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An Examination of Intercollegiate Athletic Injury Tracking Systems Within Canadian Universities

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by

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Hon. BA Kinesiology, Wilfrid Laurier University, 2007

THESIS

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Abstract

Information regarding the practice of athletic injury tracking within Canadian intercollegiate institutions has been relatively deficient. The study aimed to assess the current status of athletic injury tracking systems (AITS) in Canadian universities within the Canadian Interuniversity Sport Association (CIS). A secondary purpose was to obtain data from therapists within Canadian Universities, to identify and analyze issues, benefits, barriers and obtain information regarding how athletic injury tracking methods are conducted. This was achieved by obtaining data regarding the current state of AITS in CIS institutions, clinical demographics, athletic therapists and/or physiotherapists' opinions regarding the pro's and con's of athletic injury tracking and AITS protocol implemented within each institution across the CIS. The study had a sample of 45 athletic therapists and/or physiotherapists, representing 38 universities that are members of the CIS. Results of this study suggest that there is no standard in place for athletic injury tracking in Canadian universities. Nine universities are currently tracking athletic injuries, while twenty-nine universities are not tracking athletic injuries through a formalized athletic injury tracking program. The majority of therapists recognized benefits of injury tracking and believed that injury prevention and injury management can be achieved though understanding trends that occur within athletic injuries. The three primary barriers reported as to why universities are not tracking athletic injuries were: time, funding, and resources. The results of the study indicated that although there are recognized barriers, the majority of responding therapists were interested in tracking athletic injuries within their respective institutions through a more formalized system.

Additionally the majority of therapists indicated their interest in forming a collaboration to participate in a national injury tracking system among member institutions of the CIS.

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Table of Contents

Appendices

List of Tables

List of Figures

1.0. Introduction

Canadian athletic injury tracking has been limited in it scope and practice. In the past there have been attempts at establishing an athletic injury tracking system within Canadian intercollegiate athletics (see Glossary) but have operated with limited success. Injury tracking can provide vital information to intercollegiate athletic programs across Canada. A comprehensive data collection system can assist in promoting reliable health care, the development of injury prevention strategies, and collection of data towards a wider variety of varsity and non-varsity student athletes at the intercollegiate level. Data collection of injuries can assist in obtaining information regarding the programs and policies in operation across Canadian universities, which can support the formation of an improved foundation for resource allocation, information sharing among academic institutions, and student-athlete well-being.

The proposed study aimed to obtain an overview of how sport (see Glossary) related injury data is collected within Canadian universities and to assess current injury tracking practices within their athletic programs. An investigation of practices in use was used to identify the current state of injury tracking and barriers that arise when operating an Athletic Injury Tracking System (AITS). The objective of the study was to gather data from athletic therapists and physiotherapists within Canadian universities to collect information on how athletic injury tracking methods are organized in Canadian universities, and to identify potential barriers encountered with these methods. As a long-term goal, a collaboration amongst Canadian academic institutions to standardize the practice of athletic injury tracking would be beneficial for athletic programs.

The study employed a survey of athletic therapists and physiotherapists from the 52 institutions within the CIS. Obtaining specific data on injury tracking systems (e.g.,

type and protocol), along with details such as the software program in use, available resources and how the program was being organized and implemented, can assist therapists working with student-athletes in treatment and injury management.

The primary goal of the research was to obtain an accurate understanding of the current state of athletic injury tracking in Canadian universities. A desired outcome of this study was to share good practices across institutions within the CIS. From the data collected, we aimed to examine the methodology of injury tracking for the purpose of providing credible injury data in order to make informed decisions regarding the health and safety of all student-athletes within the CIS.

2.0. Review of Literature

2.1. *Introduction*

To properly assess and determine appropriate methods of injury prevention within CIS sport, it was important for institutions to be able to identify mechanisms and causes of athletic injuries within varsity sport. This section reviews the literature that highlights background information on physical activity, sport and injury, providing an overview of athletic injury tracking, the features of athletic injury tracking systems, problems associated with athletic injury tracking, and discusses the primary AITS in use internationally.

2.2. *Physical Activity*

Participation rates in physical activity increased over the last decade. It was important to recognize that as involvement in physical activity increased the involvement in sport also increased (Craig, Russell, Cameron, & Bauman, 2004). In the *Canadian Community Health Survey* (CCHS) physical activity was defined as "a daily energy expenditure of 1.5 kilocalories/kilogram of body weight/day or more; roughly equivalent to walking 30 minutes a day everyday" (Statistics Canada, 2006. p. 4). The 2002/03 CCHS illustrated an increase in the physical activity of Canadian adults (i.e., individuals aged 20 years and older) with respect to sex; there was an 11% increase among females, and a 10 % increase among males between 1994 and 2002. In 2002, 46% of adult females and 52% of adult males were physically active. The age cohort with the highest rate of participation was 20-24 year olds, with 60% being physically active (Statistics Canada, 2006). The Canadian Fitness and Lifestyle Research Institute (CFLRI) refers to organized

physical activity as "the practice of sport or the participation in a sporting activity" (Canadian Fitness and Lifestyle Research Institute, 2005. p. 2).

2.3. *Sport*

The increases in the participation rates of physical activity, had resulted in a larger portion of the population participating in organized and unorganized sport (Statistics Canada, 2006). Participation in sport had increased substantially over the last decade (Statistics Canada, 2006). According to the 2004 CFLRI Physical Activity Monitor (PAM), participation in organized and unorganized sports have both risen in the past decade (Canadian Fitness and Lifestyle Research Institute, 2005). . Organized sports are generally centered around learning rules and following rules under supervision, while unorganized sports are generally centered around action and maintaining certain actions while allowing for the flexibility of rules (Weinberg & Gould, 2007). The PAM reported that 54% of 18-24 year olds participated in organized physical activities (sport) and 85% participated in unorganized physical activities on an annual basis (Statistics Canada, 2006).

Among the highest rates of participation in sport are individuals within post-secondary institutions. In 2004, 42% of individuals who have completed education at the university level were participating in sport. As the level of education decreased, rates of participation also decreased; college 36%, secondary 31%, less than secondary 28% (Statistics Canada, 2006). These rates are also common among participation rates in unorganized physical activity; university 81%, college 72%, secondary 67%, less than secondary 59% (Statistics Canada, 2006). This would illustrate that individuals attending post-secondary institutions at the university level would be likely to have the highest

rates of participation in organized physical activity falling in the age cohort of 18-24. It is important to note that participant education is important to athletic injury tracking in the CIS, as all athletes being tracked are currently enrolled in education at the university level and represent an ideal sample to track due to the greatest participation rates in physical activity. As participation increases then there will naturally be an increase in the total number of injuries that occur. Health Canada had illustrated an increase in injuries over the past decade accompanied by the increase in participation in physical activity, which has resulted in an added burden of injuries treated within the Canadian healthcare system (Statistics Canada, 2006). Due to the increased participation in sport, there was an increased likelihood of a raise in the rate of injuries.

2.4. *Injury*

The Public Health Agency of Canada (PHAC) estimated that in 2002 intentional and unintentional injuries resulted in an economic burden of $14.7 billion annually in healthcare costs and lost productivity within the Canadian healthcare system (Health Canada, 2002). The medical definition of sports injury from the Dictionary of Nursing is "an injury related to the practice of a sport, often resulting from the overuse and stretching of muscles, tendons, and ligaments" (Dictionary of Nursing, 2008. ¶. 1). Sports injuries may have various classifications, therefore there is currently no standard operational definition in place worldwide (Hodgson-Phillips, 2000). Most individual definitions of sports injury have flaws and are not applicable to all institutions due to the broad spectrum of the mechanisms of sports injuries. Canadian sport is in need of creating a theoretical definition of sport injury before it can create a consistent operational definition to classify the unique injuries specific to athletics. This was

important as Health Canada classifies sports injuries in the category of "unintentional" injuries also referred to as accidental injuries. Injuries result in the third highest cost regarding hospitalization in Canada accounting for over 10% of overall hospitalization costs in Canada (see Appendix A) (Health Canada, 2002). In 2004, the category of injury was placed in one of the lowest priority areas in Canada for research funding (see Appendix B) (National Scientific Advisory Committee, 2004). Due to the quantity of injuries and cost associated with injuries within Canadian healthcare system, it was clear that there needs to be further research devoted to the reduction of injuries and the implementation of injury prevention strategies to reduce costs imposed on the Canadian healthcare system.

In 2004, PHAC performed an assessment of the onset of injuries across age cohorts and variable contexts. The study was done throughout hospitals in collaboration with the Canadian Hospital Injury Reporting and Prevention Program (CHIRPP). Sport related injuries, accounted for 23.2% of all injuries, closely followed by leisure and recreation injuries, which accounted for 22.7% of all injuries treated within the CHIRPP Emergency Departments (ED). The leading cause of ED visits in 2004 were attributed to the category "other events". "Other events" accounted for 27.2% of all injuries treated within CHIRPP ED (Health Canada, 2007). "Other events" consisted of a range of contexts grouped together from a variety of contexts and were more common in the age cohorts of <1 and 65> years old. Assessing these results, 45.9% of all injuries treated within the subset of Canadian hospital ED resulted from a form of activity. The age cohort of 15-19 years accounted for 44.7% of all sports and recreation injuries in the emergency department. The age cohort of 20-64 years old accounted for 13.3% of all

sports and recreation injuries in the emergency department. The issue with tracking athletic injuries that are treated in the ED is that there was a large percentage of injuries that are unreported and untreated in the ED. Self reported injuries are the only injuries that are tracked and recorded which becomes problematic and weakens the quality of data due to the large volume of injuries that are unreported.

The data may not properly characterize the university age cohort of typical varsity athletes within Canada, this was important to note as individuals in the age cohort of 20-64 years old tend to become less active in sport as they age. This reduced exposure to sports and recreation would result in a reduction of sport related injuries (Statistics Canada, 2006). CHIRPP groups individuals in the age cohorts of <1 year, 1-4 years, 5-9 years, 10-14 years, 15-19 years, 20-64 years and 65>. The age cohorts of importance to the present study are 15-19 and 20-64 years, due to the average age of varsity athletes. Interuniversity statistics in the annual injury report at Wilfrid Laurier University (WLU) indicated that the typical age of a varsity athlete in the CIS ranged from 17-26 years old (Ross, 2008).

In the United States the current volume of annual sport related injuries has prompted national awareness of the prevalence of sport related injuries (Centers for Disease Control and Prevention [CDCP], 2001). As a result of this, the CDCP incorporated sport related injuries as a primary concern in its 2002 injury research agenda (National Center for Injury Prevention and Control [NCIPC], 2002). The CDCP and NCIPC (2002) reported approximately 3.65 million emergency room visits were a result of participation in sport, exercise, or recreational activity. Sport specific related injury accounted for 1 out of 5 emergency room visits in 2002 (NCIPC, 2002).

Currently, Health Canada and the SMARTRISK Foundation are collaborating to lower the economic burden of unintentional injury in Canada by recommending a national injury prevention strategy (Health Canada, 2002). The national injury prevention strategy was to be supported by the collaborative efforts across injury prevention groups within Canada. The goal of this strategy was to create the establishment of injury prevention priorities and provide new and innovative approaches to injury prevention in Canada. The design of the national injury prevention strategy was built upon three core components: comprehensive programming, an established national injury tracking system, and ongoing research.

The first component, comprehensive programming, involves generating public awareness of Canadians to the risks that unintentional injury present on a daily basis (Smartrisk, & Canadian Collaborating Centres for Injury Prevention and Control [CCCIPC], 2003). The design was to create community-based programs that will distribute public awareness messages to reduce the risk of injury. Creation of a national injury tracking system, will assist measurement of a number of variables that have an effect on unintentional injury. The use of these variables will dictate specific injury prevention strategies for unintentional injury, which will focus on high-risk populations, injuries of high economic cost, and common injuries. The last component of the national injury prevention strategy was ongoing research, where the strategy will focus on the epidemiology of preventable injury, as well as the evaluation of prevention initiatives (Smartrisk & CCCIPC, 2003).

Janda (1998) conducted a study which illustrated injury in general, as an "under-recognized major health problem facing the world community" (p. 169). As injury is still

a growing public health issue, there is a large volume of sports injuries within the classification of "injury" that are preventable and are consuming a large portion of the limited financial resources within the Canadian (see Appendix A) and American healthcare system. As a result, Janda stated that the importance of a comprehensive injury tracking system is to help determine the effectiveness of preventive intervention, categorize risk factors and types of injuries, and to reduce the cost of injury, to develop appropriate financial resource planning (Janda, 1998). Since many injuries can be prevented, it is vital to know enough about their nature and occurrence in order to apply the appropriate preventive measures (Finch, Ozanne-Smith, & Williams, 1995). It is also important that these preventive measures be evaluated in order to use the available resources efficiently. Data obtained through the means of tracking athletic injuries clearly underlies effective injury prevention and the appropriate evaluation of preventive measures (Finch, Ozanne-Smith, & Williams, 1995).

2.5. Injury Tracking

2.5.1. *United States*

Injury tracking was a practice that was fairly limited until the 1970's when the concept of athletic injury reporting systems were established. In the United States prior to 1970 there was limited data available regarding athletic injuries. In 1974 the first athletic injury specific injury tracking system was established. This system known as the National Athletic Injury Reporting System (NAIRS) was established through the National Collegiate Athletic Association (NCAA), the Consumer Product Safety Commission, the National Athletic Trainers Association (NATA), the Sporting Goods Manufacturing Association, Pennsylvania State University, and some National Football League (NFL)

team physicians (Meeuwisse & Love, 1997). This program was designed to provide information to researchers, institutions, sporting goods manufactures, rules committees, and medical practitioners within the United States. NAIRS was in operation from 1972-1983 when it was discontinued due to a lack of operation funding. The founding members of the NAIRS have continued to establish alternative athletic injury tracking registries including: NCAA Injury Surveillance System (ISS), Canadian Athletic Injury/Illness Reporting System (CAIRS), and Sports Injury Monitoring System (SIMS) (Meeuwisse & Love, 1997).

The view of some injuries being predictable and preventable has changed the approach to injury tracking in North America and has initiated the implementation of an AITS within sport and the collegiate institutions (predominantly in the United States) in order to reduce the rate and severity of injury (Dick, Agel, & Marshall, 2007a; NATA, 2007). Through the implementation of injury tracking systems at the intercollegiate level in the United States, important findings were illustrated within the student athlete population. These findings were:

- Lower extremity injuries accounted for over half of all collegiate athletic injuries
- Injury rates resulting from competition were higher than injury rates during practice sessions
- Recognition of concussions and anterior cruciate ligament injuries increased significantly. This was likely due to improved reporting and identification of these injuries
- Pre-season practice injury rates were two to three times higher than injury rates recorded during regular season practice

(Hootman, Covassin, & Evans, 2007a; National Athletic Trainers Association, 2007). The findings generated from the NCAA has promoted the practice of injury tracking at a national level, where countries like Australia have began to develop injury tracking systems to track athletic injuries.

2.5.2. *Australia*

Finch (1999) described injury tracking as "an ongoing collection of data describing the occurrence of, and factors associated with injury" (p. 43). Analysis of the injury tracking data may be able to generate relationships for mechanisms of injury by calculating the risk through an exposure to injury rate ratio. Injury tracking was initially established in Australia in 1986, through the *Looking Forward to Better Health* program a project of the Better Health Commissions, a branch of the Commonwealth Government of Australia (Mitchell, McClure, Williamson, & McKenzie, 2008). The Better Health Commission created a strategy that focused on three primary prevention initiatives including cardiovascular disease, nutrition, and injury (Mitchell & McClure, 2006). These areas of concern were overseen by the National Better Health Program (NBHP). The NBHP was responsible for the annual review of progress in the initial prevention initiatives.

Since 1986 there has been substantial growth in injury prevention initiatives from the Commonwealth government to develop national goal for Australia's overall health (Finch, 2006). As of the year 2000, the Australian Commonwealth government has 76 target areas for injury tracking and prevention, including sport-related injuries (Mitchell & McClure, 2006). The growth from 1 target area to 76 from 1986 to 2000 indicates that there has been a considerable increase in focus on injury tracking and injury prevention

initiatives in Australia. Since 2000 Australia has been developing a sophisticated AITS at a national level through Sports Medicine Australia (SMA). As Australia has been developing a national AITS, Canada has made various efforts to develop injury tracking systems at the national level.

2.5.3. *Canada*

In Canadian sport in the 1980's, there was a shift in attention from limited interest in athletic injury data towards collecting athletic injury data, for the purpose of creating strategies to reduce injury in sport and recreation (Saunders, & Stewart, 1991). This shift has stemmed from the perception that injury occurs as a non-random (see Glossary) event. In 1979 the first athletic injury tracking registry was created known as the CAIRS. The CAIRS was created to identify contributing factors to injury, in order to reduce high risk factors to make participation in sport safer (Pelletier, 1992). The initial goals of implementing a athletic injury reporting system in Canada was to:

- "provide a mechanism for continuous collection and retrieval of health problems related to sport
- provide a service to maintain injury/illness records to a variety of institutions and sports
- form a database for periodic epidemiological analysis
- act as a resources to decision makers and qualified researchers
- investigate the relationship between sports equipment and injury" (Meeuwisse & Love, 1997, p. 191).

At this point in time the CAIRS is no longer in operation due to lack of operational funding and support. The system was in operation from 1979 to 1986 where it tracked

athletic injuries across elementary, high school, university, the professional club level, and in hospital and clinical settings (Meeuwisse & Love, 1997).

Canadian sport does not have a standardized athletic injury tracking protocol; however, it does have one of the highest rates of sports participation in the world as 55% of Canadians in 2004 were involved in sport annually and 32% participate in sport competition on an annual basis (Bloom, Grant, & Watt, 2005). By assessing previous interpretations that illustrated injury as a random event, perceptions have changed to the current view in athletic injury research, to interpret injuries as a non-random event, a concept that has facilitated the assumption that some injuries can be predictable, as well as preventable (Francescutti, Saunders, & Hamilton, 1991). In order to capture information regarding incidence and prevalence of injuries, institutions must have a means of tracking and recording injuries.

In 2003, a study was conducted by the Center for Tracking Coordination, a branch of Health Canada (MacKay, Schopflocher, Groff, Webster, Mackenzie, & da Silvia, 2003). The purpose of the study was to examine the current state of injury tracking in the Canadian healthcare system and to support the formation of a national agenda for injury tracking that emphasized program policy, research, injury prevention and control in Canada. According to a program review on injury tracking systems operating in Canada, Health Canada reported that the current state of injury tracking in Canada has many associated challenges. Health Canada (2003) illustrated that there was an urgent need to establish a framework on the national level. The framework should address issues in injury tracking such as data holding, capacity, ability of system, communication, interconnectivity of data and tracking products. To operate effective injury tracking

systems, there is an immediate need to attain quality data across all sectors in order to maintain the ability to fulfill accurate policy and programming needs (MacKay et al., 2003).

2.6. Importance of Athletic Injury Tracking Systems (AITS)

Health Canada (2003) has recognized injury tracking as an essential tool for various levels of injury prevention and management. Hlobil, van Mechelen & Kemper (1989), acknowledged that ongoing injury tracking was a core component and a essential practice behind successful injury prevention (Hlobil & Colleagues, 1989). By incorporating an AITS within an institution, the AITS has illustrated benefits as a fundamental tool for: the systematic monitoring of injury trends; risk and protective factors; recognition of emerging injury issues, policy and program-based management of injury risks; and planning of health services (Angus et al., 1998; Langley, 2004; MacKay et al., 2003). Health Canadas' CHIRPP program does not direct the focus of its findings towards sports injuries, so while CHIRPP was not sport injury based, we can draw parallels to sport. From the findings generated by Health Canada, we can recognize that there would be a benefit to focus on sport and recognition of the importance of incorporating injury tracking within sport.

The practice of athletic injury tracking has become more common, while employing diverse applications. Worldwide there is a diverse set of privately owned injury tracking tools in operation to track a variety of athletic injuries. The outsized volume of data collection methodologies for injury tracking has limited the use of data for comparative and generalization purposes (Finch et al., 1995). As a result, the diversity has weakened the reliability of information for injury prevention strategies.

Consequently, there is a lack of clear operational definitions for injury that does not allow for standardization across data collection methodologies. Finch et al. (1995) concluded that there is an immediate need for consistency of the systematic approach to the methodology of injury tracking to improve the quality of data to be sampled.

Injury tracking systems are implemented for numerous reasons and serve to collect data for a variety of reasons. These systems can be useful to individuals at all levels, beginning with the athletes and expanding into the community and society. Injury tracking systems can be beneficial in sport injury prevention research through the community (Finch, 2006). The systems can provide information to inform research across the spectrum of sports medicine disciplines. Injury tracking systems can assist in the evaluation of the effectiveness of changes to policy or equipment standards. This can be achieved by assessing the adjustments that have been applied to rules or equipment modifications such as the implementation of facemasks in women's lacrosse within the NCAA (Dick, Hootman, Agel, Marshall & Messina, 2007b). The data obtained within injury tracking systems can also be beneficial for risk management preparation for upcoming events, planning for resources required to treat and manage injuries, planning of medical coverage for sporting or recreational events, and identifying priority areas of research in regard to higher risk sport or risk components of a sport (Finch et al., 1995). Identifying these areas of risk are important for future preventive measures.

Health Canada, recognizing the importance of injury tracking as a crucial component of an institutional health and safety structure, concluded that the use of tracking information should be an ongoing part of the data management cycle (Health Canada, 2002). To achieve this, the tracking system needs adequate funding, and a

business environment that encourages and supports the collection, analysis and appropriate use of data (Angus et al., 1998). With the lack of a formal structure and support in the practice of sports injury tracking across Canadian universities, there is an immediate need to regulate the practice of injury tracking to produce quality data. An AITS system should be designed primarily to meet the needs of individual institutions or groups of institutions. If definitions are universal injury tracking systems can be useful to provide information to a broad range of potential users.

2.7. Features of Athletic Injury Tracking Systems (AITS)

2.7.1. *Uses of Injury Tracking Systems*

AITS, are used within the clinical setting to obtain the incidence and prevalence of injuries. As AITS have evolved, one of the important goals has been to generate data that can be useful in achieving accuracy in the incidence and prevalence of injuries occurring within sport. In addition, there are many other facets that injury tracking is able to accomplish. Finch (1999) includes, "monitoring trends in injuries over time, targeting research and data collection to interpret causal factors, measuring the incidence, nature and severity of injury in sport, planning, implementing and evaluating measures to prevent and control injury, gaining insight into the causes and mechanisms of injury by identifying possible risk factors, assess policy with regard injury prevention, and prioritize the allocation of resources to injury prevention" (pp. 43-56). The predominant reason for implementing an AITS is for injury prevention.

The ability to predict or prevent injury lies in the ability to assess risk factors appropriately. If the identified risk factors can be managed and reduced, injuries may be prevented (Meeuwisse & Love, 1998). An AITS can provide data from past injury

occurrences enabling identification of higher risk activities, or risk factors present in sport or recreation. Knowledge of incidence rates, trends, and contributing factors leading to injuries in the population is a prerequisite for planning, implementation and evaluation of injury prevention strategies (Lund, Bjerkedal, Magne-Gravseth, Vilimas & Wergeland, 2004).

2.7.2. *Recommended Features of Athletic Injury Tracking Systems*

In 1974, the Accident Compensation Corporation (ACC) was founded in New Zealand. The ACC was responsible for the creation of SportSmart, a multi-factorial injury prevention and an educational tool for injury tracking. As referred to by the ACC, an adequate tracking system should have the flexibility to meet changing needs; be affordable; be simple and easy to operate; remain consistent and available over time; provide an accurate representation of injury in the sport over time; provide timely information; and be acceptable to athletes (CDCP, 2001; Egger, 1992; Finch, 1998; German, Lee, Horan, Milstein, Pertowski & Waller, 2001; Hume, 1997). These variables are all vital components of an injury tracking system, which will attract potential users and will maintain ethical tracking of injuries over time. Injury tracking systems, once implemented, should be evaluated to ensure that the data collected in the process of collection is up to standard. In 1988, the CDCP recommended that there should be an examination of all tracking systems to ensure that they encompass the characteristics of a quality injury tracking system. These components should be fulfilled to ensure that institutions are producing accurate data of the represented sample.

The quality of data is judged in each of the represented samples on specifics to the area of interest of the individual. There are different types of data that are required to

supplement the quality of data produced. The level of detail collected is dependent on the aim of the study. Lund and colleagues (2004) has illustrated three levels as determinants of information detail transferred into data: low, medium, and high. Low-level data, referred to as a minimum data set, would include general case indicators (e.g. competitive sports, leisure activities). Medium-level data, referred to as standard data sets, would include detailed indicators (e.g. type of sports, type of activities). High-level data sets, referred to as expanded data sets, would include detailed case histories of accident or injury type (Lund et al., 2004). Although many organizations have unique characteristics that are used as variables when tracking sport injuries, there are common variables which are collected in numerous injury tracking systems.

These variables are:

- Sport or activity in which the athlete was participating at the time of injury
- Place the injury occurred
- Name of athlete recorded
- Date and time of injury
- Level of activity
- Demographic characteristics of injured athlete
- Mechanism of injury
- Body region injured
- Type of injury
- Use of injury prevention strategies
- Severity of injury
- Type of treatment

- Length of treatment

(Albright et al., 2004; Fuller et al., 2007; Hootman, Covassin, & Evans 2007a; Scanlan, & MacKay, 2001).

A comprehensive collection of the occurrence of injuries should obtain data that would benefit a variety of organizations, institutions and individuals within Canada. According to American Sport Data Incorporated (ASDI) (2003), the individuals who may experience immediate benefits from the data collected with an injury tracking system would be: athletic therapists, sports medicine practitioners, athletes, collegiate health and safety act committees, sporting goods and protective equipment manufactures, athletic medical equipment supply companies, risk management consultants, insurance companies, and lawyers. The results obtained from the data may directly effect the day-to-day operations of these institutions and individuals (ASDI, 2003).

2.7.3. *Study Designs*

The design of AITS will predict the type and quality of data available within the system. Meeuwisse and Love (1997), indicated that there are various types of designs available to develop an AITS. There are three core types of AITS presently in operation to track sport based injuries. These systems can be recognized as: case series design, cohort design – with exposure estimation, and cohort design-with exposure measurement. The case series design is the most commonly used because it requires the lowest level of resources, has the least complex approach to injury tracking, and can collect a variety of injury types in different settings. A case series design follows a group of participants who experience the same diagnosis (e.g. Injury) over the same period of time (Meeuwisse & Love, 1997). The limitation of a case series design AITS is that this design does not

express causal associations from the data (Meeuwisse & Love, 1997). AITS, which incorporate a cohort design, obtain a sample of athletes at the initiation of the study and follows them longitudinally in time to observe injuries that occur within the sample (Meeuwisse & Love, 1997). This design allows for the observation of characteristics that differ between injured and non-injured athletes. The benefit of a cohort design for AITS is that the therapist can observe injury rates as well as generate an estimation of injury risk. The ability to generate injury risk from injury rates creates the ability to produce relationships within rate and types of injuries across different sports related conditions. A cohort design with exposure estimation has the ability to estimate exposure (see Glossary) by calculating the athletes' participation as a group index (Meeuwisse & Love, 1997). Exposure rates are calculated as the number of athletes participating, multiplied by the number of game or practice sessions. Estimation is used rather than actual measurement because it reduces the amount of time and resources that would be required to perform a complete measurement of exposure. A cohort design with exposure measurement tracks the individual athlete's participation across all sports. Exposure rates can be achieved by collecting participation data across all conditions. This technique is time consuming, but creates the most accurate measurement of individual athlete exposure rates (Meeuwisse & Love, 1997). It is dependent on the resources of the institution as to which study design can obtain the best results. If time and funding is readily available, the most accurate results can be generated through a cohort design-with exposure measurement. An institution lacking time and resources would be more adept to implement an AITS that operates via a case series design.

2.7.4. *Coding Classification Systems*

A common practice between established AITS was to incorporate a coding classification system to standardize data collection methods. The most widely used worldwide classification system is the International Classification of Disease (ICD), developed by the World Health Organization (WHO) (NCIPC, 2002). The ICD codes are universal, but do not provide specific detail to be sport-injury specific. There are currently two core diagnostic coding systems in place for the purpose of data collection for sport injuries. These systems are the Sport Medicine Diagnostic Coding System (SMDCS) (Meeuwisse & Wiley, 2007), and the Orchard Sport Injury Classification System (OSICS) (Rae & Orchard, 2007). The SMDCS, developed in 1990 at the University of Calgary, was designed to be the primary diagnostic tool for the Canadian Intercollegiate Sport Injury Registry (CISIR). The SMDCS has spread worldwide and is currently used as a coding system for the NCAA, Canadian Athlete Monitoring Program (CAMP), and the National Hockey League (NHL). The SMDCS was designed to be used universally because it follows an anatomical design. The SMDCS coding system begins with region (Appendix C), then structure (Appendix D), and then type of injury (Appendix E), and is combined to create a single code for each injury (Appendix F) (Meeuwisse & Wiley, 2007). By using structure codes, the system allows for the analysis of injuries by structure of the body regardless of the area of the body. The SMDCS was designed to allow codes to be easily searched within data banks for injury tracking and research purposes.

The OSICS, developed in 1992, is used primarily to classify the diagnosis of an injury for injury tracking studies and allows for the grouping of data for specific injuries

Rae & Orchard, 2007). The OSICS uses specific injury codes to classify the descriptive components of the injury (Appendix G & H). The OSICS is currently in use as a primary sport specific injury classification system within Australia for sport-based injury tracking (Rae & Orchard, 2007). The OSICS is an open-access system and used by numerous injury tracking companies world wide. Some of the well known organizations using the OSICS are: Sports Injury Manager, Australian Sport Injury Data Dictionary, Injury Tracker 5.0, Australian Institute of Sport, and Australian Commonwealth Games Association (Rae & Orchard, 2007).

Both the OSICS and the SMDCS are attractive sport injury classification systems, because they provide institutions with a coding system that is free and easy to use to group and classify data collected through injury tracking (Meeuwisse & Wiley, 2007; Rae & Orchard, 2007). When applying sport to a large scale, an international consensus towards appropriate definitions through coding would significantly assist the collection of reliable sports injury data. In order for this to be achieved, a national governing organization would need to commit to funding and overseeing a standardized national based injury tracking system across intercollegiate athletics.

2.8. Injury Tracking Systems

2.8.1. *Background*

There are a variety of national injury tracking systems in operation throughout Canada, but none at the moment are specific to sports injuries. Outside of Canada, there are currently numerous sport specific injury prevention initiatives in operation across a variety of countries. Currently, Australia has a growing interest in athletic injury prevention methods from a musculoskeletal and sports medicine perspective. In 2004, a

partnership was formed involving a variety of researchers at a number of collegiate research sites at the University of New South Wales and the University of Sydney's Risk Management Research Center. The partnership focused on factors that lead to injuries incurred during practice and competition of sport. The researchers applied the data towards the design of prevention programs, health and safety policy, and practice. The program was designed to address one of the national health priority areas within Australia, that being injury prevention and control (Finch, 2004).

Currently Canada has numerous well-established injury tracking systems for the purpose of injury prevention, which are primarily used throughout the healthcare system to track intentional and unintentional injuries. As sport related injuries are classified as an unintentional injury, they are often placed as injuries treated in hospital ED, and analyzed specifically in the broad category of "unintentional injury". A large number of these national tracking data sources provide high quality information to Health Canada to generate annual injury trends throughout Canada. Some well-known national tracking data sources are:

- National Trauma Registry (NTR)
- Canadian Hospital Injury Reporting and Prevention Program (CHIRPP)
- Canadian Collaborative Centers for Injury Prevention and Control (CCCIPC)
- Canadian Injury Research Network (CIRNet)
- Canadian Institues for Health Information (CIHI)
- National Population Health Surveys (Canadian community health survey)
- National Corner Medical Examiner Database
- National Ambulatory Care Reporting System (NACRS)

- Traffic Accident Information Database
- Health Connectivity Limitations Survey
- Mortality data from death certificates

(Mackay et al., 2003; SMARTRISK, 2005).

Canadian institutions may be independently tracking injuries within their own institution, but currently there is no collaborative network or system in place to observe injuries at the collegiate level. The current methods for tracking sports injuries within Canada are lacking in quality and consistency compared to what is in place in the United States within the NCAA.

2.9. Australian Injury Tracking Systems

2.9.1. *Sports Medicine Australia*

The Australian Health Ministry endorsed injury prevention and control as a National Priority Area in 1986 in recognition of the national burden of injury. Finch (1995) teamed with the National Sports Research Program, Australia Sports Commission and the Victorian Health Promotion Foundation, to perform a comprehensive review on the feasibility of improved data collection methodologies for sport injuries within Australia. Finch examined the current state of injury tracking within Australia and recognized that the systems in place required extensive information on exposure rates and frequency of playing time in order to determine the risk of injury occurring within various sports (Finch et al., 1995).

Since 1995, Australia has been gathering data from a variety of sport-based injury tracking systems that obtain data on the occurrence of sport injuries. Their source of data collection are: the NBHP, hospital-based data collection, sports medicine clinics,

medical coverage services, sports-based injury tracking systems, sporting body data collections, school-based tracking, insurance records, special event purpose tracking systems, workers' compensation statistics, longitudinal studies of athletes and sports participants, population-based tracking, and surveys of sports participants. This information is submitted and annually collected from nine national databanks (Finch, 2006). In 1995, the framework of the national sport injury tracking system was based on collecting injury and exposure data from separate sources. It has been recognized that in order to create an AITS at the national level, it would require commitment from both the sport and health sectors to take joint responsibility in promoting injury prevention in sport (Finch et al., 1995).

Finch et al. (1995), performed an extensive examination of the current state of injury tracking within Australia. This study involved a full examination of current trends of tracking to provide recommendations for future injury tracking procedures. The examination has been utilized to provide the framework for the current tracking methods for sports injury tracking within Australia (Finch, 2006). The study illustrated core components of creating and maintaining a national sport-based injury tracking system (Finch et al., 1995). The first component was the need to establish a lead agency within the country to establish a national sports injury tracking advisory committee. Secondly, was the involvement of sport associations, which will satisfy the need to involve sports bodies directly in the process of data collection during the course of injury tracking. By the inclusion of sports bodies, direct observation is available to record occurrence severity and the nature of injuries as they occur. This was aimed to enhance government collections and data collection activities. This component can be satisfied by conducting

state and national surveys on sports exposure data at all age levels. The aim of incorporating government bodies is that Australia can implement future national health surveys to collect information on risk factors for sport related injuries. The third component is to develop a standardized data collection procedure. Developing a standardized data collection method will ensure consistent coding and data entry of injuries that occur, as well as creating a standard protocol for analyzing the data. By developing a standard, the opportunity for an electronic data collection program on a national level would be feasible. The fourth component is the implementation of standard definitions of injury. In order to achieve standard definitions among the agencies performing injury tracking, there would be a requirement to formulate educational workshops to create national and international definitions of sports injuries across Australia. The opportunity to implement these workshops can be achieved at international conferences for injury prevention, which are held annually in Australia (Finch, 1998). An additional required component is the establishment of regulated data collection. There is a need for the development of a single register that gathers data from various sources. Cooperation of the health and sports sectors will allow for shared data sources. With both sectors working together, there will be combine data collections and the provision of accurate estimates of the total number of sports injuries occurring annually (Finch et al., 1995). The last component is to incorporate adequate training methods for data collection. This procedure can be implemented with online training modules that will train agencies or individuals to maintain consistent methods and protocol of data collection (Finch et al., 1995).

In 2008, the Australian government provided funding to SMA promoting the recently developed Sport AITS known as Sport Injury Tracker (SIT). This is Australia's first online AITS developed for community sport within Australia. The approach of the launch of SIT was to encourage the sport industry to take greater responsibility for its organization and its safety within its clubs, facilities, and leagues. SIT was designed to be a free public utility for injury tracking that allows the general public to monitor sport injuries and share information online by submitting online reports of the occurrence of injuries (SIT, 2008).

2.10. United States Injury Tracking Systems

2.10.1. *National Collegiate Athletic Association*

The NCAA has been at the forefront of injury tracking within intercollegiate sport with the development of an extensive AITS to track the occurrence of injuries among student-athletes at American universities. In 1982, the NCAA began collecting standardized injury and exposure data for collegiate sports through its AITS. In 1988, the NCAA began tracking athletic injuries using a cohort design with exposure estimation to observe 16 different sport activities. Athletic trainers, as members of the National Athletic Trainers Association (NATA), and the NCAA, have collaborated for over 25 years through the NCAA Injury Surveillance System (ISS) to create the largest ongoing collegiate sports injury database in the world (NATA, 2007). The primary goal of the NCAA ISS is to collect injury and exposure data from a representative sample of NCAA institutions and a variety of sports (Dick et al., 2007a). Dick et al. (2007a) provided an understanding of the mission of NCAA's injury tracking system. The system was designed to provide credible data which would allow the NCAA to inform health and

safety divisions on rules and policy and further injury prevention research in order to improve athletic programs in the quality of student athlete care from 1988 through 2004 (Dick et al., 2007a).

The NCAA ISS program is funded and run in partnership through the Datalys Center, a non-profit research center. The Datalys Center targets approximately 250 NCAA schools annually to provide injury information for the ISS. Each institution is responsible for one primary sport in each of the three intercollegiate athletic seasons (fall, winter, and spring). The NCAA ISS initially oversamples institutions in order to account for inadequate participation and attrition in the sample. This process maintains a cross section of the sample that is reasonably representative of NCAA institutions. Therefore, the NCAA uses a deterministic sample rather then a random sample as it is the appropriate method for an AITS with a primary focus on patterns of injury and athletic injury trends (Dick et al., 2007a).

Hootman, Dick, and Agel (2007b) recognized that the NCAA presently has a well-established AITS to obtain and document all injuries occurring within the Division I, II, and III collegiate levels. From 1988-2004 NCAA ISS sample institutions (10% of NCAA Institutions) have recorded over 182,000 sport related injuries throughout slightly more than 1 million exposures to game or practice settings (Hootman et al., 2007b).

Hootman et al. (2007b) discussed that the NCAA has designed criteria for a reportable injury in the ISS. The classification of an injury had to meet all of the following criteria: "(1) injury occurred as a result of participation in an organized intercollegiate practice or contest; (2) injury required medical attention by a team certified athletic trainer or physician; and (3) injury resulted in restriction of the student

athlete's participation or performance for one or more days beyond the day of injury" (p. 311). With injury definitions well classified the results of the NCAA study illustrated that there were differences in the rate of injury between practice and competition. Hootman et al. (2007b), also recognized that there was significant variability that existed across sports for the intensity of both the game and practice activities. There was a significant correlation between the increase of intensity and the rate of injury. As intensity increased at both the practice and competition levels, there was a significant increase in the rate of injury (Hootman et al., 2007b).

With the analysis of the data gathered through the NCAA ISS several sport and administrative areas had been addressed for prevention initiatives to promote safety across collegiate sport. For some, policy changes that have been implemented as a direct result of the NCAA ISS have seen an increase in prophylactic ankle taping and bracing, the incorporation of balance training exercise programs, and rule and policy modifications for athletic programs (Hootman et al., 2007b). As a result of the NCAA ISS, several national changes in collegiate sport policies and rules have been made to promote safety in sport.

These changes are:

- Increased attention towards prevention research for female athletes, due to the increased risk of non-contact anterior cruciate ligament injuries
- Requirement of protective goggles or eyewear for female lacrosse players to decrease the risk of eye injuries
- An appropriate response and treatment of bleeding in collegiate sports, decreasing the risk of HIV transmission

- New regulations to reduce the occurrence of concussions and spinal injuries in ice hockey by implementing rules to prevent hitting from behind and contact to the head
- Modifications to regimen in spring football regarding permissible equipment, contact or practices, to reduce risk of injury
- Modifications in pre-season football camp to reduce heat illness and general injury risk (NATA, 2007)

Variations of these modifications have been adopted by Europe and Canada to improve injury prevention techniques throughout sport.

The goal of the NCAA ISS is not only to collect quantitative data on injuries, but to obtain data in order to monitor formal team activities, the number of participants and associated time lost with athletic injuries, among others, for the purpose of research towards injury prevention and improving health and safety policies. The success of the NCAA ISS is dependent on an annual review of the data collection (Hootman et al., 2007a). The NCAA sport rules and NCAA sports medicine committee reviews the data annually, which has led to significant advances in health and safety policy within and beyond collegiate athletics.

There are some core components of an AITS: collection, statistical analysis, and application of the data. The NCAA uses negative binomial regression to assess trends in the injury rates over time (Dick et al., 2007a). With this method the system can estimate the average annual percentage increase or decrease of injury rate, assuming that there is a linear trend over time. Recognizing trends within injuries is important for the understanding of the incidence of injury.

2.10.2. *Limitations of NCAA ISS*

The NCAA has recognized limitations, which occur as a result of trend analysis. Unlike Canadian universities, the NCAA has different levels of divisions for their collegiate athletics (Dick et al., 2007a). As the NCAA has been collecting data on injuries longitudinally, many of their divisions have experienced changes in size or athletic ability with the addition of new collegiate institutions. A further issue is the measurement of injury trends over time. The NCAA will only assess linear trends and does not take into account non-linear trends within its data collection. As linear data has greater importance, it would be beneficial to recognize injuries that are not occurring in a linear fashion in order to assess any longitudinal trends. Dick (2007a) has noted problems with trend analysis stating: "Trend statistics assess only linear trends in the injury rate and do not quantify non linear trends (such as an increase in the first half of the study period, followed by a decrease in the second half)" (p. 178). The final problems recognized for the use of samples annually over 25 years of injury tracking were advances in diagnostic tools and the improvement in the identification of athletic injuries, limiting the data collected within the early stages of the ISS.

The NCAA has expanded the ISS nationwide producing increased awareness of injury tracking systems within the sports medicine community to recognize the importance of sports injury tracking at the intercollegiate level. As a result, there has been a decrease in the relationship between injuries occurring in the past few seasons and injuries observed in the startup phases of the NCAA injury tracking system due to the larger number of institutions currently participating (Dick et al., 2007a). As the NCAA has been operating a well-established sport injury tracking system, countries such as

Australia have been designing systems of their own to keep up to date with the current trends.

2.11. Canadian Injury Tracking Systems

2.11.1. *Canadian Hospital Injury Reporting and Prevention Program (CHIRPP)*

In Canada, there are currently numerous hospital based injury tracking systems operating on an annual basis. CHIRPP is a detailed online database, designed for the prevention of injuries, which collects and analyzes data on individuals, primarily children who are seen in emergency rooms in selected hospitals across Canada (Health Canada, 2007). The program originated in 1990 in pediatric hospitals and by 1995, data collection became regular practice within selected general hospitals. CHIRPP is based on a case series design AITS. The CHIRPP system was generated through a section of the Health Tracking Epidemiology Division for the Center of Health Promotion, which is a part of the Public Health Agency of Canada (Health Canada, 2007). The data collected by CHRIPP generally concerns children and youth in the age cohort 19 years and younger (Health Canada, 2007).

CHIRPP generates the information for its database by examining the injury being performed when the injury occurred, what went wrong that caused the injury to occur, and the geographical location (e.g. field turf, ice, grass, etc.) the injury occurred. Hospitals obtain this information by requesting patients to complete a single page questionnaire (CHIRPP form) regarding their injuries (Health Canada, 2007). A second page is filled out by the emergency department staff to verify details on the nature of the injury, body part injured, and treatment received. At every hospital operating the CHIRPP tracking program, there is a requirement for two individuals to administer the

program: the CHIRPP director who oversees the emergency department, and a CHIRPP coordinator who administers release and collection of the forms (Health Canada, 2007). The collection of the CHIRPP forms can then be logged into an online electronic database, through the Public Health Agency of Canada. All data collected is stored in a national electronic database within the Public Health Agency Center for Health Promotion. The data collected is used to observe patterns of injury occurrence in order to recognize hazards and high-risk situations (Health Canada, 2007).

A primary goal for CHIRPP is to obtain data so that companies and health care providers can help reduce injuries of youth in Canada (Health Canada, 2007). Throughout the 18 years CHIRPP has been operating, the data collected has been used to observe subjects obtaining injuries sustained during various sport and leisure activities. For injury prevention, CHIRPP analysts provide reports to injury prevention communities, hospitals, health care units, sports associations, governments, the media, and the general public (Health Canada, 2007). The data is used to develop and assess injury prevention strategies and set priorities in reducing high-risk activities and hazards in communities across Canada. CHIRPP has served as an admirable resource to the community as its primary goal is to contribute to the reduction in the occurrence and severity of injuries within Canada.

2.11.2. *Limitations of CHIRPP*

Although CHIRPP tracks sports injuries, the results obtained are not applicable to student athletes participating in sport at the intercollegiate level because CHIRPP samples injuries from individuals at the age of 18 and younger. CHIRPP does not have a division that focuses directly on athletic injuries to obtain trends of the injuries recorded

at CHIRPP hospitals. CHIRPP classifies athletic injuries as "unintentional" injuries when recording an injury. In order for athletic injury information to be useful for trend analysis, a division of CHIRPP must assign athletic injuries to an appropriate classification group. CHIRPP is not a suitable model to follow in intercollegiate athletics, as it was designed as a hospital based program and it does not have a direct focus on athletic injuries or policy in intercollegiate institutions. If the criteria for CHIRPP provided a focus on solely tracking athletic injuries then the structure of the CHIRPP program would provide an excellent framework for using sample institutions within the CIS to track and analyze athletic injuries.

2.11.3. *Canadian Interuniversity Sport Injury Registry (CISIR)*

Although there is no standard for injury tracking across intercollegiate institutions within the CIS, there are currently many individualized injury tracking systems operating within individual academic institutions. In the past, a pilot study was performed by Meeuwisse and Love (1998), to develop an intercollegiate sport AITS in the western provinces. This project was the development of the Canadian Interuniversity Sport Injury Registry (CISIR), which was developed at the University of Calgary. The CISIR was initially developed to track injuries occurring to male intercollegiate football players, within five western universities in Canada. Although the CISIR was initially designed for football, the registry is adoptable to track various sports that operate at the collegiate level.

The CISIR implemented three data collection tools to obtain data on the occurrence of sports injuries. These tools were: The Canada West University Athletic Association (CWUAA) medical form, individual injury report form (IIRF) (Appendix I),

and weekly exposure sheet (WES) (Appendix J) (Meeuwisse & Wiley, 2007). The CWUAA medical form was a pre-participation medical evaluation already in place as a screening method to measure preseason risk factors. For each sport there are revisions made to measure sport specific intrinsic and extrinsic risk factors. The CISIR also designed a CWUAA medical form for returning athletes to observe changes in injuries from baseline measurements. The WES was designed to observe daily exposures of the athlete to their respective sport. The WES by means of the SMDCS coding system included practice and game hours, playing surface, weather conditions, and field conditions. The IIRF was designed as a simple time-efficient collection tool to be used by team therapists when treating intercollegiate athletes. The form allowed for both fixed and open-ended responses when collecting data for the injury (Meeuwisse & Love, 1998)

In this developmental project, Meeuwisse and Love (1998), depicted how intercollegiate athletes are already suited to be an ideal sample for developing an injury tracking system. Intercollegiate athletes are an ideal sample because they are a homogeneous population that is well-defined and practices and competes in a similar fashion (Meeuwisse & Love, 1998). As the intercollegiate institutions compete in divisions, each sport respectively has predetermined start and end date for their competitive seasons. Another characteristic that an intercollegiate institution possesses is that within each athletic department there is typically a coordinated health care system in place. The health care system incorporates either an athletic therapist, or a physiotherapist who is present on a daily basis (Meeuwisse & Love, 1998). At all athletic events, a physician and an athletic therapist or physiotherapist must be present in order to assess and treat an injury if one occurs. This would be an ideal observation technique for injury

tracking as athletic therapists/physiotherapists would provide service on a day-to-day basis to all active intercollegiate teams.

CISIR was designed to be a state-of-the-art athletic injury reporting system that could be used for a variety of sports at the intercollegiate level. The development of CISIR promoted a sport specific injury tracking system with the ability to be applicable for a variety of sports. The basic premise of the CISIR was to measure rates of injury at the intercollegiate level and individual athlete risks in sport. The characteristic that placed the CISIR in front of other intercollegiate injury tracking systems currently operating within Canada was that it could measure individual athlete risk whereas other tracking systems currently operating did not have that ability (Meeuwisse & Love, 1997). Meeuwisse created a model to predict how multiple factors interact to affect the risk of injury. The model was used to examine the link between variables of the setting and outcome of an athletic injury (Meeuwisse & Wiley, 2007). If the AITS was to be used for the assessment of risk factors, specific data must be collected within the CISIR to satisfy all levels of the model. The factors which affect the measurement of risk are: the volume of exposure to known risk factors, status of intrinsic risk factors prior to participation, extrinsic risk factors during participation, and injury outcome. In order to properly assess risk factors, there must be an initial examination of risk factors for each sport being examined. There are nine components which were collected within the pre-participation evaluation form, the IIRF, and WES. The components were: player position, history of injury, risk-taking behavior, type of footwear, use of bracing, individual time exposed, field surface type and condition, type of injury and type of activity during injury (Meeuwisse & Love, 1998).

During the preseason medical testing, the CISIR assesses intrinsic factors that have affected the athlete in the past. The intrinsic risk factors measured were: joint laxity and flexibility, body composition, muscle weakness or imbalance, local anatomy, and level of conditioning. The nine components in addition to the intrinsic factors measured were taken into account when assessing risk for intercollegiate athletes within the CISIR.

Data entry for the CISIR was done in a central registry within the University of Calgary (Meeuwisse & Love, 1998). Each institution collecting data on injuries would mail the data to this central registry, which would eliminate the need for any technical computer-based programs. Since the IIRF used coding methods, variability of data submitted by the principal investigators at each institution was limited. The CISIR would be an appropriate AITS to implement across Canadian institutions, if there were improvements made to reduce resources required to organize the hard copies of the data and improve the system methodology to transmit information electronically replacing hard copy injury files transferred through the postal system. Although the CISIR is no longer in operation and was restricted to western Canada, the system is a primary model for future development of AITS within Canadian intercollegiate institutions.

2.12. *Development of the Wilfrid Laurier University Injury Tracking System*

WLU is currently entering the third year of performing a more formalized method of athletic injury tracking to collect and observe data on injuries occurring within its athletic program. The information is used by the athletic therapy department to recognize trends among athletic injuries across the WLU varsity athletic program. The software program used is Injury Tracker 5.0 (Grant, 2003). The program consists of a one-time fee software program, used as an electronic databank to monitor and analyze multiple

characteristics of athletic injuries. The variables under analysis are: age distribution, sex differences, injury occurrence, playing surface, event segment, time of season, mechanism of injury, body structure, type of injury and the distribution across sports. For the 2007/08 and 2008/09 seasons, athletic injuries were recorded across 11 sports and 16 teams at WLU. For the 2007-2008 athletic season the WLU injury tracking system recorded 341 injuries, while for the 2008-2009 season 381 injuries were recorded. The increase in recorded injuries was most likely in part as an improvement in the injury tracking compliance and improvements in tracking protocol. Injuries were recorded through individual injury report cards (Appendix K) and the clinic's treatment log book. The software program recognizes injuries that are logged for each athlete, which would eliminate replication of injuries that were recorded within both collection tools. WLU is not tracking exposure rates among athletes at the present time. As a result, WLU is currently unable to calculate risk of injury.

Data obtained during the first two years of injury tracking has allowed WLU to obtain a greater understanding of how and why injuries are occurring to their student athletes. From the initial assessment, it is clear that there are areas of improvement and room for growth regarding the procedures and methodology of injury tracking within the WLU athletic department. Injury tracking within WLU is having issues with definitional problems and accuracy of the findings. The definitional issues are a result of student therapists adapting to changes in their job requirements and limited training in the new injury tracking program. To address these issues, modifications are made on an annual basis upon evaluation of the injury report forms, therapists injury logs and opinions of athletic therapists and student therapists.

A primary limitation recognized within the WLU IT system is therapist compliance to recording. When the clinic experiences increased injuries during the season, a lack of consistent compliance to accurately following protocol to record and track injuries was present in WLU IT program. The result of inconsistent compliance rates in the overall data and injury trends will decrease in accuracy if athletic therapists and student therapists are not completing all injury forms and therapists' injury logs. The WLU athletic therapists are individually responsible for an assigned set of teams. As a result of this, the data collected is representative to each of the teams on an independent basis. Other problems recognized within the initiation of the WLU IT program were: communication among therapists, definitional issues, lack of formal training across student therapists, lack of resources and time restrictions. The institution has dealt with these issues by developing consistency in tracking procedure and placing responsibility on the athletic therapists to be working directly with the student therapists to ensure that injuries are recorded accurately and consistently. At the end of the 2007/2008 season (June 1st, 2007- May 31st, 2008), a full report was created to assess the data recorded. The data collected was charted (e.g. sport) (Appendix L) and analyzed to create a report for the therapists and athletic department as a tool to demonstrate the distribution of injuries occurring within WLU varsity athletics.

It would be beneficial for the program to begin to track exposure rates in order to assess exposure rates within athletics. By obtaining exposure rates through participation, the athletic department would be able to calculate and assess risk of injury. By reducing and eventually eliminating the "unknown" variables, there will be improvement in the quality of data being recorded for student-athletes. The process of injury tracking needs

to be an ongoing process in order to assess longitudinal trends associated with injury at WLU. As the program is currently in the third year of operation, there are many issues being addressed to improve the quality of the data recorded. A new IIRF (Appendix M) was created for 2008/2009, and again for 2009/2010 (Appendix N). Both forms were based on the current form in use by SMA Injury Tracker injury record form (Appendix O) and the SMA School Sport injury record form (Appendix P). As the program develops, it is important for WLU to create a standard protocol that will allow the program to continue in the future, and better assist in the maintenance of the safety and well-being of WLU student athletes. If a program were to be implemented at a national level the ongoing program would adhere to the changes required in a national program to improve data collection and retain consistency in its data collection protocol.

2.13. Limitations with Athletic Injury Tracking

There are many definitional issues associated with injury tracking systems. The results of a study by Finch (1999) illustrated that the success of any sport injury tracking system and its applicability and ability to generalize the data, is dependent on reliable and valid definitions of sport injury, injury severity, and participation levels. Finch (1999) found that published sport injury reports are often difficult to interpret and compare with other published data due to different analysis methods and data collection techniques. In order to improve comparability and interpretation of published data, there must be a standardization of data collection methodologies and definitional terms across institutions (Finch, 1999).

In 1974, one of the original AITS's was created in North America to observe injuries occurring at the high school and collegiate levels. This system, known as the

National Athletic Injury Reporting System (NAIRS), was in operation until 1983 when the NCAA implemented an improved AITS by modifying components of the NAIRS (Meeuwisse & Love, 1997). The creation of a intercollegiate AITS had many initial complications (Appendix Q), some of which are still barriers today. There were 11 features of injury tracking illustrated by Clarke (1975), which presented barriers to development of injury tracking systems within Canada. The areas that must be satisfied for a successful injury tracking system must provide: availability of athletic injury data, uniform criteria among therapists and institutions, financially sustainable for the institution, continuous input of data (epidemiologically supported standards), an ability to provide routine and specialized assessments of data, feasible and noteworthy recording expectations, national definitional standards, confidentiality of systems data, accurate diagnosis of injuries (standard level of therapist training), standards to assess degree of severity of injury and must have a governing body (Clarke, 1975). Some of the initial pitfalls to injury tracking have been resolved with improvement in technology over the past 33 years from the initial Canadian collegiate AITS.

2.14. Purpose and Research Question

The purpose of the study was to assess the current status of athletic injury tracking systems in Canadian universities within the CIS as well as obtain data from therapists within Canadian Universities to identify and analyze issues, benefits, barriers and obtain information regarding how athletic injury tracking methods are conducted. This was achieved by obtaining data regarding the current state of AITS in CIS institutions, clinical demographics, therapists' opinions regarding the pro's and con's of athletic injury tracking and AITS protocol implemented within each institution across the CIS. By

obtaining an understanding of current AITS in CIS institutions, it will be possible to provide interuniversity athletic departments sports medicine clinics this information to enhance the awareness of AITS and the benefits they can provide.

Given our understanding and background research on injury tracking in Canada, some institutions may be operating formal AITS on an independent basis, but there is currently no consistency among AITS used or athletic injury tracking protocol. This illustrated the importance of our research question: what is the current status of AITS in CIS institutions? Without a national AITS, institutions do not have the ability to apply the intercollegiate athletic injury data within and outside of their institutions, share good practice and collaborate to obtain data from a larger sample of athletes. This is important, because having the ability to gather information from a larger pool of athletes will eventually allow for increased accuracy when assessing risk attributed to injuries across various conditions. Implementing a nationwide AITS would allow for the creation of appropriate injury prevention strategies and athletic safety policies based on trend analysis of recorded injuries. Gathering data about the current practice of AITS in the CIS was the initial step in creating a framework for an incidence-based data collection system that can be shared across collegiate institutions in Canada. Comprehensive data collection can be useful to promote: reliable health care, the development of injury prevention strategies, collection of data in a wider variety of sports and data collection on incidence, severity, and timing of injuries within intercollegiate sport.

In this study, data were examined on injury tracking practices across CIS institutions in order to identify injury tracking methods currently in place. This information provided demographic data and current trends of injury tracking which helped to determine what

would be best suited for a standardized sport based AITS. As there have been no previous studies regarding the status of AITS in Canadian universities, it was deemed important to analyze the current status. In order to accurately examine the current status of injury tracking it was felt that in order to achieve an accurate depiction it was important to obtain an understanding on clinical demographics, therapists opinions towards athletic injury tracking' and the current practice of athletic injury tracking within each institution.

3.0. Methodology

3.1. *Introduction*

This study was conducted using quantitative methodology and open-ended questions by means of a survey to investigate the current state of injury tracking within each sports medicine clinic. The survey contained questions to assess clinical demographics, and open-ended questions to describe methodology of current athletic injury tracking techniques and standards.

3.2. *Participants*

The initial survey sample population of participants (N= 77) was composed of athletic therapists and/or physiotherapists across 49 Canadian intercollegiate institutions within the CIS. The original prospective sample population was comprised of 85 athletic and/or physiotherapists across 52 Canadian intercollegiate institutions within the CIS. More than one therapist per institution was contacted as the majority of institutions employ more than one fulltime athletic therapist and/or physiotherapist. Multiple participants within the 52 CIS institutions were contacted as it was felt that a larger sample population the outcome would result in a greater response rate from participants and a greater representation of intercollegiate institutions across the CIS. There were three institutions employing seven therapists who were removed from the list prior to administering the survey. Removal from the study was due to institutions that were unwilling to participate due to undisclosed reasons.

3.3. *Instrumentation*

The Canadian Universities Injury Tracking Survey (CUITS) (Appendix R) was developed by Andrew Ross and Dr. Jill Tracey in 2008, to obtain information regarding

demographic data, injury tracking methods, and the opinions of athletic therapists and physiotherapists within the CIS institutions athletic therapy departments. The CUITS was developed to assess current trends of clinical demographics and methods of athletic injury data collection within university sports medicine clinics in Canada. The primary function of this instrument was to evaluate the practice of athletic injury tracking by assessing methods of athletic injury data charting and recording.

Questions in the survey were generated from field research in a sample of sports medicine clinics in Canadian universities, past research in the area of athletic injury tracking, and areas of interest to the research team where no previous literature had been completed. The primary field research in the area of athletic injury tracking in Canadian universities was generated from the graduate student whom worked in the sports medicine clinic at WLU for a period of two years. While working at the sports medicine clinic the graduate student assisted in the development of the WLU injury tracking system where many questions were brought up regarding the practice of athletic injury tracking. These questions were considered in the development of the CUITS in order to obtain information from institutions regarding alternative perspectives on athletic injury tracking in Canada. Past research in the area of athletic injury tracking in Canada was generated primarily from the work of Meeuwisse and Love (1997), Meewisse and Love (1998), and Health Canada (2007). As athletic injury tracking is relatively limited in Canadian sport, there is a narrow field of research in the area discussing issues surrounding AITS.

The questionnaire was composed of 36 questions for institutions tracking and 28 questions for institutions not tracking athletic injuries. The CUITS was composed of

three primary sections: Section A collected data from all responding participants clinic demographics, Section B collected data from institutions that were presently using a formalized injury tracking system and Section C collected data from institutions that were presently not using a formalized injury tracking system. The survey was split into three sections in order to split questions into core areas of interest for analysis of data. When questions were split into sections it reduced time required to complete the study as the questions that were not applicable for different types of institutions could be omitted when responding online. If a question was not applicable to the institution it would be removed from the CUITS automatically when a specific response was generated from Section A. If institutions were tracking athletic injuries then Section C would be omitted from the survey and if institutions were not tracking athletic injuries then Section B would be omitted from the survey.

The survey required approximately 15 minutes time to complete. The research team created the survey that could be completed within 15 minutes since the team felt that due to the time demands placed on therapists within Canadian intercollegiate sports medicine clinics, if the survey required a commitment of longer then 15 minutes then the response rate would decrease. The questionnaire tracked responding participants as their electronic mail (e-mail) were coded into the online survey databank. The coding was used so that the graduate student was able to organize the participants along with their institution.

3.4. *Consent*

Consent to perform the study was provided through the Wilfrid Laurier University Board of Ethics. The CUITS was submitted to WLU Board of Ethics to be approved for

use in the study. The participants provided consent when they agreed to participate in the online questionnaire through the survey link via the initial e-mail (Appendix S). Consent was granted by the participants to use the information provided when they submitted the online completed survey.

3.5. *Procedure*

The participant's contact information was retrieved either via each of the academic institution websites or through the CIS website (www.universitysport.ca). Prospective participants were contacted through the means of an electronic mail (e-mail) survey that contained a link to the survey via SurveyMonkey. The graduate student coordinated the CUITS questionnaire delivery via an online questionnaire through SurveyMonkey. It was decided to implement e-mail surveys over postal surveys as e-mail surveys have resulted in an increased rate of response speed and cost efficiency (Sheehan & McMillan, 1999). An additional reason why e-mail surveys were used was that this method was more cost effective as e-mail surveys have an average cost of 5%-20% of a postal survey (Sheehan & Hoy, 1999). The e-mail survey tool (SurveyMonkey) was beneficial in tracking responses and received surveys. Another reason an e-mail survey was implemented, was that past research indicated that e-mail surveys can provide increased response quality, since participants are inclined to provide longer qualitative responses to e-mail surveys over other types of surveys (Paolo, Bonaminio, Gibson, Patridge & Kallail, 2000). Participants were contacted through an initial e-mail during the last week of November. A brief description of the study was provided and an invitation to participate when the study was set to commence in early December. Two weeks after initial contact, an e-mail was sent out including: an invitation to take part in the study and

a link to the online survey. The program was able to track undeliverable mail, whether the survey e-mail was opened and whether it was replied to after it was opened. This was beneficial information, as the research team was able to target potential participants with reminder e-mails regarding the survey.

SurveyMonkey employs multiple levels of online security such as Verisign, BBBonline, Hackersafe, and TRUSTe.. To ensure maximal confidentiality of our participants, an additional Secure Socket Layer (see Glossary) was purchased at an additional fee and applied to the account to ensure information was kept confidential during the data collection phase (Verisign, 2009). All possible methods of confidentiality were applied to the data collection, however because SurveyMonkey is an internet software product, and due to the nature of the internet the institution of WLU could not completely guarantee confidentiality while a participant's completed survey was in transit.

The consent and the link to the survey was incorporated in the initial e-mail (Appendix S) to the perspective participants. The graduate student informed the athletic therapists and physiotherapists regarding the purpose of the study during the initial recruitment e-mail. The e-mail was forwarded to the sample through the athletic therapist at WLU in order to increase response rate though therapist recognition. Participants were asked to complete an online questionnaire to provide information regarding the status of each institution's injury tracking system. To generate the greatest response rate, subsequent e-mails were sent out as reminders, approximately every three weeks for a total of three follow up e-mails, to allow time for response from the initial e-mail. Once

participants completed the survey, their contact information was removed and stored in a separate file until completion of the study.

The surveys were left open to allow participants to reopen the survey in order to provide an opportunity to complete or clarify any information that was submitted throughout the questionnaire. The surveys were left open to ensure that participants could complete an incomplete survey from the previous rounds of responses. If the responding participants from the first round of surveys submitted an incomplete survey, they were kept on the e-mail list and notified in the secondary e-mail that the survey would be left open to clarify responses or complete, incomplete surveys from the initial round. As there were multiple incomplete surveys submitted within the initial round of e-mails, leaving the survey open allowed partial responses to be completed in full. The final round of the survey resulted in 15 responses from therapists. Leaving the surveys open allowed participants to review the completed responses and helped to ensure the quality of a completed response.

In order to achieve the greatest response rate, specific recommendations were followed to set appropriate length of survey, apply practical questions for participants, notify participants prior to the survey and follow up with participants to increase response rates. Response rate can be affected by length of the survey, pre-notification, follow-up contact and issue salience (see Glossary) (Sheenhan, 2001). The length of the survey was tailored to be specific to participants representing a tracking or a non-tracking institution. Questions that were not applicable to either type of institution was removed to reduce the length of the survey. Pre-notifications and follow-up notifications were sent out to increase awareness of the study and pose as a reminder that the study was in progress and

participation was encouraged. Issue salience was accounted for, as the participants in the target sample were currently active members in the CIS institutions being surveyed. The material in the study was specific to the population being sampled, and had a focus on improving a core component of their profession.

From the initial e-mail, 23 responses were collected within the two week period. The second e-mail was sent out in the first week of January as a reminder of the study. The 23 participants who responded to the initial survey were removed from the participant e-mail list and stored in the completed file. The second e-mail resulted in 12 responses accumulating 35 responses in total. The same process was administered to remove participants who had already responded to the survey from the initial e-mail list. The third and final e-mail was sent out in the first week of February to the remaining participants on the contact list. A deadline date was included in the final e-mail, stating that the study would be completed by February 24th, 2009, and responses would no longer be accepted after that date. The final e-mail bolstered the others with 10 responses, totalling 45 responses resulting in a 58.4% response rate from therapists contacted by the survey. Of the 45 responses, 41 were complete surveys. Partially completed surveys were still analyzed and included into the data collection as results were analyzed by individual questions.

There were seven institutions that provided dual responses from two separate therapists. We included multiple therapists from institutions to ensure an adequate response rate allowing for a sufficient representation of CIS institutions. The institutions that provided two responses were analyzed separately prior to the full analysis. Dual responses acted as a validity check to ensure consistency and quality of data. In order to provide an accurate

representation of the institutions providing dual responses, answers from each question were analyzed in order to provide an average response for each response between therapists.

To deal with quantitative questions that received dual responses, we combined answers from responding therapists from the sample group to calculated the average between their responses. We chose this method because we felt it would have a greater accuracy in the representation of the institution by taking an average of the quantitative score and use that as the institution's representative response. If one of the therapists from an institution submitting two responses did not respond to a particular question we used the other therapist's response to provide data for the institution's representative response. When assessing dual responses to open-ended questions, consideration was taken for both responses from the therapists. Responses were combined to form one unit prior to thematic analysis. No information was omitted from the original responses when the two responses were combined. The reason for using this method is so that there could be one representative response from the institution while using both therapists' opinions. If one of the therapists did not respond to a particular open-ended question, we used the individual therapist's response as the institution's representative response. There was little variation across type and frequency of responses between therapists with dual responses in an individual institution. The method contributed to the strength of the responses provided by these institutions and aided as a response if one of two responding therapists failed to complete a question.

3.6. *Validation Check*

In order to ensure the validity of the survey, a trial survey was tested on five participants who are members of CIS institutions. They were provided hardcopy versions

of the survey and asked to review the questions to ensure that questions were not leading, questions were suitable for the survey and there was no confusion with the layout of questions within the survey. This process assisted us in determining that the survey satisfied face validity (see Glossary) and content validity (see Glossary) by illustrating that the survey was actually measuring what it was intended to measure and included relevant content. After the initial trial survey was completed, minor changes were made to enhance content validity of the CUITS. Prior to the release of the survey the subset of participants who completed the initial check were provided with the online version of the survey to complete. After the trial survey was completed, the responses were analyzed for content validity.

In order to obtain accurate representation of CIS institutions we contacted all CIS institutions and all of the current athletic therapists and physiotherapists on staff with this study. As a result of this sample, an accurate representation of the current state of CIS AITS and the opinions of therapists within CIS institutions regarding this subject matter was generated. By using the entire population of CIS therapists, threats to external validity were reduced by having an accurate representation athletic therapists and physiotherapists within CIS institutions.

3.7. *Data Treatment*

The information obtained in connection with the study via SurveyMonkey remained confidential to protect the identity of the participant. A password protected database ensured the confidentiality of the participant and the institution. Once the information was collected from the survey, the name of the participant and institution was allocated a code for further research. Only information provided will be presented in publications and conference

presentations, but all therapists and institutional data will be kept confidential. Data presented or published will not contain information that would allow participants to be identified. The information gathered will be kept for a minimum of five years in order to build on this database in subsequent years that will generate a comprehensive longitudinal injury tracking database.

The data collected was discussed between the graduate student and his advisor to determine commonalities within the data. Missing values in completed surveys were coded to indicate that the response was missing in the data set and would not be included in the analysis. After the data had been analyzed, a brief report of the findings obtained was produced and will be distributed to the therapists within the CIS once the study has been completed in its entirety.

3.8. *Data Analysis*

A descriptive statistical investigation was used to analyze the quantitative data to provide a summary across the sample. Descriptive statistics and a quantitative analysis of the institution demographics were performed to section A of the CUITS. Frequencies and averages were calculated for the quantitative data to form an average response from responding CIS institutions. Sections B and C contained both open-ended and quantitative based questions. Descriptive statistics were applied to Sections B and C of the CUITS. The data were split into two sections (open-ended questions and quantitative questions) to be analyzed. The quantitative data were analyzed to determine frequencies and means of the demographic data. A univariate analysis was performed to create frequency tables and frequency distribution bar charts for the quantitative data. The open-ended question data were analyzed to determine commonalities and patterns among words and phrases within

responses and themes to be generated through analysis. Thematic analysis of text was used to identify major themes and ideas within the responses from the open-ended questions which were then grouped into sections. The themes obtained were based on the strength of responses acquired from the participants. A thorough examination of the data was performed to assess responses and trends within the data. There was a complete review of responses for each question to ensure that the analysis provided an accurate representation of the participants' responses.

4.0. Results

4.1. *Introduction*

Analysis of data collected from the examination of CUITS questionnaire for therapists within Canadian intercollegiate institutions are presented hereafter. This section has been divided into four sub-sections: sample description, clinic description, results of institutions tracking athletic injuries, and results of institutions not tracking athletic injuries.

4.2. Quantitative Results

4.2.1. *Description of the Sample*

The overall response rate obtained from the study was above average. The survey resulted in a response from 38 of the 49 institutions contacted, yielding 77.6% institutional response rate from the sample. Eighty-five therapists were contacted with the recruitment e-mail to participate in the study. Seven therapists were removed from the list prior to administering the survey as a result of their unwillingness to participate due to undisclosed reasons. The initial e-mail containing the survey was sent to 77 therapists among 49 institutions within the CIS. There were 45 therapists who replied to the survey representing 38 of the institutions within the CIS. The 45 subjects completing the survey represented a 58.4% participant response rate of the sample to the survey. The 38 institutions responding to the survey represented 73% of 52 institutions within the CIS.

The implementation of an online survey produced a sufficient response rate from institutions in the CIS. Of the 14 institutions in the Canada West (CW) division, 12 institutions responded resulting in a 85.7% response rate. Of the 19 institutions contacted in the Ontario University Athletics (OUA) division, 16 institutions responded, resulting in an 84.2% representation rate. Of the 11 institutions contacted in the Atlantic University Sport

(AUS) division, 6 institutions responded resulting in a 54.5% representation of their division. Of the 8 institutions in the Quebec Student Sport Federation (QSSF) division, 4 institutions responded resulting in a 50% representation of their division. Since the survey was sent out to 5 of the 8 institutions in the QSSF divisions, the 4 institutions responding resulted in an 80% response rate. Institutions not responding among divisions resulted in 3 in the OUA, 2 in CW, 5 in AUS and 1 in QSSF. Of the four divisions responses were received from 20 therapists in the OUA, 14 in CW, 7 in AUS and 4 in QSSF totalling 45 responses from therapists in the CIS. From a CIS institution representation (see Figure 1) OUA received representative responses from 16 institutions, 12 in CW, 6 in AUS and 4 in QSSF.

Table 1

Divisional Demographics

Divisional Demographics

CIS Division	OUA	CW	AUS	QSSF
Therapist Responding	20	14	7	4
Institution Responding	16	12	6	4
Institutions Tracking Athletic Injuries	4	3	0	2
Institutions Not Tracking Athletic Injuries	12	9	6	2
Therapist Sex				
Male	8	5	4	3
Female	12	9	3	1

The distribution across positions held by the 45 therapists responding (see Figure 2) were: 24 (53.3%) head athletic therapists, 12 (26.7%) assistant athletic therapists, 5 (11.1%) therapy clinic directors/coordinators, 3 (6.7%) physiotherapists and 1 (2.2%) medical doctor. Approximately 44.4% of the participants were from the OUA division, 31% from the CW division, 15.6% from the AUS division and the remaining 9% were from the QSSF division (see Figure 3).

Therapist experience varied across the CIS (see Figure 4). The average time period the therapists have been working within their respective institutions was 12 years.

4.2.2. *Description of Clinics*

Approximately 42.2% of the institutions were from the Ontario Interuniversity Sport (OUA) division, 31.5% from the Canada West (CW) division, 15.8% from the Atlantic University Sport (AUS) division and the remaining 10.5 % were from the Quebec Student Sport Federation (QSSF) division.

The number of therapists employed by an institution varied across the CIS (see Table 2). Over 70% of the institutions had a maximum of 2 therapists working within the institution. Institutions that had a greater student athlete population employed more therapists within their institution. There were four institutions that employed 5 or more therapist within their therapy clinics. The average CIS institution employs 2.4 full time therapists working within their sports medicine clinics. The average CIS therapist sees and treats an average of 33.5 student-athletes per day.

Table 2

Demographics of Clinics

Demographics of Clinics	Frequency	Percentage
Coordinated w/ Health Services		
Yes	14	36.9
No	22	57.9
N/A	2	5.2
Billing Clients		
Yes	20	52.6
No	18	47.4
Multi-Venue Clinic		
Yes	13	34.2
No	25	65.8
Therapists on Staff		
One	13	34.2
Two	14	36.8
Three	6	15.7
Four	1	2.6
Five+	4	10.5
Tracking Athletic Injuries		
Yes	9	23.7
No	29	76.3
Totals Responses:	38	100

Of the 38 institutions in the sample, 13 institutions were operating their sports medicine programs through multi-venue clinics and 25 institutions were operating out of a single clinic (see Table 2). Institutions operating multi-venue clinics currently have an average of 3 clinics within their institution to provide treatment for their student-athletes.

The basic size of the primary sports medicine clinic is 1901 sq. ft. Institutions with multi-venue clinics operate a second clinic with an average size of 670 sq. ft. and a third clinic with an average size of 638 sq.ft (see Figure 5).

Among 36 institutions with completed responses, 14 clinics (38.9%) operate their clinic in coordination with the health services clinic at their institution . The remaining 22 institutions operate as independent sports medicine clinics (see Table 2).Currently 20 (52.6%) of clinics were billing their patients, the remaining 18 (47.4%) clinics provide an open clinic for student-athletes and the cost is absorbed by the athletics program (see Table 2).

Institutions were asked if they are currently using a formal injury tracking system to track athletic injuries. The data indicated that 23% of institutions in the sample were tracking injuries through a formalized system and 77% were not using a system to track athletic injuries (see Table 2). Breaking the sample down by divisions: 50% of institutions in the QSSF were tracking athletic injuries, 25% of in the OUA were tracking athletic injuries, 25% in the CW were tracking injuries and there were no institutions in the AUS that are currently tracking athletic injuries.

4.2.3. Quantitative Results of Institutions Tracking Athletic Injuries

CIS institutions that are currently tracking injuries (9) have been operating a formalized tracking system for an average of 3.75 years. Currently there are 2 (22.2%) institutions that have been operating an injury tracking system for 11+ years, 1 (11.1%) for 5-10 years, 1 (11.1%) for 3-4 years and 5 (55.6%) for 1-2 years (see Table 3).

Current injury tracking software programs in use are: InjuryZone (2), Microsoft Excel (self designed program) (2), Accuro (1), Presagia (1), InjuryTracker (1), Sportware (1) and Cramer Injury Software (1) (see Figure 6). Of the nine institutions currently tracking injuries, 55.6% have used different injury tracking programs in the past prior to the current program in use. The remaining 44.5% have only used the current system that has been

established at their institution. Programs used in the past have been InjuryTracker 5.0 (4), Cramer Injury Software (2) and Medicentre (1).

Institutions purchased or obtained injury tracking software in a variety of ways (see Figure 7); 3 (33.3%) had an initial purchase cost and subsequently pay an annual fee, 2 (22.2%) had an initial purchase cost with no further fees, 2 (22.2%) designed their own program, 1 (11.1%) bore no initial cost, pay annual fee and 1 (11.1) did not pay for a program.

Institutions have a variety of staff and volunteers responsible for collecting and recording data into their AITS. The support staff responsible for data collection and input (see Figure 8) includes: 5 (55 .5%) of the institutions use student therapists, 8 (88.9%) of the institutions use Athletic/Physiotherapist, 2 (22.2%) of the institutions use student volunteers/graduate students, 1 (11.1%) institution uses doctors and 1 (11.1%) institution uses administrative assistant

All 9 (100%) CIS institutions that are tracking athletic injuries are currently tracking varsity athletes, 3 (33.3%) track non-varsity student-athletes (intramural), 3 (33.3%) track student non-athletes, 3 (33.3%) track staff and 3 (33.3%) track the general public seen within the clinic.

Information is logged electronically to store the data, 3 (33.3%) were logging through one computer and 6 (66.7%) were using multiple computer networks to log their data. The institutions logging injury statistics log data at different points in the academic year. Five (55.6%) were logging information daily, 2 (22.2%) weekly, 1 (11.1%) monthly and 1 (11.1%) at the end of each athletic season.

Institutions tracking injury statistics were logging a variety of information into their software programs. Common injury statistics that institutions were logging are: degree of injury (100%), date of injury (100%), sex (88.9%), type of injury (77.8%), assessment of injury (77.8%), sport (77.7%), age (66.7%), mechanism of Injury (55.6%), playing surface (55.6%), time of day (44.4%), player position (44.4%), referral appointment (33.3%), weather conditions (11.1%), playing status (11.1%). Data is primarily being used for trend analysis (83.3%), rehabilitation progression (41.7%), clinical research (33.3%), justification of resources (22.2%) and billing (11.1%).

There were currently 2 (22.2%) institutions tracking exposure rates of their student-athletes in their respective sports while 7 (77.8%) were not tracking the exposure rates of their student-athletes (see Figure 9).

Currently 1 (11.1%) institution is using a formalized diagnostic coding system to code and define athletic injuries, while 8 (88.9%) were not organizing their injuries through diagnostic codes (see Figure 10).

There is 1 (11.1%) institution using a coding system to maintain athlete confidentiality within the system, while the remaining 8 (88.9%) institutions were not coding student-athletes to maintain student athlete confidentiality when inputting their injury files into the injury tracking software programs (see Figure 11).

All nine of the institutions already tracking would be interested in tracking at a national level if a program was provided to their institution at a reasonable cost. Of the 12 therapists who were currently tracking, 42% replied "yes" and the remaining 58% replied "conditionally". These conditions require that the national program does not have a negative

interaction with the current system in use, dependent on avoiding added time restraints for the therapists, and that they must be able to access all data specific to their institution.

All of the institutions would be willing to pay for a national program. Two (22%) were willing to pay $1-$199 annually, 3 (33.3%) were willing to pay $200-$399 annually, 2 (22.2%) were willing to pay $400-$599 annually, 1 (11.1%) is willing to pay $600-$799 annually and 1 (11.1%) is willing to pay $800+ annually. The current average cost an institution already tracking injuries is willing to disburse is $300 annually.

4.2.4. Quantitative Results of Institutions Not Tracking Athletic Injuries

Of the 29 institutions currently not tracking injuries occurring within their institutions, 25 (86.2%) indicated they would be interested in tracking athletic injuries at their institution in the future. The remaining 4 (13.8%) institutions would not be interested in tracking athletic injuries. The reasons why institutions would not be interested in tracking were: 2 were operating through a hospital based system, 1 had attempted injury tracking in the past and was not successful, and 1 was unable to comment.

There were 22 institutions that responded to question #38 (Appendix R) that were interested in tracking athletic injuries and would be willing to pay for a national program. Of those willing to pay; 41% would be willing to pay $1-$199 annually, (18%) would pay $200-$399 annually, (14%) would pay $400-$599 annually, (4.5%) would pay $600-$799 annually and (4.5%) would pay $800+ annually. The four institutions that were not interested in tracking athletic injuries were not willing to pay for the program (18%). The average cost that an institution not tracking athletic injuries is willing to disburse is $200.

If the non-tracking institutions were to implement an athletic injury tracking system, the data input would primarily be the responsibility of the; athletic/physiotherapists 26

(89.6%), student therapists 13 (44.8%), administrative assistants 7 (24.1%), work study student 2 (6.9%) and clinical doctors 1 (3.4%). Institutions were currently organizing their student athlete files in: a filing system (93%), injury logs (24%), online charting (6%) and data banks (3%).

Common injury statistics that 28 of the 29 institutions not tracking were interested in obtaining are: type of injury (100%), sport (93%), mechanism of injury (89%), degree of injury (75%), playing surface (75%), player position (71.5%), date of injury (64%), sex (61%), assessment of injury (61%), age (46%), referral appointment (43%), time of day (36%), weather conditions (36%) and period of season (21%)

4.3. Open Ended Question Results

4.3.1. *Open-Ended Question Results for Institutions Tracking Athletic Injuries*

The methods employed to maintain consistent operational definitions for injuries consist of 33.3% who use dropdown menus with preset definitions/data keys, 22.2% allowing only the certified therapist to perform assessments and input data, 11.1% providing training for the therapists and student therapists prior to the use of the injury tracking software and 22.2% who do not control for consistent definitions within the data input process.

Institutions were choosing to keep track of athletic injuries primarily for injury analysis/trend analysis, risk management, legal documentation and an assessment of the needs of the therapy clinic. Athletic injury tracking software is being used among these institutions for practical uses other than tracking injuries. The software programs were being used for billing (11.1%), insurance claims (11.1%), medical profiles (11.1%) and event/therapist scheduling (11.1%).

Highlighted trends among protocol for tracking athletic injuries were:

- The initial therapist/student therapist to assess/treat the injury is responsible for completing an injury assessment form.
- Each therapist is responsible for inputting data into the software program for the athletes they assess and treat.
- Information is logged into the software program to be assessed and debriefed weekly.
- Assessments and treatments are logged into an assessment form, injury data is then logged at a later date.

Barriers these institutions experienced while trying to evolve their injury tracking systems into their institutions were: maintaining consistent terminology for injuries, therapist compliance to the program, incomplete charts, consistency between therapists, build up of injury logs due to the volume of patients, difficulty ensuring that all injuries are assessed and logged into the system, and that the programs require an economic cost which the institution cannot afford in their therapy budgets.

Barriers to injury tracking at institutions that are currently tracking were: a lack of staff to record injuries, institutions presently requiring to much work from their therapists, time, defining injuries consistently, cost of the system and the ability of resources to teach the system to new student therapists each year.

The therapists recommendations to improve sports injury data collection were:

- The creation of a software program that is user friendly for athletic therapists/physiotherapists

- The universities' acceptance of accountability for record keeping from administration (e.g., department must make it a job requirement for athletic therapists/physiotherapists)
- The program must be time efficient for therapy staff
- The program should be introduced and run by the CIS
- Grants should be investigated to provide funding for institutions

4.3.2. *Open-Ended Question Results for Institutions Not Tracking Athletic Injuries*

Institutions currently not tracking were asked if they would be interested in tracking athletic injuries at a national level if a program was provided to their institution at a reasonable cost. Of the institutions responding, 13% replied "no", 35.5% replied "yes" and 51.5 % replied "conditionally". Institutions that would be willing to tracking injuries in the future among the conditions outlined, there are requirements: that the national program does not have a negative interaction with the current system in use, that it is dependent on not producing added time restraints for the therapist and that institutions must be able to access all of data specific to their institution. Common themes across conditions to enrol in this program were:

- That the program will fulfill security concerns and maintain student athlete. privacy.
- The program is designed to be user friendly.
- Enrolment is dependent on cost of the program.
- That the program is available in French.
- That the program does not require a large time commitment from therapists.

Two of the institutions were unable to comment on the question as the clinic budget is not in their job responsibility.

Primary reasons for 23 of the 29 (79.3%) institutions not tracking athletic injuries were: time constraints (78.3%), cost (69.6%), understaffing (65.2%), no introduction to injury tracking (43.5%), use of their own method of organization within the institution (13%), hospital based (8.6%) and institutions that do not see the benefits of tracking athletic injuries (4.3%).

The primary reasons 28 of 33 (84.8%) therapists were not individually tracking are: time constraints (35.7%), tracking using their own informal methods (32.1%), cost of system being removed from clinics annual budgets (7%), therapists use recollection of injuries to understand trends within clinics (7%), and tracking not being a standard set in the clinic (7%).

There were 19 of the 29 (65.5%) institutions not tracking athletic injuries who recognized potential barriers to creating an national athletic injury tracking program in Canada. Common themes among barriers acknowledged were:

- Cost
- Paper trail
- Manpower
- Administration support
- Privacy issues
- Lack of knowledge of student therapists
- No standardization for collection methods
- Definitional issues among therapists

- Insufficient participation
- Increased time commitment (cost/time benefit)
- Inconsistent data possibly affecting overall results
- No one is currently in charge of implementing this program

There were 21 of the 29 (72.4%) institutions that recognized potential barriers towards running a shared database for injury tracking across Canadian universities. Common themes among potential barriers were:

- Security and confidentiality
- Non-reporting
- Lack of administration support
- Increased time demands
- Regional differences may create data that is not applicable across the country
- Differences in rehabilitation styles among therapists
- Limited access to equipment
- Inconsistent data could possibly affect overall results
- Therapist compliance
- Not all institutions carry the same standard for assessments
- No one is in place to monitor, update and disseminate information to others

There were 23 of the 29 (79.3%) institutions not tracking athletic injuries who recognized potential benefits from sharing information across Canadian universities. Common themes among potential benefits are:

- Help in reducing rates of injury to prevent overtraining and reduce hazards
- Assistance in changing rules for injury prevention

- An ability to share best practices across CIS institutions
- Help in developing better functional injury prevention programs for individual sports across the CIS
- Help to identifying injury trends across individual sports
- The possible introduction modifications to protective equipment so as to reduce injury rates
- Assistance in resource allocation (justify purchases, hiring of qualified strength and conditioning coaches/athletic/physiotherapists)
- The possibility of helping to adjust training camp protocols to reduce injury rates in the fall
- Possible assistance in setting rules, policies, staffing, funding, risk management and liability within institutions

5.0. Discussion

5.1. *Introduction*

This section has been divided into three sections. The first section is composed of a summary of the problem and response rate; the second section attends to the quantitative data of tracking and non-tracking institutions; the third section attends to the open-ended question data of tracking and non-tracking institutions.

5.2. *Summary*

The purpose of this study was to examine the current status of athletic injury tracking in the CIS. This was achieved through obtaining an overview of clinic demographics; acquiring data on how sport related injury data is collected within Canadian universities; and, to assess the current injury tracking practices within each institutions' athletic programs. A second purpose of the study was to gather data from therapists within Canadian Universities to identify and analyze issues, barriers and information on how athletic injury tracking methods are organized across institutions. The final purpose was to gain a general understanding on why certain institutions are currently not tracking athletic injuries.

5.3. Quantitative

5.3.1. *Quantitative Data for Institutions Tracking Athletic Injuries*

Currently only 9 of the 38 institutions responding to the survey were tracking athletic injuries through a formalized AITS. This illustrates that 23.6% of institutions within our sample were using a system to track and organize injuries occurring within their respective institutions. This is a low percentage of institutions that are tracking athletic injuries at the intercollegiate level through a formalized AITS. We can assume

that with 76.4% of institutions not tracking injuries through an AITS, does not have capability to achieve an accurate understanding of the type and frequencies of injuries that are occurring to its student-athletes. As illustrated by Meeuwisse and Love (1997) athletic injury tracking systems have the ability to identify trends from data, which can be used to recognize risk associated with various athletic injuries. This is important because without the ability to recognize injury trends, athletic departments will be unable generate decisions on policy and injury prevention based from statistical findings.

The results obtained illustrated that there was a variation in methods of purchasing software programs for implementing AITS. This demonstrates that there are a variety of programs in use that require various payment methods. It also demonstrates that institutions have a variety of expectation standards for incurring the cost of an AITS. It was illustrated by Meeuwisse and Love (1997) that each athletic injury tracking entity operates on an independent basis and does not compare data or collaborate with other injury tracking programs to share data. As a result of the data obtained regarding the current state of AITS within these nine institutions, it is clear that there is no consistency among types of programs used, methods of payment or loyalty to programs.

There was also a variation of resources used for the process of data collection. It is clear that institutions operating an AITS use a combination of staff who are responsible for recording injuries into their AITS. For question #16 on the CUITS (Appendix R), institutions were able to identify multiple sources of resources that are used to collect and input data into their AITS. The primary resource being utilized within an sports medicine clinic to operate the AITS is currently the athletic therapist and physiotherapist in addition to student therapists and volunteers. This is similar to the resources in use in the NCAA ISS as

the data collection was the primary responsibility of the NCAA institutions athletic therapists or physiotherapists (Dick et al., 2007a). This data demonstrates how clinical personnel resources are utilized to collect and input athletic injury data. When clinics assign primary responsibility of therapists to operate and run their AITS, it will reduce the therapists' time and resources from treating clients entering the clinic. As illustrated in previous studies (Clarke, 1979), the failure of AITS was due to a lack of data, as a result of overwhelming demands of cost, and time. As noted earlier, time and resources are a primary concern in limiting an AITS. Reducing the therapists' involvement in the data input process and placing the responsibility of data input on student therapists and student volunteers with the assistance of certified therapists would allow for the therapists' time and expertise to be better utilized within the clinic. The possible limitations associated with this is that if student therapists do not have adequate training and support from the athletic therapists or physiotherapists then the quality of data may suffer, due to definitional issues and variation of injury assessments.

The protocol for data input varies among institutions within the CIS as a result of available resources in the clinic. Institutions that have multiple computer networks available have the ability to input data from multiple locations within their institutions. This allows for greater accessibility to data input stations and may result in an increased consistency data input. When institutions are operating their AITS through a single computer station, barriers may appear regarding time conflicts, and accessibility to the computer station. Operating an AITS through a single computer station can pose a barrier to institutions trying to provide consistent input of injury records during high volume periods of the day. Multiple computer networks pose to be beneficial on the condition that a limited number therapists input data.

Greater consistency of results can be achieved when there are fewer therapists inputting the data. As there has been no past literature on technologies used in Canadian intercollegiate sports medicine clinics, it was important to recognize that not all clinics are operating multiple computer systems in their sports medicine clinics.

The clientele clinics were tracking consisted of varsity student-athletes, non-varsity (intramural) student-athletes, student non-athletes, staff and the general public. All nine of the clinics tracking injuries were recording injuries for varsity student-athletes. These records are used to keep student athlete files and obtain information on team specific injuries. Currently 33.3% of the clinics are tracking non-varsity (intramural) student-athletes, student non-athletes, staff and the general public. The institutions that are tracking these subgroups of clients are operating through pay-for-treatment clinics. These institutions are tracking injuries occurring to this population to maintain medical records, and track injury progression and treatments. The remaining 66.7% of institutions are tracking injuries solely for varsity student-athletes and are not operating through a pay-for-treatment clinic. The benefit of all institutions tracking varsity athletes in their AITS would be that these institutions are accustomed to dealing with athletic injuries that are common across individual sports. This method is similar to the NCAA ISS as the NCAA tracks solely varsity athletes when recording injuries occurring within their institutions (Dick et al., 2007a). Using primarily varsity athletes, these institutions would be able to generate a general idea of what types of injuries are occurring to individuals participating at a varsity level of athletics.

As 78% of institutions currently tracking are not using any method to track exposure rates of athletes, it is clear that the majority of institutions in the CIS do not have the ability

recognize risk associated with injuries. If institutions are not collecting exposure rates of varsity athletes, this results in the inability to predict the risk of injuries across individual sports and situations. The two institutions that are tracking exposure rates are tracking exposures to practice and game situations. As Dick et al. (2007a) indicated, tracking exposures will allow the institutions to obtain an understanding of the rate of injuries and the risk associated with injuries occurring in a competition setting versus a practice setting. The ability to calculate risk provides the institutions with the ability to recognize trends of injuries and implement policy and allocate staffing to reduce or maintain the rate of injuries occurring within these settings (Dick et al., 2007a). The seven institutions that are tracking injuries, but not exposure rates have the ability to recognize trends occurring across injuries; but, are unable to associate a risk to injuries occurring in individual sports or settings.

Coding systems were generally absent from the AITS of institutions that are currently tracking, as 8 of the 9 institutions were not using any formal structure of coding to classify athletic injuries. Thus, those without a standard coding system, an AITS may have discrepancies across the definition of injury. The single coding system operating, used a similar structure to the OSICS by the means of using alphabetical classifiers to indicate region, structure, and type of injury occurring. As discussed by Rae and Orchard (2007), the institution using a coding system, has the ability to group and classify their athletic injury data collected through input into their AITS. As discussed by Mueewisse and Wiley (2007), without the use of a formal structure of coding for athletic injuries there will be different operational definition classifications for injuries across institutions. The positive component of sports injuries lacking a worldwide operational definition is that institutions can adapt the definition through a theoretical definition to suit their organizational needs. However

without a consistent operational definition, the inability to maintain consistent definitional standards will pose as a barrier to the development of an AITS and will reduce the quality of data when comparing injury data between institutions (Clarke, 1975).

Another form of coding that is limited in practice across CIS institutions is the inclusion of individual athlete codes. The results illustrated that 8 of the 9 institutions were not using individual athlete codes to maintain the confidentiality of their student-athletes during data input. The eight institutions were tracking athletes by their full names when inputting the athletic injury data into their AITS. The tracking of student-athletes by their full names, limits the Ontario and Federal privacy laws and maintain the confidentiality of student-athletes. The files may be kept secure within the AITS to maintain confidentiality; but anyone with access to the AITS is able to search student-athletes and view their records of injuries and personal information. Coding individual athletes will comply to the Health Insurance Portability and Accountability Act (HIPPA) to ensure health card numbers, student information and student athlete identifiers are kept private within the institution (Health Insurance Portability and Accountability Act, 2007). By implementing a numerical or alphabetical coding system, an athlete's files can maintain confidentiality within the institution's AITS. The implementation of a coding system can help satisfy privacy laws to achieve the ultimate goal of obtaining reliable data while maintaining the privacy and well-being of each institutions student athlete population. As discussed by Rae and Orchard (2007), a coding system can be implemented through student therapists and athletic therapists/physiotherapists classifying each student athlete with a numerical or alphabetical code (e.g., student number) during training camps. The IIRF's should then contain a code for

each athlete replacing the athlete's name, in order to maintain the athlete's confidentiality when inputting athletic injury data into the AITS.

5.3.2. *Quantitative Data for Institutions Not Tracking Athletic Injuries*

As illustrated with the current finding there is 76.4% of institutions not tracking sports injuries. From this data it can be assumed as hypothesized, that presently no consistency exists within the sample of institutions affiliated with the CIS. The information characteristics of data Canadian institutions would be interested in (see Figure 12) are similar to that of the characteristics discussed by Albright et al. (2004) Hootman et al. (2007a) and Fuller et al. (2007). It is clear that type of injury, degree of injury, date of injury, and sport are of importance to institutions tracking and institutions not tracking athletic injuries. One data characteristic, which was a primary issue for Albright et al. (2004), Fuller et al. (2007) and Hootman et al. (2007a), was the category "use of injury prevention techniques". The reason this may have not been a core issue for the Canadian institutions was that the institutions would have had to file that under the category "other" when responding to the survey question. The use of injury prevention techniques was an important category to include as it allows institutions to assess the effectiveness of their injury prevention techniques and use the data to compare to trends without the application of injury prevention strategies. As expected, Canadian institutions are or would be interested in tracking characteristics of injuries that are common across injury tracking literature (Albright et al., 2004; Fuller et al., 2007; Hootman et al., 2007a.) This illustrates that if Canadian intercollegiate institutions are interested in forming AITS within their individual institutions or at a national level, institutions should collect similar data to that collected in successful systems in the past mentioned by Meeuwisse and Love (1997).

5.4. Open-Ended Questions

5.4.1. *Open-Ended Question Data for Institutions Tracking Athletic Injuries*

As hypothesised, there is presently no consistency among AITS's being used within these nine institutions. As previously illustrated when using different software programs, each method for data input may be unique. This can create definitional issues and decrease consistency of results when attempting to apply the injury tracking results among institutions. A consequence of this is that data obtained within these institutions can only be used to represent injuries which are occurring in their own institutions and would not be applicable in providing quality and representative data for external assessment. This issue has been recognized in past literature by Clarke (1975) regarding the issue of a lack of versatile uniformity, where institutions are hesitant to conform to a uniform standard. Without continuity in the AITS, then the results may be interpreted differently as a result of the system in use.

There are core issues that are associated with all of techniques used to maintain consistent operational definitions. Institutions using drop-down menus with preset definitions are able to maintain definitional consistency when inputting the data; but, may experience variations within the athletic injury definitions when forming an athletic injury definition. Another issue surrounding definitions used within drop-down menus is that therapists may have a different personal interpretation of the definition of injuries when assigning definitions to the drop-down menu. If there are a variety of individuals collecting the data without appropriate training to assess and classify the injury, there can be variability in the classification of the athletic injury on the IIRF. The allowance of only certified therapists to input the data can be a more reliable method of maintaining

consistent operational definitions. If there is more than one therapist inputting data, there may be variation across assessment of the injury due to differentiation in the therapists educational background and opinions regarding severity of injuries (Finch, 1998). The implementation of training prior to operating an AITS will be beneficial in obtaining consistent operational definitions. AITS protocol training will allow therapists to be equally educated regarding the program for collection procedure and data input. There will always be definitional issues regarding variations of assessment across multiple therapists, but with proper training of individual AITS and a standard protocol for inputting athletic injury data, these systems can maintain an adequate level of consistency (Finch, 1998). Institutions lacking structure to maintain consistent operational definitions will not be able to maintain the level of quality and reliability in the trends observed within their AITS.

Institutions are tracking athletic injuries are doing so for a variety of reasons, knowing this it is important to note the practical applications available from the AITS that are currently in use. Each institution has the ability to track individual athletes to provide a collection of individual athlete injury files to archive for legal documentation of injuries occurring within the institution. Archiving individual athlete's files provides the opportunity to improve risk management techniques through an annual assessment of athletic injuries (Finch, 2006). The application of injury analysis/trend analysis applied to the data allows the therapists to generate a greater understanding of the type and frequency of injuries to anticipate for each sport at a given point of the season (Dick et al., 2007). Educating therapists and coaches of common trends of injuries, allows institutions to apply strategies to maintain and prevent athletic injuries occurring within individual sports (Finch et al., 1995).

The provision of athletic injury data to athletic departments, administration would have the opportunity to assess the cost and resources required from every athletic team. As time required for the treatment of injuries can be calculated into an associated cost, athletic departments are able to assess the contributions of varsity athletic teams in correlation to the cost of running each varsity program. This process can better assess the needs of the sports medicine clinics throughout the year and allow for the justification of allocating funding across therapy clinics and varsity athletic programs. At this point nine institutions in the CIS have the ability to allocate funding based on statistical findings from athletic injury tracking data.

Institutions are using their AITS for reasons other than athletic injury tracking. The institution using the AITS for a purpose other than tracking athletic injuries is operating through their health services department and operates as a pay clinic. This institution can use the system to address billing, scheduling, medical profiles, and insurance claims for clients treated in the clinic. As there is only one institution that is using its AITS to address areas other than injury tracking, it can be assumed that AITS primarily serve as a tool for tracking athletic injuries, but also fulfills other needs in the clinic. This is present with the Health Canada's (2007) CHIRPP program where the program also organizes patient files and stores records in the hospitals data bank to keep past injuries on record.

The trends among protocol were similar across all institutions currently tracking. It was the primary responsibility of the therapist/student therapist to assess/treat the injury and then complete an injury assessment form. Each individual therapist is responsible for inputting data into the software program for each of the athletes they assess and treat. The therapist's assessments and treatments are logged into an assessment form, injury data is

then logged at a later date. It was clear that the institutions operating an AITS placed the primary responsibility on athletic therapists or physiotherapists to collect and input the data. Placing the primary responsibility on the therapists provided an additional time requirement of the therapists which removed them from their primary responsibility of treating athletes within the clinic. Positive components of the current protocol of running AITS are that many of the therapists are working with teams of student therapists to collect injury data occurring outside of the sports medicine clinics to ensure athletic injuries are being tracked even though they are not treated within the clinic. This is a positive component for the university as it will provide students with practical experience in the field of sports medicine. It also benefits the clinic as student therapists are an added resource for the clinic and will help to reduce costs and time demands required from the athletic therapists and physiotherapists working in the clinic. Student therapists do not have the professional training to accurately assess sports injuries independently. As a result of this, it is important to note that athletic therapists or physiotherapist involvement must be present to assist the work of the student therapists to ensure that quality of data is maintained.

5.4.2. *Barriers Experienced*

It is clear that barriers experienced when evolving an AITS stem from the three core limiting factors in injury tracking being a lack of: time, funding and resources. These three factors will be discussed in section 6 within recommendations and future perspective strategies to dealing with barriers of AITS.

Maintaining consistent terminology can be provided through the means of creating standard definitions for the assessment injuries and severity prior to logging the athletic injury data (Finch, 1998). As discussed previously there has been no worldwide operational

definition set for sports injury (Hodgson-Phillips, 2000). A result of this is that organizations have the ability to define sport injury to fit the specific needs of the institution. If the definition remains consistent across institutions in the organization the consistent terminologies can be used across institutions. A lack of therapist compliance is an issue that may stem from a variety of factors including: interest in the program, time, availability of resources, and job description. If any of these factors are compromised then the therapist may not consider the program as a priority. Without therapist's compliance to collecting and inputting data into an AITS, the quality and reliability of the athletic injury data produced from the system will be limited. Funding issues within an institution will create an absence for AITS which bring forth an economic cost which the institution cannot afford in their therapy budgets. If institutions are unable to maintain annual funding for running an AITS, then the system will fail or remain stagnant (Meeuwisse & Love, 1998). The remaining barriers can be primarily attributed to a lack of time. The barriers which stem from time issues are: incomplete charts, a build up of injury logs due to the volume of patients and the inability to ensure that all injuries are assessed and logged into the system. These barriers are consistent with barriers recognized by Clarke (1975) (see Appendix Q). If therapists do not have the time to provide accurate charts and injury logs, the resulting outcome will be poor quality data inputted into the AITS and inaccurate trends associated among athletic injuries.

5.4.3. *Open-Ended Question Data for Institutions Not Tracking Athletic Injuries*

It is important to note that although institutions are not formally tracking athletic injuries through AITS, the majority of institutions are using some method of organizing student athlete files to maintain student athlete medical information and contact information. Organizing student athlete files is the initial step to maintaining an organized AITS. If

institutions are keeping student athlete files and records in a filing system, these institutions will have the ability to transfer these records and similar to the NCAA ISS and SMA organize student athlete files through the means of an AITS.

As mentioned previously time, cost, and resources are common themes within this study for institutions not tracking athletic injuries. These three components are indicated as the primary barriers to why institutions are not tracking athletic injuries. It is consistent with characteristics demonstrated in previous literature by Clarke (1975) that posed as barriers to athletic injury tracking. It is clear that institutions are limited in their ability to commence a program until these components can be satisfied. These issues are not in the control of institution's sports medicine clinic. It is dependent on the institution's athletic department to provide adequate funding and resources for sports medicine clinics to function sufficiently. The lack of time is an issue that will be satisfied with adequate resources within the clinic. Understaffing the sports medicine clinics places added demands on the current staff and will not allow for the therapists to perform their job effectively. It is important for institutions to recognize the end result of implementing an injury tracking system which is the reduction in the cost of injuries and the ability to develop appropriate financial resource planning (Janda, 1998). If institutions are able to reduce the costs that injuries impose on the sports medicine clinic through the use of athletic injury data, injury prevention strategies can be implemented, and clinics will ultimately have more resources and funding available for future use.

Institutions that are using their own informal methods to track injuries did not disclose their individual methods of tracking. As this is a large sample of the group of institutions not tracking, it would be beneficial to obtain information regarding the informal

methods of athletic injury tracking. This information would be useful to assess development, protocol, barriers and benefits within their athletic injury tracking methods. Another barrier to why institutions are not tracking is that 7% of the institutions are using recollection of injuries over recording to try and determine trends within the clinic. The problem with this is that there could be a recall bias (see Glossary) that would affect the quality and accuracy of their trends (Lippincott Williams & Wilkins, 2006). This method is not an acceptable standard within injury tracking as it will decrease the accuracy of data through improper data recollection. The last issue is that athletic injury tracking is not a standard within the sports injury clinic. If it is not in the therapists job description or a requirement of the university institution, it is unlikely that the therapists will begin to use a formalized AITS if the institution is not supporting it.

These results of institutions not tracking athletic injuries are quite similar to institutions that are currently tracking athletic injuries in regards to the responsibility of an AITS. It is the assumptions of therapists that the primary responsibility of injury tracking would be placed on the athletic therapist. Although therapists have a primary role in the AITS, the therapists do not have to have soul responsibility for the data input. To place the primary responsibility of data input on the therapist will place added time, funding, and resource demands on the clinic. The time the therapist is required to invest into running an AITS will be determined by the availability of time, resources and funding within the clinic. Therapists' time invested into a AITS will take away from their time treating patients within the clinic. The view of the therapists required to manage and implement every component of an AITS would not be efficient for a therapy clinic. The ideal would be to reduce the amount of time the therapist is expected/required to invest into running and organizing the AITS and

use their specialized skills to address priority needs, such as treatments and assessments. As discussed by Finch (1998), there needs to be standards set in place with recommendations and protocols for all institutions. In order to manage an effective AITS at a national level, a standard for expectations and time requirements must be established in order to reduce the amount of funding, time, and resources within required to run an AITS in the therapy clinic.

The barriers recognized by institutions overall results are similar to institutions currently tracking though a AITS. These barriers present common themes that are consistent to issues observed in the past with injury tracking systems (Meeuwisse & Love, 1997). Many systems failed as a result of cost, time requirements, definitional issues and limited resources (Meeuwisse & Love, 1997). It is important to note that these issues of time, cost and definitional issues are still perceived as barriers to injury tracking and will continue to be until strategies are created to reduce the impact of these barriers. A commonality of these barriers is that they are apparent in the introductory stages of the development of an injury tracking system. Once the program is established, there will be reduced costs, time requirements and resources required to run a program of this nature due to the recognition and implementation of injury prevention techniques (Clarke, 1975). In regard to the issue of a paper trail, in the past there were many issues regarding the quantity of the hardcopies required by the CISIR. The required protocol of the CISIR formed an vast paper trail as all institutions tracking within the CISIR were required to habitually mail hardcopies of their data, to a central location (Meeuwisse & Love,1998). With the technology available in recent years the amount of hardcopy paper could be drastically reduced through the means of an online collection tool.

5.5. Open-Ended Question Data for All Institutions

Currently only 9 of the 38 institutions responding to the survey are tracking athletic injuries through a formalized AITS. This illustrates that only 23.6% of the institutions responding have the ability to recognize injury trends which are occurring within their institution. This raises the question of what methodologies are being employed by athletic departments to generate decisions on safety policy and funding within their athletic programs. At this point we are unable to recognize policy based decisions within the remaining 76.4% of institutions who are not tracking athletic injuries. This is vital information to the field of sports medicine in Canadian universities as a study of this nature has never been done and data obtained from institutions has resulted in novel findings. It is clear that out of the countries discussed in this study, Canada is the only country not collecting sports injury data across intercollegiate institutions. The United States operates AITS out of the NCAA which is the largest collegiate base in North America (Dick, 2007a), while Australia is tracking athletic injuries through the SMA to obtain data from collegiate institutions (Finch, 2006). This demonstrates, that as athletic injuries are not being tracked formally across Canadian intercollegiate institutions, Canadian sport organizations such as the CIS should consider tracking athletic injuries at a national level.

The responses indicated that all of the institutions currently tracking athletic injuries would have a vested interest in being part of a national injury tracking system among CIS institutions. As there are various conditions to enrolment it is important to be able to address the barriers that would be preventing enrolment. It is clear that there are themes to participating in this program as enrolment is dependent on: avoiding added time restraints for the therapists; that the institution must be able to access all data specific to their

institution; that the program will fulfill security concerns and maintain student athlete privacy; the program is designed to be user friendly; enrolment is dependant on cost of the program to fit into the annual budget of the institution; that the program is available in French and there is an appropriate cost/benefit ratio. These issues are common among barriers recognized by institutions to athletic injury tracking.

As mentioned by Clarke, (1975) an adequate injury tracking system must fulfill required security concerns and maintain student athlete privacy. This can be achieved through the implementation of an adequate coding system set into place to maintain confidentiality for injuries and athletes (Rae & Orchard, 2007). Another requirement would be that the program must be designed to be user friendly in order to maintain therapist compliance to the program. The program must be designed to be user friendly in order to maintain continuous input and output of injury data (Clark, 1975). In addition to being user friendly, it is important that the program is flexible to meet needs of various institutions as stated by Meeuwisse and Love (1997). Since Canada is a bilingual country, it is important that the program is designed to be transferable across both English and French languages. In order to adapt to primarily French institutions, the system must be available in French and have the ability to be transferable to English.

For all institutions who are interested in a participating national program, it was important to understand if these institutions would be willing to provide funding towards this program (see Figure 13). The range of responses indicates that there is interest and these institutions would be willing to allocate funding for a program of this nature. At this point it is not possible to predict an annual cost of implementing and running a national program within Canada. It is important to note that if a national system was created it would not be

required to be supplemented solely through the mean of external funding, as the majority of universities are willing to absorb a portion of the cost. As internal funding is an option, it would be ideal to obtain a source of external funding similar to the Datalyst center with the NCAA ISS and government funding within SMA.

As mentioned previously, recognized barriers have primarily consisted of time, money and resources. To add to these issues it is important to recognize core components that may pose as barriers when attempting to create a national system. There are many concerns regarding privacy within a national system to maintain student athlete confidentiality. In order to achieve this and maintain the confidentiality of institutions students athletes the national system will assign codes to assign to individual student-athletes. Through the implementation of a coding system, it may assist in the maintenance of athlete confidentiality (Meeuwisse & Wiley, 2007; Rae & Orchard, 2007). Two other potential barriers recognized were a lack of participation from staff and administration support. First and foremost, the administration must have vested interest in the program for a data collection system to run efficiently within the institution. If the administration prioritizes athletic injury tracking as a standard within the therapy clinic, it would promote the clinics staff to comply with the program. As demonstrated in the NCAA ISS, if all institutions were to implement athletic injury tracking as a standard within the institution and agree upon a national standard for implementation of an AITS and definitional consistency within it, the protocol could help eliminate issues such as regional differences in assessments, therapist compliance, and assist in conformity to definitional standards within injury assessments.

The concern regarding the quantity or hardcopies required to organize this program can be controlled with the use of modern technology with electronic filing and electronic mail. The institutions would be required to file hardcopies of the IIRF and therapists injury logs within their institution for a period of five years. As the IIRD and therapists' injury logs are generally concise, and would not longer be required to be mailed through the postal service for data input (Meeuwisse & Love. 1997). Technological advancements will limit the issues regarding the transfer of hardcopy files to a central location which would manage the AITS.

Teaching the protocol of the AITS to new student therapists at the beginning of every new academic year will continue to be a challenge that will annually require time and resources of the clinic. A solution to this problem would be to include a training tool, including handouts and a detailed instructional video regarding procedures and guidelines of the national system. In order to reduce the learning curve and have an aid to refer to and introductory training tool should be issued to each institution taking part in a national AITS. This is similar to the current practice in the NCAA, where therapists are provided with training with enrolment in the NCAA ISS then provided with updated injury tracking protocol to ensure consistency across institutions. It should be understood that there will be a substantial start-up cost to implement a national AITS (Clarke, 1975). However, the goal of implementing a system of this nature would ultimately reduce costs and required resources within each CIS institution by reducing the rates of injuries.

Institutions achieving the benefits recognized can ultimately reduce the rates of injuries and the cost associated with injuries within their institution. The institutions that recognize perceived benefits can assist in the promotion of implementing AITS's within their

individual institutions and can serve as potential facilitators in building a national system. This can be done through creating awareness, and benefits obtained from AITS to other institutions in the CIS. Institutions recognize that a national system can provide assistance in setting rules, policies, staffing, funding, risk management and liability within institutions. This is a core focus of the study by MacKay et al. (2003) recognizing the ability to set appropriate policy, safety protocol and risk management strategies as a result of a quality injury tracking system at a national level.

It is clear that there are benefits to operating an AITS at the intercollegiate level, as illustrated with successful injury prevention strategies implemented at that level in the NCAA and SMA (Finch, 2006; Hootman et al., 2007b; NATA, 2007). A highlight in these themes is the recognition to share best practice across institutions. This is a fundamental component of attaining a successful system and achieving benefits from the program within the first few years of operation. As a trend analysis will not be able to be produced until a minimum of two years in operation, the program must present benefits to institutions immediately to continue to build and maintain compliance from institutions. The ability to share best practice among institutions will allow institutions to adjust their current safety policy and discuss ways to reduce costs, time and resources within the therapy clinics. Institutions need to recognize that there is a greater cost to benefit ratio for implementing injury prevention strategies (see Appendix T) through the use of quality injury tracking system. In addition to the benefits recognized by CIS institutions, there is a wealth of features an AITS possesses including student athlete records, therapist treatment logs, and therapists scheduling which can be used to reduce costs and increase efficiency within an sports medicine clinic.

It is clear from the work of Finch (2006), that in order to run successful AITS there would be a need for a lead agency. By forming a national database it would develop a standardized data collection method to ensure consistent coding and data entry of injuries that occur, as well as creating a standard protocol for analyzing the data (Finch, 1995). Consistency across injury tracking methods would allow for increased accuracy in the analysis of injury trends due to a larger sampling pool and predetermined protocol across institutions. This is a primary reason that illustrates the importance of operating an AITS at a national level within Canada. If Canadian intercollegiate institutions had national AITS then comparisons of trends across divisions and sports could be achieved. If the institutions participating in Canadian intercollegiate sport could assess trends of athletic injuries within their respective divisions, appropriate injury prevention techniques could be applied across divisions to potentially reduce the rates of athletic injuries. Reducing the rates of injuries occurring within intercollegiate athletics would substantially reduce costs imposed on CIS institutions sports medicine clinics and in part reduce cost in the Canadian health care system through the reduction of acute injuries treated within the ER. The CIS would be an ideal organization to pose as the lead agency as this organization has access to student files and all active athletes within Canadian universities.

If the CIS or a Canadian agency aspires to eventually form a national AITS for intercollegiate sport, the recommendations stated from the sample of institutions currently tracking athletic injuries should be taken into consideration in the development of a national system. It is clear from the work of Dick et al. (2007a), Finch (1998), Hootman et al. (2007a), and Meeuwisse and Love (1997) that an athletic injury tracking system must generally be user friendly and have the ability to be flexible to meet changing demands of

institutions. As discussed previously, programs operating at a national level require sources of funding outside of the institutions to start-up and manage a AITS of this magnitude (Datalyst Center, 2009). It is important that the institution and staff within the institution are on board with the program and the requirements applicable to it. The success of the program is reliant on institutions' conformity to the program and adhering to the standards set within it. Recommendations for improved methodology are not unrealistic or difficult to apply. A program of this nature is feasible, assuming institutions in the CIS can provide commitment to the program and abide by a standardized protocol within it.

5.6. Study Strength

The overall response rate obtained from the study was above average. The survey resulted in a response from 38 of the 49 institutions contacted yielding 77.6% response rate from the sample. This can be viewed as an excellent response rate for the survey. Past research has indicated that the average response rate for e-mail surveys distributed from academic institutions was 36.8% (Sheehan, 2001). Our study indicated that we had a 40.8% greater response rate than the industry average with our sample population. As there are 52 institutions within the CIS, the 38 institutions responding represented 73% of institutions currently in partnership with the CIS. The initial survey e-mail was released during the second week in December, as prior field research indicated that this period of December would be the ideal release date (J. Childs, personal communication, July 5, 2008). Athletic therapists indicated that at this time of the academic year their sports medicine clinic generally have the lowest volume of student-athletes visiting, due to increased academic demands on the students.

6.0. Recommendations and Future Directions

6.1. *Limitations*

There were several limitations observed throughout the data collection period, which may have effected the results obtained from the study. The initial limitation was a concern regarding the collection of participants' responses. The data collection tool was coded so that it did not require a mandatory response for each question within the survey. This resulted in four incomplete surveys that did not provide a representation of data from all institutions responding. We implemented this technique as we felt the participants might not have felt comfortable or may not have knowledge to respond to all of the questions provided, in particular the financial based questions. As it is unclear the impact that requiring a mandatory response on all questions might have had on the overall response rate, we would classify this as a potential limitation of the study. The CUITS was first used in this study to assess the current status athletic injury tracking in Canadian universities. As this survey had been previously untested it could be susceptible to issues regarding validity and reliability of responses.

Another issue when collecting responses was that the survey would only allow for one response from an individual Internet protocol address (see Glossary). This was a limiting factor as many of the institutions employ multiple therapists; but, may have only one computer in the therapy clinic. As discussed earlier the survey was distributed to multiple therapists in order to generate a greater response rate from CIS institutions. The restriction allowed for one response per Internet protocol address, which allowed a single survey to launch on an individual computer station. The implementation of survey submission restrictions was applied so participants would be able to finish an incomplete

survey from the same workstation. Illustrated in the Survey Monkey data collection tool, one institution submitted changes to the responses of their initial survey. The change that was submitted was the addition of information to questions that were partially incomplete.

As a result of a single response from an Internet protocol address, the researchers are unaware if multiple participants were attempting to respond through a single computer station. This issue was accounted for through the delivery of an e-mail to the sample of participants, stating the issue and providing instructions that the survey providing alternative submission methods, allowing the survey to be completed through other computer stations within the institution or elsewhere in the community.

It is important to address non-responding institutions, as information obtained from non-responding institutions would have been valuable and would have contributed to the quality of the data obtained in this study. Responses from survey participants may vary considerably from the responses that may have been present from non-responding institutions. We must assume that there is the potential for additional views regarding quantitative and open-ended questions from non-responding institutions.

The final limitation recognized was absence of institutions with French as a primary language. The data is unable to form an accurate representation of institutions in Quebec that are predominantly French. These institutions were contacted through e-mail and telephone to request participation, but due to the language barrier present between the research team and the institutions, we were unable to receive responses from any of the predominantly French speaking institutions in the QSSF. The institutions responding in the QSSF resulted in an adequate response rate, but did not form an accurate

representation from predominantly French institutions. Although the invitations were available in French, institutions using French as a primary language did not wish to participate in this study. In future studies it could be beneficial to hire a French to English translator to transcribe phone interviews or transcribe French surveys to obtain results for this study. For this study, we did not have the funding or resources readily available to accommodate verbal translation of the survey.

6.2. Recommendations

As this study provided an overview to enhance the understanding and recognition of athletic injury tracking currently being performed within Canadian universities, it opens up many future directions to be explored. This section will cover a discussion on future possibilities that will assist in the development of creating a framework for a national athletic injury tracking system across Canadian intercollegiate institutions.

6.2.1. *Suggestions for Improved Methodology*

In order to develop an effective AITS at a national level within Canada we must recognize the primary barriers which have been acknowledged and design the program to help control these barriers. From this study and the past literature of Clarke (1975), Dick et al. (2007a), Finch (2006), Meuwisse and Love (1997), and Meuwisse and Love (1998), it is now recognized some mandatory components for developing a framework for a national AITS.

The initial step would be to develop our program based on the strengths and advancements from existing AITS, in order to effectively record all athletic injuries that occur. We can develop components of the program based on past attempts and current programs that provide strategies to account for reducing time, cost, and resources. As

characterized in the past through Meeuwisse and Love (1997), an AITS must be constantly evolving and utilizing technology to reduce the required time and resources. Reducing the time and resources required from therapists within the institutions will ultimately reduce the cost of running AITS within each institution.

The next step is to account for responsibility regarding individuals who will be collecting and recording injuries. It is clear from our results that the primary reasons CIS institutions are not tracking injuries are due to a lack of time, funding, and resources. The barriers of time, resources, and funding may be reduced through the use of student volunteers. Kinesiology, Human Kinetics and Physical Education programs are common programs available within institutions within the CIS. In 2009, 40 of the 52 (76.9%) institutions in the CIS are operating programs in Kinesiology, Human Kinetics or Physical Education (Hecterra, 2009). Student volunteers are a valuable cost effective resource for intercollegiate sports medicine clinics. There is a wealth of students within intercollegiate institutions who require volunteer experience in their field. These students can be utilized as active volunteers within the sports medicine clinic by appointing them as student therapists for the varsity athletic teams. The integration of student volunteers inside and outside the clinic can assist the athletic therapists and physiotherapists working within the clinic to aid in the collection and submission of athletic injury data. Student volunteers are an excellent resource when used in combination with certified athletic therapist or physiotherapist. As student therapists do not have the formal training to adequately assess sports injuries, it would be mandatory that certified therapists provide the training and provide guidance to student therapists while tracking athletic injuries to ensure consistency and confidentiality of student athlete files. Incorporating student

volunteers into the clinic with the assistance of certified therapists will reduce time, cost and need for resources for intercollegiate sports medicine clinics within the CIS.

The next area of concern is that a Canadian AITS would need an assigned individual or a team of individuals responsible for the review and analysis of the electronic data. There would be an unavoidable cost associated in the creation of these positions to run the program. In order to have a successful national AITS there would be a need to determine potential sources of funding for this program. It would be important to have a governing organization overseeing and implementing this program to collect and organize athletic injury data of Canadian intercollegiate institutions. The CIS is an organization that may be able to govern and support a program like this, but would be unable to individually support a national program of this nature due to the current size and available funding. It is important to recognize external funding opportunities through government and private sector organizations to promote health and safety of citizens participating as Canadian student athletes. The NCAA ISS and SMA are currently funded through the support of external government and non-government organizations (Datalyst, 2009; Finch, 2006). These organizations continue to seek support to develop and advance their athletic injury tracking programs. There are various agencies and sources (Appendix U) for potential funding for the CIS to consider a collaboration with, to develop and fund a national AITS. The CIS must recognize and contact all potential funding opportunities to support the initialization and development of a program of this magnitude.

If funding were to be provided to begin a program of this nature, those resources would provide the ability to allocate a team responsible for preventative and corrective action planning. A research team would potentially be able to reduce the rates of athletic

injuries occurring within the CIS by recognizing injury prevention techniques through ongoing injury trend analysis. In order to launch a program at a national level, policy and procedure must be created to provide documented copies of methodology and procedures of the national AITS. In order to appropriately establish consistent definitions there would need to be a conference with all of CIS therapists, to discuss definitions and process suggestions and collaborate on consistent definitions for injury and assessments. Therapists of participating institutions must be contacted and provided with written procedures to provide training prior to the launch of a program. In order for a national program to be effective, the data collection methodology must be standardized across all institutions to ensure consistency of data and to reduce definitional issues.

In order to assess limitations within athletic injury tracking, an understanding of past and current athletic injury trends should be evaluated. The comparison of past athletic injury studies and AITS are limited as there are differences within definitions of injury and exposure rates. Athletic injury tracking in Canada cannot be applied to form a comparison structure between countries that are currently operating well-established AITS as the definition of sports injuries vary across different AITS. This is due to many Canadian sports having different rules, equipment standards from similar sports internationally. In addition there may be different standards for the definition of injury among different countries. We must establish concrete definitional standards for injury, severity of injury and degree of exposure to sport. This must be done in order to appropriately assess the risk of injuries occurring in CIS sport. An initial attempt to control definitional standards would be to implement a national coding system across CIS institution.

As highlighted in the results section, only 1 of 38 (2.6 %) institutions in our sample use a coding system within their sports medicine clinics to classify injuries. As mentioned previously by Meeuwisse and Love (1998), using a coding system will assist in standardizing injury definitions. In order to reduce definitional issues within athletic injury tracking, a standardized coding system must be set into place to code and define athletic injuries prior to submission into the databank. Institutions must be trained and provided the adequate tools to allow for an easy transition into this method of charting injuries. As discussed previously, other current national AITS require that injury coding be a mandatory component of their systems. Although various coding systems could be used within AITS, Canadian AITS's would have the access to a valid coding system designed in Canada, specific to athletic injury research illustrated previously as the SMDCS (Meeuwisse & Love, 1998). The SMDCS would be an ideal coding system to implement within a Canadian AITS, as it has the ability to be easily identified within data banks for injury tracking and research purposes. The next step is to establish concrete definitional standards for each of these codes. It is important to ensure that therapists are coding injuries and assessing injuries appropriately and consistently. All therapists must have a set standard for assessing the severity and type of injury incurred. This would require pre-set definitional standards, which would label and classify an injury based on a set criterion. The severity of an injury could be assessed on a grading system that would be established by a regulated group of governing therapists (e.g. Canadian Athletic Therapists Association). If we have the ability to assist in the standardization of assessments of athletic injuries, the system will be able to produce data with greater validity to support future research in the area of athletic injury prevention and treatment.

The assessment of the severity of injuries can be predicted through a variety of variables. The CIS can choose to predict the severity of injuries occurring based on: duration and nature of treatment; time lost from sport; financial cost to the institution; permanent damage or disability; and, loss of athletic performance. It is up to a governing body to form consistency in the definition of the severity of injury of an athlete (Finch, 1998). The athletic injury data collected will lose strength if severity is judged through various outcomes. The assessment of the severity of injury must be consistently based on a single characteristic or a standardized assessment tool provided to all institutions classify the severity of the athletic injury. It would be important for a governing organization to decide which determinant of severity would be best suited for the group of institutions.

In order to calculate risk of athletic injury a framework must be generated in order to regulate the assessment of exposure rates within CIS sport. By obtaining exposure rates through participation, the institutions are able to calculate and assess risk of injury within their institutions. It will assist CIS institutions in obtaining a greater understanding of rates of injuries per exposure to a practice or competition setting. It will allow therapists to generate a superior understanding on the commonalities across athletic injuries occurring within CIS sport. This supports the aspiration of institutions having the ability to share good practices and new findings across CIS institutions. If there is standardization of assessments of athletic injuries, then the system will be able to produce data with greater validity to support future research in the area of athletic injury prevention and treatment.

6.3. Future Direction

6.3.1. *Athletic Directors*

It is important to illustrate the current state of athletic injury tracking systems operating within Canadian intercollegiate institutions. From the institutions currently tracking athletic injuries, the question that is raised focuses on what specific data athletic directors are basing their justifications for allocating funding, resources, and the implementation safety protocol for each individual varsity sport. Without any research conducted in this area, it is unspecified as to what athletic directors are basing decisions on, in order to organize the institutions budget across their therapists and varsity athletic teams. At this point, interviews with athletic directors across the CIS would be beneficial to aid in understanding how decisions are being made to determine policy and funding within varsity athletics. It is important to understand that if a national system were to be established, would the athletic directors use this data to assist in decision-making based on data driven statistics of the cost imposed by athletic injuries on individual teams and to the athletic therapy department? Obtaining this data from the athletic directors in the CIS will help create awareness of AITS's across the CIS and give a stronger prediction of the need for a national based AITS within Canadian intercollegiate institutions.

6.3.2. *Canadian College Athletic Association*

A future subsample of potential participants to consider as candidates for national AITS would be institutions within the Canadian College Athletic Association (CCAA) that operate competitive athletics programs. The CCAA is currently the largest intercollegiate athletic organization in Canada that currently holds 106 member institutions spread across five divisions (Canadian College Athletic Association [CCAA],

2009). The CCAA represents over 9000 intercollegiate athletes across six national level sports (CCAA, 2009). This is a large sample population that operates within the same climate as CIS institutions. These institutions were not include within this study since they currently operate under separate governing bodies and it was not feasible to include both the CIS and the CCAA in this study. As well, The CCAA was not included in this study as there are a limited number of CCAA institutions that operate sports medicine clinics. Due to the lack of representation of sports medicine clinics within CCAA member institutions it was felt that we would obtain limited responses from CCAA institutions regarding injury tracking within athletics.

6.3.3. *Online Database*

It is important to recognize the need for an online AITS that allows individual intercollegiate institutions across the CIS to track all athletic injuries through one online system. It is also important to recognize the need for confidentiality in keeping personal information of the injured athletes private. A national system would be able to provide a secure private network by implementing numerical codes for athletes for submission of each athletic injury. Every institution must be able to access and analyze their own personal data through this system, but as well be able to submit the information to a larger online database for a national assessment of the injuries occurring. In an attempt to reduce costs and to allow for convenience of data input, an online system must be established. It would be clear that CIS institutions would receive greater benefits from an online system. An online AITS would provide institutions the ability to access the database online through a secure website from any computer station rather than creating this system through a computer software program, as done in the past with programs such as InjuryTracker5.0 and Sportsware.

Through the provision of an online web based system, institutions could submit injury statistics from personal digital assistant (PDA) devices directly from athletic practices and competitions.

6.3.4. *Online Communication*

The application of an online message board to provide open communication across institutions would provide the ability to post and discuss advancements in the field, and to provide an outlet to share best practice across the CIS. This would be an excellent addition to incorporate into the online AITS, as the ability to access and submit information could be secured through a password-protected login. Only registered therapists affiliated with intercollegiate institutions would have the ability to access and use the AITS. Incorporating an active message board would also allow therapists to provide comments and feedback regarding the system to ensure ongoing advancements and improvements to the system.

6.3.5. *Technology*

The long term goal of a national intercollegiate athletic injury tracking system is to reduce the amount of work and costs associated with athletic injuries and injury treatment. An initial start-up cost of a national system may be subsidized through the use of available technology to reduce tracking time incurred by the therapists. The current technology that is available to institutions will contribute to the successfulness of implementing a national AITS in Canada. There are many approaches to designing and implementing a program based on upcoming technology. As illustrated in the results, the majority of Canadian therapists are paper-charting athlete's files when treating athletes. One of the barriers that is acknowledged within a AITS is that it creates time constraints

resulting in added work for the therapists. As technology improves, current standards are becoming affordable to institutions. With the current availability of PDA devices and computerized tablets, therapists would be able to chart their information electronically within these devices instead of having to scribe onto a hardcopy chart. The benefit of charting electronically is that the therapist would be able to directly chart onto the form provided by the national AITS, store it for personal file use and submit it electronically after assessment. This would cut out the stage when the therapist has to transfer assessment notes from hardcopy form into electronic copy for submission of data. The benefit of the PDA or tablet devices are that they can be carried around with the therapist with minimal inconvenience as well as be used for scheduling, storing athletes' files and as a telecommunications contact device within their institution. When institutions make the transfer from hardcopy format charting to electronic charting, there will be a reduction in the paper trail required for charting and filing assessments which posed to be a problem in the CISIR (Meeuwisse & Love, 1998). By implementing this standard, this process will eliminate and control barriers to athletic injury tracking experienced in the past by reducing time and storage space within sports medicine clinics.

It is important to adhere to recommendations of past research to ensure characteristics that constitute a quality tracking system are met. The recommendations listed above can supplement past recommendations of Clarke (1975), Finch (2006), and Meeuwisse and Love (1997), to ensure the system meets the guidelines of a quality AITS. To move forward, in attempt of achieving compliance of institutions within the CIS the system must be design to provide: simplicity (layout and ease of use); flexibility (ability to adapt to changes); predictive value positive (the proportion detected who actually have

the condition under tracking); timeliness (speed between steps); sensitivity (proportion of cases detected); acceptability (the willingness for individuals to participate); and, representativeness (occurrence over time and distribution) (CDCP, 2001; Finch, 1998; Meeuwisse & Love, 1997).

6.3.6. *Wilfrid Laurier University Studies*

At the completion of this study, therapists will be provided a report of the results to provide institutions with the current status of athletic injury tracking in the CIS. The therapists will have the opportunity to respond to Dr. Jill Tracey regarding the report and discuss the data and any future perspectives with the researchers. This method of debriefing will allow further discussion on the topic and will confront potential bias associated with future studies of this nature. The report provided to the therapists will serve as an educational tool to promote awareness of current trends in the CIS and allow therapists to generate an understanding of current practices of injury tracking. It will allow therapists to provide input towards future recommendations or interests in the area of study to promote future athletic injury tracking research at WLU and other CIS institutions.

6.4. Conclusion

Obtaining information from the therapists regarding the current state of their AITS and clinic, has allowed the research team to obtain a greater understanding of current injury tracking practices at the intercollegiate level within Canada. This study will assist in enhancing the awareness of CIS institutions of current practice of athletic injury tracking and increase the CIS's understanding of current operations and practices within sports medicine clinics in their institutions. We hope to move the CIS forward in

addressing the need of implementing a national AITS among its institutions to promote the health and safety of student-athletes competing in the CIS and reducing the direct and indirect costs of athletic injuries.

This study has generated a preliminary assessment of the current status of athletic injury tracking in CIS institutions by assessing current practice, methods and protocol, clinical demographics and therapists opinions towards athletic injury tracking. This foundation can be used to assess future initiatives for implementing AITS at the intercollegiate level and has created a framework of information to assist future research in the area of athletic injury tracking. The ability to obtain data on specific injury trends occurring within the CIS will allow intercollegiate institutions to assess and implement appropriate strategies to accommodate for injuries that are predictable and preventable.

While there are limitations to operating an AITS, the potential benefits would outweigh the limitations present to the CIS. Past research has illustrated that the cost to benefit ratio is superior for injury prevention initiatives (SMARTRISK, 2005). By addressing the status, benefits, and barriers of current AITS we aim to enhance initiatives in the creation and implementation of a national AITS in CIS institutions. Overall there is great importance in instituting an injury tracking practice within Canadian intercollegiate institutions. By analyzing the data, researchers can contribute to increase awareness of injury prevention, incorporate injury prevention strategies and provide appropriate resource allocation as a standard practice throughout Canadian universities. This can be achieved through the implementation of a National system in place across Canadian universities that would ensure consistency athletic injury tracking protocol and injury definition. It is hoped that this study will assist in developing an understanding of the

current state of injury tracking and provide information regarding clinical demographics and the benefits to developing a national AITS within CIS institutions. From this study it is clear that there is no current system in operation that is ideal for Canadian intercollegiate sport. In our observation we should use a combination of past athletic injury tracking tools, taking into account the main recommendations from other researchers, as well as the input from the institutions surveyed in this study to generate a national AITS that is ideal for tracking athletic injuries within Canadian intercollegiate sport.

Glossary

Content Validity- 1. Validity of a test or a measurement as a result of the use of previously tested items or concepts within the tool.
2. The degree to which the items within a research instrument or measurement tool represent the universe of content for the concept being measured or the domain of a given behavior (Mosby's Medical Dictionary, 2009)

Exposure- one athlete participating in one practice or game where he or she is exposed to the possibility of athletic injury (Dick et al., 2007a)

Face Validity- the degree to which a questionnaire or other measurement appears to reflect the variable it has been designed to measure (Jona, 2005)

Internet Protocol Address – A logical address of a network adapter. The Internet protocol address is unique and identifies computers on a network (ip-address.com, 2009)

Intercollegiate- pertaining to, or representative of two or more colleges or universities (dictionary.com)

Intercollegiate athletics - Taking place between or participating in activities between different colleges or universities (dictionary.com)

Non-Random - The occurrence of things wittingly or unwittingly by human design and procedure; not mathematically predictable on the basis of the classical theory of probability (NADbank, 2009).

Recall Bias-systematic error due to differences in accuracy or completeness of recall to memory of past events or experiences (Lippincott Williams & Wilkins, 2006).

Salience- Association of importance and/or timeliness with a specific topic (Martin, 1994)

Secure Sockets Layer- Technology that protects your website by enabling encryption of sensitive information during online transactions (VeriSign, 2009)

Sport- a. Any physical activity which has the character of play and which involves a struggle with oneself or with others, or a confrontation with natural elements. **b**. autotelic (from auto, "it's own"and telos "goal, end or purpose") physical contests (Guttmann, 2004)

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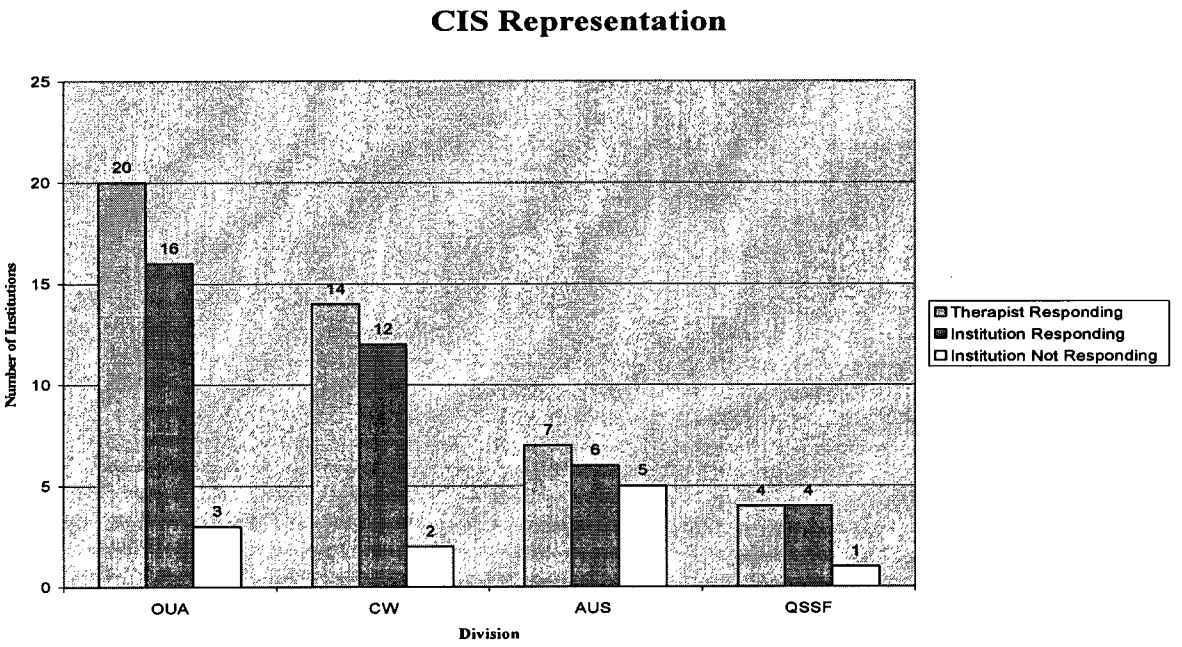
Figures:
#1 - #13

Figure 1:



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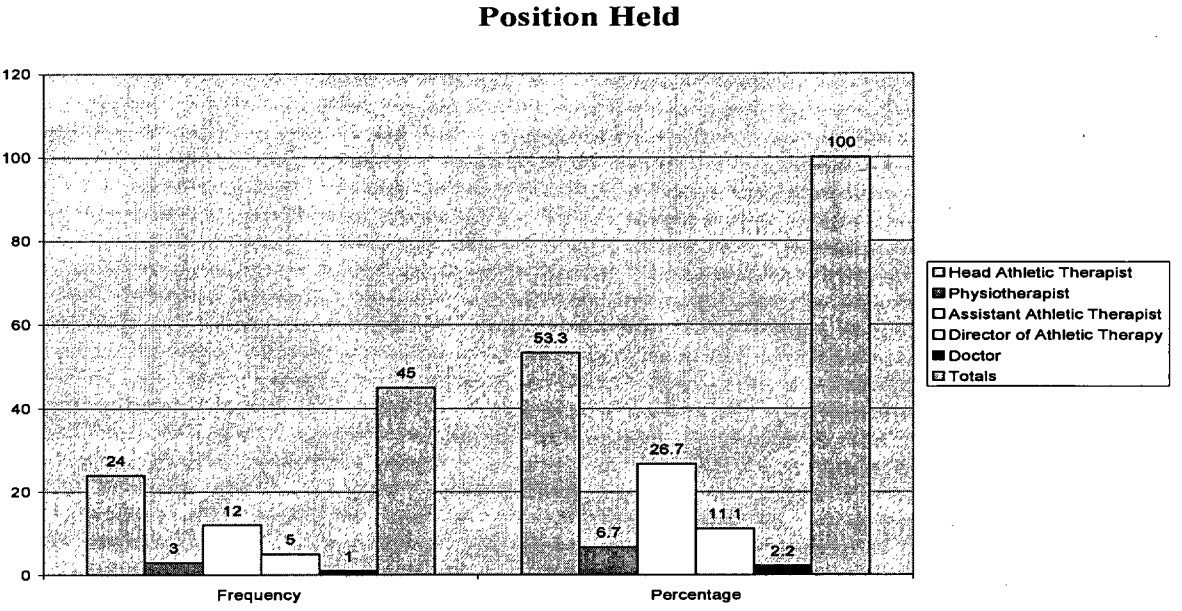


Figure 3:

State of Athletic Injury Tracking Among Divisions

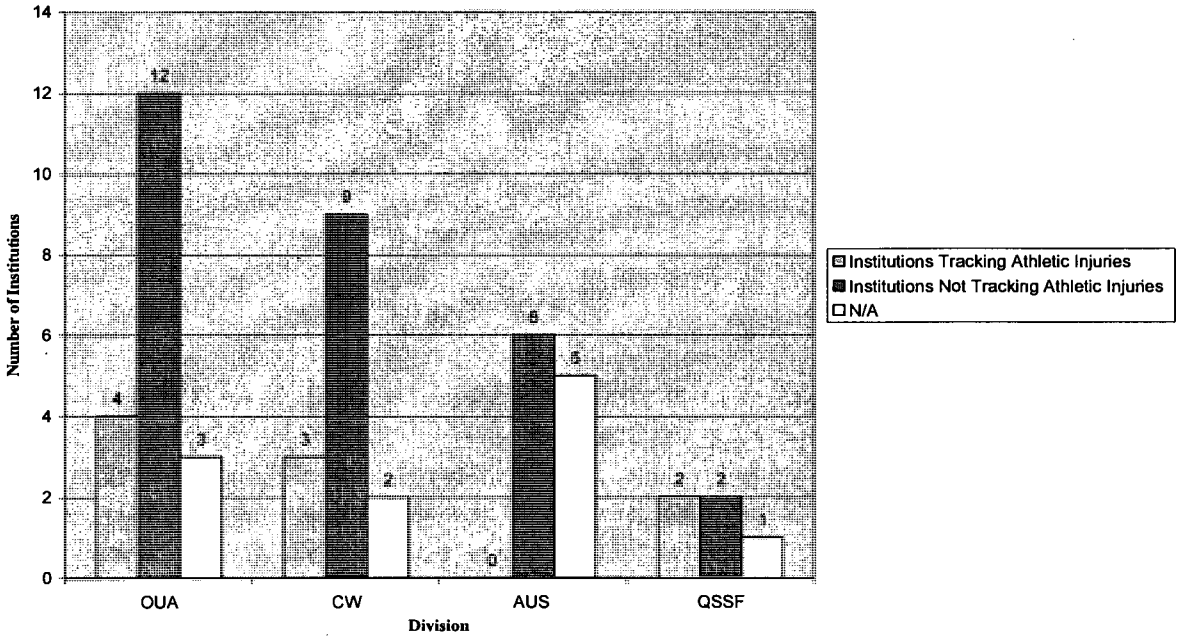
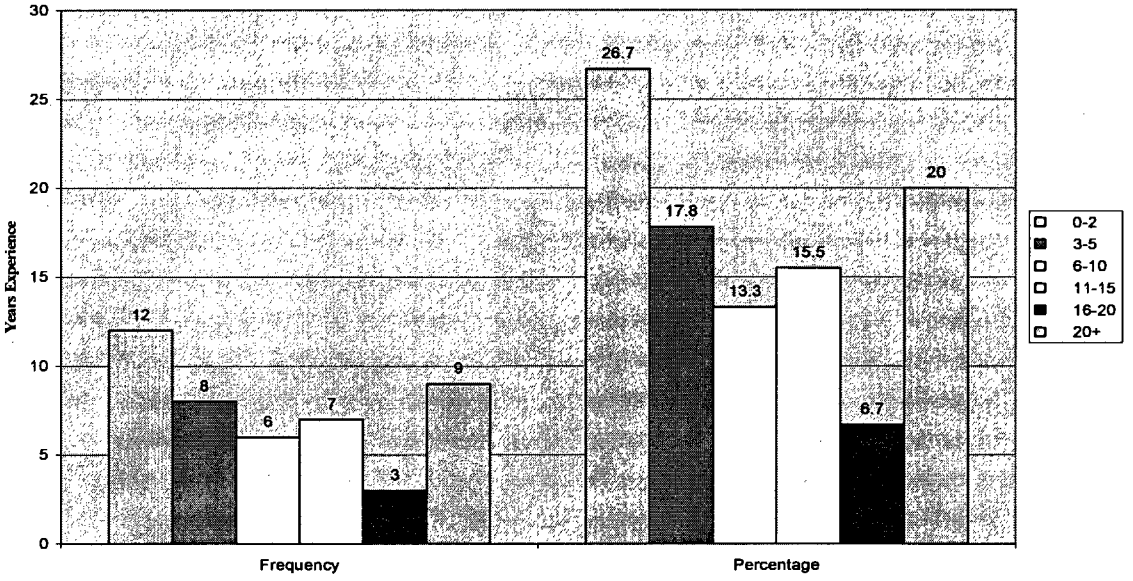


Figure 4:

Therapist Experience



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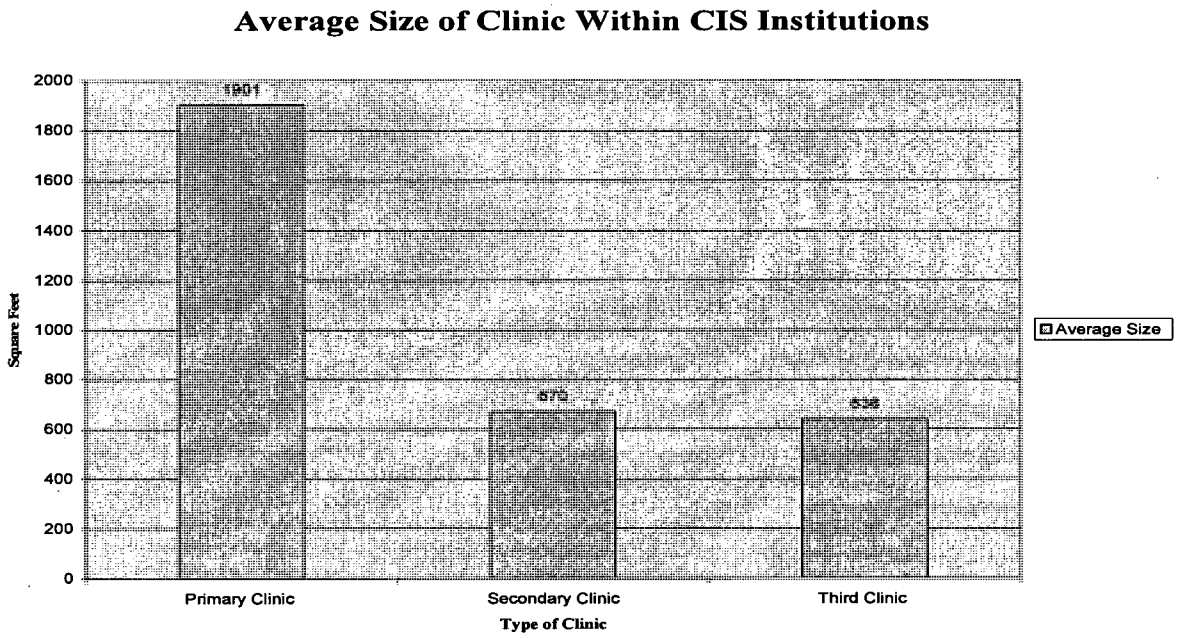

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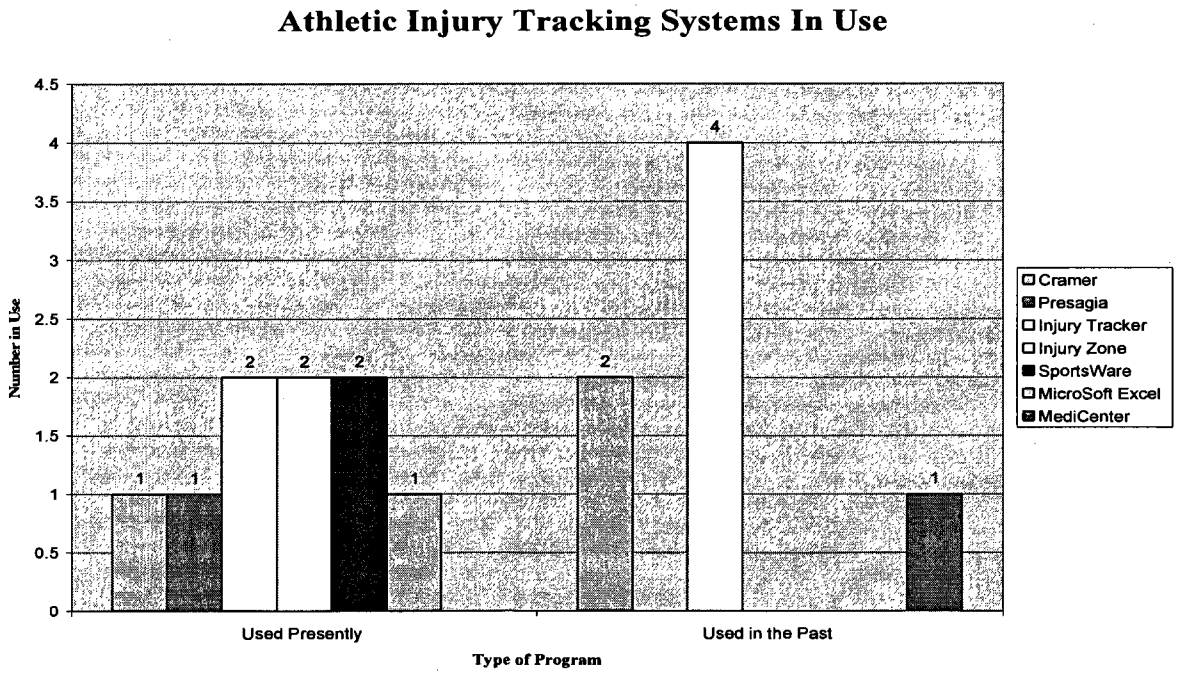

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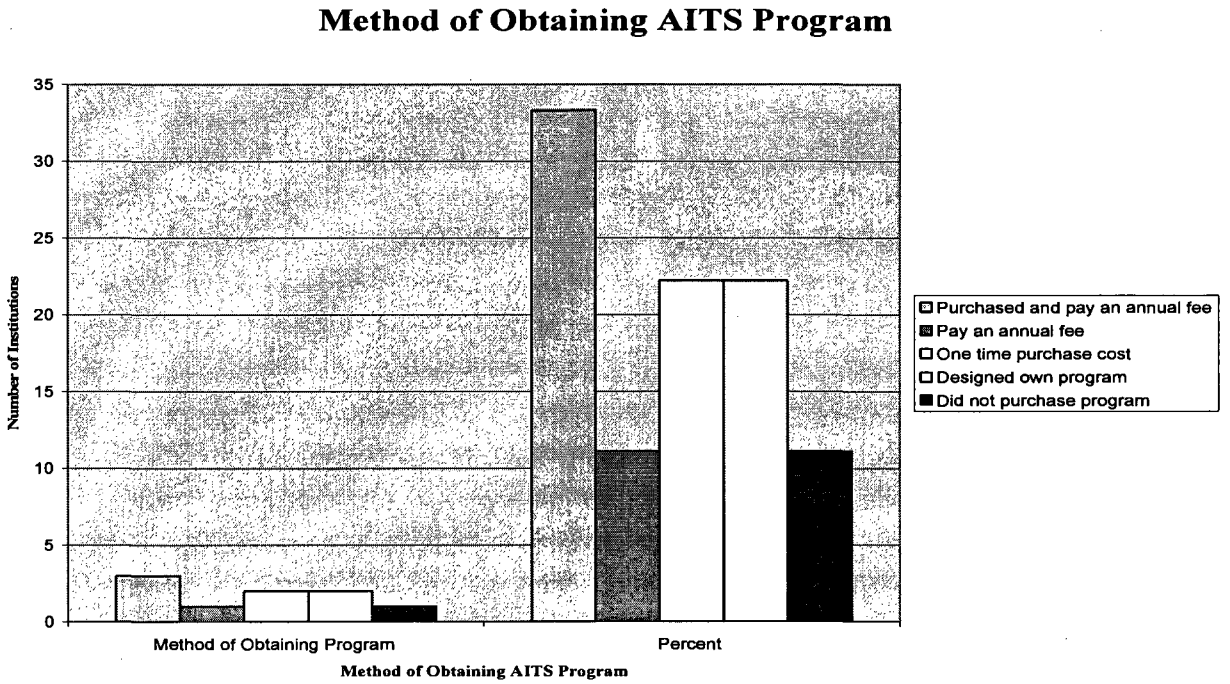

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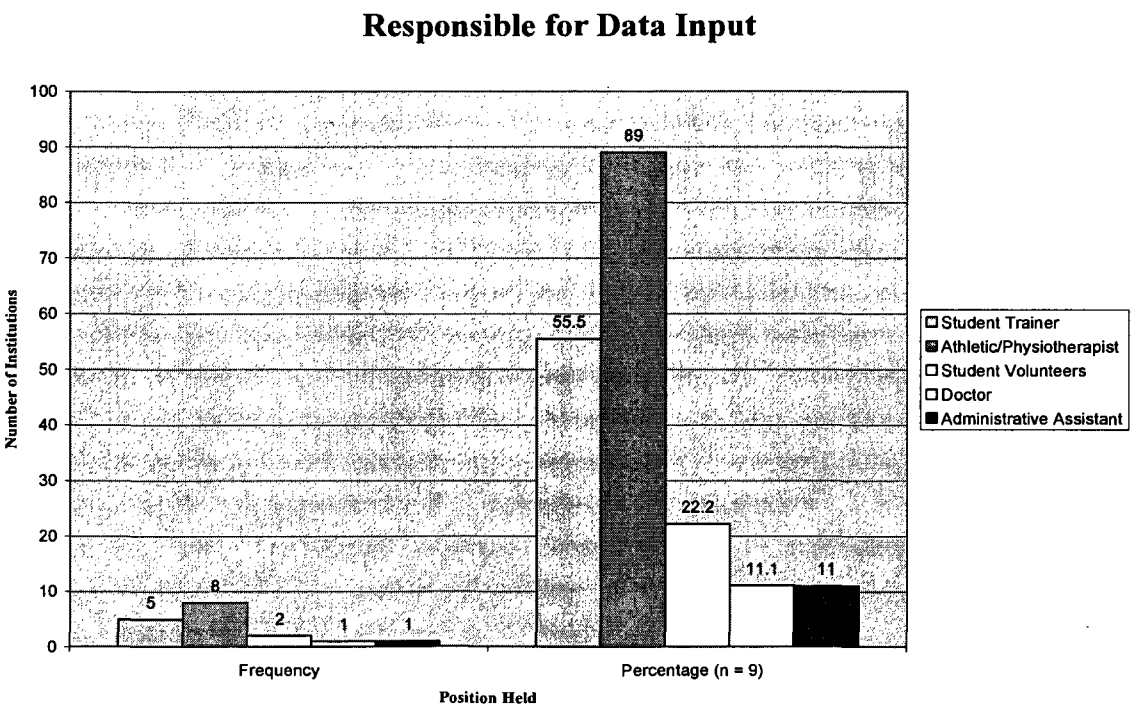

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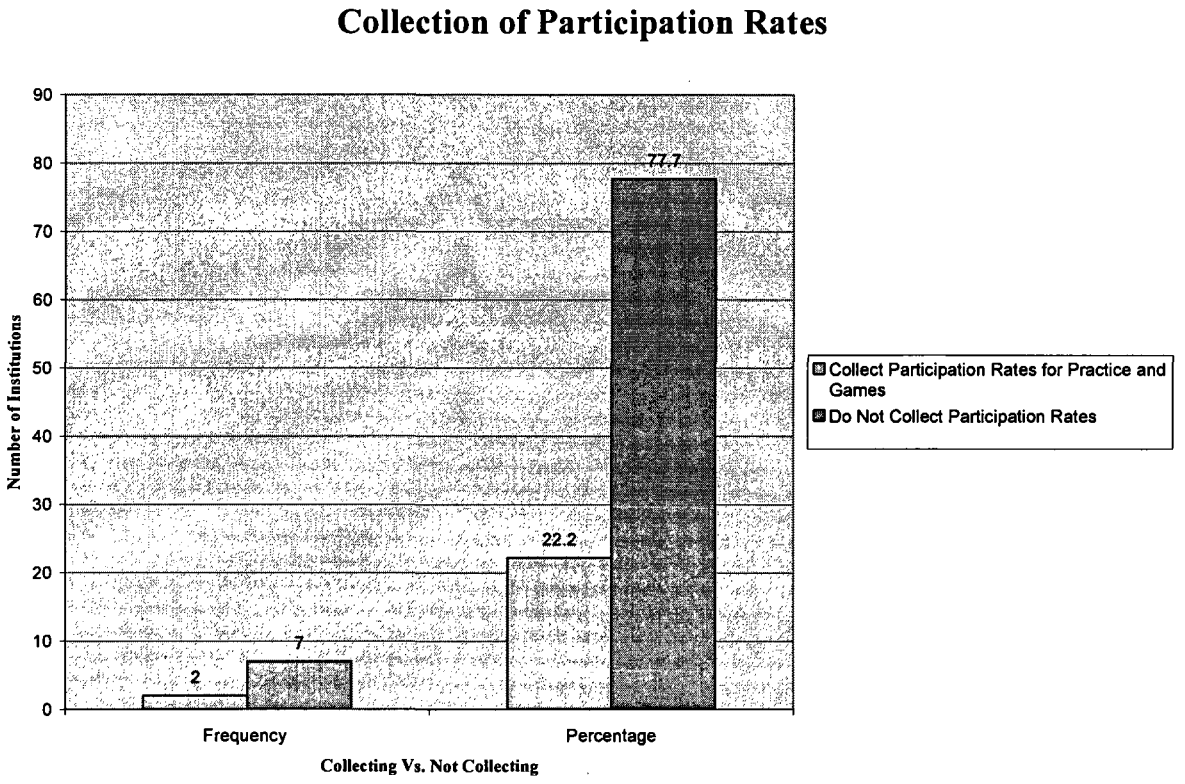

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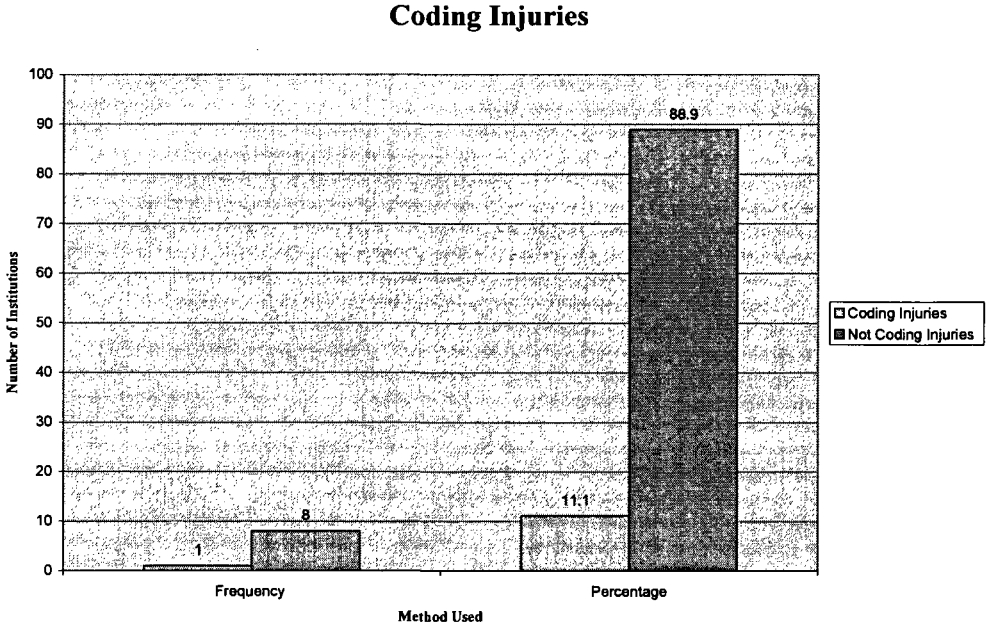

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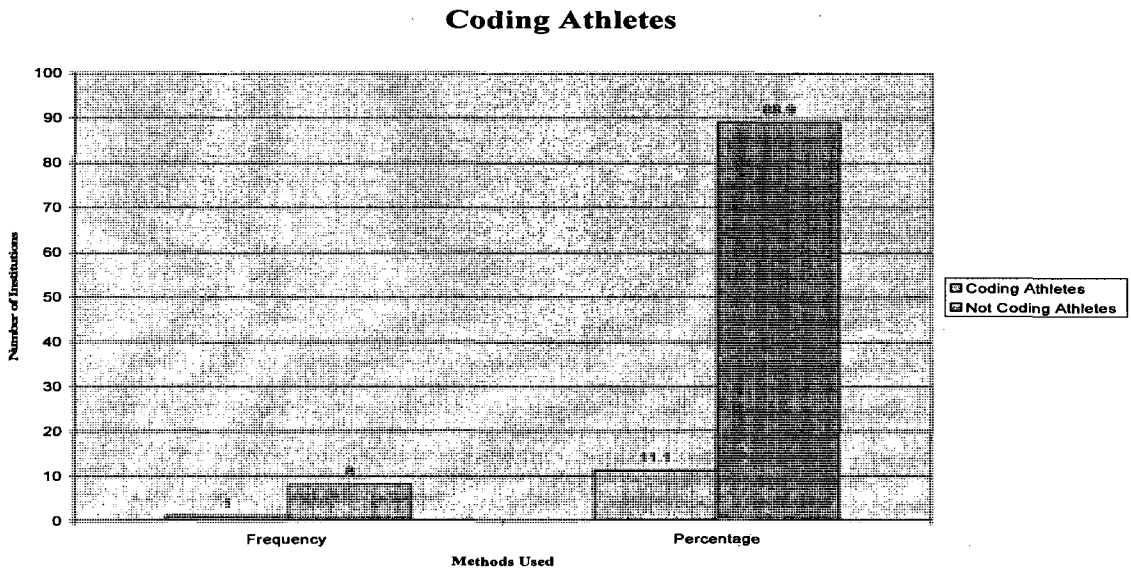

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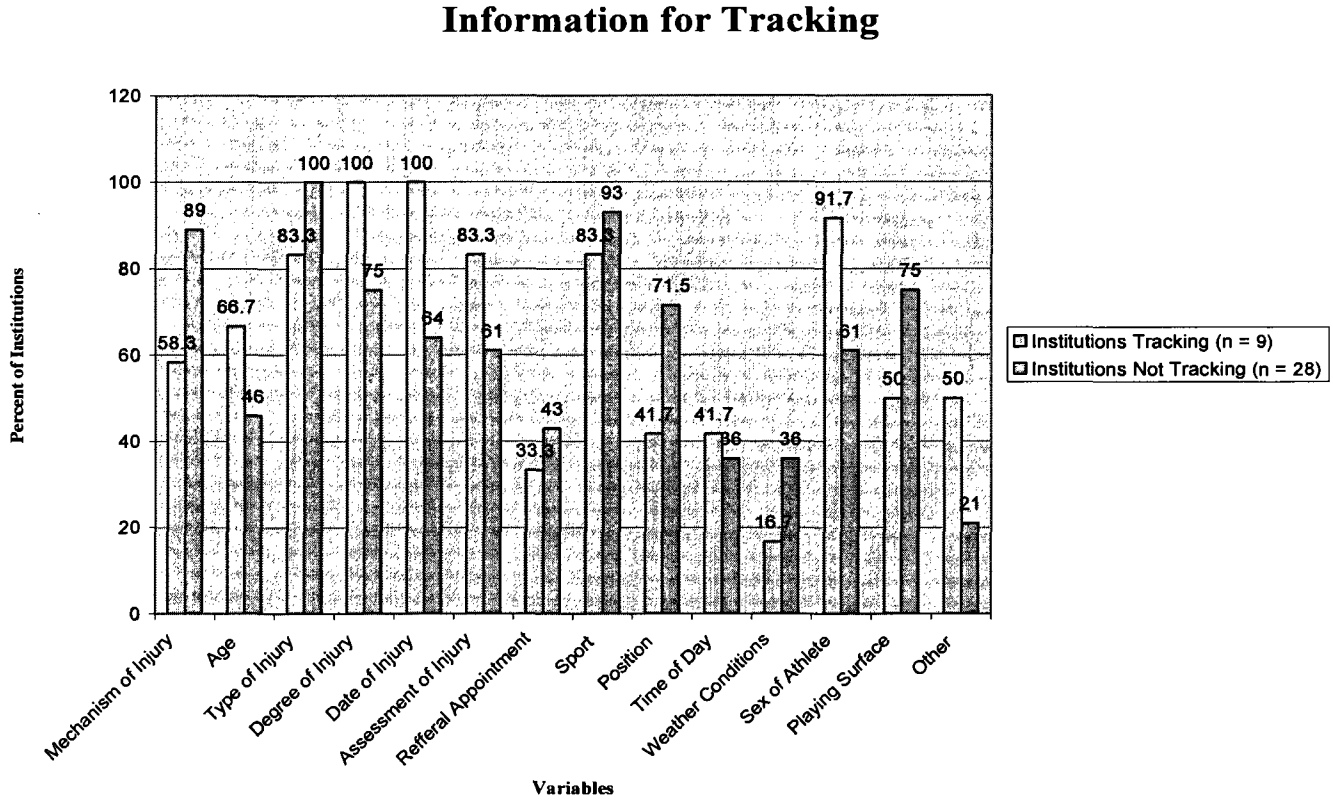
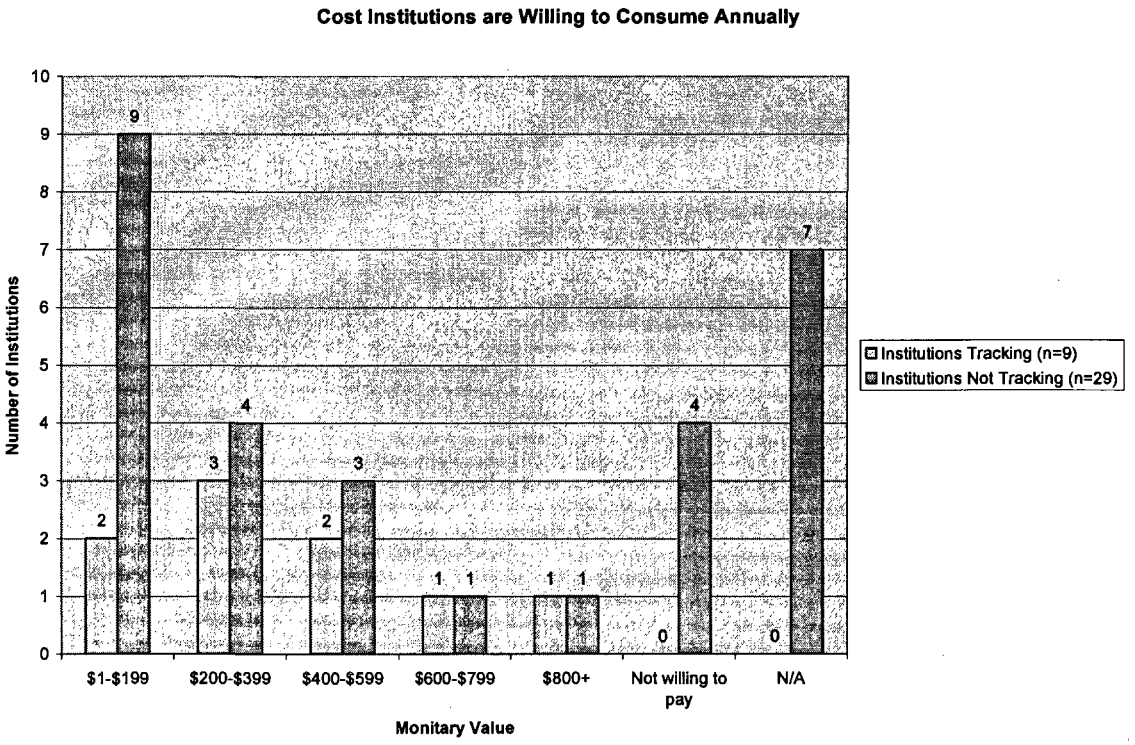


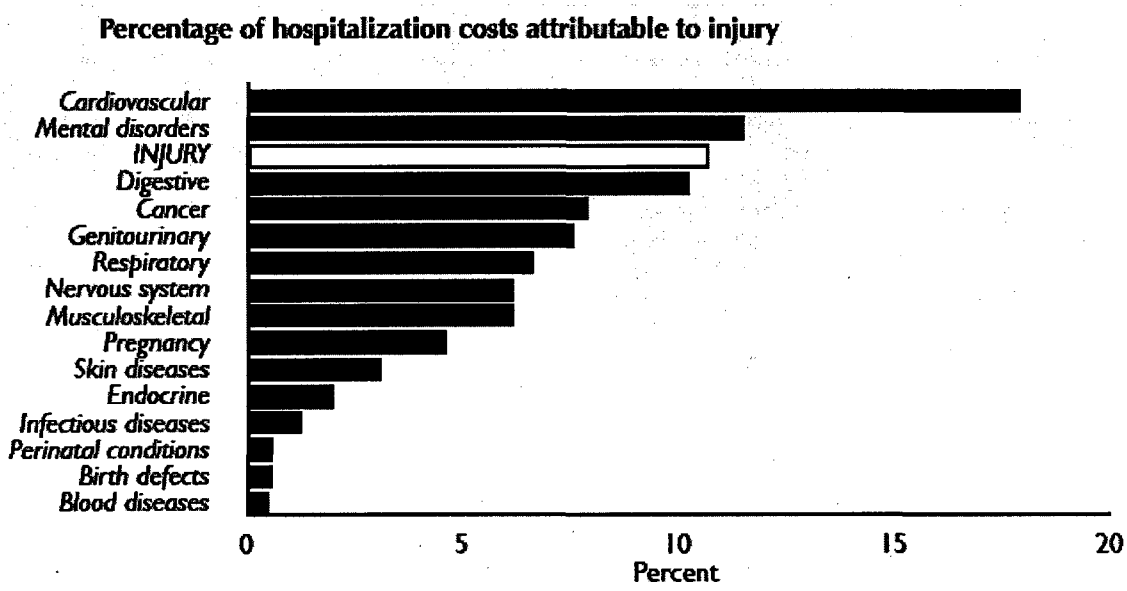
Figure 13:


Cost Institutions are Willing to Consume Annually
Number of Institutions
Monitary Value
$1-$199
$200-$399
$400-$599
$600-$799
$800+
Not willing to pay
N/A
Institutions Tracking (n=9)
Institutions Not Tracking (n=29)
2
9
3
4
2
3
1
1
1
1
0
4
0
7

Appendix A.

Appendix A.

Percentage of Canadian Hospitalization Costs Attributable to Injury

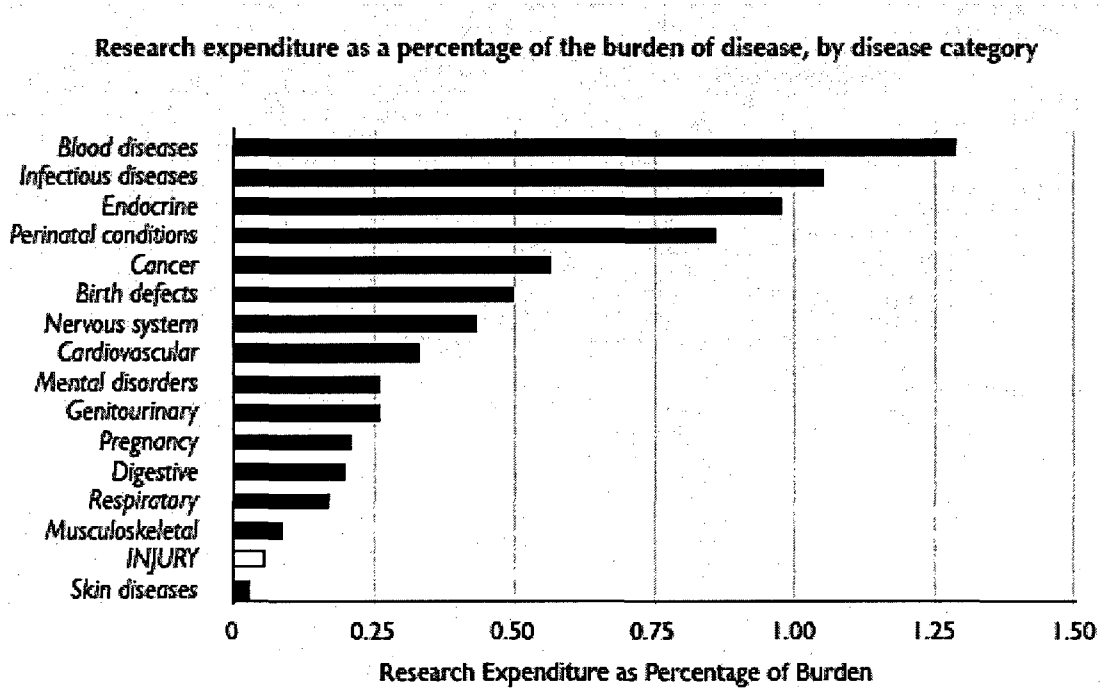


(Health Canada, 2002)

Appendix B.

Appendix B.

Research Expenditure as a Percentage of Burden of Disease



(National Scientific Advisory Committee, 2004)

Appendix C.

Appendix C.

SMDCS Region Code List

Region Code	
Body Region	**Medical "Region"**
HE = head	CV = cardiovascular
NE = neck	DE = dermatology
SH = shoulder	EN = endocrinology
AR = upper arm	EV = environmental
EL = elbow	FE = fluid + electrolyte
FA = forearm	GI = gastrointestinal
WR = wrist	GU = genitourinary
HA = hand	BL = hematologic
TR = T-spine/ribs	ID = infectious disease
LP = L-spine/pelvis	NS = nervous system
AB = abdomen	PS = psychiatric
HI = hip	RE = respiratory
TH = thigh	RM = rheumatologic + metabolic bone
KN = knee	
LE = lower leg	
AN = ankle	OO = noninjury/illness related
FO = foot	
MS = nonspecific musculoskeletal	

(Meeuwisse & Wiley, 2007)

Appendix D.

Appendix D.

SMDCS Structure Code List

Structure Code
.00.00 = medical/non-MSK
.10.00 = muscle (including tendon)
.20.00 = nerve
.30.00 = bone (.31 = vertebrae)
.40.00 = joint (including capsule + cartilage)
.50.00 = ligament
.60.00 = bursa
.70.00 = vessels
.80.00 = misc.
.90.00 = misc.

(Meeuwisse & Wiley, 2007)

Appendix E.

Appendix E.

SMDCS Type of Injury Code List

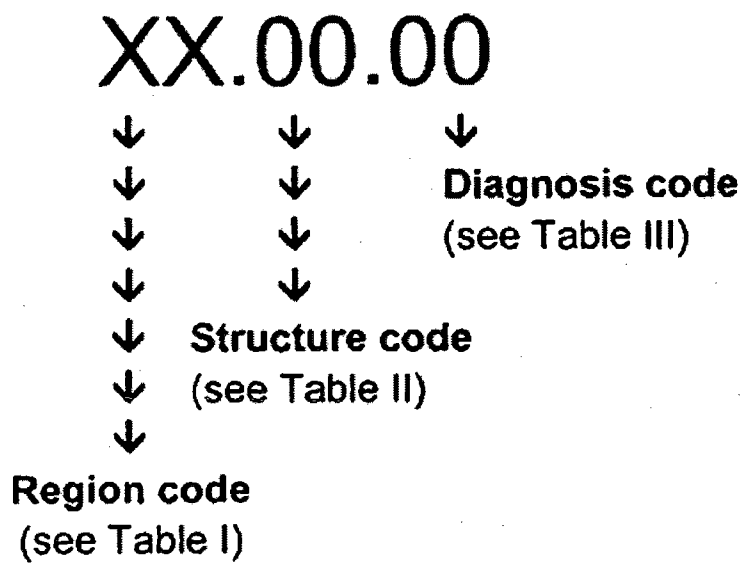
.00 Misc./Nonspecific			Inflammatory	Other
Trauma	—	—	.26 tendonitis/tendinopathy	.35 Brodie's abscess
.01 1° sprain—acute	.10 dislocation	.19 fracture-greenstick	.27 tenosynovitis	.36 exertional comp. syndrome
.02 2° sprain—acute	.11 subluxation	.20 growth plate injury	.28 synovitis	.37 exostosis
.03 3° sprain—acute	.12 instability	.21 effusion	.29 bursitis	.38 infection
.04 1° sprain—chronic	.13 fracture—acute	.22 swelling	.30 periostitis	.39 osteomyelitis
.05 2° sprain—chronic	.14 fracture—avulsion	.23 contusion	.31 inflammation	.40 osteochondritis
.06 3° sprain—chronic	.15 fracture—nonunion	.24 laceration	.32 degen./osteoarthritis	.41 reflex symp. dystrophy
.07 strain	.16 fracture + dislocation	.25 abrasion	.33 other rheumatologic condition	.42 neoplasm
.08 spasm	.17 fracture—osteochondral	—		.43 hypomobility
.09 tear/rupture	.18 stress fracture	—	.34 avascular necrosis	.44 neuroma

(Meeuwisse & Wiley, 2007)

Appendix F.

Appendix F.

SMDCS Code Layout



(Meeuwisse & Wiley, 2007)

Appendix G.

Appendix G.

OSICS Region & Type of Injury

Anatomical Site Code (Tier One)		**Pathology Code for Musculoskeletal Diagnoses (Tier Two)**	
Head	H	Non specific injury	X
Neck	N	Bruising/haematoma	H
Shoulder	S	Laceration/Abrasion	K
Upper arm	U	Whiplash	W
Elbow	E	Muscle injury	M
Forearm	R	Tendon injury	T
Wrist and hand	W	Joint sprains	J
Chest	C	Cartilage injury	C
Trunk and Abdomen	O	Joint dislocations	D
Thoracic spine	D	Chronic instability	U
Lumbar spine	L	Synovitis, impingement, bursitis	G
Pelvis and buttock	B	Fracture	F
Hip and Groin	G	Stress fracture	S
Thigh	T	Other stress/Over use injury	Y
Knee	K	Organ injury	O
Lower leg	Q	Nerve injury	N
Ankle	A	Vascular injury	V
Foot	F	Arthritis	A
Location unspecified	X	Other injury no elsewhere specified	Z
Other categories			
Medical	M		
Congenital	I		
Paediatric	J		
Disabled	V		
Post surgical	Y		
No presenting illness/injury	Z		

(Rae & Orchard, 2007)

Appendix H.

Appendix H.

Example of OSICS Injury Code

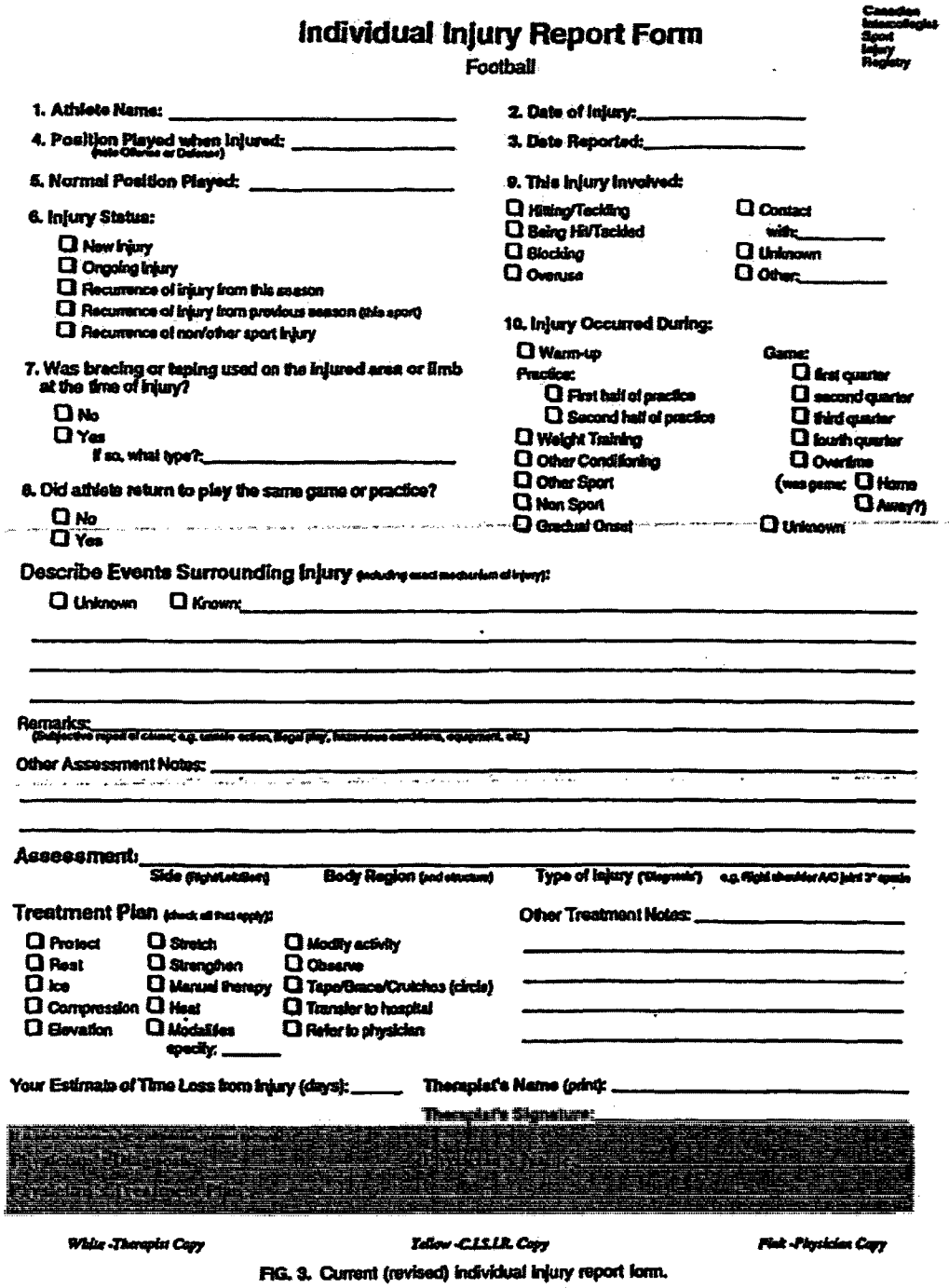
Injury Code	Injury Description	Parent Code	OSICS-10 Translation(s)
HF1	Nose fracture	HF1	HFNX
HF2	Skull fracture	HF2	HFSX
HFF	Fractured frontal bone	HF2	HFSF
HF3	Mandible fracture	HF3	HFMX or HFMC (compound)
HF4	Fractured facial bone	HF4	HFXX
HFE	Fractured orbital socket	HF4	HFEX or HFEF or HFEM or HFEZ
HFM	Fractured maxilla	HF4	HFUX
HFZ	Fractured zygoma	HF4	HFZX

(Rae & Orchard, 2007)

Appendix I.

Appendix I.

CISIR Individual Injury Report Form



Individual Injury Report Form

Football

Canadian Intercollegiate Sport Injury Registry

1. Athlete Name: _____
2. Date of Injury: _____
3. Date Reported: _____
4. Position Played when Injured: _____ (note Offense or Defense)
5. Normal Position Played: _____
6. Injury Status:
   - ☐ New Injury
   - ☐ Ongoing Injury
   - ☐ Recurrence of injury from this season
   - ☐ Recurrence of injury from previous season (this sport)
   - ☐ Recurrence of non/other sport injury
7. Was bracing or taping used on the injured area or limb at the time of injury?
   - ☐ No
   - ☐ Yes
     If so, what type?: _____
8. Did athlete return to play the same game or practice?
   - ☐ No
   - ☐ Yes
9. This Injury Involved:
   - ☐ Hitting/Tackling
   - ☐ Being Hit/Tackled
   - ☐ Blocking
   - ☐ Overuse
   - ☐ Contact with: _____
   - ☐ Unknown
   - ☐ Other: _____
10. Injury Occurred During:
    - ☐ Warm-up
    - Practice:
      - ☐ First half of practice
      - ☐ Second half of practice
    - ☐ Weight Training
    - ☐ Other Conditioning
    - ☐ Other Sport
    - ☐ Non Sport
    - ☐ Gradual Onset
    - Game:
      - ☐ first quarter
      - ☐ second quarter
      - ☐ third quarter
      - ☐ fourth quarter
      - ☐ Overtime
      - (was game: ☐ Home ☐ Away?)
    - ☐ Unknown

Describe Events Surrounding Injury (including exact mechanism of injury):

☐ Unknown ☐ Known: _____

Remarks: _____
(Subjective report of athlete; e.g. tackle action, illegal play, hazardous conditions, equipment, etc.)

Other Assessment Notes: _____

Assessment: _____
Side (Right/Left/Both) Body Region (and structure) Type of Injury (Diagnosis) e.g. Right shoulder A/C joint 3° sprain

Treatment Plan (check all that apply):

- ☐ Protect
- ☐ Rest
- ☐ Ice
- ☐ Compression
- ☐ Elevation
- ☐ Stretch
- ☐ Strengthen
- ☐ Manual therapy
- ☐ Heat
- ☐ Modalities specify: _____
- ☐ Modify activity
- ☐ Observe
- ☐ Tape/Brace/Crutches (circle)
- ☐ Transfer to hospital
- ☐ Refer to physician

Other Treatment Notes: _____

Your Estimate of Time Loss from Injury (days): _____ Therapist's Name (print): _____

Therapist's Signature: _____

White -Therapist Copy Yellow -C.I.S.I.R. Copy Pink -Physician Copy

FIG. 3. Current (revised) individual injury report form.

(Meeuwisse & Love, 1998)

Appendix J.

Appendix J.

CISIR Weekly Exposure Sheet

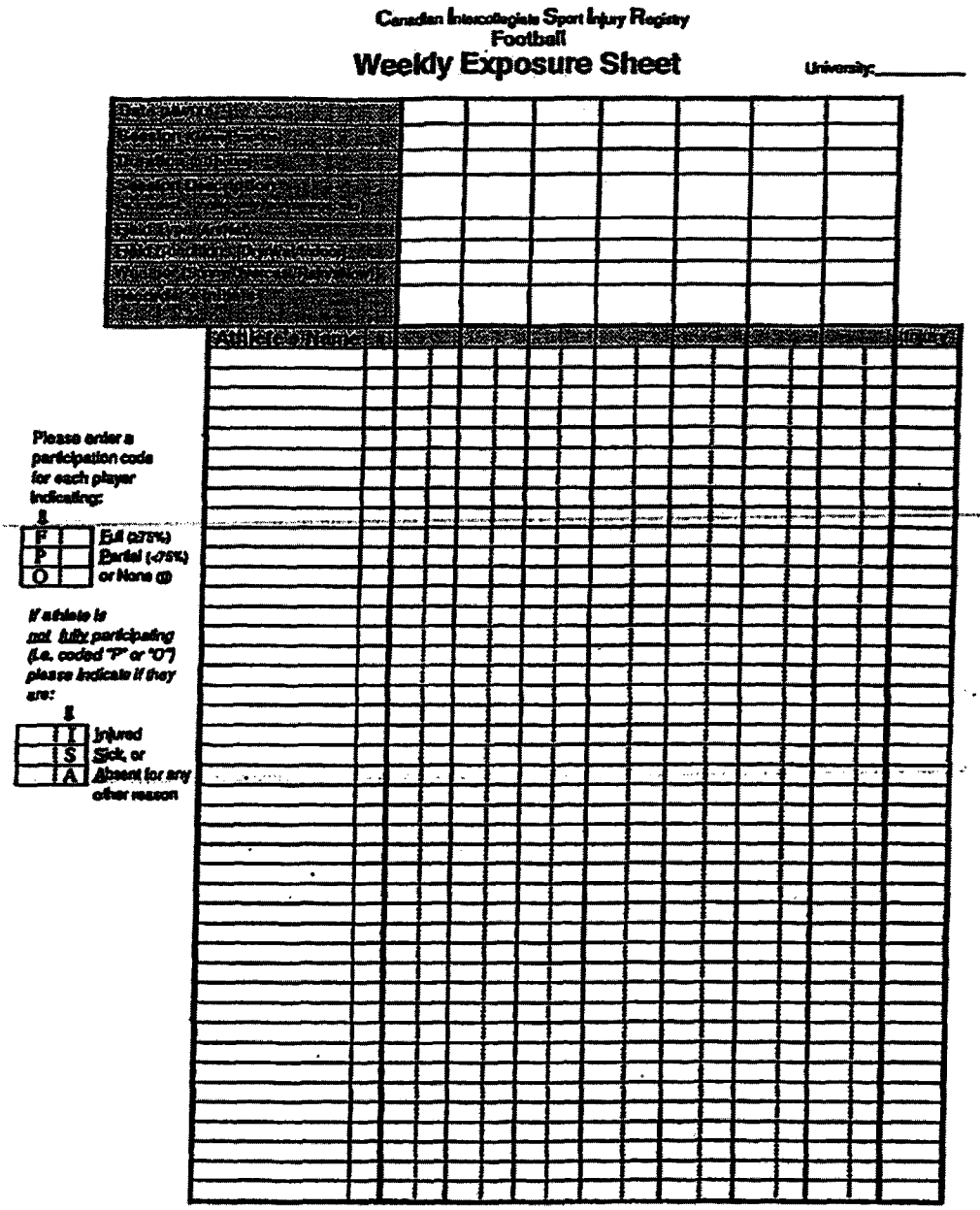


FIG. 2. Current (revised) weekly exposure sheet for documentation of daily individual athlete participation.

(Meeuwisse & Love, 1998)

Appendix K.

Appendix K.

2007/2008 WLU Individual Injury Report Card

CODE#_____

INJURY TRACKING CARD

Date of Injury: _____

Student Therapist's Name: _____

Name of Athlete: _____

Sport/Team: _____

Time of Injury (if known/estimate): _____

Type of Injury: _____

Site of Injury: _____

Location (please check one only):
Home ☐ Field/Court _____
Away ☐ School/Field _____

Time in Season (please check one only):
Training Camp ☐ Pre-Season ☐ Reg. Season ☐
Post Season ☐ Playoffs ☐

Setting (check one only) Game ☐ Practice ☐
Situation (if relevant) Non-contact ☐ Contact ☐

Mechanism of Injury: _____
_____
_____

History: _____
_____

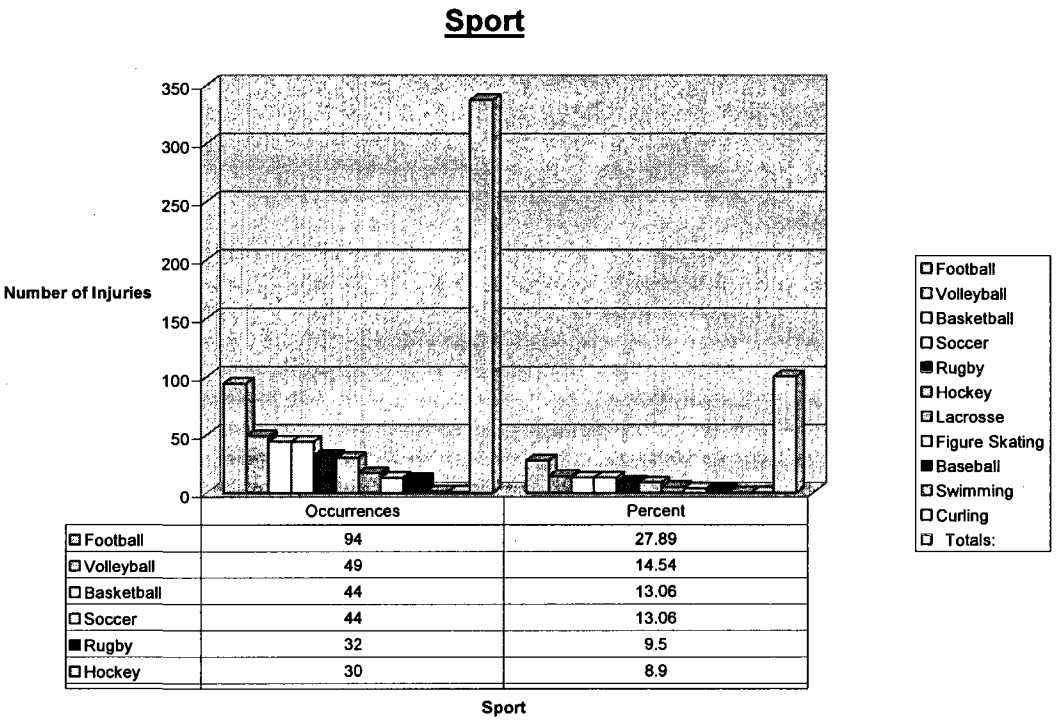
Notes:

(Tracey, 2008)

Appendix L.

Appendix L.

WLU Injury Occurrence by Sport



	Occurrences	Percent
Football	94	27.89
Volleyball	49	14.54
Basketball	44	13.06
Soccer	44	13.06
Rugby	32	9.5
Hockey	30	8.9

(Ross, 2008)

Appendix M.

Appendix M.

2008/2009 WLU Individual Injury Report Card

WLU Individual Injury Report Form

Athlete Name:_____
Date of Injury: ___/___/___
Time of Injury ___ ()a.m ()p.m
Location: _____
Sport _____
Sex: ()Male ()Female

Location (check one only)
() Home () Away

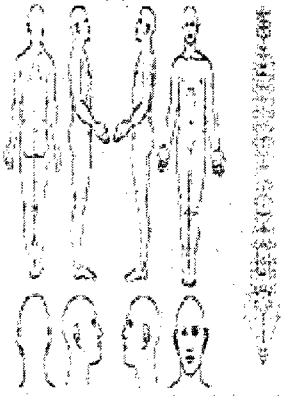
Setting (check one only)
() Game () Practice

The injured person is a:
() Roster player
() Practice player
() Coach
() Other _____

Type of activity
() Training () Warm-up
() Competition () Cool-down
() Other _____

Reason for completion:
() New Injury
() Aggravated injury
() Recurrent Injury
() Illness
() Other _____

Body Region Injured
Circle the body part injured



Site of injury (body part/s)
_____
_____

Nature of injury
() Abrasion/Graze
() Strain (e.g. muscle tare)
() Sprain (e.g. ligament tare)
() Laceration/Open wound
() Contusion/Bruise
() Inflammation/Swelling
() Fracture (inc. suspected)
() Dislocation/Subluxation
() Overuse injury
() Blisters
() Concussion
() Cardiac problem/Chest pains
() Respiratory problem
() Loss of consciousness
() Unknown medical condition
() Other _____

Provisional diagnosis _____
_____
_____

The injury was a result of:
() Contact
() Non-contact

Cause of injury
() Struck by other player
() Struck by ball or object
() Collision with player/referee
() Collision with fixed object
() Fall/Stumble on level ground
() Fall from height
() Jumping
() Awkward landing
() Overexertion (muscle tear)
() Overuse
() Slip/Trip
() Temperature related
() Other _____

Explain how the incident Occurred: _____
_____
_____
_____
_____
_____

Were there any contributing factors to the incident? (E.g. unsuitable footwear, equipment, foul play, past injury)
_____
_____

Protective equipment
Was protective equipment Being used on the injured area
() yes () no
If yes, what type (e.g. Taping, Mouth guard, ankle brace):
_____

Playing Surface
() Field turf () Astro turf
() Grass () Wood court
() Ice () Ashfault
() Other _____

Time in Season
() Training Camp () Pre-Season
() Regular Season () Post Season
() Playoffs

Treatment
Initial Treatment
() None given (not required)
() Sling/splint () Dressing
() Ice () Crutches
() Taping () Stretch
() Other _____

Advice given
() Immediate return
() Able to return w/ restriction
() Unable to return
() Other

Referral
() No referral
() Athletic/physiotherapist
() Emergency room/hospital

Provisional severity assessment
() Mild (1-7 days limitation)
() Moderate (8-21 days)
() Severe (22+ days)

Treating person
Title _____
Name _____
Signature

(Tracey & Ross, 2008)

Appendix N.

Appendix N.

2009/2010 WLU Individual Injury Report Card

Athlete Name:_____
Date of Injury: ____/____/____
Time of Injury:____ ( ) am ( ) pm
Location: _____
Sport:_____
Position:_____
Sex : ( ) Male ( ) Female

Location (check one only)
( ) Home ( ) Away

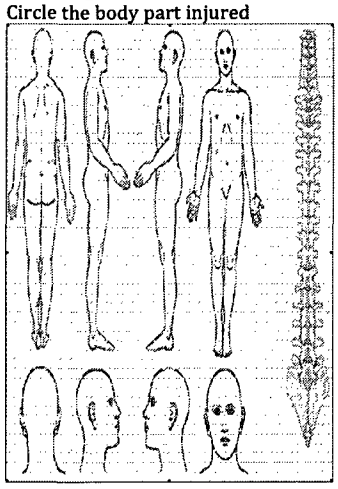
Setting (check one only)
( ) Game ( ) Practice
( ) Non-Sport Related ( ) Conditioning
( ) Weight room ( ) Scrimmage

The injured person is a:
( ) Roster player
( ) Practice player
( ) Coach
( ) Other _____

Period of Injury
( ) 1st ( ) 2nd ( ) 3rd ( ) 4th
( ) N/A

Reason for completion
( ) New Injury
( ) Aggravated injury
( ) Recurrent injury
( ) Illness
( ) Other _____

Body Region Injured
Circle the body part injured



Site of Injury (body part/s
_____
_____

Nature of Injury
( ) Abrasion/Laceration
( ) Strain (e.g. muscle tear)
( ) Sprain (e.g. ligament tear)
( ) Contusion/ Bruise
( ) Fracture (Inc. suspected)
( ) Dislocation/Subluxation
( ) Muscle cramping/ Spasm
( ) Blisters
( ) Concussion
( ) Respiratory problem
( ) Unknown medical condition
( ) Other _____

Suspected Condition: _____
_____
_____
_____

Degree of Injury
( ) Mild ( ) Moderate ( ) Severe

The Injury was a result of:
( ) Contact
( ) Non-contact

Mechanism of Injury:_____
_____
_____
_____
_____
_____
_____

Explain how the incident occurred: _____
_____
_____
_____
_____
_____
_____

Were there any contributing factors to the incident?
(E.g. unsuitable footwear, equipment, foul play):
_____
_____

Protective Equipment
Was protective equipment Being used on the injured area?
( ) Yes ( ) No
If yes, what type (e.g. Taping, Mouth guard, ankle brace):
_____

Playing Surface
( ) Field turf ( ) Gravel/Sand
( ) Grass ( ) Wood court
( ) Ice ( ) Track (rubber)
( ) Other _____

Time in Season
( ) Training Camp ( ) Pre-Season
( ) Regular Season ( ) Off-Season
( ) Playoffs

Treatment
Initial Treatment
( ) None given (not required)
( ) Sling/splint ( ) Ice
( ) Crutches ( ) Taping
( ) Tensor Wrap ( ) Stretch
( ) Other _____

Advice Given
( ) Immediate return
( ) Able to return w/restriction
( ) Unable to return
( ) Other _____

Referral
( ) No referral
( ) Athletic/physiotherapist
( ) Emergency room/hospital
( ) Sports Medicine Doctor

Treating person
Title _____
Name _____
Signature _____

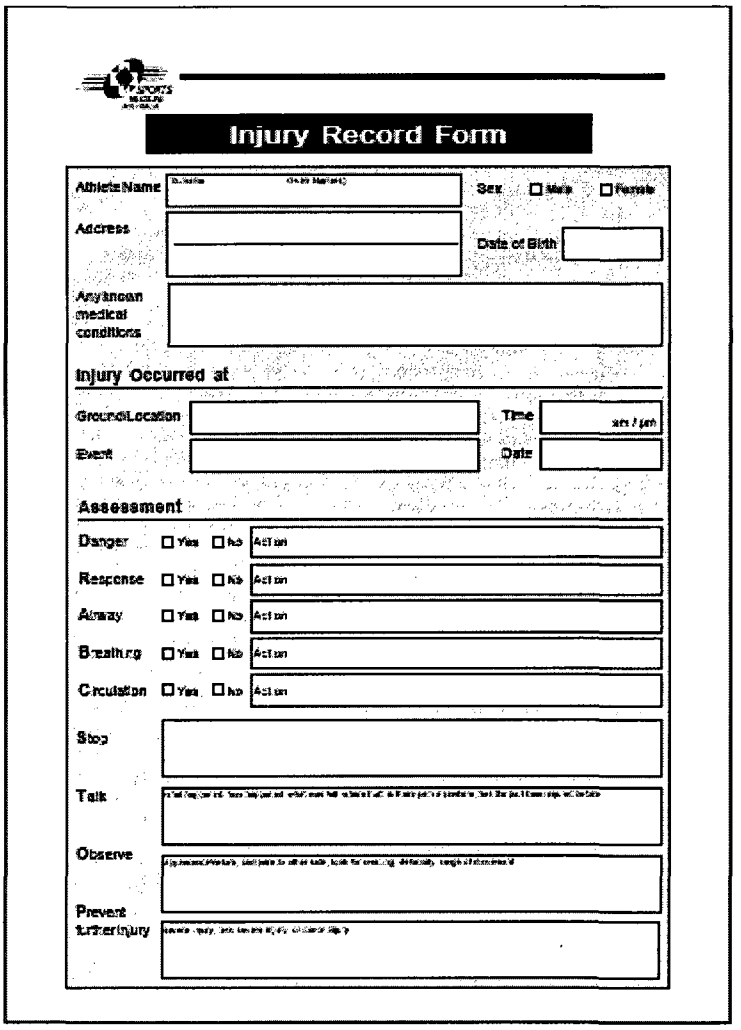
Notes:_____
_____
_____
_____
_____
_____
_____
_____
_____

(Ross & Tracey, 2009)

Appendix O.

Appendix O.

SMA Injury Tracker Injury Record Form



Injury Record Form

Athlete Name | Sex ☐ Male ☐ Female

Address | Date of Birth

Any known medical conditions

Injury Occurred at

Ground/Location | Time

Event | Date

Assessment

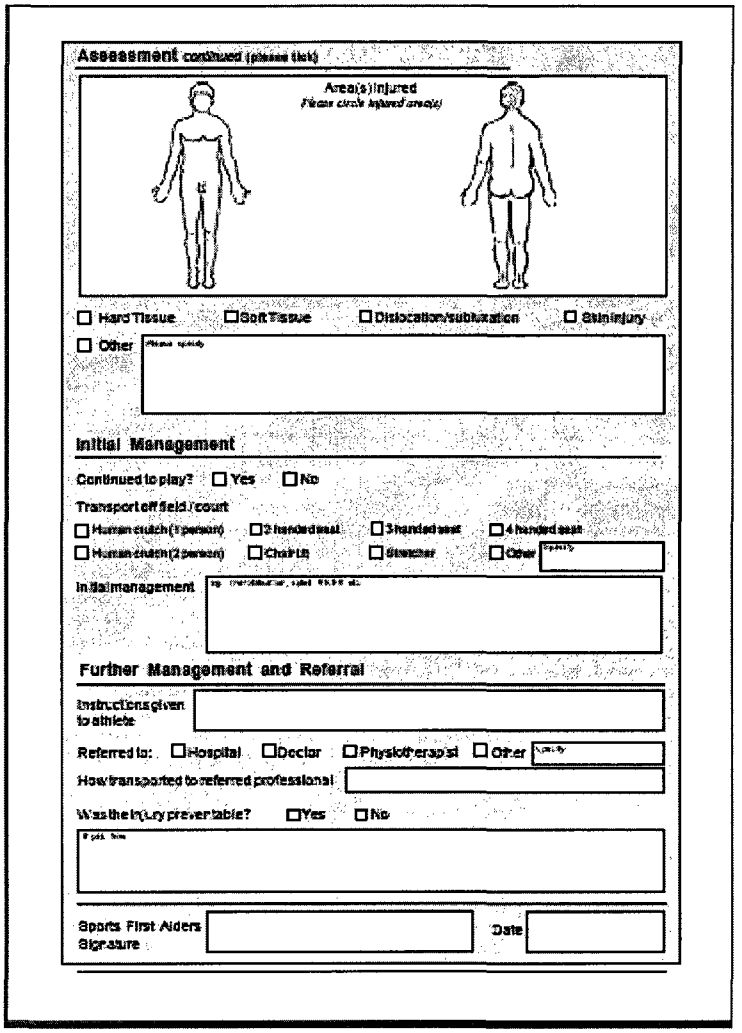
Danger	☐ Yes	☐ No	Action
Response	☐ Yes	☐ No	Action
Airway	☐ Yes	☐ No	Action
Breathing	☐ Yes	☐ No	Action
Circulation	☐ Yes	☐ No	Action

Stop

Talk

Observe

Prevent further injury


Assessment continued (please tick)
Area(s) injured
Hard Tissue
Soft Tissue
Dislocation/subluxation
Skin injury
Other
Initial Management
Continued to play?
Yes
No
Transport off field / court
Other
Initial management
Further Management and Referral
Instructions given to athlete
Referred to:
Hospital
Doctor
Other
How transported to referred professional
Was the injury preventable?
Yes
No
Sports First Aiders Signature
Date

(SMA, 2008)

Appendix P.

Appendix P.

School Sport Data Form

SPORTS MEDICINE AUSTRALIA

INJURY REPORTING FORM

www.smaevt.org
www.injurytracker.com.au

Name of patient/jersey No: _____ Age _____ Sex: Male ☐ Female ☐

Date of Injury: ___/___/___ Time ___:___am/pm Is the injured person : Player / Referee / Coach / Spectator

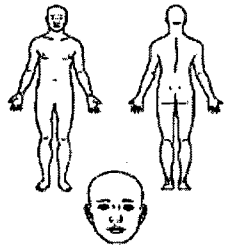
Patient Address: (only if ambulance called) _____ Patient Phone Number: _____

Club: PINE RIVERS PUMAS RUC Team Name: Under_____ Colour: _____ Venue: PINE RIVERS

Type of activity at time of injury
- ☐ training
- ☐ warm-up
- ☐ competition
- ☐ cool-down
- ☐ other

Reason for Presentation
- ☐ new injury
- ☐ exacerbated/aggravated injury
- ☐ recurrent injury
- ☐ illness
- ☐ other

Body Region Injured
Tick , colour or circle body part/s injured & name them below



Body part/s

_____
_____
_____
_____
_____

Nature of injury/illness
- ☐ abrasion/graze
- ☐ sprain eg ligament tear
- ☐ strain eg muscle tear
- ☐ open wound/laceration/cut
- ☐ bruise/contusion
- ☐ inflammation/swelling
- ☐ fracture (including suspected)
- ☐ dislocation/subluxation
- ☐ overuse injury to muscle or tendon
- ☐ blisters
- ☐ concussion
- ☐ cardiac problem
- ☐ respiratory problem
- ☐ loss of consciousness
- ☐ unspecified medical condition
- ☐ other _____

Provisional diagnosis/es

_____

CAUSE OF INJURY

Mechanism of Injury
- ☐ struck by other player
- ☐ struck by ball or object
- ☐ collision with other player/referee
- ☐ collision with fixed object
- ☐ fall/stumble on same level
- ☐ jumping to shoot or defend
- ☐ fall from height/awkward landing
- ☐ overexertion (eg muscle tear)
- ☐ overuse
- ☐ slip/trip
- ☐ temperature related eg heat stress
- ☐ other_____

Explain exactly how the incident occurred

_____
_____
_____

_____
_____
_____

Were there any contributing factors to the incident, unsuitable footwear, playing surface, equipment, foul play?

_____
_____

Protective Equipment
Was protective equipment worn on the injured body part?
- ☐ Yes
- ☐ No

If yes, what type? eg mouthguard, ankle brace, taping.

_____

Initial Treatment
- ☐ none given (not required)
- ☐ RICER
- ☐ sling, splint
- ☐ CPR
- ☐ dressing
- ☐ crutches
- ☐ stretch/exercise
- ☐ taping only
- ☐ none given - referred elsewhere
- ☐ other _____

Advice Given
- ☐ immediate return, unrestricted activity
- ☐ able to return with restriction
- ☐ unable to return at present time

Referral
- ☐ no referral
- ☐ medical practitioner
- ☐ physiotherapist
- ☐ ambulance transport
- ☐ hospital
- ☐ other_____

Provisional severity assessment
- ☐ mild (1-7 days modified activity)
- ☐ moderate (8-21 days modified activity)
- ☐ severe (>21 days modified or lost)

Treating person
- ☐ medical practitioner
- ☐ sports trainer
- ☐ other _____

Information to be conveyed to patient:
(please tick to indicate information conveyed)

- ☐ ***The patient knows that a copy of this injury record will be kept for insurance purposes. The patient knows that the injury information (not including the patients name, address or phone number) will be entered into the online SMA Sports Injury Tracker Tool. Data in the Sports Injury Tracker is used for statistical analysis of injuries that have occurred. This informs and creates a safer sporting environment for future events. The patient has been advised that they are anonymous in this process.***

The patient has agreed to have their information entered into the Sports Injury Tracker
- ☐ Yes
- ☐ No

Trainers Name

_____

Sports Trainer ID

_____

Today's Date: ___/___/___

(SMA, 2008)

Appendix Q.

Appendix Q.

Pitfalls of Injury Tracking

Item	Premise	Pitfalls
1. Paucity of available data	That available sport injury data are insufficient, obsolete or uninterpretable	Past attempts were episodic, returning poor information, and making unreasonable demands on the time of recorders or being too costly to continue
2. Versatile uniformity	That uniform criteria must be applied to make the data comparable between centres, teams, sports, years, and factors of influence. But, must also be customisable at the local level to meet needs	Lack of prior success has likely bred apathy toward systems, with a potential reluctance to conform to a uniform system
3. Inexpensive for continuous use	That it must be financially sustainable because of need for ongoing revision and high start-up costs	Commitment to long term use requires a 'faith' that is not initially justified because of the lack of immediate reward
4. Continuous input	That reliance on end-of-season recall does not satisfy epidemiological research standards	Periodic transmission of data will require incentive, reorganisation, recommitment of priorities to assure good information flow and incentive for continued compliance
5. Continuous output	That the system should be responsive to both routine and ad-hoc inquiries which attend to confidentiality and cost	Periodic reporting requires automation and standardisation
6. Feasible and meaningful recording expectations	That one must balance the amount of information collected between what is feasible for the trainer in terms of work load, and detail of information	Given the detail sought, the capability of the system may be out of line with the surveillance capability
7. In-depth investigations enhanced	That a national uniform standard should enhance in-depth study by qualified investigators	If investigators do not wish to work within the constraints of NAIRS criteria or definitions, they may find it to be more of a competitor than a resource
8. Confidentiality	That policies must be drawn to govern access to the system's data	Some investigators may want access to the data without justification and government or legal bodies could subpoena the data
9. Medical diagnosis	That the ability to provide accurate diagnoses varies across institution since there is not a standard level of training among those collecting the data	
10. Degree of severity	That patterns of minor injury differ from patterns of major injury. System should screen out 'nuisance' injuries, but also include some non-time-loss trauma as well. Distinction should be based on severity and time loss	Severity depends on the demands of the specific sport. An injury with the same diagnosis could have no effect on one athlete, yet be disabling for another
11. Interdisciplinary control	That an advisory council must share overall policy concerns and a national office must provide continuity and direction	There must be some flexibility to allow for innovation

(Clarke,1975).

Appendix R.

Appendix R.

Canadian University Injury Tracking Survey

Survey Questions

SECTION A

1. Demographic Data
   - Name _____
   - Institution _____
   - City _____
   - Province _____
   - Phone Number _____

2. How many years have you been at your institution?

3. What is your job title at your institution?

4. How many full time therapists do you have at your institution?

5. How many student-athletes does your clinic treat (on average) per day? (e.g. 10-15)

6. Do you have a multi-venue clinic? If so how many?
   - Yes _____
   - No

7. What is the basic size of your clinic/clinics?(square feet)
   - Clinic 1 _____
   - Clinic 2 _____
   - Clinic 3 _____

8. Does your clinic currently operate in coordination with health services or a hospital?
   - Yes
   - No

9. Does billing occur within your clinic? If yes please explain.
   - Yes _____
   - No

10. Are you currently using an injury tracking system within your institution?
    - Yes
    - No

SECTION B

11. What software program or method are you currently using to track injuries?

12. Have you used any programs prior to the program currently in use? If so which one/s?
- Yes _____
- No

13. How many years has your institution been operating an injury tracking system?
First year
1-2
3-4
5-10
11+

14. How did you purchase your injury tracking program?
- Purchased and pay an annual fee
- Pay an annual fee
- One time purchase cost
- Designed own tracking program
- Did not purchase program
- Other (please specify

15. What are you currently paying for your program?
- One time fee
- Monthly
- Annually
- No payment

16. Who records the data into your injury tracking system? (Check all that apply)
- Student trainer
- Receptionist
- Athletic therapist/Physiotherapist
- Other

17. Do you use one computer for logging data or do you network with multiple computers?
- One computer
- Multiple computer network

18. What type of information do you currently log into your injury tracking system? (Check all that apply)
- Mechanism of injury
- Age
- Type of injury
- Degree of injury
- Date of injury
- Date of input
- Assessment of injury
- Referral appointments
- Sport
- Position
- Time of day
- Weather conditions
- Sex
- Playing surface
- Other (please specify) _____

19. What do you use your data for? (Check all that apply)
- Research
- Billing
- Rehabilitation progression
- Trend analysis among injuries
- Other (please specify) _____

20. How often are you logging information into your system?
- Daily
- Weekly
- Monthly
- End of season
- Other (please specify) _____

21. What clientele are you inputting into your injury tracking records? (Check all that apply)
- Student-athletes (varsity)
- Student-athletes (recreational/intramural)
- Student non-athletes
- Staff
- Community
- Other (please specify)
-

22. Do you currently collect participation rates of athletes? (Exposure to practice or competition)
- Yes-Games

- Yes-Practice
- Yes-Practice and games
- No-We do not track participation rates

23. Are you currently using an injury coding system for inputting injuries? (e.g. OSICS-10 coding system: Partial ACL tear-"KJAP")
- Yes _____
- No

24. Are you currently using a coding system to maintain athletes confidentiality? (e.g. Individual athlete code: John Smith- athlete #452)
- Yes _____
- No

25. How do you maintain consistent operational definitions for your submissions of data?

26. As a therapist, why are you choosing to keep track of athletic injuries? (Please explain)

27. If your institution uses an injury tracking system for anything other then tracking injuries, what features does it use? (Check all that apply)
- Billing
- Medical profiles
- Insurance claims
- Market research
- N/A
- Other _____

28. If there was a national web based injury tracking program available at a reasonable cost, would your institution be interested in this type of program?
- No
- Yes
- Conditionally (Please explain) _____

29. If you agree what would your institution be willing to pay for this program?
- $1-$199 annually
- $200-$399 annually
- $400-$599 annually
- $600-$799 annually
- $800 + annually
- I would not pay for this program

30. Describe the protocol for tracking injuries at your institution.

31. Describe any difficulties you may have had while evolving your injury tracking system into your institution.

32. Do you recognize any barriers to injury tracking at your institution? (If yes, please explain)
- Yes _____
- No

33. Do you have any recommendations for improved sports injury data collection or storage?
- Yes _____
- No

34. Do you agree to the use of quotations regarding your answers, provided you and your institution are not identified within the quotations?
- Yes
- No
- Other

35. Are you satisfied with your answers within the survey?
- Yes (finish survey)
- No (return to beginning of survey)

SECTION C

36. Would you be interested in performing injury tracking at your institution in the future?
- Yes
- No

37. If there was a national web based injury tracking program available at a reasonable cost, would your institution be interested in this type of program?
- Yes
- No
- Conditionally (Please explain) _____

38. If you agree, what would your institution be willing to pay for this program?
- $1-$199 annually
- $200-$399 annually
- $400-$599 annually
- $600-$799 annually
- $800 + annually
- I would not pay for this program

39. Why is your institution not performing injury tracking (check all that apply)
- Cost
- Time constraints
- Understaffed
- Have not been introduced to injury tracking
- Other (please specify) _____

40. As a therapist, why are you not currently tracking injuries? (Please explain)

41. Who would be responsible for performing injury tracking at your institution?(check all that apply)
- Student trainer
- Receptionist
- Athletic therapist/Physiotherapist
- Other (please specify) _____

42. What type of information would you be interested in obtaining in regards to your student-athletes? (Check all that apply)
- Mechanism of injury
- Age
- Type of injury
- Degree of injury
- Date of injury
- Date of input
- Assessment of injury
- Referral appointments
- Sport
- Position
- Time of day
- Weather conditions
- Sex
- Playing surface
- Other (please specify) _____

43. How are you currently organizing your student athlete files?
- Data bank
- Injury logs
- Filing system
- Other (please specify) _____

44. Do you recognize any barriers to injury tracking?
- Yes (Please explain) _____
- No

45. Describe any potential benefits from sharing injury information across Canadian universities
46. Describe the potential challenges of creating a shared database of injury tracking across Canadian universities.

47. Do you agree to the use of quotations regarding your answers, provided you and your institution are not identified within the quotations?
- Yes
- No
- Conditionally (please explain) _____--_

48. Are you satisfied with your answers within the survey?
- Yes (finish survey)
- No (return to beginning of survey)

Appendix S.

Appendix S.

Therapist E-mail

Research Study:
An Examination of Canadian Intercollegiate Athletic Injury Tracking Systems

You are invited to participate in a research study conducted by Andrew Ross from Wilfrid Laurier University. Andrew is an MSc candidate in the Department of Kinesiology & Physical Education at WLU. This project is being coordinated with his advisor Dr. Jill Tracey, an assistant professor in the Kinesiology & Physical Education Department at WLU. The purpose of this study is to examine the current injury tracking practices within the CIS. We are interested in gaining data on the current trends among injury tracking systems across Canadian universities. An additional goal of this research is to eventually create a shared database to evolve Canadian injury tracking systems to be consistent with current trends of the NCAA, Injury Surveillance System (ISS), as well as implementing some of the recommendations from the NCAA study that are feasible within a Canadian context.

We feel that this study requires attention because there is currently no formalized structure in place to track injuries within Canadian universities. Injury tracking can provide vital information to intercollegiate athletic programs, athletic therapists, and physiotherapists across Canada. A comprehensive data collection can assist us to promote reliable health care, the development of prevention strategies, information sharing, and will assist us in obtaining data on the programs and policies in operation across Canadian universities. This data can assist those working with student-athletes with respect to treatment and injury management, as well as those who are responsible for providing appropriate resources to utilize the data in order to form the foundation for injury management, risk management, rules and policy changes, resource allocation, and decision making.

We are approaching all current athletic/physical therapists for all 52 Canadian universities who are members of the CIS.

*** THE LINK TO THE SURVEY IS AT THE END OF THIS LETTER.

INFORMATION

The survey will take approximately 10-20 minutes to complete.

If you volunteer to participate in this study, I would ask you to do the following:

- Provide information regarding the current status of your institutions injury tracking system.
- Complete the survey in full.

- The information being gathered is based on the following:

Software program or methodology for collecting injury information, history of injury tracking within your institution, information regarding your clinic and protocol for injury tracking within your institution.

RISKS

There are no foreseeable risks or discomforts associated with this study.

BENEFITS

A comprehensive data collection can assist us to promote reliable health care, share good practice, promote the development of prevention strategies, to collect data in a wider variety of sport institutions and to gain data on prevalence, usage and history of injury tracking which all impact resource allocation, inform risk management practices, and enhance student-athlete well-being. This phase of the study will help us to assess the current status of injury tracking systems in Canada and to identify methodology, protocol, barriers, issues, and benefits about injury tracking.

CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential. SurveyMonkey employs multiple layers of security (TRUSTe, Verisign, McAfee and BBonline) to ensure that your responses and data received remains private and secure. Only Andrew Ross and his advisor Dr. Jill Tracey will have access to the information in the database. A password protected database will ensure confidentiality and your name or institution will not be published. Only information provided will be presented in publications and conference presentations, but any data presented or published will not contain any information that would allow you to be identified. The information gathered will be kept indefinitely as we are planning to build on this data in subsequent years in order to generate a comprehensive longitudinal injury tracking database.

COMPENSATION

You will not be paid for completing the survey.

CONTACT

If you have questions at any time about the study or the procedures, (or you experience adverse effects as a result of participating in this study) you may contact the researcher, Andrew Ross at Wilfrid Laurier University, Department of Kinesiology & Physical Education, 519-500-7559, ross8260@wlu.ca or Dr. Jill Tracey, at Wilfrid Laurier University, Department of Kinesiology & Physical Education, 519-884-0710 x4216, jtracey@wlu.ca. If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Dr. Bill Marr, Chair, University Research Ethics Board, Wilfrid Laurier University, (519) 884-0710, extension 2468.

PARTICIPATION

Your participation in this study is voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the study at any time without penalty and without loss of benefits to which you are otherwise entitled. If you withdraw from the study before data collection is completed your data will be returned to you or destroyed. You have the right to omit any question(s)/procedure(s) you choose.

FEEDBACK AND PUBLICATION

The results of the study will be used for publication in academic journals and conference presentations. I will meet with Dr. Jill Tracey and Athletic Director at Wilfrid Laurier University, Peter Baxter, to provide a summary of the findings. We will provide a summary of our findings to you at the conclusion of the study.

*If there are any therapists at your institution that did not receive this e-mail, we would appreciate it could you please forward a copy of this e-mail to them.
All current therapists are encouraged to complete a survey individually as some of the questions are based on opinions.

Please click on the link below OR copy and paste into your web browser:

https://www.surveymonkey.com/s.aspx?sm=5s6olPb9YpR7cVfWzKXUqw_3d_3d

This is also a direct link:

Click Here to take survey

We sincerely thank you,

Jen Childs	Andrew Ross	Dr. Jill Tracey
Certified Athletic Therapist	MSc. Candidate	Assistant Professor
Wilfrid Laurier University	Kinesiology & Physical Education	Kinesiology & Physical Education
jchilds@wlu.ca	Wilfrid Laurier University	Wilfrid Laurier University
519-884-0710 x2178	ross8260@wlu.ca	jtracey@wlu.ca
	519-500-7559	519-884-0710 x4216

Appendix T.

Appendix T.

Benefit to Cost Ratios for Key Injury Prevention Investments

Estimated benefit-cost ratios for key injury prevention investments

Investment	*Benefit-Cost Ratio (U.S.$)*
Painting Traffic Lines on Roads[37]	61:1
Installing Rumble Strips on Roads[38]	60:1
Seatbelts (Front Seats)[37]	49:1
Harlem Hospital Injury Prevention Program[37]	63:1
Smoke Detectors[37]	15:1
Comprehensive Community-Based Fall Prevention for High Risk Seniors[37]	7:1
Provisional (e.g. Graduated) Licensing[37]	7.3:1
Big Brother/Big Sister Mentoring for Violence Prevention[37]	5.8:1
Intensive Sobriety Checkpoint Campaign[37]	3.2:1

(SMARTRISK, 2005)

Appendix U.

Appendix U.

Potential Sources of Funding in Canada

Atlantic Network for Injury Prevention
www.anip.ca

Alberta Health and Wellness
www.health.gov.ab.ca

Alberta Centre for Injury Control and Research
www.med.ualberta.ca/acicr

British Columbia Injury Research and Prevention Unit
www.injuryresearch.bc.ca

Canadian Agricultural Safety Association
www.casa-acsa.ca

Canadian Agricultural Surveillance program
www.meds.queensu.ca/-emresrch/caisp

Canadian Centre for Occupational Health and Safety
www.ccohs.ca

Canadian Health Network
www.canadian-health-network.ca

Canadian Injury Prevention and Control Curriculum
www.canadianinjurycurriculum.ca

Canadian Public Health Association
www.cpha.ca

Canadian Red Cross
www.redcross.ca

Canadian Injury Research Network
www.cirnet.ca

Canadian Institutes of Health Research
www.cihr-irsc.gc.ca/index.html

Canadian Institutes for Health Information
www.cihr-irsc.gc.ca

Canada Safety Council
www.safety-council.org

Centre for Surveillance Coordination Public Health Agency of Canada
www.phac.aspc.gc.ca/csc-ccs/

Health Canada
www.hc-sc.gc.ca

Injury Prevention Web
www.injuryprevention.org

Insurance Bureau of Canada
www.ibc.ca

Lifesaving Society
www.lifesaving.ca

National Centre for Injury Prevention and Control
www.cdc.gov/ncipc

Nova Scotia Office of Health Promotion
www.gov.ns.ca/ohp/injuryprevention.html

Quebec WHO Collaborating Centre for Safety Promotion and Injury Prevention
www.inspq.qc.ca/ccOMS/SecuriteTrauma/

Quebec Public Health
www.inspq.qc.ca

Rick Hansen Institute
http://www.rickhansen.com

Safe Communities Foundation
www.safecommunities.ca

Safe Kids Canada
www.sickkids.ca/safekidscanada/

Safe Start
www.cw.bc.ca/safestart/index.asp

SMARTRISK
www.smartrisk.ca

Saskatchewan Institute on Prevention of Handicaps
www.PreventionInstitute.sk.ca

St. John Ambulance
http://www.sja.ca

ThinkFirst Foundation
www.thinkfirst.ca