less attention. This might be compounded by the fact that technology, equipment and injury management techniques change and continually improve. This occurs at such a rapid rate that it may well be impossible for a general physical education teacher to keep up with the current knowledge (Bowlus, 1979; Hossler, 1985; Kelley & Brightwell, 1984; Kelley & Miller, 1976). This may not be the fault of the teacher as there are no recommendations or requirements in the Education Administration Act that provide for the retraining or upgrading of teachers after they become certified and are permitted to teach in the Manitoba school system (Education Administration Act, Section 515.88, 1993).

It should be the primary concern of the student and teacher to ensure the health and safety of participants in athletic activity. Idiculla and Goldberg (1987, p. 145) suggest that "the ability to perform physical activity, whether at work or as recreation, is an important aspect of human experience for men and women of all ages." Should a student become injured, the ramifications extend beyond tissue injury. If an athlete were injured, they could suffer physically, psychologically, or socially (Cobb, Maxwell & Silverstein, 1990). The positive value of exercise is well demonstrated (Koplan, Powell, Sikes, Shirley & Campbell, 1982). Canada's Health Promotion Survey, 1990 (Stephens & Fowler Graham, 1993, p. 140) reported that "for men and women of all ages, being more active is associated with better self-rated health status and lower stress levels. Being more sedentary is related to worse self-rated health status and higher stress levels". Hatziandreu, Koplan, Weinstein, Caspersen, &

Warner (1988, p. 1419) reported that "exercise is a cost-effective approach to lowering the risk of coronary heart disease." Should the injury be severe enough, the athlete may not be able to exercise and consequently could be affecting their life not only for the present, but also the future. If all goes well, the injury will heal without any long term problems, this is not always the case however. Mansell and Smith (1980, p. 71) asked "if young men and women are to have a future in sports or, at the very least, to escape debilitating injury, high school athletic programs must be reexamined so that proper care and treatment becomes a part of these programs". Nelson and Goc Karp (1991, p. 67) stated "there will always be risks in a physical education program, but they can be minimized".

In Manitoba, the policy for school safety is the responsibility of the individual school division (K. Thomas, personal communication, September 18, 1992). There are 57 school divisions in Manitoba. Some view student safety as very important. This is evidenced through the implementation of comprehensive policies and procedures aimed at ensuring student safety. Other school divisions do not place the same priority on student safety. According to K. Thomas, an inspection of policy manuals for the 57 school divisions in Manitoba revealed that most school divisions do not have a policy regarding school or student safety.

A typical Manitoba high school's safety policy may read as follows (K. Thomas, personal communication, September 18, 1992). "In case of accidents involving injury to persons in school or on playgrounds, appropriate action should be taken by the teacher and or principal and the accident reported by the principal to the superintendent in writing within 24 hours" (St. James School Division, 1992, p. 25). Note that appropriate action is not explained or defined for the principal or teachers. Unless the teacher or principal is

adequately trained in first aid techniques, he or she is not likely to know what an "appropriate action" is. There is a lack of definition and standardized first aid instruction for the teacher. This lack of training does little to ensure proper treatment of an athlete in the event of an injury.

Athletics in Manitoba high schools are aimed at encouraging the high school student to participate in activities that will assist in the realization of physical, social and emotional values (Manitoba High School Athletics Association, 1992). However, in the pursuit of this goal, many high school athletes encounter injuries through their participation in sport (Shively, Grana & Ellis, 1981).

Several factors which can lead to injury can be controlled. This includes the prevention of injury, re-injury (Lackland et al. 1985; Legwold, 1983), the time away from school or athletics due to injury, the prevention of further injury, the prevention of injury due to faulty equipment (Duda, 1989), and the identification of injury-causing factors through investigation of injury trends (Albright, 1988; Hossler, 1985; Stopka & Kaiser, 1988). Comprehensive study and monitoring of these factors can occur, if a trained professional is in charge.

There are a number of studies that support the need for certified athletic therapy professionals within the school system (Kelley & Brightwell, 1984; Parr, Porter & Hodgson, 1984; Tucker, O'Bryan, Brodowski & Fromm, 1988). As well, several authors (Hossler, 1985; Kelley & Miller, 1976; Rowe & Miller, 1991; Stopka & Kaiser, 1988) have suggested how this issue could be addressed to the satisfaction of the school board, the student athlete, parents and the athletic therapist. The inevitable response by those responsible for hiring is the lack of adequate funds to create such a position. On the other hand, a little money spent could return large dividends in terms of minimizing the injured athlete's time away from the classroom, reducing health-care costs in the long run and

reducing the costs of expensive litigation which can come as a result of injury or even death from school sports participation.

In summary, the incidence of athletic injuries in Manitoba High schools, coupled with the lack of professional preparation in the area of athletic injury management, raises the question about the ability on the part of physical education teachers to provide for the care and prevention of athletic injuries.

Statement of the Problem

The purpose of this study was to determine the level of knowledge that physical education teachers possess in the area of athletic injury management and to determine if knowledge is related to certain personal characteristics. A second purpose of this study was to determine the relationship between physical education teacher knowledge test achievement and a self-report of athletic injury incidence in corresponding Manitoba high schools.

Hypotheses

Two hypotheses were made as follows:

H_1 Characteristics of physical education teachers will be related to their knowledge scores on an athletic injury management knowledge test. These characteristics include gender, first aid training, years of physical education teaching experience, educational background and location of school (rural/urban). It was hypothesized that there would be no difference between male and female performance; respondents with higher levels of first aid training would score significantly better than those with lower levels; respondents with fewer years of physical education teaching experience would score significantly higher than those with more years of experience; respondents with a Bachelor of Physical Education Degree would score

significantly higher than respondents with lower levels of physical education; and urban respondents would score significantly higher than rural respondents

H_2 Teacher-reported athletic injury rates would be inversely associated with athletic injury management knowledge among high school physical education teachers.

i Teacher-reported athletic injury rates would be inversely associated with the total score of athletic injury management knowledge among high school physical education teachers.

ii Teacher-reported athletic injury rates would be inversely associated with the three subsections on a) diagnosis (SUBDX); b) treatment (SUBRX) and c) emergency care (SUBEX) .

Operational Definitions

Athletic injury: "Must be sports related. Keeps player out of practice or competition on the day following the injury. Requires medical attention (by a physician or trainer), or dental care of any kind beyond icing or wrapping, all concussions, nerve injuries no matter how transient, and eye injuries are included" (Noyes, Lindenfeld & Marshall, 1988, p. s68).

High school: A Manitoba educational institution which teaches youth from Grades nine to twelve as determined by the Manitoba High Schools Athletic Association.

Limitations

This study is limited by its reliance on the respondents to accurately report the number of injuries that occurred during the school year. At the time of this study a more accurate method of data gathering did not exist.

Delimitations

This survey was delimited to physical education teachers within the province of Manitoba. All subjects were teachers in public high schools.

Significance of the Study

All physical education programs operating in Manitoba should be able to ensure that any student sustaining an injury could be provided immediate, adequate and appropriate medical care. This will be unlikely if the person supervising the athletic activity is not adequately trained. To date, there have not been any studies conducted in Manitoba high schools which have investigated the relationship between teachers' knowledge of athletic injury management and the incidence of injury. The information collected in this study will serve to increase awareness of the problem, if not to encourage its resolution through the development of sound recommendations.

The information obtained will also provide the data from which school administrators can develop and implement policies and procedures related to student health and safety. The student athlete may benefit from new policies and procedures that minimize the potential for injury and the time away due to injury. In addition, efforts to promote the likelihood that an injury will be treated immediately and appropriately will also benefit the athlete. Physical educators and coaches may also gain from this study through an increased awareness of the potential for injury and the need for immediate and appropriate care. In

conclusion, the strengths and/or shortcomings of the present health and safety regulations related to physical activity are identified and recommendations developed.

This study has assessed the level of expertise of Manitoba's high school physical education teachers in the area of primary first aid to determine whether they possess competent knowledge to efficiently and effectively deal with critical injury management situations. Researchers (Rowe & Robertson, 1986; Rowe & Miller, 1991) have reported that there is considerable cause for concern when examining the results of a physical education knowledge inventory. Coupled with reports from Kelley and Brightwell (1984), Redfearn (1975), and Weidner (1989), this shows that persons designated within the school to perform the duty of athletic trainer are not adequately prepared to do so.

There is very little Canadian data available, however, the related American research is very important due to a generally accepted belief that Canadian trends tend to follow those in the U.S. (Agro, 1981). Therefore, injury trends in American high schools are likely to become a growing concern for Manitoba schools in the future. This study has attempted to fill the gap created by the lack of specific and applicable knowledge in this area.

Chapter 2

REVIEW OF LITERATURE

Introduction

Although much of the literature on high school physical education teachers and athletic injuries has originated in the United States, many of the concepts, suggestions and models lend themselves to application in other populations with similar educational systems. This chapter will describe the competence of persons employed in high schools who are designated to manage athletic injuries; medical coverage provided in high schools; and the incidence of athletic injuries in high schools. Lastly, the need, suitability and role of a certified athletic trainer as a possible alternative are examined.

Coach, Teacher, Nurse, and Superintendent Competency

Due to the incidence of athletic injuries sustained by high school students, it is important to determine the competency of persons in schools who would likely be called upon to treat injured athletes. Coaches, teachers, and school nurses as well as school superintendents may be asked to respond to an athletic injury. Thus, research into the knowledge of people in these positions is presented.

Knowledge of care and prevention of athletic injuries in high schools was investigated by Rowe and Robertson (1986). The authors pointed out that it is not uncommon for the coach to be responsible for attending to an injured athlete, as they are likely to be the only one present at the time of injury. The coach must render immediate decisions regarding the nature and severity of the injury. These decisions must be based upon an understanding of the

relationships between the bone/joint structure and muscle function of the human body, in addition to an understanding of the stresses to which the body is subjected during athletic performance. This study was performed to determine if those responsible for injury care are competent.

This was accomplished by means of a questionnaire and general information survey which was sent to all high schools in Alabama, USA. The instrument consisted of 20 multiple choice questions related to anatomy, conditioning, diet, equipment, heat, physiology and the care and treatment of athletic injuries. A level of 70% was established as a passing score and a valid indication of current knowledge.

Rowe and Robertson (1986) concluded that 73% of the people responsible for the treatment of injured athletes in Alabama high schools lack sufficient knowledge of the care and prevention of athletic injuries and failed to meet the criterion level. They also suggested there is need for concern when only 27% of persons responsible for making correct and quick decisions about injury care are capable of making the proper decisions. The authors suggested that each school should have a nationally certified athletic trainer to better meet the needs of each athlete.

Rowe and Robertson (1986) present very alarming but important information, yet there is some concern regarding the generalizability of their results. A response rate of only 28% was achieved. A much higher response rate (60% or more) is desirable (Dolsen & Machlis, 1991). A larger response rate would make the results more valid and thus lend more credibility to the authors' conclusions.

The competence of coaches and trainers was also investigated by Rowe and Miller (1991), in a replication of the work by Rowe and Robertson (1986). In the 1991 study, the same questionnaire and general information survey were distributed to public and private high school principals in Georgia, U.S.A. Although the methods do not specify the selection process, the reader was told that all geographical areas and athletic team classification levels were represented. A response rate of 35% was achieved. This is disappointing as a much higher response rate is desirable (Dolsen & Machlis, 1991). This same problem is also noted in the 1986 study by Rowe and Robertson.

Rowe and Miller (1991) reported that 62% of those responsible for care, treatment and rehabilitation of injured athletes did not possess adequate athletic training competence. These results can be compared to the 1986 study by Rowe and Robertson, (which reported 73% of respondents lacked sufficient knowledge in the care and prevention of athletic injuries), with limited generalizability. The lack of external validity from such a small return rate has already been questioned.

The competence of coaches in the area of athletic injuries was also examined by Weidner (1989). When a person is appointed to a coaching position, it is assumed that they are competent in regards to athletic injury care, prevention and treatment. Many coaches feel that athletic injury care and knowledge is a valuable asset to have as a coach. It is therefore discouraging to learn that a majority of coaches (47% - 71%) do not even complete a first aid or emergency care course, nor do 43% complete any CPR training (Conley, 1982; Porter et al., 1982).

It would be impossible to expect that all coaches become experts in athletic injury management when their primary concern is coaching their particular sport. However, it is not unreasonable to expect that coaches at least become competent in the recognition and primary care of athletic injuries. Weidner (1989) makes suggestions on how to achieve this goal. A minimum 3-unit introductory course in the prevention and care of athletic injuries should be instructed by a competent athletic training professional and required of all physical education majors with a teaching/coaching option. The author also advises that active coaches maintain current certification in both first aid and CPR.

The coach's role in medical care of athletes was questioned by Hage and Moore (1981). Most coaches who provide initial and emergency care to athletes are unqualified and unlicensed people (Redfearn, 1980). The concept of certifying coaches in emergency medical care techniques was put forth by the American Alliance for Health, Physical Education Recreation and Dance in 1968. It recommended that coaches complete college level courses in the medical, sociological and theoretical aspects of coaching, as well as kinesiology and physiology of athletic performance.

A controversial debate exists over the question of requiring coaches to take additional courses in athletic injuries. In support, Hage and Moore (1981) said that high school athletes would certainly benefit from just such a move. However, "it would be pretty tough to require coaches to function as athletic trainers - that would probably eliminate all coaches" (Hage & Moore, p.143).

Hage and Moore (1981) continued to point out the disparity between the two opinions. The medical community recommended that all coaches have first

aid training. Coaches on the other hand, were concerned with the cost and time associated with participating in extra workshops and continuing education courses.

Davis, Jelsma and Van Valey (1985) reported data from their survey on health concerns and teacher training in Michigan. Surveys were completed by K-6 elementary school teachers, a 54.6% response rate was achieved. This response rate is generally within acceptable limits as described by the author. The results showed that 31.8% of respondents had no undergraduate training in health education, 25.7% had four semester hours or more and 9.4% had training at the graduate level. Results also showed that more of the younger and least experienced teachers had a minimum of four more undergraduate hours than did the older and more experienced ones. In every instance, the average scores of teachers with at least four undergraduate hours of health training were higher than those of teachers with less training. Other results demonstrated that teachers with little training felt far less comfortable about dealing with student health problems, especially those that were potentially serious.

Davis et al. (1985) concluded that many teachers would rather leave health education and health care to health professionals. Teachers are aware of their limitations and therefore their preference is to refer student health problems to those people who have more appropriate training and experience. Davis et al. thus recommended more teacher training and extra workshops. However, they would prefer the hiring of a health care professional to manage health concerns (Davis et al.).

Alt (1986) examined the possibility of the school nurse acting as the athletic trainer within the school. She saw the increasing involvement of high school students in athletics as an opportunity for the nurse to become involved in assessment of athletic injury, the rehabilitation process, and teaching injury prevention to youth athletes and coaches. Alt reported that employing a licensed trainer was considered but dismissed because a trainer at the high school level was not mandated by Iowa state law. To add a nonmandated salary into the school budget would have proven prohibitive due to limited funding.

Alt (1986) listed the specific responsibilities of the nurse-athletic trainer. These include injury assessment, medical referral when necessary, working under the direction of the appropriate physician, taping and related activities, record keeping, advising conditioning and rehabilitation programs, and supervising students and staff wishing to acquire clinical experience. Hossler (1985), on the other hand, felt that these duties are more capably handled by a certified athletic therapist.

Carey and Shute, (1982) compared the responses of school nurses and certified athletic trainers on a Sport Trauma Management Inventory questionnaire. They reported that "the athletic trainers are more knowledgeable than school nurses about athletic injury recognition and management. As a group, athletic trainers have had more education, training, and experience in these areas" (Carey & Shute, p. 157). Furthermore, 75% of nurse and 25% of athletic trainer respondents failed to meet the pass mark criterion. This difference was found to be significant ($p > .01$).

A survey of Michigan high schools was undertaken by Ray (1987). This survey intended to measure school superintendents' knowledge and attitudes about high school athletic injuries and athletic trainers. A 30-item questionnaire was sent to school superintendents in all public school districts in Michigan. An 80% return rate was achieved. The results showed that over 75% of superintendents perceived the athletic trainer to be the most qualified person to prevent and treat athletic injuries. However, some discrepancy existed in the number of certified athletic trainers reported to be employed by the school district (70) and the actual number of certified athletic trainers employed in Michigan high schools (20). This number was vastly overestimated by the school superintendents.

It is evident that school superintendents know the number of athletic injuries that occur (Ray, 1987). They also know how to best treat and care for these injuries and they think that they are already taking care of the problem. The reality is that the people who are employed as athletic trainers are not certified professionals (Ray). It is therefore possible that they are not providing the best care and treatment for the student athlete (Kelley & Brightwell, 1984; Parr et al., 1984).

Knowledge of nutrition and nutrition practices of coaches, trainers and athletes was investigated by Parr et al. (1984). This study involved sending a survey to all athletic trainers who agreed to participate. These athletic trainers distributed the questionnaire to athletes, coaches and other athletic trainers in their schools. This study was intended to identify nutrition knowledge and habits of coaches, trainers and athletes.

The results demonstrated that athletic trainers certified by the National Athletic Trainers Association had the best nutrition background of those studied (Parr et al., 1984). Seventy percent of the athletic trainers had a formal course in nutrition while only 39% of coaches had some experience with nutrition issues. This work supports past research (Wolf, Wirth & Lohman, 1979) which stated that coaches are ill prepared in nutrition. It was also evident from this survey that noncertified athletic trainers had a much better background than coaches but were significantly less prepared than certified athletic trainers. The athletic population was undecided, some athletes preferred to take the advice of their coach, while others preferred that of their athletic therapist. It seems that as athletes become acquainted with dietary guidelines, they will use them in their daily eating habits (Parr et al., 1984). In their comparison of non-certified and certified athletic trainers, Parr et al. concluded that athletic trainers are the most educationally prepared for giving athletes nutritional information. The importance of a certified athletic therapist was well demonstrated by the authors.

The question of certifying interscholastic coaches was also addressed by Kelley and Brightwell (1984). The authors pointed out that there was some difficulty in securing enough qualified coaches to coach teams at the high school level. With the addition of Title IX, many more girls' teams were added to athletic programs around the country (USA). This increased the need for coaches even more and forced schools to hire coaches from outside the teaching profession. This seemed to solve one problem, but created another. The lack of adequate injury management knowledge by coaches has been demonstrated by many authors (Parr et al. 1984; Weidner, 1989; Ray, 1987).

Kelley and Brightwell (1984) described several other studies which examined coaching competence, knowledge obsolescence and health care for student athletes by (1) current teachers (2) current coaches (3) persons serving as athletic trainers and (4) senior physical education majors. These results showed that all groups needed a better understanding of athletic training principles, and more information regarding the frequency, duration and intensity of training and conditioning programs.

This lack of knowledge appears to justify concern. Kelley and Brightwell (1984) asked the question "If professionals already involved in athletics need updating, how can one be naive enough to expect nonprofessionals to be qualified?" (Kelley & Brightwell, p.50). The authors concluded that for the most part, the individuals making decisions on the severity of injuries and the administration of primary care are to a large extent not competent or familiar with the current knowledge. The authors suggested that unqualified people should not be hired to coach interscholastic sports. They reminded the reader that educational trends in professions relating to the health and well being of individuals frequently favour specialization.

The need for professional advise was echoed by Crossman, Jamieson & Hume (1990), in their investigation of athlete and coach perceptions of injury. This was accomplished through personal interviews with athletes and coaches. The authors found that coaches tended to overestimate the disruptive effects of injury to higher level athletes, while athletes tended to underestimate the importance of their own injury.

Legwold (1983) reported that injury rates of high school athletes are lower in schools that employ nationally certified athletic trainers. Instead of a

certified athletic trainer, some schools in North Carolina have teacher-athletic-trainers. These are teachers that must be certified in first aid and CPR and then must complete a basic and advanced course in athletic training. Legwold reported that almost two thirds of North Carolina's high schools participated in such a program. This program places somewhat capable individuals in the high schools to aid in injury management.

In summary, research (Kelley & Brightwell, 1984; Ray, 1987; and Alt, 1986) has shown that coaches, teachers, school nurses and school superintendents lack adequate competency in the area of athletic injury management.

Medical Coverage for High School Athletes

It has been demonstrated that individuals within schools lack the competence necessary to manage athletic injuries. Assistance from medical professionals is an alternative. Present medical coverage for high school athletes will thus be explored.

Medical coverage for a high school population was described by Tucker et al. (1988). The authors sent a questionnaire concerning medical coverage for athletes to the principal of each high school in New York State. Results showed that 76% of schools with varsity teams had a physician at field-side during games. There was some discrepancy concerning the criteria for physician coverage. It may have been attendance at all games or attendance at only one game all year. More alarming however, is the realization that for practices, virtually no schools with varsity teams provided field-side coverage.

Tucker et al. (1988) concluded that it may well be impossible to secure a physician for all games and all practices. Therefore, it is suggested that a certified athletic trainer be hired. Legwold (1983) supports this position by pointing out that high schools that have specially trained persons, also have increased correct diagnoses and decreased re-injury rates. In addition, other studies (Hage & Moore, 1981; Parr et al., 1984; Weidner, 1989) reported that many coaches (with whom this responsibility rests in the absence of certified personnel) are not adequately trained to care for athletic injuries, and at times are apprehensive about having this responsibility.

Lindaman (1991), on the other hand, reports that there was a physician in attendance for interscholastic athletics 61% of the time in Michigan. The criteria for physician attendance, however, was quite minimal, being presence at a game or practice "at least one time" (Lindaman, p. 83) throughout the entire year. In this study, the respondents were the athletic directors in Michigan high schools. This data may be misleading. By reporting a 61% physician attendance, the reader may be lead to believe that the student athletes are receiving somewhat adequate supervision. In reality, however, a one time visit by a physician really "does not offer the athlete any real access to physician care" (Lindaman, 1991, p. 83).

Porter, Noble & Bachman (1980) reported a 42% physician attendance at home games in Illinois. Attendance between 45% and 76% was reported for Alabama high schools while 70% attendance was noted for Northern Virginia schools. It is impossible to make meaningful comparisons because the criteria for attendance is not defined by the authors.

Lindaman (1991) concluded that 74% of varsity teams in all sports rely on the coach for emergency medical attention. As the coaches are not adequately trained or educated, this study implies that a significant medical need is not being met. The author suggested that the most obvious and realistic way to meet this need is to place qualified athletic trainers in the high schools.

The utilization of athletic trainers and team physicians to treat high school football injuries was examined by Lackland et al. (1985). Thirty-six high school football programs were selected for the survey. Each school was requested to report all injuries in accordance with the authors' definition. In this case, an injury was defined as any "recognized disability event" (Lackland et al., p.21).

The results showed that of the 36 schools participating, nine did not have the services of either a trainer or a team physician while three had a trainer but no physician. Nine others had a physician, but no trainer, and 15 had the services of both a trainer and a physician (Lackland et al., 1985).

The method of school selection by Lackland et al. (1985) was not described in this report. There is a possibility that a completely randomized sample was not achieved so as to guarantee the generalizability of the results. Similarly there is some concern as to the validity of the results as the respondents at the school were not identified or standardized. As well, neither the validity or reliability of the questionnaire was reported by the authors.

Lackland et al. (1985) suggested that trainers recognize substantially more injuries that occur during practice sessions than non-trainers, who were only likely to recognize injuries occurring during games. Detecting an injury early means that the athlete has a better opportunity for early treatment and return to play (Lackland et al.). The authors suggested that a successful

medical service team would rely on daily monitoring of injuries by a certified trainer and reviewed by a physician.

In conclusion, research has shown that it may be very difficult to secure physician coverage at all high school games, and next to impossible for practices. This suggests that a significant medical need is not being met.

Injury Incidence among High School Athletes

In order to determine the extent of the medical needs of high school athletes, the incidence of athletic injuries among high school students is further investigated. Health care for student athletes is a very controversial topic among health care professionals. Survey after survey has pointed out the incredible numbers of student athletes injured and killed each year (Lindaman, 1991; Rowe & Miller, 1991; Rowe & Robertson, 1986). A government survey reported by Kegerreis (1979a) estimated that one million sports-related injuries occur in schools each year in the US. Of these, 111,000 are deemed serious, forcing the student to miss at least three weeks of classes or practice. Kegerreis also indicated that less than 10% of the nation's estimated 22,000 high schools possess adequate medical care for student athletes. Similarly, a study of Michigan high schools also reported by Kegerreis, did not provide students with any athletic injury care.

Kegerreis (1979a) also noted that by the time an injured student athlete typically gets to see a physician, it is too late to provide the most effective care. The same study found that 26% of treated athletes incurred recovery times which were extended at least 30 days due to delays in seeking necessary medical help.

Football is one of the sports where a high proportion of injuries occur. Curtailing catastrophic head and neck injuries in the game of football was addressed by Mendel (1992). Causes and trends of head and neck injuries have been tracked since the early 1970's when about 30 players a year in the United States became paralyzed from football-related injuries. By 1975, 34 such injuries resulted in permanent quadriplegia. This prompted the National Collegiate Athletic Association, (NCAA) and the National Federation of State High School Associations to make changes to the rules in 1976. Such changes restricted using the helmet in any way to butt or ram an opponent. As a result, catastrophic injury rates dropped immediately, but began to climb at the end of the 1980's. Rules could not be modified anymore, so the roles of the coach, athletic trainer and equipment managers were examined to see what type of positive contribution could be made by each.

The coach's responsibility includes demonstration of proper techniques and insisting that they be used by all players in the interest of safety (Mendel, 1992). It was suggested that the athletic trainer's role was to provide in- and out-of-season neck and shoulder conditioning. This would include strengthening and stretching exercises. The equipment manager was responsible for the proper maintenance and fitting of all equipment.

Mendel (1992) indicated that only 4,000 out of the 20,000 high schools in the nation enlist the services of a certified athletic trainer. The author clearly states that high school administrators need to see athletic trainers as a necessity, not a luxury.

Need Demonstrated for Qualified Personnel

The severity and incidence of athletic injuries occurring in high schools, as well as the lack of competent and sufficient medical coverage, point to a need for a competent and certified professional to manage athletic injuries.

The need for a certified athletic trainer in the Junior/Senior high schools was supported by Kelley and Miller (1976). The purpose of this study was to determine the extent of knowledge obsolescence among non-certified junior/senior high school athletic trainers. A questionnaire was answered by 128 teachers charged with the care of sports injuries in Pennsylvania public schools. A 70% pass mark was used. The results indicated that 85% of the respondents could be considered obsolete in their understanding of the current knowledge.

Since the items on the questionnaire employed by Kelley and Miller (1976) were directly related to athletic training, it might be assumed that they would score highly. The fact that they did not, lead the authors to conclude that hundreds of decisions are made daily by individuals without adequate preparation and training.

Kelley and Miller (1976) have developed a 24 credit instruction program as a possible solution to this problem. Although they are well intentioned, there is some concern as to whether persons having completed such a course will be competent to handle all injury circumstances which arise in interscholastic sports. This concern is in light of the fact that the course has not been endorsed by the NATA.

Several reports have affirmed the need for a responsible person to be hired by the school system to manage athletic injuries and related concerns

(Lindaman, 1991; Tucker et al., 1988). They identified a certified athletic trainer as the ideal person to address these concerns (Rowe & Miller, 1991; Rowe & Robertson, 1986). Foster, Yesalis, Ferguson and Albright (1989) have therefore researched the competence of these professionals in a quality assessment of athletic trainers.

Foster et al. (1989) collected data from the XIX Junior Olympic Games (USA) that were held in 1985. All injuries that were attended to by a certified athletic trainer (ATC) were recorded. This study focused on 30 of the total 60 ATC's that attended the games. Nine months after the Games, an athlete satisfaction phone interview, related to the evaluation and management services provided by the attending athletic trainer was conducted. This information was collected from both the athlete who experienced significant injuries and their parents. According to Donabedian (1980), patient satisfaction is an accepted measure of quality assessment.

Foster et al. (1989) reported that the overwhelming majority of the participants indicated that they were in agreement with the competency of the attending athletic trainer. Foster et al. reported that most physicians agreed that the athletic training staff accurately and efficiently carried out evaluations of athletic injuries/illnesses. According to the authors, "it appears that athletic trainers were successful in determining the relative significance of injuries and illnesses that were screened by them " (Foster et al., p. 261). The authors concluded that the knowledge and skills required to recognize and make medical referral, and then appropriately manage sports injuries appears to be well applied by professionally prepared athletic trainers.

Bowlus (1979) stated that the need for athletic trainers in high schools is partially due to the increase in the number of participants, and a growing sensitivity to the role that schools play in the safety and well-being of students. The author reported that the benefits of a qualified athletic trainer outweighed the cost to a school district. He felt it was the duty for everyone related to the school and school district to speak out on these benefits, to urge parents and school boards to take action, and start to hire certified athletic trainers in high schools. Information provided by Legwold (1983) and Duda (1989) supported the hiring of certified athletic trainers in high schools.

Athletic Trainer Most Qualified for Athletic Injury Management

As a result of the need demonstrated for a more qualified person to assume the responsibilities of athletic injury management in high schools, the suitability of a certified athletic trainer is investigated. Legwold (1983) reported a study that showed schools with teacher athletic trainers had a football injury rate of 22% and a re-injury rate of 11% per year. On the other hand, in 28 schools that have a nationally certified athletic trainer, the injury rate was higher at 29%, but the re-injury rate was only 3%. The author compared these results with research from 1968-72 which "showed that schools without an athletic trainer had an injury rate of 50% and a re-injury rate of 71%" (Legwold, 1983, p. 36). This work provided a good baseline from which comparisons could be made in the future. As well, it lends strong support for the hiring of certified athletic therapists in high schools.

Duda (1989) reported a study by the National Athletic Trainers' Association (NATA) regarding high school football injury rates. The purpose of

the survey was to document the number, severity, and type of injuries and allowed the authors to demonstrate the need for injury management and prevention in high schools. The three year study revealed that about 1 million injuries, or about 60% of all injuries, occurred during practice sessions. The author pointed out that this is a time when most schools do not have a qualified on-site health care professional available. Other research (Lackland et al., 1985; Lindaman, 1991; Tucker et al., 1988) also found that most injuries occurred in practice.

The information for the NATA study (Duda, 1989) was taken from a sample of players from schools nation wide. Time-loss injuries were recorded by a certified athletic trainer in survey format. A time-loss injury was defined as one that required a player to suspend activity for the remainder of the day that the injury occurred, or for the day after onset of injury.

"Trainers can help decrease practice injury rates by implementing safe stretching programs, taping athletes, and providing daily injury management to prevent re-injury" (Duda, 1989, p. 32). The author indicated that athletes at schools without trainers are more likely to experience injuries that go unrecognized or untreated (Duda). It is recommended that high schools develop a well-planned, well-administered program of injury management and prevention for all sports. In conclusion, related literature has demonstrated that a certified athletic trainer is the most suitable person to be responsible for the management of athletic injuries.

Role of the Athletic Trainer

The management of athletic injuries is complicated and diverse. The role and specific duties that a certified athletic trainer might be responsible for are described here.

Moss (1991) reported that the growth in number of people interested in athletic therapy prompted the formation of the Athletic Trainers Association (NATA) in 1950. By 1970, certification of athletic trainers had begun in the United States. In 1990 the American Medical Association formally recognized athletic training as a viable allied health profession. The Canadian counterpart of the NATA is the Canadian Athletic Therapists Association (CATA). Initially recognized as an association of trainers in professional football and hockey, the CATA was established in 1966 (CATA, n.d.).

Rankin (1989) described a program at the University of Toledo which offered different options in athletic training in a degree program. The author reported that injury and re-injury rates of high school athletes decreased with a full time athletic trainer. Rankin suggested that although many high schools would like to hire an athletic trainer, many are unable to provide the accompanying teaching position that would make hiring feasible. As a result, schools are starting to subcontract athletic trainers from sports medicine clinics. Recent statistics indicated that more recent graduates are being hired in clinics rather than high schools (Rankin).

Rankin (1989), therefore, emphasizes preparing athletic training students for clinical as well as high school placement. The two different programs require the interchanging of teaching methods courses with basic and applied sciences. Rankin concluded by reaffirming the commitment to teacher

preparation for athletic trainers who desire teaching certification.

There is some concern regarding possible negative effects of the program suggested by Rankin (1989). Students choosing one area of study may be ill-prepared compared to students taking slightly different courses. As well, specific courses for a specific professional position may restrict a person from changing areas of practice after graduation. One program which included all areas of possible employment after graduation may be more effective in producing a generic certified athletic therapist (Rankin).

Albright (1988) described the role of the athletic trainer with respect to their value in research. Albright believed that from the standpoint of health care delivery, the team trainer's daily contact with athletes and coaches during high injury risk situations extends the traditionally facility-based system of medical care onto the practice field and creates a comprehensive health maintenance scheme.

From a research perspective, Albright (1988) valued athletic trainers for two reasons. First, daily presence on the field is critically linked to the completeness of injury data collected, since injuries often occur in practice sessions when there is not likely to be a team physician present. Second, the medical orientation and diagnostic skills of the team trainer are indispensable to assure the validity and accuracy of the information for epidemiological research.

"Common to a variety of previous sports injury investigations has been the inaccuracy that arises when coaches, parents and other members of the lay public are asked to make medical observations. These persons lack sufficient orientation, motivation, medical knowledge and examination skill to expect them to identify with any certainty, the general nature, or even the occurrence of an

injury" (Albright, 1988, p.S-5). The author concluded that the role of the athletic trainer is an important one due to the background and experience that this professional has achieved through education and clinical internship (Albright, 1988).

Certified Athletic Trainers in High Schools

Placing certified athletic trainers in high schools becomes a challenge in times of fiscal restrictions. Several authors offer creative solutions to address most school situations.

Bell, Cardinal and Dooley (1984) reported the results of an athletic trainer manpower survey of selected Illinois high schools. The survey involved a questionnaire mailing to all high school athletic directors in Illinois. A 66% return rate was achieved.

The results of the Bell et al. (1984) survey showed that 27.3% of schools employ an athletic trainer. Of these schools, 61.7% had certified trainers. The study looked at the teaching capabilities desired by athletic directors when they were employing an athletic trainer. The results indicated that 49.8% of athletic directors looked for people who could also teach physical education/health while 42.5% wanted math/science as the teachable component. Prentice and Mischler (1986) reported similar teaching requirements.

Kegerreis (1979b) reported that there is a serious void in the area of health care for student athletes. A follow-up report suggested guidelines which may be used to fill that void. Kegerreis (1979b) suggested the following questions be asked when planning to hire a health care professional:

(1) Will the athletic health care be competently administered? Kegerreis (1979b) pointed out that NATA certification ensures that an athletic trainer possesses a minimal level of academic and clinical skills as evidenced by completing certain specific criterion and passing a written and practical test. Professional competency is confirmed by Foster et al. (1989).

(2) Will the student athlete health supervision be comprehensive? Kegerreis (1979b) pointed out that an athletic trainer is more likely to be present when most injuries occur (during practice). The author assured the reader that the qualified athletic trainer serves not only in providing health care, but also in assuring continuity of care. This topic is also addressed by Bowlus (1979); Hossler (1985) and Parr et al. (1984).

(3) Is it economical? Kegerreis (1979b) suggested certified athletic trainers be hired first as teachers and be reimbursed for their health care duties. Other suggestions are made by Stopka and Kaiser (1988) and Hossler (1985).

Hiring a certified athletic trainer primarily as a teacher may serve to open the door. Once hired by the school, the trainer may prove their importance. In a short amount of time, the teacher/trainer may assume full time training duties. A full time trainer is most desirable (Hossler, 1985; Stopka & Kaiser, 1988). Research has also shown that of those schools who already hire a certified athletic trainer, 55.9% would like to hire a second (Bell et al., 1984).

The need for certified athletic trainers in high schools was also examined by Stopka and Kaiser (1988). The authors demonstrated the need by recounting the number of injuries that occur each year. Nearly one sixth of all student athletes will incur injuries serious enough to restrict them from continuing play on the day of or subsequent to injury. Approximately 100,000 of

all inter-scholastic injuries will be severe enough to preclude sport participation for at least 21 days. The authors felt that many of these injuries could have been prevented or lessened in severity by employing certified athletic trainers. This conclusion is supported by Duda (1989); Kegerreis (1979); Legwold (1983); Lindaman (1991); Mendel (1992); and Rowe and Miller (1991).

Stopka and Kaiser (1988) listed eight methods for hiring a certified athletic trainer in the high school setting. For the most part these suggestions originated in position papers and recommendations made by the National Council of Athletic Trainers: Athletic Trainers in High Schools and the NATA. Stopka and Kaiser offered specific recommendations for direct implementation by high schools. The authors also elaborated on the medical, legal and educational benefits of having a certified athletic trainer on staff.

The suggestions by Stopka and Kaiser (1988) include:

(1) a full-time athletic trainer

(2) a district athletic trainer

(3) a permanent substitute teacher/athletic trainer

(4) an assistant director/athletic trainer

(5) a part time athletic trainer

(6) a contracted athletic trainer from a sports medicine center

(7) a graduate assistant athletic trainer, or a

(8) teacher/athletic trainer.

The full-time athletic trainer option is ideal. The other suggestions were made to accommodate all programs and budget concerns.

Hossler's (1985) report on how to acquire an athletic trainer at the high school level outlined a very similar course of options. Hossler made one other

suggestion in addition to the eight made by Stopka and Kaiser (1988). The hiring of a certified athletic trainer for routine clerical work within the high school nurse's office may be considered. This would offer the nurse assistance in daily record keeping while making the trainer more accessible to the athletes during the day.

Hossler (1985) disagreed with the concept of loaning a university student to the high school for medical coverage (as suggested by Stopka & Kaiser, 1988). He felt this would be inappropriate, for student experience hours (a requirement for certification) must be accumulated under the supervision of a certified athletic trainer. Like Stopka and Kaiser (1988), Hossler (1985) felt these options should ease the dilemma of budgetary restraints while providing practical means of obtaining qualified medical care.

Many studies support the notion of hiring certified athletic trainers in high schools (Stopka & Kaiser, 1988; Hossler, 1985; Kelley & Miller, 1976). Prentice and Mischler (1986) investigated this suggestion with a national survey of employment opportunities for athletic trainers in public high schools. The authors argued that the increasing participation and the rapid developmental changes of young athletes would seem to require an increased effort focused on minimizing and reducing the negative effects of sports activity on the health of high school athletes. For this reason, they concluded that the most common job opportunities for entry level athletic trainers in the near future lie primarily in public and private high schools.

The results showed that of those schools which have plans to hire an athletic trainer in the future, 78.3% indicated that there will also be some teaching responsibilities. The ability to teach science and mathematics was

most desirable. Prentice and Mischler (1986) also reported that it was extremely important to those responsible for hiring that the athletic trainer be certified by the National association.

The authors concluded that teaching certification in any academic specialization will afford optimal job marketability in the public schools. Therefore, they recommended that graduating students in the area of athletic training also achieve teaching certification in some area of academic specialization.

In conclusion, persons in high schools charged with the responsibility for athletic injury management are often unqualified and incompetent. Insufficient medical coverage for high school athletics coupled with the rising incidence of athletic injuries occurring in high schools demonstrates the need for a certified and competent professional. Research has shown that a certified athletic trainer is the most competent person to manage athletic injuries in high schools. Related literature has demonstrated that high school can successfully hire certified trainers to manage athletic injuries as well as a variety of related tasks.

Chapter 3

METHODS AND PROCEDURES

Introduction

This chapter will outline the procedures that were followed in this investigation of athletic injury knowledge and its relationship to teacher characteristics and athletic injury incidence in Manitoba's high schools. A questionnaire was mailed to physical education teachers in Manitoba. It assessed their present knowledge of injury diagnosis, injury treatment and emergency care procedures. This information was then compared to five characteristics of the respondents and the incidence of athletic injuries in Manitoba high schools. A lack of specific research in the area of athletic injury management generally, and in Canada specifically pointed to the need for study in this area.

Subjects

The subjects were physical education teachers employed in Manitoba public high schools. The 1992-1993 edition of the Manitoba High Schools Athletic Directory (a publication of the Manitoba High Schools Athletic Association) was used to identify senior high school physical education teachers. There were 380 physical education teachers listed in the directory for the 1992-1993 school year. Other researchers (Rowe & Robertson, 1986; Rowe & Miller, 1991) have used a sample from a population, but this study evaluated the total population of high school physical education teachers in Manitoba in order to ensure there was an adequate number of subjects for the analysis.

Instrumentation

Athletic Injury Management Knowledge

The instrument used in this study to test the subjects' knowledge of athletic injury management was the Sports Trauma Management Inventory (STMI) developed by Carey and Shute (1982). Written consent to use this copyrighted material has been received (Appendix A).

The instrument consists of 40 multiple choice questions. The STMI can be divided into three subsections consisting of: (1) subsection on diagnosis (SUBDX) including items on anatomical identification and injury recognition; (2) subsection on treatment (SUBRX) including items on field management and treatment; and (3) subsection on emergency care (SUBEX) including items on emergency care and first aid (Carey & Shute, 1982). Each correct response receives one mark. Forty marks represents a perfect score.

Content validity for the STMI was confirmed by a national jury of medical and athletic training authorities (Carey & Shute, 1982). As well, the authors performed an item analysis on a pilot test of a group of school nurses and a group of certified athletic trainers. The final version of the STMI was developed from this pilot test. No normative data are available for this instrument. The STMI and answer key are included in Appendix B.

Specific research concerning athletic injury management knowledge and athletic injury management skill proficiency is absent from the related literature. In Kidd's (1989) analysis of proficiency testing of physical education majors, subject responses on a sport specific knowledge test were compared to the same subjects' results on several sport specific skills tests. The results showed that "those who know pertinent information on selected sports activities also tend to do well on skill tests" (Kidd, 1989, p. 199). This relationship between knowledge and performance could be applied to the present study where

subjects who perform well on an athletic injury knowledge test would be expected to act with a reasonable level of skill proficiency in an injury management situation.

Furthermore, the use of multiple-choice testing to assess athletic injury management skill is strongly supported in the related literature, and by two national associations. Kelley and Brightwell (1984), Rowe and Miller (1991) and Rowe and Robertson (1986) have used multiple choice questions to determine athletic injury management capability. Furthermore, the NATA (Prentice, 1985) and the CATA (CATA, 1990) use multiple-choice questions as part of their professional certification process. It was therefore determined that a multiple choice-based instrument would give a reasonable estimation of a subject's athletic injury management skill level, and was appropriate for use in this study.

Related Independent Variables

In addition to the STMI, a second instrument to obtain demographic information was included in the mailout. It contained questions regarding the subject's gender, first aid training in athletic injury management, physical education teaching experience, and educational background. Respondents were presented with a list of possible answers for the gender, first aid training courses and educational background questions. These responses were coded for entry into the computer program. They were also asked to report the exact number of years spent teaching physical education (these data were grouped into five-year intervals and later coded for computer entry). Information concerning the location classification (rural/urban) of each school was obtained from the Manitoba High School Athletic Association. Subjects were also asked to identify the person normally responsible for attending to athletic injuries that

occur under the school's responsibility. These questions are included in Appendix C.

Injury Rates

Data concerning the incidence of athletic injuries were supplied by the subjects. Respondents were asked to report the number of injuries that occurred under their supervision for part of the 1992-1993 school year (January 1, 1993 to May 31, 1993).

A universally accepted definition of an athletic injury is absent from the related literature. Martin, Yesalis, Foster and Albright (1987) stated that "one of the problems in reporting sports-related injuries centers around whether the injury is defined according to the extent or severity of tissue damage or according to the incapacitating nature of the injury relative to continued performance" (p. 604). Several different definitions have been used by various authors (Martin et al., 1987; Stopka & Kaiser, 1988). Considering that neither the Canadian Athletic Therapists Association nor the Manitoba Athletic Therapists Association possess an athletic injury definition, one put forth by Noyes et al. (1988) was used in this study. It states that an athletic injury "...must be sports related. Keeps player out of practice or competition on the day following the injury. Requires medical attention (by a physician or trainer), or dental care of any kind beyond icing or wrapping, all concussions, nerve injuries no matter how transient, and eye injuries are included" (p. s68). The goal for this definition was to assess the rate of all injuries other than lumps, bumps, and bruises (Noyes et al.). This definition was adopted for the present study due to the similarity in goals.

The reported injuries were separated into two categories: (1) physical education classes, (taught by the subject) and (2) interschool sports (coached

by the subject). Subjects were advised to include practice and game situations as well as the number of students that they regularly taught/coached each week. This was necessary to determine the teaching/coaching exposure rate for each subject.

Subjects were asked to allot the injuries reported in the previous question into three severity categories (mild, moderate, severe) according to a definition provided to all subjects. This was done for each injury category (class and interschool). This method of categorization was suggested by Thompson et al. (1987). Severity was defined by the number of days that the student was restricted from physical education activity as a result of the injury; measured in intervals of days lost, "i.e., 1 to 3 days lost (mild), 4 to 6 days lost (moderate), 7 or more days lost (severe)" (p. 118).

Data Collection

Names and addresses of all physical education teachers were obtained from the Manitoba High School Athletics Association. All surveys were mailed on May 5, 1993 accompanied by a pre-addressed, stamped return envelope. Three weeks after the initial mailing, a post-card reminder was mailed to non-respondents (May 25, 1993). Two weeks after this (June 8, 1993), another survey was mailed to those who had not yet responded. This procedure was suggested by Dillman (1978). Any responses received later than three weeks after the last mailing, (June 29, 1993) or after the data had been entered (the latter of the two) were not included in the analysis.

Prior to mailing, all questionnaires were numbered consecutively from 1-380. During the administration and analysis, each subject was identified by this number only. This was necessary to identify which subjects had responded and which had not. This also allowed each survey to be matched to the appropriate

school. The teachers were advised of this coding, told how it was intended to be used, and were assured of confidentiality (Appendix D).

Upon receiving the questionnaire in the mail, the subjects were instructed to respond as honestly as possible. They were reminded in the cover letter that this study was intended to evaluate their present knowledge. Subjects were discouraged from referring to textbooks or any other resource. As well, subjects were reminded that there was no intention on the part of the researcher to identify the respondents and that the questionnaire was for the purpose of research. Individual questionnaire responses (raw data) were kept confidential, this study has reported aggregate data only. The questionnaires were coded by the researcher and the data was entered into a Macintosh computer using the Statview program, version 2.0.

Data Analysis

Means, standard deviations, and minimum and maximum values were calculated for STMI total and subsection scores. The minimum/maximum information demonstrates the range of scores achieved on the questionnaire. Frequencies of correct item responses have also been calculated. This gives some indication of strengths and weaknesses in knowledge, as well as the overall knowledge level.

The STMI data were compared by groups to isolate the teacher characteristics associated with a lack of adequate knowledge. Due to the lack of information in the literature regarding such categorization, this study investigated gender (male/female); location of school (rural/urban); educational background; years of Physical Education teaching experience; and training in specific athletic injury related courses as possible correlates of a high level of athletic injury management knowledge. As a result of consultation with the

Statistical Advisory Service at the University of Manitoba, this was done using a factorial ANOVA. A factorial ANOVA was chosen due to the discrete nature of the independent variable data. If the data were of a continuous nature, a stepwise multiple regression would have been used (Safrit & Wood, 1989).

The STMI knowledge data were then compared to injury rates calculated from injury data provided by the subjects. Injury rates were calculated by dividing the total number of injuries reported by subjects, by the total number of students that the subject had been exposed to. For example, 60 injuries per 600 students taught (multiplied by 100) represents an injury rate of 10 injuries per 100 students (or 10%). This standardized the injury incidence data for teachers teaching/coaching different numbers of students. Subjects were asked to report the number of injuries that occurred in physical education classes taught by themselves and in interschool sports coached by themselves. The knowledge data and the injury rate data were tested for a relationship with a Pearson-Product-Moment Correlation Coefficient (Thomas & Nelson, 1990).

Chapter 4

RESULTS

Introduction

The results chapter will first describe the pilot study that was performed in order to validate the instrument for this application. Next, descriptive statistics concerning the scores achieved by respondents on the Sport Trauma Management Inventory (STMI) will be reported. This will include a description of the wave analysis that was performed to determine if early responders scored differently than late responders. The respondents' background information will also be included. Finally, an analysis of STMI scores for main effects and interaction effects by each characteristic of respondents (gender, first aid training, years of physical education teaching experience, educational background, and location) will be presented. An analysis of athletic injury rates will also be reported.

Validation of Instrument

A pilot study was conducted in order to determine the criterion validity of the Sport Trauma Management Inventory (STMI). Three subject groups were used: physical education teachers, classroom teachers and certified athletic therapists. In order for the questionnaire to be valid, it had to be able to discriminate (show significant difference) between the total scores of the three groups.

Ten subjects were included in each group for a total of thirty subjects. The STMI was handed out to thirty subjects in a convenience sample. The completed questionnaires were either picked up by the researcher, or returned by the subject.

There were a total of 29 out of 30 questionnaires returned (10-certified therapists, 9-classroom teachers, 10-physical education teachers). The mean scores (out of a possible 40 marks), standard deviations and standard errors are presented for each group in Table 1. The certified therapists scored the highest, followed by physical education teachers and then classroom teachers.

Table 1

Pilot Study: STMI Mean Scores for Subject Groups.

Group	N	Mean	Std Dev	Std. Error
Therapists	10	27.1	3.07	0.97
P.E. Teachers	10	22.0	3.23	1.02
Classroom Teachers	9	18.0	3.78	1.26

In order to determine significant differences between the three groups, a single factor analysis of variance (ANOVA) was used (Table 2). The ANOVA indicated a significant difference among the groups ($F(2,26) = 17.59$, $p<.01$). A Scheffé test was employed to isolate the differences and determine the source of the significant findings. The Scheffé test is quite conservative and allows comparisons to be made while preventing excessive error due to the experiment (Keppel & Saufley, 1980). The results indicated (Table 3) that there was a significant difference between certified athletic therapists and classroom teachers (Scheffé $F=17.41$, $p< .05$) and between certified therapists and physical education teachers (Scheffé $F=5.77$, $p< .05$). Therefore the STMI used in this study was found to be valid and appropriate for differentiating between the various groups with different levels of knowledge.

Table 2

Pilot Study One Way Analysis of Variance for STMI Scores

Source:	Df:	Sum of Squares	Mean Square	F-test
Between groups	2	396.34	198.17	17.59
Within groups	26	292.90	11.27	p=.0001
Total	28	689.24		

Table 3

Pilot Study Scheffé Post Hoc test.

Comparison	Mean Diff	Scheffé F-test
Therapists vs Class teachers	9.1	17.41*
Therapists vs P.E. teachers	5.1	5.77*
Class teachers vs P.E. Teachers	-4	3.36

* significant at p< .05.

Descriptive Statistics - STMI

Sport Trauma Management Inventory

Of the 380 questionnaires sent to high school physical education teachers, 191 were returned; a return rate of 50.3%. As soon as the completed questionnaires were returned (May 5, 1993 - June 29, 1993) they were coded and entered into a computer. Correct answers on the STMI were awarded one mark, and incorrect answers did not receive any marks. In order to determine the total questions answered correctly by each respondent, the coded answers were summed over the total of the forty questions.

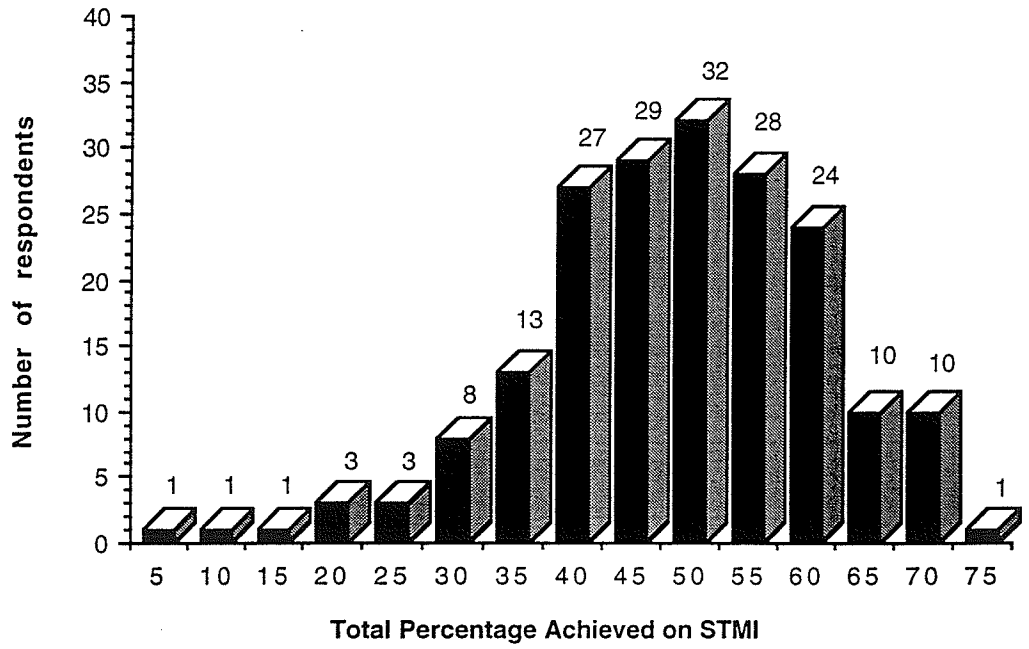
The average score achieved by the 191 respondents out of a possible 40 marks on the Sport Trauma Management Inventory was 18.8, (47.1%), sd=12,

median=19 and mode=19. The lowest score achieved was 2 (5%) while the highest score was 30 (75%). Most of the respondents (16.8%) scored between 45% and 50%. A fairly even distribution was noted among all the scores. A summary can be found in Figure 1.

The criterion level, or "pass score" reported by Carey and Shute (1982), was determined as the median score achieved by the total group of subjects plus four marks. When this calculation was applied to the present study, a criterion level of 23 out of 40 marks or 57.5% was determined.

Figure 1

Distribution of STMI Scores (Percentages) for All Respondents



Wave Analysis

A wave analysis was performed on the 191 returns to determine if there was a difference in the total knowledge score between subjects who responded early and those who responded later. The data collection period was divided into two phases for this purpose. In order to qualify for inclusion in the first group, subjects needed to return their questionnaire between the date of initial mailing (May 5, 1993) and the date of the second mailing (June 9, 1993). All questionnaires returned after June 9, 1993 became part of the second group.

The return results indicated that 124 or 65% of respondents fell into the first group, while 67 or 35% fell into the second group. A two tailed t-test (Table 4) indicated that there was no significant difference between the two groups' total scores ($t(1, 189) = -.70$, p = N.S.). It was concluded that it did not matter at which time during the data collection period that the subject had responded. Consequently, all questionnaires were treated the same.

Table 4

Wave Analysis of Early and Late Returns

Group	Mean %	DF	Unpaired t value	Prob. (2 tail)
Early Returns	46.6%	189	-.70	.48
Late Returns	47.9%			

Descriptive Statistics-Related Independent Variables

The respondents were asked a series of questions to determine if certain characteristics were related to athletic injury management knowledge. These questions were about gender, first aid training, physical education teaching

experience, and educational background. Information concerning the location of the respondent's school (rural/urban) was obtained from the Manitoba High School Athletic Association. Descriptive statistics on these five independent variables are presented.

Gender

There were 144 (75%) male respondents and 47 (25%) female respondents who participated in this study. Unfortunately, it is not possible to compare response rates for each gender, as subjects' gender was not specified before the initial mailout (in the MHSAA Directory).

First Aid/Injury Training

Respondents were asked to indicate if they had any training in first aid or athletic injury management courses. The results suggested that three distinct categories could be formed from the responses. The first category was labeled "no training" due to the fact that these respondents had not taken any training in athletic therapy related courses, or that the courses that they had reported were not related specifically to first aid (CPR courses, lifesaving, or ski patrol). There were 28 participants who fell into this category representing 14.7% of all respondents. The next category was made up of respondents indicating that they had taken a first aid course from St. John Ambulance. This category was named "general first aid". This second group included 99 members and represented 51.8% of all respondents. The third group was made up of respondents who indicated that they had sport specific first aid training ("Sport Specific Training"). This group was made up of respondents who had taken the Manitoba Athletic Therapist Association's (MATA) Athletic First Aider courses. This group included 64 subjects, or 33.5% of all respondents.

Teaching Experience

Subjects were asked to indicate the number of years they had spent teaching physical education and the number of years that they had spent teaching in total. The minimum number of Physical Education teaching experience years was one, while the maximum 32 years (range = 31 years, mean = 11.65, standard deviation = 7.86). The most frequently reported length of physical education teaching experience was shared by subjects reporting three years (7.07%) and those reporting 20 years (7.07%). This range of physical education teaching experience was further grouped into five categories of five year intervals for ease of calculation. Those categories were named 0-5, 6-10, 11-15, 16-20, and 21 +.

When total teaching experience was examined, the minimum number of years reported was one year, and the maximum value was 34 years. (a range of 33 years). The mean of total teaching experience reported by the subjects was 12.8 years with a standard deviation of 7.87 years.

Educational Background

The question concerning post secondary education required further coding due to the fact that respondents were able to indicate that they had received more than one degree. Initially all responses to this question were recorded. Upon completion of the data entry, responses were grouped to better reflect the background of the respondents with respect to training in physical education. The various combinations of degrees were recoded into three categories. Respondents who reported having a Bachelor of Education without any physical education training were placed into category one (No P.E.). This included subjects who had the degrees: Bachelor of Science (BSc), Bachelor

of Arts (BA), Bachelor of General Studies (BGS), or Masters of Science (MSc) degrees. This group represented 34 or 17.8% of respondents.

The next group was comprised of respondents who indicated they had some physical education background. Largely, this meant that they possessed a Bachelor of Education degree with either a physical education major or minor. Respondents may have held this degree alone, or in combination with a BSc, BA, BGS, or Masters in Education (MEd) degree. This group was named "some PE" and was made up of 69 subjects or 36.1% of all respondents.

The third group was made up of those subjects who reported having at least a Bachelor of Physical Education degree. Respondents may have possessed this degree in combination with a BEd, BSc or MEd degree. This, the largest of the three groups was named "BPE" and was made up of 88 subjects or 46.1% of all respondents.

Location

As indicated earlier, the rural/urban classification of each respondent was obtained from the Manitoba High Schools Athletic Association. There were a total of 126 surveys sent out to teachers in 38 urban schools and 254 questionnaires sent out to teachers in 120 rural schools. Of the 191 questionnaires that were returned, 124 or 65% were from respondents teaching in rural schools while 67 or 35% were returned from participants teaching in urban schools. A greater percentage of respondents were rural because more rural teachers were sent questionnaires in the first place. When the number of questionnaires returned was divided by the number sent out, it was determined that a similar proportion of urban teachers (53.2%) and rural teachers (48.8%) returned completed surveys.

Individual Normally Responsible for Attending to Athletic Injuries

Subjects were asked to report who at their particular school was normally responsible for attending to athletic injuries. By far, the most popular answer was the respondent (physical education teachers). This was reported by 159 or 83.7% of all respondents. The second most commonly reported answer was "another physical education teacher." This response was reported by 7.3% of respondents. Three percent of respondents reported a medical doctor, 2.5% reported a specific other staff member, 1.5% reported a school nurse, 1% reported the administration and an Emergency Medical Technician (EMT). It is important to note that in total 91% of respondents indicated that physical education teachers were responsible for attending to athletic injuries at their school.

Injuries That Occurred in PE Classes

Subjects were asked to indicate the total number of injuries that had occurred in physical education classes they taught between January and May, 1993 according to the universally supplied definition (see Chapter 3). Subjects responded a minimum of zero and a maximum of 20 injuries (a range of 20 injuries). The mean number of injuries reported to have occurred in classes was 4.05 with a standard deviation of 3.23, and a median of 3 injuries.

Subjects were asked to separate the total number of injuries they had just reported into three severity categories (mild, moderate and severe) according to a supplied definition. A break down of total PE class injuries is found in Figure 2. The mean number and range of injuries in each severity category are presented in Table 5.

Figure 2

Percent of Total Injuries Classified as Mild, Moderate or Severe in PE Classes

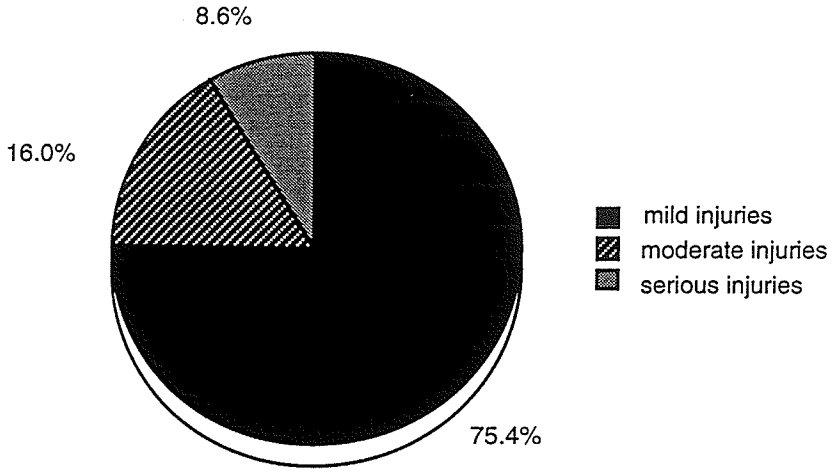


Table 5

Mean Number of PE Class and Interschool Injuries in Three Severity Categories

PE Class Injuries

Severity of Injury	Mean	S.D.	Minimum	Maximum
Mild	3.4	2.5	1	15
Moderate	1.6	0.9	1	5
Severe	1.3	0.6	1	3

Interschool Sports Injuries

Severity of Injury	Mean	S.D.	Minimum	Maximum
Mild	2.7	2.4	1	12
Moderate	1.5	1.3	1	
Severe	1.4	0.8	1	4

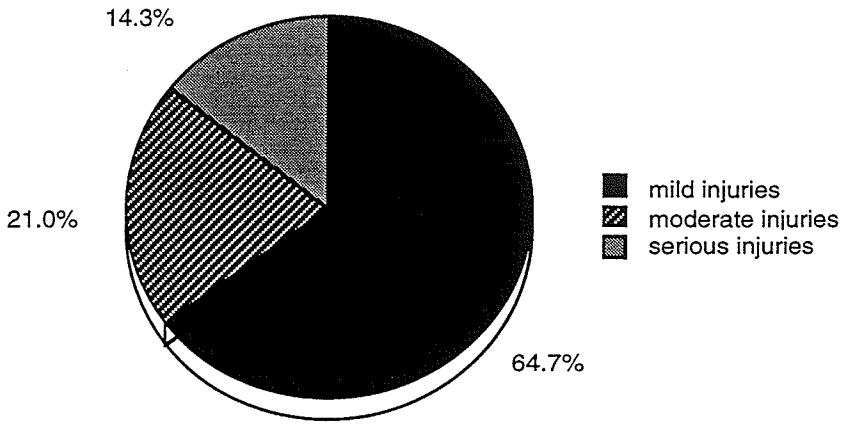
Injuries That Occurred in Interschool Sports

Subjects were asked to report the total number of injuries that had occurred in interschool sports they coached. The average number of injuries reported by teachers was 3.08 injuries with a standard deviation of 3.03, and a median of 2. There was a minimum of one, and a maximum of 20 injuries reported (a range of 19 injuries).

Next, participants were asked to separate the total number of injuries into three severity categories (mild, moderate, severe). A summary of the percentage of these three categories of interschool injuries is found in Figure 3. The mean number of injuries per severity category and ranges were presented in Table 5.

Figure 3

Percent of Interschool Sports Injuries Classified as Mild, Moderate or Severe



PE Class Exposures

In order to determine the number of times that a student had the opportunity to be injured while under the supervision of the respondent, subjects were asked to report the total number of physical education periods

they taught each week between January and May, 1993. Respondents indicated that the average number of classes taught each week was 19.27 (a range from 3 to 55 classes per week). The average number of students that each respondent taught per class was 22.79, (a range from 12 to 85 students per class). Respondents were subsequently asked to report the total number of students they had taught in PE each week between the specified dates. This could be accomplished by memory recall or by simply multiplying the previous two numbers. The self-reported values indicated that respondents taught an average of 391 students each week (a range was from 40 to 1575 students). However, when the researcher proceeded to double check this figure by multiplying the values for classes taught and students per class, it was found that on average respondents were teaching 439 students (a range from 45 to 1575). Subsequently a Pearson product moment correlation was conducted on the self-reported values and the researcher-calculated values which revealed a Pearson-r value of $r(173) = 0.84$, $p<.001$. Examination of the self-reported values indicated that several of the respondents did not calculate this figure correctly, or understand the object of the question fully. Therefore, the researcher-calculated values were used in future statistical analysis.

Interschool Sports Exposures

Finally subjects were asked to report the total number of practices, games and athletes that they coached between January and May, 1993. The number of games and practices/week were multiplied by the number of athletes involved with each team. This resulted in an estimate of the total number of times that an athlete was exposed to a potential situation where an injury could occur under the supervision of the respondent. The average exposure for the 159 respondents who answered this question was 117 (sd = 106), i.e. there

were 117 potential situations where a student could become injured. The lowest exposure reported by participants was 11, while the highest was 745. Respondents indicated that they had exposures between 0 and 50 students (22.6%), 51-100 students (34.6%), 101-150 students (18.9%), and 151-200 students (12%). The remaining categories represented only 11.9% of respondents. Although this may seem like a relatively large number of exposures, it should be noted that at the time the survey was sent out, many teachers were preparing their students for track and field season. Therefore, they may have held up to six practices a week with up to 70 athletes at each practice. This was commonly in addition to coaching other teams such as badminton, volleyball, or fastball.

Analysis of STMI Scores by Group

Comparison of Knowledge Scores by Subject Characteristics

Initially, the data were examined by means of one way analyses of variance (ANOVA) to determine if any of the five characteristics (gender, first aid training, p.e. experience, educational background and rural/urban location) tended to have an effect upon total score achievement on the forty item questionnaire (Table 6). Subsequently, the percentage of each group that achieved the criterion level (pass score) on the STMI is indicated.

There was no significant difference between male and female respondents ($F(1,190) = 1.27$, p=N.S.) in knowledge scores. When males and females were compared by passing percent, it was found that a greater percent of females passed the STMI than did the males.

Table 6

Comparison of Knowledge Score Means by Group Characteristics

	Knowledge Score					
	N	mean	sd	F-value	P-value	% passing
Gender						
male	144	46.5	12.1	1.25	.27	21.5
females	47	48.8	11.7			29.8
First Aid Exp.						
no training	28	45.9	12.9	0.49	.61	
general training	99	46.7	12.8			25.3
sport specific	64	48.2	10.2			20.3
PE Experience						
0-5	52	45.9	12.4	.901	.46	19.2
6-10	44	48.4	11.5			25.0
11-15	27	49.4	11.3			37.0
16-20	36	45.0	12.3			16.7
21+	25	48.6	11.8			28.0
Educ. Background						
no PE	34	39.8	13.5	12.17	.0001*	11.8
some PE	69	45.9	12.6			24.6
BPE	88	50.8	9.3			27.3
Location						
rural	132	45.9	12.4	4.14	0.04*	18.2
urban	59	49.7	10.8			35.6

* significant at $p \leq .05$.

The effect of training in first aid courses was then examined. A trend emerged where respondents with no training scored the lowest on average while those with sport specific training reported the highest mean of these three groups. Yet, when the effect of various first aid training was investigated by means of a one way analysis of variance, no significant difference was found ($F(2, 190) = 0.49$, p = N.S.).

The time that had elapsed since the respondent had taken the particular first aid training course was also determined (Table 7). The results showed that 35% of general first aid training respondents and 23.9% of sport specific first aid training respondents had reported taking a course in the last three years (between 1991 and 1993). It was also determined that respondents who had recently taken a course achieved a slightly higher mean score (mean=49.9%) than respondents who had taken a course prior to 1991 (mean=47.1%). This relationship was not found to be significant however.

Table 7

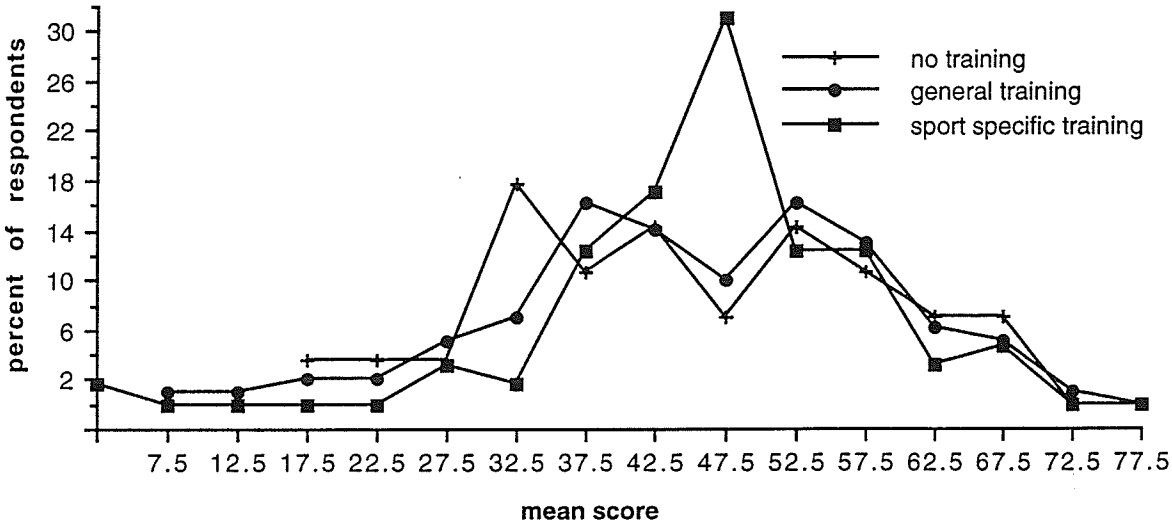
Time Elapsed Since Taking First Aid Training Courses

	General First Aid Training		Sport Specific Training	
year	n	percent	n	percent
1965-1969		1.25	0	0
1970-1974	1	1.25	2	4.35
1975-1979	10	12.5	2	4.35
1980-1984	9	11.25	9	19.57
1985-1986	5	6.25	8	17.39
1987-1988	9	10.25	8	17.39
1989-1990	17	21	6	13.04
1991	13	16.25	2	4.35
1992	10	12.5	7	15.22
1993	5	6.25	2	4.35

With respect to passing score among first aid training levels, the reverse of what one would expect was revealed in the percentage of respondents who achieved the criterion level. Results showed a greater percentage of persons with no training and general training achieved the criterion level than did those with sport specific training. Explanation of this lies in the distribution of the total scores in each group (Figure 4). The sport specific training group had a large percentage of their scores (43.8%) fall just under the criterion level, while the other two groups mean scores were more variable. This is demonstrated by the largest standard deviation associated with the no training group and the smallest with the sport specific training group. This distribution allowed for the achievement of a relatively high mean, but was not sufficient to achieve the criterion level and consequently raise the pass percentage.

Figure 4

Distribution of Pass Percentage for Three Levels of First Aid Training



Similarly, years of PE teaching experience had no significant effect upon total score ($F(4, 190) = 0.9$, p=.N.S.). There was no trend noted among mean scores for the five categories of PE teaching experience.

Educational background mean scores fell into a predictable pattern, that is, respondents with no PE experience achieved the lowest mean score (and the lowest passing percentage), while those with a BPE degree had the highest mean score and the highest percentage of respondents achieve the criterion level. A one way analysis of variance revealed a significant difference among the three groups ($F(2,191) = 12.17$, $p < .05$). A Scheffé post hoc test revealed that all group means were significantly different from one another. The smallest difference was noted between the no PE and some PE group (Scheffé F= 3.31, $p < .05$), while the largest difference was noted between the no PE group and the BPE group (Scheffé F= 11.60, $p < .05$). A significant difference was also noted between the some PE and the BPE groups (Scheffé F= 3.63, $p < .05$).

Examination of the rural/urban mean scores indicated that the urban respondents scored significantly higher ($F(1,190) = 4.14$, $p<0.05$), and had a higher passing percent than the rural respondents.

Interaction Effects of Two Independent Variables

Further statistical investigation was necessary in order to determine if there was any interaction among the five independent variables with respect to total knowledge score. Interaction is the consequence of two independent variables combining to influence behavior (Keppel & Saufley, 1980), in this case, total knowledge. Location in combination with the four other variables will be reported first. Secondly, educational background in combination with the remaining variables will be discussed. Lastly, the interaction effects of the remaining variables will be reported.

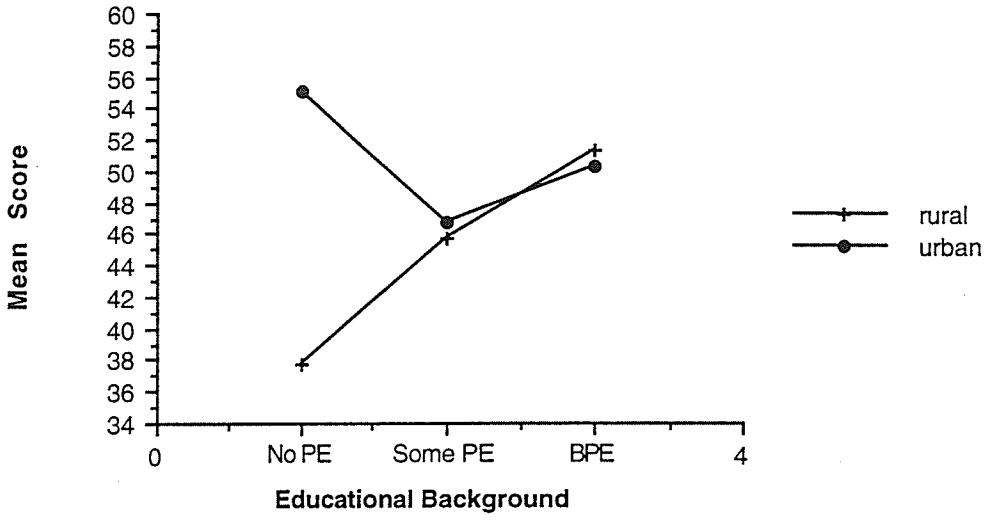
Interaction of Location With Four Other Independent Variables

Location and Educational Background

Figure 5 graphically presents the significant interaction between location and educational background ($F(2,190) = 4.091$, $p<.05$). Although urban respondents scored significantly ($F(1,190) = 5.54$, $p<.05$) higher than rural respondents overall, this trend only holds true for the lower levels of educational background. The data show that the effect of No PE is different for urban and rural respondents. Urban respondents with No PE scored highly, when rural-No PE respondents scored much lower, as would be predicted. However, the urban-no PE group had only four individuals. Rural respondents with a BPE degree scored slightly higher than urban/BPE respondents.

Figure 5

Location and Educational Background Interaction



Location and Gender

The interaction between location and gender was not significant ($F(1,190) = .54$, p= N.S). The mean scores showed urban respondents scored higher than rural respondents for both genders and female respondents consistently scored higher than male respondents across both locations.

Location and First Aid Training

When location and first aid training of the respondents were tested, a significant interaction was not found ($F(2,190) = 1.32$, p = N.S.). Urban respondents tended to score higher than rural respondents for the lower levels of first aid training. At the highest level of first aid training however, rural and urban scores were very similar. This is an anomaly as one would expect mean scores would continue to increase as level of first aid training increased.

Location and PE Experience

While rural mean scores remained relatively constant across the years of PE experience, the urban mean scores tended to be more variable. Although urban respondents scored significantly higher than rural respondents overall, in the 16-20 years of PE experience category, urban means dropped substantially. Thus, rural mean scores surpassed those of urban respondents for this level of teaching experience only. Yet, there were no significant interaction effects between location and years of PE teaching experience ($F(4, 190) = 1.39$, p = N.S.).

Educational Background With Other Independent Variables

Educational Background and First Aid Training

A significant interaction of educational background and first aid training was not found ($F(4,190) = .65$, p = N.S.). Respondents with no PE experience consistently scored the lowest while respondents with BPE experience scored the highest, among the three levels of first aid training. Therefore, it seems that the presence of a BPE degree is more important than additional first aid training in determining success on an athletic injury management inventory.

Educational Background and PE Teaching Experience

When educational background and physical education teaching experience were examined for interaction effects, a significant interaction was not found ($F(8,190) = .92$, p = N.S.). It was noted however, that those with BPE degrees consistently scored the highest among all levels of PE teaching experience. In fact, the pattern of progressively higher mean scores reported across the levels of educational background (no PE; some PE; BPE) occurs in three out of the five levels of physical education teaching experience. Only in the 11-15 and 16-20 years of experience categories did the lowest scores appear at the some PE experience level, (not the no PE category as in the remaining three levels of physical education teaching experience).

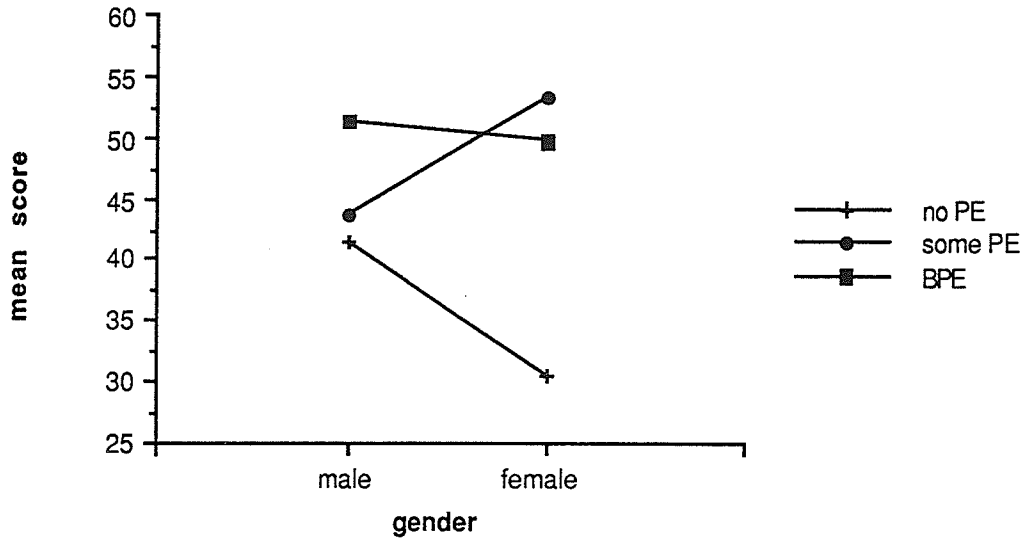
Educational Background and Gender

A two factor analysis of variance revealed a significant interaction between educational background and gender on total score (F (2,190) = 6.56, p = N.S.). This means the effect of educational background was different for males and females. The data show that the some PE group scored inconsistently among the two levels of gender. Males with some PE tended to

score low and similarly to the No PE group, while females with some PE scored highest, and closer to BPE respondents. It should also be noted that no PE respondents (especially females, n=5) scored the lowest among all respondents. The interaction is illustrated in Figure 6.

Figure 6

Educational Background and Gender Interaction.



Remaining Variable Interactions

First Aid Training and PE Teaching Experience

When first aid training and physical education teaching experience were examined for interaction effects, no significant interaction ($F(8,190) = 1.16$, p = N.S.) was found. However, it was determined that respondents with sport specific first aid training and general training scored similarly and consistently across the years of PE teaching experience. Respondents with no training achieved mean scores that were much more variable across the years of PE teaching experience. It was determined that the amount of PE teaching

experience did not seem to affect mean scores in the general training and sport specific training categories. Therefore, it seems that additional sport specific first aid training is more important than PE teaching experience in determining success on an athletic injury management inventory.

First Aid Training and Gender

When considering a possible interaction between gender and first aid training on total score, a non-significant interaction was found ($F(2,190) = 1.4$, p = N.S.). It should be noted that an anomaly occurred with the female/no training group who scored the highest among males and females. Although this group scored the highest, it may be due to the fact that it had a rather small sample size (n=7) and a rather large standard deviation (10.4).

Gender and PE Teaching Experience

The combination of gender and PE experience failed to produce a significant interaction ($F(4, 190) = 1.69$, p = N.S.). Worthy of note are the male respondents whose scores tended to remain fairly constant across the years of PE teaching experience while, the female mean scores (with the exception of the 6-10 year category) tended to increase as the years of PE teaching experience increased. However, the number of female members in each group also tended to decrease as the years of PE experience increased.

Analysis of Athletic Injury Rates

Injury Rate Calculation

Respondents were asked to report the number of injuries that occurred in their classes and interschool games/practices as well as the number of students associated with each (Table 9). It was necessary to calculate injury rates for

each subject and for each type of injury (classroom/interschool) in order to be able to compare numbers of injuries between teachers teaching/coaching different numbers of students. This was accomplished by taking the total number of reported injuries, dividing them by the number of student-exposures for each subject and then multiplying that figure by 100. This yielded the injury rate, or the number of times that an injury occurred based on exposure to 100 students. This calculation was performed for total injuries (n=218), PE class injuries (n=124) and interschool sports injuries (n=94) for each respondent with complete data. A mean injury rate was then calculated for each injury category. It was not possible to calculate injury rates for every respondent due to missing values. It was often the case that respondents did not answer one or more of the three questions which were necessary to perform this calculation.

Table 9

Summary of Athletic Injury Rates

	Total injuries	Injuries/100 exposures	SD	Minimum	Maximum
Overall injuries	834	2.26	2.68	0.11	20.00
P.E.class injuries	520	1.26	1.16	0.11	8.57
Interschool injuries	314	3.59	3.47	0.13	20.00

Injury Rates and STMI Score

A Pearson Product Moment Correlation was performed on the total scores achieved on the knowledge test and the calculated injury rates for each injury category. The relationship between STMI scores and PE class injuries was non-significant ($r(122) = -0.06$, p = N.S.). An inverse relationship had been

hypothesized, that is, high score achievement on the knowledge test would be associated with low injury rates, and vice versa. An inverse relationship was found, however, the strength of this relationship was very low. The same statistical analysis was performed on the interschool injury rates and knowledge score. Again a negative Pearson r value was found which indicated an inverse relationship as was hypothesized. However, the strength of the relationship was again very low ($r(92) = -.04$, p = N.S).

Injury Rates and STMI Subsections Score

The forty questions on the STMI were divided into the three subsections outlined by Carey and Shute (1982). Those subsections included diagnosis (SUBDX), treatment, (SUBRX) and emergency care (SUBEX). The average score for respondents on the SUBDX (n=20) was 49.0%. The average score achievement on the SUBRX (n=6) was 44.9% while the average score on the 14 SUBEX questions was 45.9%. The score achieved by the respondents on each of these subsections was then compared to the calculated injury rates for the PE class injuries and the interschool sports injuries.

PE Classroom Injuries and STMI Subsection Scores

The correlation between SUBDX scores and injury rates for PE class injuries was $r(122) = -.09$, p = N.S.. Thus, there was no relationship between score achievement on the SUBDX and PE class injuries. The second correlation between the score achieved on SUBRX and the PE class injury rates was $r(122) = .003$, p = N.A. , indicating no relationship. The third correlation performed on SUBEX score achievement and PE class injury rates revealed an $r(122) = -.016$, p = N.S., which indicated no relationship between the two variables. The lack of relationships demonstrated here were expected

due to the poor relationship between total score achievement on the STMI and PE class injury rates. Correlations between SUBDX, SUBRX, SUBEX and total score achievement were $r(189) = .87$, p = N.S.; $r(189) = .75$, p = N.S.; and $r(189) = .47$, p = N.S. respectively. Therefore, if respondents scored poorly on the total score, they were also likely to score poorly on SUBDX and SUBRX and somewhat likely to score poorly on the SUBEX.

Interschool Sports Injuries and STMI Subsection Scores

Correlations were run between the three subsection scores and Interschool injury rates. The correlation between SUBDX scores and Interschool Injury rates revealed an $r(92) = -.09$, p = N.S.. Similarly poor correlations were noted with SUBRX $r(92) = -.011$, p = N.S.; and SUBEX $r(92) = .078$, p = N.S.. The low correlations reported here demonstrates lack of relationship between achievement on the three subsections and athletic injury rates.

Chapter 5

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This final chapter will summarize the major findings of the study, and outline implications and recommendations for high school physical education teachers in Manitoba. Suggestions for future research and the contributions made by this study to present knowledge will be illustrated.

Summary of Major Findings

There are several conclusions that can be drawn from this study. Initially, results of the pilot study will be mentioned. The portion of respondents who achieved the calculated pass score will follow. Teacher characteristics related to knowledge score will also be discussed. Finally, discussion of knowledge score achievement and injury rates compared to related research will be reported.

Pilot Study

A pilot study concluded that the STMI developed by Carey and Shute (1982) was capable of determining a difference in knowledge between certified athletic therapists, physical education teachers and non-physical education classroom teachers. Thus, the STMI was appropriate for application in this study.

Criterion Level Achievement

The average score achieved by respondents on the STMI was 47.1%. Calculating the criterion level using Carey and Shute's (1982) method resulted in a score of 57.5% for the present study. Only 23.7% of the respondents

achieved this score, that is, less than one quarter of respondents had sufficient knowledge related to the diagnosis, field management and emergency care of athletic injuries.

Teacher Characteristics Related to Knowledge Scores

Characteristics of physical education teachers that were significantly related to their score on an athletic injury management knowledge inventory were educational background and location of the respondent's school. The relative effect of three first aid training levels is also discussed here.

Educational Background Effects

Respondents with a BPE degree were found to score significantly higher than respondents with no PE and some PE background. It is, therefore, apparent that the BPE degree prepares individuals in athletic injury management knowledge better than persons with less PE preparation. The data suggest that teachers with no PE background and those with PE minor degrees are insufficiently prepared to effectively and efficiently deal with the inevitable athletic injuries that occur in PE classes and interschool sports. It should also be noted however, that although BPE respondents did score significantly better than lesser PE prepared respondents, their achievement on the STMI is not without criticism. Although scoring significantly higher than others, most of this group also failed to achieve the STMI's pass level criterion.

Location Effects

It was found that urban respondents scored significantly higher than rural respondents. This may have been due to a greater awareness of importance of athletic injury management among urban respondents. The better performance

may also be due to a greater access to information afforded urban respondents compared to rural respondents. It is also possible that a preference among recently graduating physical education teachers for employment in an urban setting leads to greater competition for the urban placement. It is therefore possible that urban schools, with an abundance of applicants are able to select and hire more knowledgeable teachers. Consequently, rural schools may have less opportunity to hire physical education teachers who graduated near the top of the class. The results have also shown that a greater percentage of urban respondents (69%) tended to have BPE degrees than rural respondents (35.6%). In light of the finding that BPE respondents scored significantly higher than non BPE respondents, this may explain some of the difference between the two groups.

First Aid Training Effects

Although respondents with greater levels of first aid training did not score significantly higher than respondents with lesser training levels, it should be noted that, on average, respondents with sport specific training scored higher than those with general and no first aid training. There is one factor which may have confounded this finding. It is possible that the length of time since the respondent had taken the particular training course may have affected the knowledge that he/she was presumed to have had at the time they responded to the questionnaire. One would assume that a person who had reported taking a higher level first aid training course would score higher on the STMI, than someone reporting taking a lower level of first aid training. Yet, if respondents had not taken the course in recent years, the benefit of the course may not have been completely realized on the STMI at the time of testing. If the respondent had taken the course several years ago, it is possible that they had forgotten

some of the knowledge that they had gained at the time of the course, and consequently would not have scored as highly as they may have if they had taken the test shortly after taking the course. The occurrence of this sort of memory loss is explained by Murnane and Shiffrin (1991). This is also supported by the slight trend of respondents who had taken a first aid course recently (since 1991) achieving higher mean scores than respondents who reported taking a course prior to 1991. This result is important when only 35% of respondents had taken a general first aid training course and only 23.9% had taken a sport specific first aid training course in recent years (between 1991 and 1993). If a greater number of respondents had reported being more up to date in their first aid training, a greater difference in total scores may have been realized.

Knowledge Scores and Injury Rates Compared to Related Research

Comparison of Pass Score Achievement on STMI

Carey and Shute (1982) determined the criterion level on the STMI to be the median score plus four. In their study the criterion level was 25 out of a possible 40 marks. With respect to this criterion, their results showed 75% of 72 nurse-respondents and 25% of the certified trainer-respondents did not achieve a "passing score" on the STMI. Using the same calculation in this study, 76.4% of respondents failed to meet the criterion for passing. These results are similar to the results achieved by the nurse-respondents who Carey and Shute concluded were less knowledgeable than the athletic trainers regarding athletic injury recognition and management.

Carey and Shute (1980) did not indicate why they chose this criterion level calculation. This may not the best method to determine a pass percentage. It is obviously not very applicable to groups who either score very

well, or very poorly on the STMI. If the STMI was used to test the knowledge of a group of highly trained persons, for example, who all scored 90% or better, application of this median pass score calculation would determine that over half of them would fail. It is not logical to assign a failure to a person who has scored 90% or better. Results from this type of calculation could be misleading as a pass score for one group could be very different from the pass score of another group. A more equitable means of assigning a pass score may be to arbitrarily choose a certain percentage level as other authors have done (Kelley & Miller, 1976; Kelley & Lindsay, 1976; Rowe & Robertson 1986; Rowe & Miller, 1991). However use of this criterion level calculation in the present study has allowed comparisons to be made to previous research that has used the STMI.

Knowledge Levels Compared to Related Literature

In Kelley and Miller's (1976) investigation of 128 teachers serving in the role of the athletic trainer in Pennsylvania public high schools, the authors found that 85% of the respondents "would be considered obsolete in their understanding of current knowledge" (p.180). This study "implies that daily, hundreds of decisions, ranging from the planning and implementation of training and conditioning programs to the care and treatment of injuries, are being made by individuals without adequate preparation and training" (p.183).

A similar investigation by Kelley and Lindsay (1976) reported that "77% of the responding group (1024 male physical educators) did not meet their minimum criterion score for defining obsolescence" in the area of athletic training and conditioning (p. 471).

In their investigation about knowledge of care and prevention of athletic injuries, Rowe and Robertson (1986) found that "73% of the 127 respondents returning the questionnaire lacked sufficient knowledge in the care and

prevention of athletic injuries and failed to meet the criterion level" (p. 119). The authors concluded that "when only 27% of 100 persons responsible for making correct and quick decisions about injury care are making the proper decisions, there is reason for school personnel and parents of athletes to be concerned" (p.119).

Similarly, Rowe and Miller (1991) in their investigation of coach/trainer competencies concluded that "62% of those responsible for the care, treatment and rehabilitation of injured athletes did not possess adequate athletic training competencies" (p. 52). The authors concluded that "athletic trainers are not absolute ensurers of injury-free athletics. However, their presence will undoubtedly improve the prevention, first aid care, and rehabilitation of athletic injuries occurring in today's public schools" (p. 54).

The percentages of respondents failing to achieve the criterion level on the various knowledge tests are comparable even though the instruments differ. The percent of respondents found to lack sufficient knowledge in the present study is similar to the values reported by other authors (Table 9). When the present study is compared to Carey and Shute (1982), using the same methodology and instrument, their values for the nurse-respondents and the present study respondents are almost identical. Although other authors' methodologies and instruments differ from the present study and from that of Carey and Shute, the four other studies used a common instrument and thus can be compared to one another.

The purpose behind the present study and each of the other works mentioned here (Kelley & Miller, 1976; Kelley & Lindsay, 1976; Carey & Shute, 1982; Rowe & Robertson 1986; Rowe & Miller, 1991) is to determine the degree to which the respondents can accurately respond to questions concerning athletic injury management. In so doing, the respective authors have

developed a battery of questions which cover important aspects of athletic injury management. They have also established a criterion level which would determine if the respondent had a sufficient level of knowledge to accurately manage athletic injuries. It is possible that the criterion levels developed for each test would represent similar levels of knowledge because these six studies have reported between 62% and 85% of the respondents did not achieve the criterion level on the respective athletic injury management test.

Table 9

Comparison of Present Study With Previous Research on Athletic Injury Management Knowledge

Author	Subjects	Criterion level	% below criteria
Kelley & Miller (1976)	non-certified teachers	70%	85%
Kelley & Lindsay (1976)	male PE teachers	70%	77%
Present study (1995)	PE teachers	Median +4 or 57.5%	76.4%
Carey & Shute (1982)	School nurses	Median +4 or 62.5%	75%
Rowe & Robertson (1986)	Responsible person	70%	73%
Rowe & Miller (1991)	Responsible person	70%	62%
Carey & Shute (1982)	NATA certified trainers	Median +4 or 62.5%	25%

A comparison of the results achieved by Kelley and Lindsay (1976) (77% of 1024 male physical education teachers did not meet the criterion level) and the present study (76.4% of 191 physical education teachers did not meet the

criterion level) indicate a similar percentage of physical education teachers failed to meet the criterion level. It should be pointed out that the criterion level is different among the related research, although it is specific to the particular instrument.

Knowledge Score Compared to PE Class and Interschool Injury Rates

The results of this study indicated that there was no relationship between athletic injury management knowledge and self-reported athletic injury rates for PE classes and interschool injuries. Breakdown of knowledge test scores into three subsections did not produce any noteworthy correlations with PE class or interschool sports athletic injury rates either. The lack of relationship may be related to the fact that teachers with insufficient knowledge may not have been able to recognize that an injury had occurred and consequently may not have been able to report injury data accurately. This may affect a great many respondents in this study, as 76.4% were found to lack sufficient knowledge in the area of athletic injury management knowledge.

On the other hand, the lack of relationship between athletic injury management knowledge and athletic injury rates may be related to flaws inherent in the methodology. Perhaps if more reliable data had been collected concerning the incidence of athletic injuries, a significant relationship may have been found. Using self-reported athletic injury data was the best method available at the time of this study, as a reliable data collection system does not currently exist in Manitoba. Although self-report data can be somewhat accurate, it does have some inherent flaws that may have affected the calculations in this study. Other research (Murnane & Shiffrin, 1991) has shown that a delay in the time between studying (for example) and testing was found to

cause memory loss. It is possible that a certain amount of memory loss had occurred and subjects were unable to report exact numbers of athletic injuries.

It should be noted that athletic injury management knowledge of the PE teacher is not the only factor that will affect the incidence of athletic injuries in PE classes or Interschool sports. Other factors include the type of activities in which the students participate. Research (Pritchett, 1980) has shown that high-risk sports such as football will produce higher injury rates compared to low-risk sports such as softball (Shively et al., 1981). The type and condition of equipment is also an important factor in determining athletic injury rates. Poor or broken equipment is likely to be implicated in more injuries than new properly fitting equipment. Similarly, the expertise of the PE teacher in exerting control within the class or practice situation may also affect the rate of athletic injuries. A teacher who has complete control over the students is likely to have a lower injury rate compared to a teacher with little control who allows freak accidents to occur as a result of unnecessary horse play etc.

Injury Rates Compared to Related Research

Injury rates for participants in this study are comparable to other studies which have sought to determine the incidence of injuries that have occurred in high school physical education classes and interschool sports. A summary of related research is found in Table 10.

There are problems inherent in comparing data from the present study to results reported by other authors. The major problem is due to the lack of standardization among researchers of a universally acceptable definition of an athletic injury. Some authors (Goldberg, Rosenthal, Robertson & Nicholas, 1988; Shively et al., 1981) rely upon time-loss as an injury definition, while others rely upon the severity of tissue damage as delineation of an injury

(deLoes et al., 1990). Another problem is related to the type of data gathered. Some studies derive their data from standardized data collection methods, such as insurance claim records, (Pritchett, 1980; Pritchett, 1981; Austin, Rogers & Reese, 1980) while others may use less reliable methods such as the memory recall of the participants (Rowe & Robertson, 1986, Rowe & Miller, 1991). Other barriers to complete generalizability among related research include the lack of standardized survey populations. Data that includes injuries resulting from sports such as football (Pritchett, 1980) are likely to produce higher injury rates than studies that exclude these high risk sports (Shively et al., 1981).

Table 10

Summary of Related Research on Injury Rates

		Injury rate/100			
Author	Injury Definition	Class	Sport	Other	
Present Study (1995)		1.62	3.59		
Glassford et al. (1977)	unknown	1.21		1.99	HS activity
Shively et al. (1981)	alter ability to play		2.63		no contact
Goldberg et al. (1988)	>7 days restricted play			5.00	Pop Warner
de Loes et al. (1990)	emerg. visit to MD	2.51			
Pritchett (1981)	file insurance claim			4.10	HS soccer
Pritchett (1980)	file insurance claim			19.80	HS football
Austin et al. (1980)	no explicit criteria	3.60			

Implications of Findings

Responsibilities and Preparedness

A serious discrepancy between the responsibilities and the preparedness of the PE teacher arises when only 23.7% of PE teachers were

found to possess sufficient knowledge related to the care and prevention of athletic injuries, and 91% of the time PE teachers were reported as the persons normally responsible for attending to athletic injuries. These results suggest that due to the high demand placed upon PE teachers, they should be better prepared to meet the needs of an injured athlete.

BPE Graduates as PE Teachers

The results of this study suggest that although BPE graduates did not achieve overwhelming competency on the STMI, they did score significantly higher than respondents with lower levels of PE preparation. Therefore, it is suggestion that a PE teacher with a BPE degree should be hired preferentially over a candidate with lower levels of PE preparation.

BPE Education

As a result of the finding that BPE graduates did not universally achieve acceptable scores on the STMI, there is suggestion that they should receive more athletic injury management training while attending university. Implications for educational institutions include the training of BPE graduates to higher levels of athletic injury management knowledge.

Advantage of Sport Specific Training

Although differences among the three first aid training levels were not significant, the trend of mean scores points to the benefits of sport specific training for knowledge score achievement. This implies that the experience of sport specific training provided respondents with some level of training which positively affected their knowledge score.. Therefore, PE teachers should be encouraged to participate in sport specific first aid training courses rather than

general first aid training courses in order to augment their knowledge of athletic injury management.

Value of Training Course Updating

Although not statistically different, respondents who reported taking additional first aid training recently (since 1991), achieved higher mean scores than respondents who reported taking additional courses less recently (before 1991). This trend points to the benefit of periodic recertification of participants in additional first aid training courses. It is therefore suggested that persons who have taken various training courses should be encouraged to update their knowledge frequently in order to maintain that level of knowledge over a longer period of time.

Recommendations

Injury Reporting System

Problems encountered during the development and subsequent analysis of this study point to a need for the establishment of a reliable injury data collection system. A province-wide system of identifying, recording and analyzing injuries would be of extreme benefit to teachers, administrators, and students. This would allow the tracking of injuries and allow the identification of equipment/activities that may be commonly associated with athletic injuries.

BPE Graduates as High School PE Teachers

As far as knowledge of athletic injuries is concerned, BPE graduates should be hired preferentially over non BPE candidates as high school physical education teachers. It is apparent that their BPE program experience better

prepares them for the identification, treatment and emergency care of athletic injuries.

Continuing Education for High School PE Teachers

There should be a standardized system of continuing education for PE teachers to learn up-dated diagnostic and field management techniques related to athletic injuries. This should include ongoing risk management education for PE teachers concerning the potential for athletic injuries to occur and opportunities for prevention. At some point, the maintenance of a high level of this knowledge could become a requirement of teachers in order to maintain their employment with the School Divisions in Manitoba.

Education Administration Act Legislation

There should be Provincial legislation that provides for all PE teachers to maintain high levels of sport specific and first aid techniques. As well, every school in Manitoba should adopt a policy defining athletic injuries, responsible personnel, and appropriate action concerning athletic injuries. Each school should develop an emergency action plan that would be operationalized in the event of an athletic injury. This would help to reduce the incidence of athletic injury and help ensure that injuries are dealt with in an efficient and effective manner.

Need for More Qualified Personnel

Due to the poor performance achieved by physical education teachers in this study, it is suggested that individuals with more training in athletic injury management be hired to assume these duties. Previous research has shown

that certified athletic trainers are most capable of performing these responsibilities.

Suggestions for Future Research

Increasing Knowledge of PE Teachers

Future research efforts should be aimed at techniques which would increase the knowledge of PE teachers in the province of Manitoba. It has been demonstrated that PE teachers in Manitoba lack a reasonable level of knowledge related to athletic injury identification, treatment and emergency care. Therefore, it would be useful to determine what type of training would provide PE teachers with the necessary information to become competent in these areas. This may involve the development of a continuing education course in which active PE teachers may participate on an ongoing basis.

Effects of Additional First Aid Training

The effect of additional first aid training courses should also be examined. An issue that arose from the present study was related to the amount of time that had elapsed between taking the particular course and responding to this survey. The benefits of sport specific first aid courses could be more accurately examined through a more controlled experimental design.

Contributions of This Study to Knowledge

Description of PE Teachers in Manitoba

This study has provided a descriptive picture of the current knowledge of PE teachers teaching in Manitoba. This has not been done before, and will provide information for future research. In addition, it has provided information

from which comparisons can be made to research in the rest of Canada and in other countries.

Need for Injury Reporting System

This study has also identified the need for a reliable injury reporting and monitoring system. The use of a more reliable system would allow for the tracking of injuries and the potential identification of injury causing factors. Such a system would allow further research in this area to be more reliable and accurate.

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Appendix A

Permission to Use STMI

LYONS TOWNSHIP HIGH SCHOOL
ATHLETIC DEPARTMENT

I THOUGHT I'D DROP YOU A LION.

. . . FROM THE DESK OF
RICH CAREY
HEAD ATHLETIC TRAINER

1/29/93

Darlene:

Thanks for your interest in my 1980 Study - I've enclosed a copy of my article in The Journal of School Health. Also, enclosed is a copy of my copyrighted SIMI. I was unable to secure a copy of my thesis to send to you. I hope the above will help. Please send me a copy of your final paper. Good luck!

Rich Carey/ATC/R

Appendix B

Sport Trauma Management Inventory

SPORTS TRAUMA MANAGEMENT INVENTORY (STMI)

Directions: Please answer each of the following questions. Circle the letter that is the most correct response. This will take approximately 15 minutes to complete. Once finished, please return it in the envelope provided. Thank you for your cooperation.

1. Damage to ligaments on the lateral side of the ankle is usually caused by excessive:

   A. eversion
   B. plantar flexion
   C. dorsiflexion
   D. inversion

2. When a meniscus is torn in the knee, which of the following is a common sign/symptom?

   A. click felt or heard as the joint moves
   B. knee joint is locked
   C. slight swelling noted
   D. All of these encountered

3. Of the following, which is the best immediate method to relax a muscle cramp in the calf?

   A. stretch the muscles antagonistically
   B. apply ice & compression
   C. massage with heat
   D. passively contract the muscle

4. Activity on hard surfaces or repeated stresses on the balls of the feet may result in:

   A. hammer toes
   B. fallen longitudinal arch
   C. fallen metatarsal arch
   D. any of these

5. Osgood-Schlatter's disease affects athletes in the early adolescent age range. The athlete usually complains of pain over the:

   A. femoral head
   B. head of the fibula
   C. medial malleolus of the ankle
   D. tibial tuberosity

6. Calcium deposits produced within a muscle are termed as:

   A. osteochondritis dissecans
   B. myositis ossificans
   C. coxa vara
   D. osteomyositis

7. The most common athletic knee injuries are to the:

   A. medial collateral ligament
   B. lateral collateral ligament
   C. lateral meniscus
   D. none of these

8. What is the primary purpose of elevating an injured part as soon as the injury occurs?

   A. to allow the student to walk sooner
   B. to prevent cramping
   C. to prevent pooling of fluid/blood
   D. to lessen the pain

9. In recognizing and evaluating the extent of trauma to a victim who is unconscious, which procedure should be done first if normal breathing and other vital signs have been established?

A. move the victim to a comfortable position
B. learn the sequence of the accident from a bystander
C. check the other body parts
D. loosen clothes

10. The anterior shoulder dislocation usually occur when the arm is abducted and:

A. internally rotated
B. medially rotated
C. externally rotated
D. dorsiflexion

11. Which active movement would be most limited if the gastrocnemius were severely strained?

A. inversion
B. eversion
C. plantar flexion
D. dorsiflexion

12. Heat exhaustion is not characterized by which of the following signs and symptoms?

A. eye pupils usually dilated
B. dry, flushed skin
C. weak, rapid pulse
D. chills

13. If medical help is within availability, the preferred procedure in the management of a scrotum contusion in which the testicles withdraw is:

A. apply ice or other form of cold application
B do nothing
C. raise knees to chest in a supine position and pump them
D. any of these

14. In knee injuries, which examination procedure could be used to determine the extent of an injury?

A. find the point of tenderness
B. test range of motion
C. palpate the crepitus
D. any of these

15. The recognition of infectious diseases in sports-related activities is paramount to prevent a team epidemic. Impetigo is one such example and displays which of the following skin appearances in its later stages?

A. pus-filled lesions
B. boils and carbuncles
C. crusty lesions
D. itchy lesions

16. Which of the following is a common mechanism in meniscal injuries to the knee?

A. knee partially flexed
B. foot planted
C. rotary forces applied
D. all of these

17. Which of the following procedures would you employ to best alleviate chronic pain of flat feet in an athlete?

A. instruct athlete to withdraw from competition until asymptomatic.
B. place a triangular-shaped felt pad along the inner metatarsal arch
C. tape longitudinal arches
D. place a C-shaped felt pad along the medial longitudinal arch

18. Which of the following is a common mechanism for moderate to severe hamstring strains?

A. unbalanced quadriceps/ hamstring strength
B. fatigue
C. inadequate warm-up
D. any of these

19. The reflex pain which radiates to the left shoulder and one third of the way down the left arm, (the classic Kehr's sign) is indicative of an injury to the:

A. liver
B. spleen
C. heart
D. deltoid bursae

20. Which of the following is an immediate treatment procedure for severe heat stroke?

A. keep victim free from chills
B. give victim salt solution
C. strip victim and immerse in cold and/or icy water
D. none of these

21. Pneumothorax is a condition when the lung has been punctured and air enters the pleural cavity from that lung or outside the chest. There are two types, traumatic and spontaneous. In both cases, how should the victim be transported to the hospital (provided no signs or symptoms of a rib fracture were present)?

A. on his uninjured side
B. in a semi-reclined position with support
C. in a supine position
D. none of these

22. The type of athletic activity that has been found to produce bone degenerative changes in the female pelvis area is:

A. jumping
B. tumbling
C. jogging
D. none of these

****

SITUATIONS

Directions: Read each situation and answer the question (s) by circling the most correct response

SITUATION #1 A student is unconscious on the gym floor. Her eyes are dilated. Her respiration has ceased, and no carotid pulse is present. CPR must be given and <u>you are alone.</u>

23. What is the breath/heart compression ratio that must be administered to the victim?

A. 15 breaths/5 compressions
B. 2 breaths/5 compressions
C. 2 breaths/15 compressions
D. 15 breaths/2 compressions

SITUATION #2 You are called to the aid of a physically education student who has sustained a shoulder injury after falling out of the high jump pit. He states that his shoulder has 'slipped out' but you cannot find evidence of gleno-humeral dislocation or subluxation, acromio-clavicular sprain, or supraspinatus muscle damage.

24. What condition would you suspect first if he could not abduct his arm or hold it is abduction?

A. damage to the deltoid
B. damage to the trapezius
C. a fractured clavicle
D. none of these

SITUATION #3A basketball player limps into your office the day after a basketball game with a sore ankle. He has seen his family physician and the x-rays were negative. You palpate the ankle and note effusion is still present.

25. What follow-up action would you have the athlete do first?

A. suggest to coach to use cold whirlpool twice daily for 20 minutes for 7-10 days.
B. suggest to athlete that he be on crutches and continue ice treatments
C. suggest that athlete soak his ankle in Epsom salts and warm water
D. suggest hot packs daily and have ankle taped for play

SITUATION #4You are summoned, without your kit, to the outdoor track during a school-sponsored meet. A girl has fallen after the last leg of a 440 relay and once there you note her breathing is abnormally fast and her breaths are quick and short.

26. What immediate treatment procedure would you initiate first?

A. calm and reassure the athlete
B. remove the athlete to the inner field for evaluation
C. cup both hands over the athlete's mouth
D. none of these

27. What respiratory condition most accurately describes the above situation?

A. traumatic asphyxia
B. hyperventilation
C. solar plexus insult
D. none of these

SITUATION #5Two girls have collided with each other in a volleyball class. One girl received a contusion to her knee, while the other girl has a mild concussion though she is still conscious.

28. Many functional tests can be administered to conscious concussion victims. One such test involves checking her eyes while she looks to one side and is instructed to hold that position. If her eye jerks, this is known as:

A. nystagmus
B. the Romberg sign
C. convulsive behavior
D. disorientation

SITUATION #6A girl participating in intramural basketball sustains a contusion to the quadriceps. She reports to you office limping and in pain.

29. What would be the preferred immediate treatment procedure to follow?

A. apply heat packs for 30 minutes and refer her to her physician
B apply heat with massage for 20 minuted and refer her to her physician
C. apply ice pack and compression for 30 minutes and refer her to her physician
D. apply ice massage for 5 minutes and refer her to her physician

SITUATION #7 A student comes running into your office. He wants you to come to the wrestling room in the gymnasium. Upon arrival, you note a physical education student holding his elbow. The physical education instructor tells you that the student injured the elbow in a wrestling drill. He has an obvious posterior dislocation of the elbow. You treat for shock.

30. What important procedure would you do then?

A. immobilize in a sling and transport by ambulance
B. apply ice packs and compression wrap
C. evaluate circulation and nerve function in the hand
D. none of these.

SITUATION #8 You are summoned to the football practice field by one of the players. Upon arrival, you observe an athlete lying supine and unconscious on the field. He is in full football gear including neck roll. He is breathing, and a normal pulse is present. The head coach tells you that the athlete received a blow to the neck during a tackling drill. The other coaches have stabilized the neck, but do not know what to do next.

31. What procedure would you follow first?

A. perform a neurologic examination
B. remove the helmet and neck roll to relieve pressure on the area.
C. immobilize on stretcher and call for an ambulance
D. check other body parts for further damage and transport

32. Injuries to the neck of this nature could result in which of the following?

A. monoplegia
B. paraplegia
C quadriplegia
D. any of these

SITUATION #9 You are summoned to the men's locker room. In the first aid room, a boy is lying supine and conscious on the couch. The physical education instructor has just brought the boy from the sauna where he had fainted. The boy appears pale, sweaty, weak and in muscular spasm. You note his breathing is shallow and his eye pupils are dilated.

33. What condition would you suspect?

A. heat cramps
B. heat stroke
C. heat exhaustion
D. none of these

34. Which of the following treatments would not be indicated?

A. keep him free from chills
B. massage the extremities
C. check against shock
D. give the boy sips of salt solution

SITUATION #10 After school you attend an intersquad basketball scrimmage as a spectator. Halfway through the game, you observe one of the players go up for a rebound, lose his balance and come down twisting his ankle. You go to the bench because there are no other medical or para-medical personnel in attendance. Upon arrival, you hear the athlete complain of pain all over the ankle.

35. What would you do first to determine the extent and nature of the injury?

A. remove the shoe and examine swelling present
B. palpate area of pain to find point tenderness
C. ask athlete where his pain is in the ankle
D. ask athlete to see if he can move his ankle through a range of motion

SITUATION #11 A girl from a physical education swimming class comes running into your health office. She is screaming and exclaims that she has broken her finger on the side of the pool. Upon inspection, she shows no physical signs of a fracture, but she has dislocated the PIP joint of her ring finger.

36. What immediate treatment procedure would you employ when confronted with this injury?

A. apply ice and elevation for 5 minutes
B. splint finger using a metal, flexible splint and refer to a physician/hospital
C. realign the finger joint using reduction
D. none of these

37. In adolescents, which of the following joints can be realigned through techniques before the victim sees his or her physician?

A. fingersC.
B. shoulder
C. thumb
D. none of these

SITUATION #12 You are summoned to the football field just before you leave your office for the day. A varsity player is lying on the field. The coach tells you that the boy landed on his neck during some horseplay in a tackling drill. You note he is conscious and is breathing fine. However, the possibility of the boy having a neck fracture is highly suspected.

38. If you do suspect a neck fracture, what would you do first in the above situation?

A. immobilize the neck in line with the shoulders
B. remove the helmet prior to neck immobilization
C. immobilize the neck and then remove the helmet
D. none of these

SITUATION #13 You are called to the girls' gym during a basketball class. The supervising physical education instructor tells you that two girls collided while jumping. One girl is alright, while the other girl has her "wind knocked out".

39. Which of the following is not a common sign/symptom at the onset of a solar plexus blow?

A. in primary shock
B. ashen pallor
C. breathing is rapid
D. any of these

40. Which of the following is a proper immediate treatment procedure for the solar plexus blow condition once you have checked for shock and breathing?

A. bounce the trunk of the victim up and down
B. let it pass spontaneously
C. pump the legs
D. none of these

SPORTS TRAUMA MANAGEMENT INVENTORY (STMI)
answer key

1	D	21	B
2	D	22	D
3	A	23	C
4	C	24	A
5	D	25	B
6	B	26	C
7	A	27	B
8	C	28	A
9	B	29	C
10	C	30	C
11	C	31	D
12	B	32	D
13	B	33	C
14	D	34	B
15	C	35	B
16	D	36	B
17	D	37	D
18	D	38	A
19	B	39	C
20	C	40	B

Appendix C

Related Variables

1. Are you male ___ or female _____

2. What is the highest level of education that you have attained?
   high school_____ BPE _____
   BEd. (no P.E.)_____ MEd _____
   BEd. (P.E. minor)_____ MPE/MSc _____
   BEd. (P.E. major)_____ Other _____(specify)

3. How many years of teaching experience do you have? _____

4. Have you had any training in first aid courses?
   No _____ Athletic First Aider (MATA) _____
   C.P.R _____ St. John's Ambulance _____
   Other_____(specify)

5. Who is normally responsible for attending to athletic injuries at your school?
   yourself _____ other P.E. teacher _____
   physician _____ student athletic therapist_____
   school nurse _____ certified athletic therapist _____
   other _____(specify)

Please answer the final two questions based on your instruction of physical education classes and your coaching of interschool sports.

"An athletic injury must be sports related which keeps the player out of practice or competition on the day following the injury. It requires medical attention (by a physician or trainer) or dental care of any kind beyond icing or wrapping. It includes all concussions, nerve injuries, no matter how transient, and all eye injuries"(Noyes, Lindenfeld, & Marshal, 1988).

6a. Using the above definition, how many injuries have occurred in physical education classes taught by yourself during the 1992-1993 school year? _____

b. How many of the total number of injuries that have occurred in your physical education classes would you consider to be:
   Mild? _____
   example: keeps player out of P.E. activity for 1-3 days.
   Moderate? _____
   example: keeps player out of P.E. activity for 4-6 days.
   Serious?_____
   example: keeps player out of P.E. activity for 7 days and over.

c. How many students per week have you taught during the 1992-1993 school year? (teaching the same student twice in the same week counts as two students etc.)_____

7a. Using the above definition, how many injuries have occurred on interschool sports teams coached by yourself during the 1992-1993 school year? _____

b. How many of the total number of injuries that have occurred with your interschool teams would you consider to be:
   Mild? _____
   example: keeps player out of P.E. activity for 1-3 days.
   Moderate? _____
   example: keeps player out of P.E. activity for 4-6 days.
   Serious?_____
   example: keeps player out of P.E. activity for 7 days and over.

c. How many students per week have you coached during the 1992-1993 school year? (coaching the same student twice in the same week counts as two students etc.)_____

Appendix D

Cover Letter

May 1,1993

Dear Physical Education Teacher,

This study has been designed to determine the knowledge of physical education teachers towards athletic injury management and how it relates to the incidence of injuries in Manitoba's high schools. Information gathered through this study will serve to increase the understanding of athletic injury incidence in high schools and potentially identify ideas to reduce the risk and occurrence of such injuries in high school athletics. Mr. Douglas Edmond, Chair of the Research Advisory Committee in Winnipeg School Division No. 1 has reviewed and approved this research project.

Please take about 15 minutes to complete the enclosed questionnaire regarding athletic injury management. Each question is optional, you may refrain from answering any question(s) should you prefer not to.

This study is intended to determine your present knowledge, and therefore you are asked to refrain from refering to any textbooks or other resources. Only physical education teachers in Manitoba are being included in this study. It is very important that you complete this questionnaire and return in the next few days so that your responses may be included in this analysis. A pre-addressed envelope is provided to return your completed questionnaire.

Please be assured that your responses will remain **completely confidential**. You will notice an identification number on your questionnaire, this will be used to identify that your questionnaire has been returned so that you will not be sent any unnecessary reminders. If you have any questions, please feel free to contact me at 474-8724, or 237-1104.

Thank you for your assistance

Sincerely,

Darlene Beeusaert
Graduate Student
Faculty of Physical Education & Recreation Studies
University of Manitoba