

EVALUATION OF THE CANADIAN FORCES INJURY SURVEILLANCE  
PILOT PROJECT IN VALCARTIER, QUEBEC

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Thesis submitted to the Faculty of Graduate and Postdoctoral Studies in partial  
fulfillment of the requirements for the M.Sc. degree in Epidemiology

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## Abstract

**Introduction:** An injury surveillance system was piloted in 2011 to monitor injuries in Canadian Forces. This evaluation of the key system attributes examined system performance.

**Methods:** A retrospective chart review, a coding reliability study, a completeness of forms study and a key informant interview.

**Results:** Sensitivity was 0.36 (95% CI: 0.28, 0.46). The system was missing patients over age 35. Kappa coefficients over 0.80 demonstrated good agreement. Completeness of forms study demonstrated high percentages of response for most questions and lower rates for questions related to using protective equipment, and consent for information sharing. Interviews proved acceptability to stakeholders, usefulness for identifying clusters and trends, simple and complete data collection, and flexibility.

**Conclusion:** The injury surveillance system had good potential for several reasons: data collection did not require additional work in clinics; the system was well accepted and partially proved usefulness and timeliness in identifying unusual injury events.

## Acknowledgments

This research was supported by the Department of National Defence (DND) who provided access to data. However, DND had no role in the conduct of the study. The views expressed are those of the author, and do not necessarily reflect the views of DND.

I would also like to acknowledge the contribution of my supervisors Dr. Maureen Carew and Dr. Tim Ramsay, whose guidance and critique have been essential for the success of this project, the editorial support and critique from Dr. Brenda Wilson, Dr. Stuart Nicholls and Dr. Jeff Whitehead.

Similarly, the endorsement and support from the 5th Field Ambulance Commander, Lieutenant Colonel Bouchard for the project evaluation activities in Valcartier has been very important, as well as the effort and the support for the interviews from all the participants and the combat unit commanders from the Canadian Forces Base Valcartier, the stakeholders from the Directorate of Force Health Protection and the members of the Injury Surveillance Project working group.

I thank my husband Mihai for his understanding and support, and to my daughter Meredith and mother Stela for their unconditional love and patience.

Claudia Sarbu.

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## **List of abbreviations**

CDC	Centre for Disease Control
CDU	Care Delivery Unit
CF	Canadian Forces
CHIRPP	Canadian Hospitals Injury Reporting and Prevention Program
DND	Department of National Defence
ED	Emergency Department
FSI	Fitness Support Instructor
HLIS	Health and Lifestyle Information Survey
ISPP	Injury Surveillance Pilot Project
U.S.	United States
WHO	World Health Organization

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# Chapter 1

## Context and Concepts

The promotion of physical activity is a key health priority for the Canadian Forces (CF) in order to achieve and maintain a good fitness level and ensure the operational readiness of military personnel. However, physical training and military training are often associated with increased injuries and with the subsequent costs associated with treatment and rehabilitation of injured personnel.

The first step in guiding injury prevention efforts is to understand the magnitude of the problem and the associated costs associated with injuries. Injuries represent a major public health problem. Worldwide 9% of mortality and 12% of the global burden of disease are due to unintentional and intentional injuries (Peden M, McGee K and Sharma G., WHO, 2002).

In Canada, the total cost associated with unintentional and intentional injuries in 2004 was estimated at \$19.8 billion (SMARTRISK, 2009). Injuries were the leading cause of death for persons aged 1 to 34 and the sixth leading cause of death for Canadians of all ages (Public Health Agency of Canada, 2005).

It is well documented that injuries are a significant problem for military personnel in several countries. For the Australian Defence Force, in 2004 the liability costs for the Australian military compensation claims related to injury were 1.9 billion \$ (McKinnon,

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Joan Ozanne-Smith and Pope, 2009). In the United States (U.S.), the costs associated with non-battle injuries were an estimated \$ 100 million annually for military trainees (Kelley, 2004). One 1987 US Army study estimated a loss of 60,000 new recruits per year as a result of injuries, at a cost of \$35,000 US per recruit (Tomlinson, 1987). Other surveillance data from the U.S. military (Jones et al., 2010) indicated that injuries were the leading cause of medical encounters for military personnel. Another study that involved US Army Airborne military personnel (Schneider, Bigelow, and Amoroso, 2000) found that soldiers with a recent history of injury (within 18 months) were 7 times as likely to suffer traumatic injuries (not overuse injury).

The focus of this study is non-battle injuries, defined as injuries suffered during physical and military training (Strauss et al., 2007).

In the Canadian Forces, non-battle injuries are a leading cause of morbidity and mortality. In the 2008/2009 CF Health and Lifestyle Information Survey (Canadian Forces Health and Lifestyle Information Study 2008/2009), 23% of CF Regular Force personnel reported experiencing a repetitive strain injury and 21% reported experiencing an acute injury serious enough to limit their normal activities in the preceding 12 months. The same survey showed that for CF personnel who did not deploy in the previous two years, musculoskeletal injuries were cited as the main reason why personnel did not deploy. In addition, a retrospective review of almost 3000 CF medical charts estimated that 8 out of 10 military personnel suffered from an injury during the 5 year study period of 1998-2002 (Strauss et al, 2007).

The Canadian Forces has worked to understand the occurrence of injuries in its workforce through a comprehensive analysis using several sources of information, including: the CF mortality database, the Health and Lifestyle Information Survey, the retrospective chart review, and the Sick Leave Database. The following statistics summarize CF mortality and morbidity findings from the data sources mentioned above (Whitehead, 2008):

- 25% of deaths were due to unintentional injuries – nearly half of which were transportation-related.
- Acute injuries and repetitive strain injury rates were twice as high compared to the age-adjusted Canadian population (26% vs. 13% in 2004).
- Acute injuries: were higher among younger personnel for the land (army) element. A substantial proportion occurred during sport or physical training related activities and involved the lower extremities.
- Injuries are a leading cause of lost work time with costs estimated between \$5 and \$ 35 million annually; the \$5 million estimate considered only the first visit disposition.

Taking all these statistics into account, we can conclude that the costs to CF are likely high, especially with regards to attrition, financial costs, the proportion of personnel affected by injury and the operational readiness of CF personnel.

For many years injuries were viewed as accidents or random events. Today, however, most injuries are known to be preventable. There are several studies conducted in military populations demonstrating the effectiveness of targeted interventions to reduce injuries. Also, civilian jurisdictions have advanced in the prevention of injuries through the

introduction of effective interventions such as the use of seat belts, bicycle helmets, air bags and lower speed limits.

A 2005 study conducted by Knapik et al. indicated that modifying the training regimen of military recruits during basic combat training by reducing the intensity and frequency of training while maintaining fitness outcomes, had a 35% reduction in risk of injuries in men and a 32% risk reduction in women.

Other studies using surveillance data have demonstrated the effectiveness of injury prevention interventions. For example, (Pope et al., 1999) demonstrated a reduction of the incidence of pelvic stress fractures in female Australian Defence Force recruits from 11.2% to 0.6% by introducing several measures that reduced the training load.

In another study based on the specific identification of the hazard, a rubber matting on an obstacle course, Pope (2002) was able to demonstrate that the removal of the hazard was an effective measure to reduce the risk of anterior cruciate ligament rupture.

Given the extent of injuries among military personnel, the introduction of prevention measures to eliminate or minimize known or suspected risk factors, guided by good quality data, can achieve important reductions in the burden and cost of injuries.

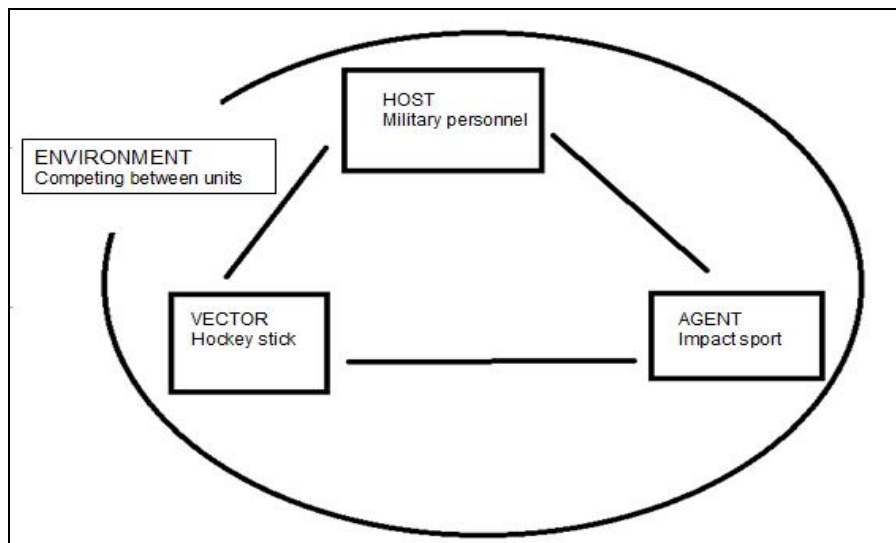
In developing interventions that can prevent, control and reduce injuries it is critical to understand where, how, when and to whom the injuries occur. This information typically is obtained through an injury surveillance system.

## 1.1. Injury Prevention Key Elements

Several models may be used to analyze injuries. The classical epidemiological model involves four factors that may interact in the context of an injury event: the host, the agent, the vector and the environment (Holder et al., WHO, 2001).

Such a model is presented in Figure 1 and it may be used to identify the risk factors as well as the potential places where the interactions between factors could be modified to prevent or reduce the impact of future events (Figure 1).

**Figure 1. Epidemiological Model Adapted for Contact Sports in Military Personnel.**



\*Adapted from Holder Y, Peden M, Krug E et al. (2001)

The example in figure 1 is based on a real injury event, in which the military personnel is the host (the person suffering the injury), the agent is the sport practiced at the time of the injury, respectively hockey which generates the mechanical force, the vector would be the hockey stick which transfers the mechanical energy into the injured person's chest. The environment would include the military culture with the specific norms or values: competitiveness, excellence, risk taking or sense of belonging.

The use of such models may help to identify the risk factors and design interventions to prevent or reduce the harm from injuries. In the hockey example described above, interventions such as the use of protective equipment or educating participants in competitive team sports or their supervisors about the impact of these injuries on their readiness for deployment and the costs associated with injuries may be effective in reducing injuries associated with hockey.

Another important framework for injury prevention (Haddon's Matrix) was developed in 1970 by William Haddon (figure 2). Haddon's matrix combines the four factors from the epidemiological model with the time sequence of events: pre-event, event and post-event. The cells of Haddon's matrix demonstrate the range of risk or protective factors involved in the injury event.

To illustrate the use of Haddon's matrix, we could consider another type of event that produced injuries in military personnel: a motor vehicle accident (MVA) (Figure 2).

**Figure 2: Haddon’s Matrix**

	<b>Host</b> (person affected)	<b>Vector</b> (vehicle)	<b>Physical environment</b>	<b>Social environment</b>
<b>Pre-event</b> (primary prevention)	<ul style="list-style-type: none"> <li>- Driving skills</li> <li>- Time pressures</li> <li>- Impaired driving due to sleep deprivation, use of medication or alcohol</li> <li>- Risk taking behaviors</li> </ul>	<ul style="list-style-type: none"> <li>- Vehicles’ design and handling</li> <li>- Maintenance of car</li> <li>-Tendency to roll</li> </ul>	<ul style="list-style-type: none"> <li>- Road design</li> <li>- Signs to signal danger</li> <li>- Speed limits</li> </ul>	<ul style="list-style-type: none"> <li>- Compliance with seat belt and protective equipment</li> <li>- Competitiveness of military environment</li> </ul>
<b>During the event</b> (secondary prevention)	<ul style="list-style-type: none"> <li>- Wearing protective equipment</li> </ul>	<ul style="list-style-type: none"> <li>- Air bags working?</li> <li>- Size of car and resistance to crash</li> <li>- Seat belt use</li> </ul>	<ul style="list-style-type: none"> <li>- Weather conditions: fog, rain, snow fall</li> <li>- Field training: slippery roads, ice on road?</li> </ul>	<ul style="list-style-type: none"> <li>- Quality of emergency assistance</li> <li>- Assistance from bystanders</li> </ul>
<b>Post-event</b> (tertiary prevention)	<ul style="list-style-type: none"> <li>- Availability for calling 911</li> <li>- First aid knowledge</li> </ul>	<ul style="list-style-type: none"> <li>- Risk to catch on fire</li> </ul>	<ul style="list-style-type: none"> <li>- Emergency vehicle access to collision site</li> </ul>	<ul style="list-style-type: none"> <li>- Emergency services</li> <li>- Medical technicians on scene</li> </ul>

\*Adapted from Haddon (1972)

This model could be very helpful in analyzing the events and determining which interventions could be used and where to intervene, in order to prevent injuries. The first critical step in the utilization of this framework is the collection of quality data to provide the data for the pre-event and event boxes.

## 1.2. Injury Surveillance Systems

Injury surveillance systems are utilized for the following activities:

- To provide information regarding injury morbidity/mortality.
- To provide data to monitor trends.
- To detect clusters and emerging new injury events.
- To identify factors associated with injury occurrence: where, when, how and who.
- To trigger injury prevention interventions.
- To provide an evidence base for design of prevention initiatives.
- To determine the effectiveness of previous prevention measures.
- To stimulate epidemiologic research to determine specific focus for control and prevention.

The implementation of injury surveillance systems is the first step in injury prevention activities. A second essential step is the dissemination of data obtained from such surveillance systems for the initiation and support of successful injury prevention interventions.

A component of the Directorate of General Safety is the Occupational Health and Safety system which is external to Health Services. It oversees work related injuries and collects information in the General Safety Database through the use of the Accident

Investigation Report form (DND 663) and the CF98 form (Strauss et al. 2007). CF98 form is intended to record details for the purposes of compensation, there is no focus on prevention. (Jeff Whitehead, personal communication, December 17, 2012).

Although the DND 663 was partially designed for the purpose of data collection to identify recommendations to prevent re-occurrence, this occupational accident reporting system had poor compliance (as identified in the CF retrospective injury study (Strauss, 2007). In this study only 10-20% of injuries documented in medical charts were reported through the CF Occupational Health and Safety reporting process.

The WHO, in collaboration with the CDC recommended that an injury surveillance system should contain as part of the core Minimum Data Set (MDS), the following fundamental eight data elements (Holder et al., 2001):

- A unique identifier for the person injured – which, to preserve anonymity, should not be their name;
  - The age of the injured individual;
  - The gender of the injured individual;
  - The intent of the injury, unintentional or intentional;
  - The place where the injury occurred;
  - The activity being performed at the time of the injury;
  - The mechanism or cause of the injury;
  - The nature of the injury.
-

## 1.3. Injury Prevention in Military Context

Military forces in many nations have implemented surveillance systems to monitor injuries, identify trends and utilize data for the development of specific injury prevention measures. Recognizing the increasing importance and the associated burden that injuries have placed on the CF, the Directorate of Force Health Protection, with the funding from the CF Health and Physical Fitness Strategy, developed and implemented in 2010 an injury surveillance pilot program at Canadian Forces Base Valcartier.

### **1.3.1. Characteristics of Canadian Forces military personnel.**

To gain an appreciation of the unique characteristics of military organizations, a description of the CF is presented below; after this description I will proceed to the analysis of the main objectives of injury surveillance.

The Canadian Forces makes up a small segment of the Canadian population. It is very special population comprised by approximately 65, 000 Regular Force and 25,000 Reserve Force personnel. There are three commands (Army, Air Force and Navy) and 32 CF Bases and Wings across Canada. Beside the three commands, the schools and certain training areas are under the auspices of Chief of Military Personnel (CMP) and Vice Chief of the Defence Staff (VCDS) respectively (written communication with Cdr. Ian Torrie, November 2012).

Military personnel in Canada may be deployed to international or domestic destinations where they may be exposed to occupational hazards such as hostile

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environments, extreme temperatures, physical and mental stressors and other environmental hazards.

Members of the military are demographically different from the Canadian population. As documented by Park (2008), CF personnel are younger than the general population (more than 70% under the age of 40 compared to 53% for Canadians in 2002). CF members between the ages 55 and 64 represented less than 1% of all CF personnel in comparison to 11% of the working Canadian population (in fact the maximum age is 60 in the CF).

Overall, military personnel are predominantly male. In recent decades women's representation has risen, up to 15% in 2002. The study conducted by Park showed that the education and income levels of CF personnel increased over the past decade.

Health care for the Canadian Forces is provided by Canadian Forces Health Services. CF personnel are not covered under the Canada Health Act and therefore the CF must provide primary and public health services to their personnel. CF Health Services employ multidisciplinary teams, formed with military, public service, and contract civilian health care professionals to deliver primary care in clinics on Bases and Wings which are organized into Care Delivery Units (CDU). Every morning at each CDU a clinic (where appointments are not required) is available scheduled and is called Sick Parade. In the afternoon, patients are usually seen for booked follow-up appointments, periodic health assessments and other administrative visits.

A part of CF Health Services is the Directorate of Force Health Protection (DFHP) which has the mission to help CF personnel achieve and maintain a healthy lifestyle and

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protect CF personnel from preventable illness and injuries, both in garrison and on deployment.

To contribute to the operational readiness of the CF, the Personnel Support Programs provide military personnel with physical fitness programs, fitness sport instructors and implement standards and policies that are designed to prepare and assess the ability of CF personnel to meet the physical standards.

### **1.3.2. Injury Surveillance Pilot Project in CFB Valcartier, Quebec.**

The main objectives of the Injury Surveillance Pilot Project were to monitor non-battle injuries, to identify and describe trends of injuries and to utilize surveillance data in order to develop prevention measures to reduce injuries among military personnel.

This active surveillance system, which was modeled after the Australian Defence Force system and the Canadian Hospital Injury Reporting and Prevention Program (CHIRPP), captured detailed information about injuries at the point of medical contact. This form of surveillance (at point of medical contact) is the preferred form of injury surveillance as systems dependent on passive, self-reporting have low rates of participation.

The CF Injury Surveillance Pilot Project collected data by identifying patients with an injury who presented to Sick Parade in one of four Care Delivery Units (CDUs) and two physiotherapy clinics in Valcartier, Quebec opened for medical care from Monday to Friday from 0700-1200 h. Sick Parade is comparable to a civilian walk-in medical clinic where patients can be assessed by medical staff for any medical problem without an appointment. Different military units are assigned to a specific CDU for medical care. The average number

of patients seeking medical attention at Sick Parade at CFB Valcartier is about 100-120 per day, in all four CDUs (M.-N. Vallée, personal communication, August 2011).

Information regarding CF patients who receive initial medical care for an injury at a civilian clinic or emergency department should be captured at the first follow-up visit at a CF clinic, which is recommended for all personnel who attend off-base civilian clinics.

The flow of patients at Sick Parade in Valcartier is different for each CDU, with two of the four CDUs having a triage nurse who evaluates the patient first. For the rest of the CDUs, patients may be screened by nurses or medical technicians (the medical technicians may not have been aware of the data collection form).

Patients identified with injuries were asked to complete a “Patient Injury Questionnaire” (shown in Appendix A) which is a bilingual two-page form containing information on the following variables: age, sex, rank, military unit, occupation, place, date/time of injury, location of injury, surface conditions, environmental conditions, cause of injury, activity, activity supervisor, protective equipment worn at time of injury, contributing factors, a free text field for further detail, and the date the form was filled. The patient was instructed to give the completed questionnaire to the attending medical staff who reviewed the form and placed it on the medical chart.

There was also a section completed by Injury Surveillance Pilot Project staff once they reviewed the form to collect and provide codes for the following information: diagnosis (up to three), body part affected (up to three), number of days of occupational restrictions and limitations, medical referrals, the activity code, whether a follow-up visit was required and the code for the person who completed the form.

The main features adopted from CHIRPP and Australian Defense Force data collection forms, were the ‘tick and flick’ format<sup>1</sup> and having the information provided almost entirely by patients.

## 1.4. Study Goal and Objectives.

Surveillance, which is defined as the systematic collection, analysis, interpretation and application of health data to a public health problem is an important part of injury prevention and control. High quality data are required to quantify the magnitude of the problem, identify potential risk factors and guide program and policy development. As surveillance systems consume valuable public health resources in terms of personnel and costs, regular evaluation is essential.

The overall goal of this evaluation was to determine the effectiveness of the Injury Surveillance Pilot Project. The specific evaluation objectives were to assess the performance of the surveillance system by describing the following system attributes: data quality (data completeness, sensitivity, representativeness, and reliability), operational characteristics (timeliness, simplicity, flexibility), practical characteristics (acceptability) and overall the level of usefulness.

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<sup>1</sup> The ‘tick and flick’ format allows users to make quick choices between several options using check marks.

## Chapter 2

# Evaluation of injury surveillance systems

In the first chapter the injury surveillance system concept was introduced as well as the motivation for this study. An ongoing evaluation of surveillance systems is recommended to ensure that they are meeting their objectives. In this chapter I will present the recommended methods to evaluate surveillance and injury surveillance systems as well as the findings of the literature review on injury surveillance systems to inform selection of attributes for evaluation.

### 2.1. Frameworks for evaluating of surveillance systems

Recommendations and criteria for evaluation of disease and injury surveillance systems have been developed by the U.S. Centers for Disease Control (CDC), the World Health Organization (WHO) and other expert studies.

The CDC guidelines for evaluating surveillance systems (2001) define six tasks adapted from the program evaluation framework, as follows:

- Task A: Engage the stakeholders in the evaluation;
- Task B: Describe the surveillance system to be evaluated;
- Task C: Focus the evaluation design;
- Task D: Gather credible evidence regarding the performance of the system;

- Task E: Justify and state conclusions and make recommendations;
- Task F: Ensure use of evaluation findings and share lessons learned.

The activities suggested for task D completion are:

- to indicate the level of usefulness and
- to describe the system attributes.

CDC defined usefulness as: “A public health surveillance system is useful if it contributes to the prevention and control of adverse health-related events, including an improved understanding of the public health implications of such events.”

The usefulness is assessed by describing the actions taken as a result of analysis and interpretation of the data from the public health surveillance system and by identifying the stakeholders involved in using this data for decision-making purposes.

The key attributes are defined as follows:

a) Simplicity.

The simplicity of a public health surveillance system refers to both its structure and ease of operation. Surveillance systems should be as simple as possible while still meeting their objectives.

b) Acceptability.

Acceptability reflects the willingness of persons and organizations to participate in the surveillance system.

c) Timeliness.

Timeliness reflects the speed between steps in a public health surveillance system.

d) Flexibility

A flexible public health surveillance system can adapt to changing information needs or operating conditions with little additional time, personnel, or allocated funds.

e) Data completeness

One of the components of data quality, this evaluates the completeness of the form fields to determine any systematic issues affecting data completion.

f) Sensitivity

The sensitivity of an injury surveillance system is measured as the proportion of the total number of injuries that are actually captured by the surveillance system and the capacity of the system to detect changes in incidence over time.

g) Representativeness

Representativeness is defined as the system's ability to accurately describe the occurrence of health events over time distributed by person and place within the population.

h) Reliability

Reliability is defined as the consistency of coding the same surveillance information (such as diagnosis, sport activity code, disposition) between different coders.

In 2009, Mitchell, Williamson and O'Connor, through an extensive research that involved a literature review as well as expert opinion consultations, developed specific guidelines to help evaluate injury surveillance systems. The authors grouped the characteristics of injury surveillance systems into three categories:

- data quality characteristics (refers to the quality of the information collected by the system: completeness of data, sensitivity, predictive value positive, representativeness, and reliability),
- operational characteristics (refers to the purpose and objectives of the system, data collection, case definition, simplicity, flexibility, timeliness, stability, sustainability and security and confidentiality of the system) and
- practical characteristics (refers to acceptability, usefulness, data accessibility, potential for data linkage, routine dissemination of information).

## 2.2. Review of the literature reporting evaluation of injury surveillance systems

A systematic review of scientific documents as well as of the grey literature published on evaluation of injury surveillance systems was beyond the scope and resources of this thesis. A literature search was conducted to identify studies reporting evaluation of injury surveillance systems.

The search methods for identification of studies included electronic searches in the PubMed database, Reference and Citation searching of selected articles (the search key

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words are presented in Appendix C) as well as articles provided by the Injury Surveillance Pilot Project working group.

Over 200 abstracts were reviewed and seven studies that evaluated surveillance systems were identified: six studies that evaluated the performance of injury surveillance systems and one study that evaluated the performance of a surveillance system implemented to capture adverse drug events. In all studies, retrospective review of medical charts was used to estimate the sensitivity of the surveillance system and the magnitude of systematic errors in capturing injuries. The findings from these studies are presented in the following section.

The Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) was implemented in 1990 in ten children's hospitals across Canada. Macarthur and Pless (1999a; 1999b) assessed the quality of CHIRPP by examining three surveillance system attributes: sensitivity was determined at four centres; positive predictive value and representativeness were estimated at one centre. The study was conducted between June and August 1992. The sensitivity was found to vary between 30% and 91%. The positive predictive value was 99.9%. The representativeness study found systematic errors in capturing injury cases; children presenting overnight, children being admitted, older children and cases of poisoning were more likely to be missed by the surveillance system.

Jhung et al. (2007) evaluated a surveillance system designed to capture adverse drug events using a qualitative evaluation of five attributes: acceptability, flexibility,

representativeness, simplicity, stability and through a medical chart review determined the system timeliness, data quality, positive predictive value and sensitivity. This evaluation was conducted in six centres and was based on analysis of data collected from January to December 2004. Positive predictive value was found to be 92%. Sensitivity was estimated at 0.33 and the evaluation of data quality demonstrated that completeness for key data elements ranged from 77% to 100%. The system was found to be acceptable by clinical staff, as well as useful by providing timely and detailed information on injuries from adverse drug events. As it had been in operation since 1971, the surveillance system proved to be stable and flexible. In terms of representativeness, the system captured the cases which presented to emergency departments, missing the cases presenting in other settings.

A study conducted in 2003-2004 in Bosnia-Herzegovina by Carew, Wilson, & Strauss (2006), evaluated the Canadian Forces deployment health surveillance system known as EPINATO. The authors assessed the following system attributes: reliability/validity, representativeness, timeliness, and acceptability, using a coding reliability study (medical chart review) and qualitative interviews conducted with key stakeholders. The overall reliability for all primary care diagnoses was found to be 0.40; more specifically, the reliability for training injuries was 0.03 and for sports injuries was 0.23. These values were the result of a complicated coding system and inadequate training offered to primary care providers (personal communication with Jeff Whitehead, December 17, 2013). The evaluation found low user acceptability, limited usefulness and timeliness. The information collected with this surveillance system was considered by the authors as being representative for the health events in a deployed CF population.

Another study evaluated the sensitivity and representativeness of CHIRPP from February 2001 to February 2002 (Macpherson et al., 2008). The overall sensitivity was estimated at 0.43, and for the emergency department it was estimated at 0.57. The system was found to be missing older patients and those suffering minor injuries who were presenting to other clinical settings than the children's hospital.

A system similar to CHIRPP was implemented also in Scotland and an evaluation after 10 years was conducted by Shipton and Stone (2008) with the objective to identify the strengths and weaknesses of the system. The system attributes of simplicity, flexibility and acceptability were found to meet WHO criteria. In terms of reliability the system was found to miss cases during weekends and in the evenings. The systems' attributes of utility and sustainability were considered to be low because of a lack of dedicated personnel to report results and plan prevention measures. The authors concluded that such a system would require dedicated personnel in the emergency department to support data collection and to help the staff perceive the system as a tool for injury prevention rather than as a research survey. A dedicated data analyst and a person responsible for injury prevention advocacy were also required.

Finally, a recent evaluation of CHIRPP was conducted in Calgary (Kang et al, 2012) with the objective to determine the representativeness of the system in describing sport and recreation injuries. The sensitivity was estimated at 0.64 and the captured cases were representative for the region. When compared with the system that captured local

administrative data, CHIRPP was found to provide useful, detailed information about the circumstances of the injury event.

Combining quantitative and qualitative methods in the evaluations of different surveillance systems is likely to improve the quality of this research. The quantitative methods will substantiate the findings while the qualitative methods will provide contextual information for a meaningful evaluation.

## Chapter 3

# Evaluation Methodology

### 3.1. Methodological overview

The evaluation of the injury surveillance system in Valcartier required several sets of procedures and followed an exploratory sequential mixed methods approach comprising of quantitative and qualitative phases (Creswell and Plano Clark, 2007).

The evaluation of the injury surveillance system was comprised of four different studies: a retrospective chart review, a coding reliability review, a completeness of forms assessment and a key informant interview study.

### 3.2. Rationale for a qualitative approach

Qualitative researchers work inductively, with the purpose to develop theoretical insights that describe and explain social phenomena such as interactions, experiences, roles, perspectives, symbols, and organizations (Morse and Field, 1995).

Qualitative inquiry is a process of documenting, describing and identifying patterns, concepts and relationships between concepts with the ultimate goal of creating theoretical explanations that reflect reality. The researcher works from the participant perspective,

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allowing the researcher to investigate subjective phenomena while examining underlying assumptions, attitudes, and rationale for these.

Most importantly, the qualitative analysis is a process of interpreting and reiterating "based on the value of trying to represent faithfully and accurately the social worlds or phenomena studied." (Altheide and Johnson, 1994).

This methodology is therefore ideal for our study as the focus is on exploring stakeholders' beliefs and experiences of pro or con decision-making process for the existence of an injury surveillance system, as well as their evaluations of the performance of this program during its first year in operation.

The following chapter presents the methods and the results separately for each of the four studies: chart review study, coding reliability study, completeness of forms study and key informant interview study.

Table 1 shows the different system characteristics and their corresponding methods of evaluation.

**Table 1. Surveillance System Characteristics and Correspondent Methods of Evaluation.**

<b>Injury Surveillance System Characteristics</b>	<b>Methods</b>
Sensitivity	Chart review
Representativeness	Chart review
Data completeness	Completeness of forms study
Reliability	Coding reliability review
Timeliness	Interview

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<b>Injury Surveillance System Characteristics</b>	<b>Methods</b>
Simplicity	Interview
Acceptability	Interview
Flexibility	Interview
Sustainability	Interview
Usefulness	Interview

## Chapter 4

### Studies design and results

This chapter is organized into four sections, each presenting separately the methods and the results for each study: chart review, coding reliability review, completeness of forms and the interview study.

#### 4.1. Chart Review Study

The population of interest for this evaluation was Regular and Reserve Canadian Forces personnel presenting with non-battle injuries (acute or repetitive strain) at the Sick Parade clinic in Valcartier Quebec between January 2011 and June 2011.

Since the objective of ISPP was to monitor the incidence of different types of injury, then a “case” was defined to be an injury presented by one person for the first time. Repeat visits for treatment of the same injury were not included in the evaluation. If a person had more than one injury, each injury was captured by the Patient Injury Questionnaire and verified by ISPP personnel.

The same inclusion and exclusion criteria used by the Injury Surveillance Pilot Project (as outlined in Appendix B) to define injuries were included in this evaluation.

#### **4.1.1 Chart review methods**

A retrospective health records review was completed to evaluate the following data quality attributes: sensitivity and representativeness.

The Canadian Forces has an electronic medical records system known as the CF Health Information System that was partially implemented in Valcartier at the time of this evaluation. A decision was made to review both electronic and paper versions of charts as certain information, such as progress notes, were available in paper format only. The first step was to review the electronic charts from the Canadian Forces Health Information System.

Prior to selecting the study subjects a test was conducted to assess the average number of charts that could be reviewed by the investigator during the evaluation time period and demonstrated that 25 charts /day could be reviewed in the electronic medical records system. Taking into consideration that for some medical charts the search for the paper chart would be needed for further collection of information, it was estimated that a total number of 500 charts would be acceptable based on volume of work and time deadlines.

The chart review was conducted for military personnel presenting to Sick Parade during the period March 01, 2011 to May 31, 2011. The Sick Parade setting was chosen for this study because the majority of personnel seeking care for injuries would likely be seen in this setting rather than as booked appointments. Booked appointments in Valcartier are more often used for Periodic Health Exams and administrative visits.

A block random procedure was used to select six random weekdays within the study time period. A total of 533 electronic medical records were reviewed that corresponded to the pre-selected dates. A significant part of the progress notes were still in paper, therefore the review included both the electronic and paper files. The progress notes from 183 charts were reviewed to supplement the electronic charts. Eight charts were excluded from the study as they were unavailable (the individuals had moved), therefore the final analysis included a total of 525 charts.

The objective of the sensitivity study was to determine the ability of the system to detect injuries in a primary care setting at Sick Parade. For each study day, eligible injuries were identified by reviewing medical charts for all patients presenting to sick parade. These independently identified injuries were then matched with those captured in the Injury Surveillance Pilot Project database.

The Sensitivity was computed considering the numerator being the number of eligible injuries captured by the system and the denominator being the total number of injuries of CF members visiting Sick Parade.

An important part of the analysis was to identify the predictors for missing injuries at the point of medical contact. Several aspects were taken into consideration including: the demographic factors related to the person presenting with an injury at Sick Parade, the organizational factors related to the CDU, the type of health care worker that first assessed patients at Sick Parade and, lastly factors related to injury such as affected body parts and circumstances of the injury event.

Univariate and multivariate logistic regression analysis were used to examine the association between cases missed by the surveillance system and association with the variables mentioned above. Model parameters were estimated using the method of maximum likelihood and were tested for significance using the Wald statistic. The fit of the model was assessed using Hosmer-Lemeshow test.

Representativeness was determined by comparing injury cases captured by the Injury Surveillance Pilot Project with missed injuries to identify if there were any systematic differences in the detection of injuries that may introduce bias affecting the interpretation of the results. The following key variables were used to compare injuries that were missed versus captured by the surveillance system :

- Sex: male, female.
- Age: two age groups were established: 18 to 34 years and over 35 years.
- Military ranks were grouped in two categories: junior rank for non-commissioned members (NCMs) , based on the higher risk for injuries for military personnel with ranks of Corporal and below and senior rank which included all ranks of Master Corporal and above for NCMs and all officers.
- Military unit types were categorized into four groups: support unit, combat unit, school unit and other (military personnel from other CF bases).
- Clinic Delivery Units: CDU1, CDU2, CDU 3 and CDU4.
- Time of the visit at Sick Parade: early - 7:30 to 9:29AM, late - after 9:30AM, and not recorded.

- Day of visit for injury: Monday versus the rest of the week days.
- Health care worker having the first contact with the patient was defined in three categories: registered nurses, medical technicians, and other, which included doctors, physician assistants, and physiotherapists.
- Injured body parts were divided in four groups: upper limb injuries, lower limb injuries, neck and back injuries and a fourth category “other,” which included face, mouth, ribs, sternum and head injuries.
- The type of activity when injury occurred: physical training, sports, military training, a fourth category “other”, which included injuries recorded as repetitive strain injury, produced at home of gradual onset, and a fifth category “Not Recorded” was developed due to a high number of injuries for which there was no record of information that would describe the circumstances of the accident in the medical chart.

All the statistical analysis was conducted using the SAS 9.2 software.

#### **4.1.2. Chart Review Results**

The analysis was based on a study conducted with the objective to estimate the sensitivity and representativeness of the surveillance system and to identify the factors associated with missing injury cases presenting at Sick Parade.

Data were collected for 121 CF personnel suffering an injury from the 525 charts that were reviewed. Nine reserve force personnel were excluded since their use of health care

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services is very different compared with regular CF personnel. Reservists usually have civilian physicians and seek medical care outside the CF.

The total injury events included 112 regular force military personnel presenting with an injury at Sick Parade (11 females, 101 males) with an age range between 18 and 48 years.

### ***Sensitivity***

A total of 71 injury events (63%) were missed by Injury Surveillance Pilot Project and 41 were captured by the surveillance system, representing an overall sensitivity of 37%. Sensitivity of the Injury Surveillance Pilot Project is presented in table 2.

Examining sensitivity according to CDU showed that CDU 2 had a moderate proportion of captured cases of 52%, followed by CDU 4 with a proportion of 45%, but the proportions were much lower for the remaining CDUs: 11% and 36%.

**Table 2. Sensitivity of the Injury Surveillance System by Clinic Delivery Unit : Valcartier, Quebec: March-May 2011**

	<b>Sensitivity (CI 95%) March-May 2011</b>
CDU1	0.24 (0.08, 0.34)
CDU2	0.52 (0.37, 0.67)
CDU3	0.11 (0, 0.25)
CDU4	0.45 (0.24, 0.66)
ISPP sensitivity	0.36 (0.28, 0.46)

CDU=care delivery unit; CI= Confidence Interval; ISPP= Injury Surveillance Pilot Project

## ***Representativeness***

The variables associated with the cases identified by chart review presented the following proportions:

- Sex: 90.2% male and 9.8% female.
- Age: 72.3% age group 18 to 34, and 27.7% over 35 years of age.
- Ranks: 73.2% junior and 26.8% senior.
- Unit types: 25.0% support unit, 53.5% combat unit, 12.5% school unit and 8.9% other (military personnel from other CF Bases).
- Clinic Delivery Units: 29.4% CDU1, 37.5% CDU2, 15.2% CDU 3 and 17.8% CDU4.
- Time of the visit at Sick Parade: 73.2% early - 7:30 to 9:29AM, 11.6% late - after 9:30 AM, and 15.2% not recorded.
- Day of visit for injury: 60.7% Monday, 39.3% the rest of the week days.
- Health care worker having the first contact with the patient: 50.0% registered nurses, 25.9% medical technicians, and 24.1% other (doctors, physician assistants, and physiotherapists).
- Injured body part: 19.9% upper limb injuries, 53.0% lower limb injuries, 14.4% neck and back injuries, 13.2% other injuries (face, mouth, ribs, sternum or head injuries).

- The type of activity when injury occurred: 20.5% physical training, 17.8% sports, 25.9% military training, 9.8% other (repetitive strain injury, produced at home or gradual onset) and 25.9% Not Recorded (no record of information that would describe the circumstances of the accident in the medical chart).

The prevalence of missed injury versus captured injury cases according to: sex, age, rank, type of unit, CDU, type of health care worker, time of day, day of week, injured body parts and activity when injury occurred is examined below (Table 3).

**Table 3. Percentage of Missed versus Captured Injury Cases by Risk Factor: Injury Surveillance Pilot Project, CFB Valcartier, Quebec Spring 2011**

<b>Risk factors</b>	<b>ISPP Captured n=41(36.6%)</b>	<b>ISPP Missed n=71(63.4%)</b>	<b>Total number of cases (%)</b>
<b>Sex</b>			
<b>Female n(%)</b>	2 (18.2)	9 (81.8)	11 (9.8)
<b>Male n(%)</b>	39 (38.6)	62 (61.4)	101 (90.2)
<b>Age group</b>			
<b>Age 18-34 n(%)</b>	35 (43.2)	46 (56.8)	81 (72.3)
<b>Age 35-49 n(%)</b>	6 (19.3)	25 (80.6)	31 (27.7)
<b>Rank</b>			
<b>Rank junior n(%)</b>	33 (40.2)	49 (59.7)	82 (73.2)
<b>Rank senior n(%)</b>	8 (26.7)	22 (73.3)	30 (26.8)
<b>Unit type</b>			
<b>Support unit n(%)</b>	7 (25.0)	21 (75.0)	28 (25.0)
<b>Combat unit n(%)</b>	28 (46.7)	32 (53.3)	60 (53.6)
<b>Other n(%)</b>	1 (10.0)	9 (90.0)	10 (8.9)
<b>School unit n(%)</b>	5 (35.7)	9 (64.3)	14 (12.5)
<b>Care delivery unit</b>			
<b>CDU 1 n(%)</b>	8 (24.2)	25 (75.8)	33 (29.5)
<b>CDU 2 n(%)</b>	22 (52.4)	20 (47.6)	42 (37.5)
<b>CDU 3 n(%)</b>	2 (11.7)	15 (88.2)	14 (15.3)
<b>CDU 4 n(%)</b>	9 (45.0)	11 (55.0)	20 (17.8)
<b>Day of the week</b>			
<b>Monday</b>	23 (33.8)	45 (66.2)	68 (60.7)
<b>Rest of the week</b>	18 (40.9)	26 (59.1)	44 (39.3)
<b>Time of the visit</b>			
<b>9:30 am</b>	36 (43.9)	46 (56.1)	82 (73.2)
<b>&gt; 9:30 am</b>	4 (30.8)	9 (69.2)	13 (11.6)
<b>Not recorded</b>	1 (5.9)	16 (94.1)	17 (15.8)
<b>Health care professional</b>			
<b>RN</b>	31 (55.4)	25 (44.6)	56 (50.0)
<b>Medical Technician</b>	7 (24.1)	22 (75.9)	27 (24.1)
<b>Other (MD,     physiotherapist)</b>	3 (11.1)	24 (88.9)	29 (25.9)
<b>Injured body parts</b>			
<b>Upper limb n(%)</b>	8 (32.0)	17 (68.0)	25 (22.3)
<b>Lower limb n(%)</b>	22 (40.7)	32 (59.3)	54 (48.2)
<b>other n(%)</b>	7 (50.0)	7 (50.0)	14 (11.6)
<b>Neck and back n(%)</b>	4 (21.1)	15 (78.9)	19 (15.7)
<b>Type of activity</b>			
<b>PT n(%)</b>	13 (56.5)	10 (43.5)	23 (20.5)
<b>SP n(%)</b>	8 (40.0)	12 (60.0)	20 (17.8)
<b>MT n(%)</b>	11 (37.9)	18 (62.1)	29 (25.9)
<b>Other n(%)</b>	1 (9.1)	10 (90.9)	11 (9.8)
<b>Not recorded n(%)</b>	8 (27.6)	21 (72.4)	29 (25.9)

ISPP= Injury Surveillance Pilot Project, CDU= care delivery unit; RN= registered nurse; MD= Medical Doctor; PT= physical training; SP= sport; MT= military training.

There were differences in the proportion of captured versus missed cases according to sex with 81.8% being missed in females vs. 61.4% missed in the male population.

For military personnel over the age of 35, the proportion of missed cases was higher: 80.6%, as well as for senior ranks, 73.3%.

Regular CF personnel belonging to support units were missed 75% of the time, as well as personnel from other CF Bases, who were missed in 90% of cases.

There were differences in the proportion of missed versus captured personnel related to time and place as follows: 88.2% cases missed in Care Delivery Unit 3 and 75.8% missed in Care Delivery Unit 1. Injury cases presented on Monday had been missed in proportion of 66.2%, while being seen after 9:30 am had also resulted in a higher proportion of cases to be missed 69.2%.

The health care professional seeing the patient first, influenced also the captured vs. missed status of the injury cases: 55.4% of cases seen by nurses have been captured, versus 24.1% seen by medical technicians or 11.1% seen by doctors and physiotherapists.

Looking at body parts we noticed that 68% of upper limb injuries have been missed as well as 78.9% of injuries related to neck and spine.

The type of activity when injured occurred indicated that a large number of cases included in the ``other`` category were missed: 90.9%; this group of injuries defined a mixed group of cases for which the activity could not have been clearly specified, for example, cases of gradual onset or classified as repetitive strain injuries.

An important number of injuries, 29 cases, for which the circumstances of the injury neither were mentioned in Canadian Forces Health Information System nor recorded in the patient medical paper chart and were grouped separately; 72.4% of these were missed cases.

### ***Predictive factors for missing injury cases at Sick Parade***

Multivariate analysis was conducted to identify the predictor variables for missing the injury cases from Sick Parade.

Logistic regression was the method used to test three different models that were developed to look at the association between missing cases. One model looked at person related variables, a second model analyzed Care Delivery Unit - related variables and a third model included injury related factors.

Finally, based on the findings of the three initial models, the last model included the following variables: age group, health care professional, rank, Care Delivery Unit. The fit of the model was assessed using Hosmer-Lemeshow test: p value 0.59, therefore evidence of a good fit.

The adjusted Odds Ratios are presented in table 4. An odds ratio greater than 1 after adjustment for covariates signified increased missed cases compared with referent group.

**Table 4. Adjusted OR (95%CI) for the association of missed cases and risk factors**

<b>Characteristics</b>	<b>OR(95%CI)</b>	<b>Parameter p-value</b>
Age over 35	3.70 (1.05, 12.97)	0.040
Medical technician	3.79 (1.24, 11.51)	0.018
Other health care professional	10.96 (2.65, 45.28)	0.0009
Senior rank	1.12 ( 0.34, 3.73)	0.843
CDU1	1.77 (0.56, 5.54)	0.327
CDU3	3.40 (90.58, 19.70)	0.172
CDU4	0.80 (0.24, 2.69)	0.725

OR=Odds Ratio; CI=Confidence Interval; CDU=Care delivery Unit

The odds of missing injury cases at Sick Parade were higher if the patient was seen by other health care professionals than registered nurses, 3.8 if patient was seen by a medical technician and 10.9 if patient was seen by other types of health care professionals. When considering the age as a risk factor the odds of being missed were 3.7 greater for a person over the age of 35 years.

## 4.2. Coding Reliability study

### 4.2.1. Coding Reliability Methods

To evaluate the consistency of coding between the two Pilot Project staff, a sample of 100 patient injury questionnaires were selected for re-coding. Landis and Koch (as cited by Sim and Wright, 2005) defined the agreement expressed by kappa coefficient as follows: values between 0.81 to 1 almost perfect agreement, 0.61 to 0.80 substantial agreement, 0.41 to 0.60 moderate, 0.21 to 0.40 fair, 0.10 to 0.20 slight agreement and below 0.09 is considered poor agreement.

In the present study the cases were randomly selected from all the Injury Surveillance Pilot Project data collection forms received between January 1, 2011 to June 30, 2011. The kappa statistic was calculated to assess the degree of agreement when measuring reliability.

The consistency between coders was assessed for the following fields: diagnosis, body part, type of activity and referrals. A flow chart was developed to describe steps involved in the coding reliability study (see appendix D).

### 4.2.2. Coding Reliability Results

In the present evaluation, the consistency between coders measured by kappa coefficients (95% CI) were as follows: for diagnosis 0.85, for body parts 0.85, for referrals 0.93 and for type of activity 0.88. The coefficients with 95% confidence intervals are presented in table 6.

**Table 5. Inter-rater reliability for diagnosis, body parts, referrals and type of activity:  
kappa coefficient (with 95% Confidence Intervals)**

<b>Variables</b>	<b>Kappa coefficient (CI 95%)</b>
Diagnosis	0.85 (0.78, 0.92)
Body parts	0.85 (0.77, 0.92)
Referrals	0.93 (0.86, 0.99)
Type of activity	0.88 (0.80, 0.95)

CI= Confidence interval

## 4.3. Completeness of Patient Questionnaire study

### 4.3.1. Completeness of Patient Questionnaire Methods

An important step in assessing data quality is to evaluate the completeness of the Patient Injury Questionnaire fields.

The objective of assessing the completeness of forms was twofold; first, examining the proportion of non-responses on the Patient Questionnaire is an indicator of data quality.

Secondly, the completeness of forms may reflect the willingness of patients to participate in data collection which relates to the perceived importance of the event under surveillance, therefore it is a quantitative measure of acceptability.

In a literature review covering articles published between 1975 and 1996 as well as expert opinion on the use and design of questionnaires, McColl et al (2001) concluded that experts have different opinions about response rate quality. The authors are citing few authors in this matter, as follows: Fowler that recommended as an acceptable rate at 75%; Mangione that considered response rates as “excellent” over 85%, 70–84% are “very good”; 60–69% are “acceptable”; 50–59% are “barely acceptable”; and response rates below 50% are “unacceptable” and lastly Borg and Gall who considered that bias would occur if a non-response rate was over 20%.

In a study conducted by McHorney et al. (1994) the evaluation of data completeness took into consideration the item-level completeness rates. The item-level completeness rate

were considered very high if the response rates were 85% and above. For the purpose of this study a rate over 80% was considered as being a high response rate.

Frequencies of missing data by field were analyzed as well as the proportion of partial missing responses for two-part questions.

A data set having a total of 1195 questionnaires for the time period of January 6, 2011 to December 20, 2011 was readily available and it was analyzed. Data of high quality were considered to have low percentage of “unknown” or “blank” responses to items on the surveillance form.

#### **4.3.2. Completeness of Patient Questionnaire Results**

A total number of 1195 Patient Injury Questionnaires were analyzed for completeness. Table 7 presents the proportion of responses and non-responses to questions 1 to 11, consent to share injury related information, signature and date of visit.

Most questions had high percentages of response. Over 90% response rates for questions 1, 2, 4, 5, 6, 7, 8, 9, indicated the interest of military personnel to give information about injuries.

A lower rate, 68.2% was noticed for the question related to protective equipment (question 10).

Only in one situation was the response rate 0, specifically the item that asked for consent to share the information collected by this form.

For the questions involving a text field, the response rates were very high, for example question 7 response rate was 96.2%.

**Table 6. Completeness of forms : Patient Questionnaire response rates**

<b>Question number</b>	<b>Observations n (%)</b>
<b>Question 1-demographics</b>	1194 (99.9)
<b>Question 2</b>	1151 (96.3)
<b>Question 3</b>	1011 (84.6)
<b>Question 4</b>	1092 (91.4)
<b>Question 5</b>	1144 (95.7)
<b>Question 6</b>	1125 (94.1)
<b>Question 7 -text</b>	1149 (96.1)
<b>Question 8</b>	1111 (92.9)
<b>Question 9</b>	1187 (99.3)
<b>Question 10</b>	815 (68.2)
<b>Question 11</b>	844 (70.6)
<b>Consent to share the information</b>	0
<b>Visit date</b>	1095 (91.6)
<b>Signature</b>	1095 (91.6)

## 4. 4. Key Informant Interviews Study

### *Rationale for a qualitative approach.*

In the process of evaluating a complex system, such as the injury surveillance system, it is important to investigate subjective phenomena and at the same time examine their underlying assumptions, attitudes, and rationale.

The aim of this qualitative research is to generate descriptions of the injury surveillance program leading to a better understanding of its operation and characteristics (Morse and Field, 1995). In doing so I sought to document, describe and identify patterns, concepts, and relationships with the goal of identifying variables of importance and proposing theoretical explanations of the phenomena described within the surveillance program.

### **4.4.1. Interview Methods**

#### *Study design.*

A descriptive, exploratory research method for collecting and analyzing data was used in this evaluation. The data collection and the analysis were conducted using methods of Grounded Theory (Strauss and Corbin, 1998).

The semi structured interviews collected information from all stakeholders identified as playing a role in the surveillance system. They were used to evaluate the overall usefulness of the system, as well as several system attributes: simplicity, acceptability, timeliness and flexibility. They also gathered information regarding the potential for missing military personnel suffering injuries.

***Sampling frame, eligibility and recruitment.***

The sampling frame was composed of all the staff involved at any point in the system surveillance such as operators, collaborators or at the end of receiving the surveillance products. A list of all potential participants was provided by the injury surveillance working group and the following groups were identified as important opinion leaders within the injury surveillance system:

- Senior medical management, which included: the Base Surgeon, the Brigade Surgeon, the Commander of the 5th Field Ambulance, and the Director of Force Health Protection
- Senior operational management: Operational Unit Commanders
- injury prevention stakeholders (this group included all the personnel involved in any way in injury prevention): General Safety Officers, Health Promotion personnel, physical trainers, Injury Prevention group at Directorate of Force Health Protection, physiotherapists
- clinic personnel: registered nurses, medical technicians
- patients, and

- Injury Surveillance Pilot Project staff.

As such, interviewees could be broadly categorized into staff involved in the delivery of injury prevention and training instructors, staff involved in the injury treatment, patients who are recipients of injury prevention programs and care, combat managers who are expecting healthy, ready-for-deployment military personnel and those employed in the surveillance program.

### ***Sampling***

The sample size in qualitative research is decided with the goal of inductive hypothesis-generation. Because of the use of the concepts of purposeful sampling and data saturation, an exact sample size could not be planned before the beginning of data collection and analysis. While 6-8 participants often suffice for a homogenous sample, 12-20 are most commonly needed when looking for disconfirming evidence or trying to achieve maximum variation (Lincoln and Guba, 1985; Luborsky and Rubenstein, 1995). This is achieved through the process of purposeful sampling (Glaser &Straus, 1967 and Strauss &Corbin, 1998). During this process participants are selected in order to maximize opportunities both to compare events and identify themes and to identify their properties and dimensions.

Initially the goal was to generate as many themes as possible. In order to ensure that all possible variations in experiences and relevant themes were uncovered, I attempted to achieve the maximum variation sampling, more specifically I sought out views from a wide range of perspectives. Once a number of themes were identified, then the sampling procedure aimed to further develop these by identifying all of their sub-themes and how they related to each other.

Sampling stopped once it became clear that no new issues were emerging, meaning that (a) no new or relevant data emerged in new interviews regarding a theme, (b) the theme was well developed in terms of its properties and dimensions demonstrating variation and (c) the relationships among themes were well established. (Strauss & Corbin, 1998).

### ***Recruitment***

Given the structured nature of organization and potential resistance to participation, a letter of support was provided by the 5th Field Ambulance Commander for the project evaluation activities in Valcartier.

For the staff involved in the delivery of care, the staff involved in the surveillance program or those receiving the final surveillance products, an initial approach was made by email providing a brief description of the research, the written consent and the letter of support. Those who agreed to be interviewed were invited to book a date and time during pre-established dates of visits in Valcartier or in Ottawa, based on the location of participants.

For the “Patient” target group, the participants waiting to be seen by a health care professional in Sick Parade, were invited to participate in a short interview with the investigator. The interviews each took approximately 5 minutes to complete and the responses were recorded directly on a paper questionnaire by the interviewer.

***Data collection and analysis.***

A preliminary set of questions for the semi-structured interview were developed having as a start point the attributes' characteristics mentioned in the definition of each surveillance system attribute (Appendix E).

The framework for questions was developed with the objective to target the following themes: system attributes, overall usefulness of the system, false negatives, system improvements, system limitations to respond to the inquiry about system attributes.

At the same time, in order to understand the level of perceived priority for injury prevention the theme of causes of injuries was added, as well as the theme of prevention of injuries. This last theme was introduced to explore participants' confidence in injury prevention measures to reduce injuries, which in turn would give indications for sustainability, acceptability and support for the surveillance system.

Despite this clear structure for identification of themes from the beginning, most of the questions used were open-ended allowing participants to elaborate and better explain their views.

The interview questionnaire was pre-tested with Force Health Protection colleagues during the month of August 2011.

Six slightly different sets of questions were developed depending on the target audience; however all were targeting the same areas of inquiry (Appendix G).

All key informants except the patient group, received the list of interview questions in advance by email with reassurance that participation was voluntary and that the information collected was confidential and protected under the Privacy Act.. Each individual interview was conducted in person by the study investigator and took approximately 45 minutes. Each interview began with a scripted explanation approved by the Health Service Privacy Officer about the purpose of the study.

The order in which participants were interviewed was based on convenience; they were not scheduled in any specific order (e.g. by perceived level of experience in injury prevention or involvement in the injury surveillance system).

The interviews of stakeholders were digitally recorded. To analyze data I used the constant comparison method in which the transcripts and codes were revised in the light of new data (Dye et al, 2000; Glaser, 2008; Boeijs, 2002). The refinement of this process allowed for a more effective identification, consistency and recurrence of themes in later interviews, and this was done until saturation was reached. Saturation was reached before the last few interviews were conducted.

Emerging themes were compared with findings from the literature review. Efforts were made to identify the presence or absence of themes from particular stakeholders' perspective regarding non-battle injury prevention in the military context, as well the experiences related to collaboration between different sectors. To support these findings, quotations reflecting each theme were grouped and by participant category with regards to injuries: patients, clinic staff involved in handing out the data collection forms, injury

prevention stakeholders, medical management, operations management and Injury Surveillance Pilot Project staff.

The themes emerged were grouped under the following themes: system attributes, usefulness, false negatives, system improvements, system limitations and injury causes and prevention.

#### **4.4.2. Interview Results**

A total number of 31 out of 35 stakeholders participated in the interviews (the participation rate was 89%). One person did not respond to the invitation, one person provided written responses and was excluded from analysis, and two stakeholders were not available in Valcartier at the time when interviews were conducted. The results are organized under six main themes: system attributes, usefulness, false negatives, system improvements, system limitations and injury causes and prevention.

##### **4.4.2.1. *System attributes***

Below is the description of the findings from the semi-structured face to face interviews which assessed the following system attributes: simplicity, acceptability, timeliness and flexibility.

### *Simplicity.*

The assessment of this attribute was done using the following methods:

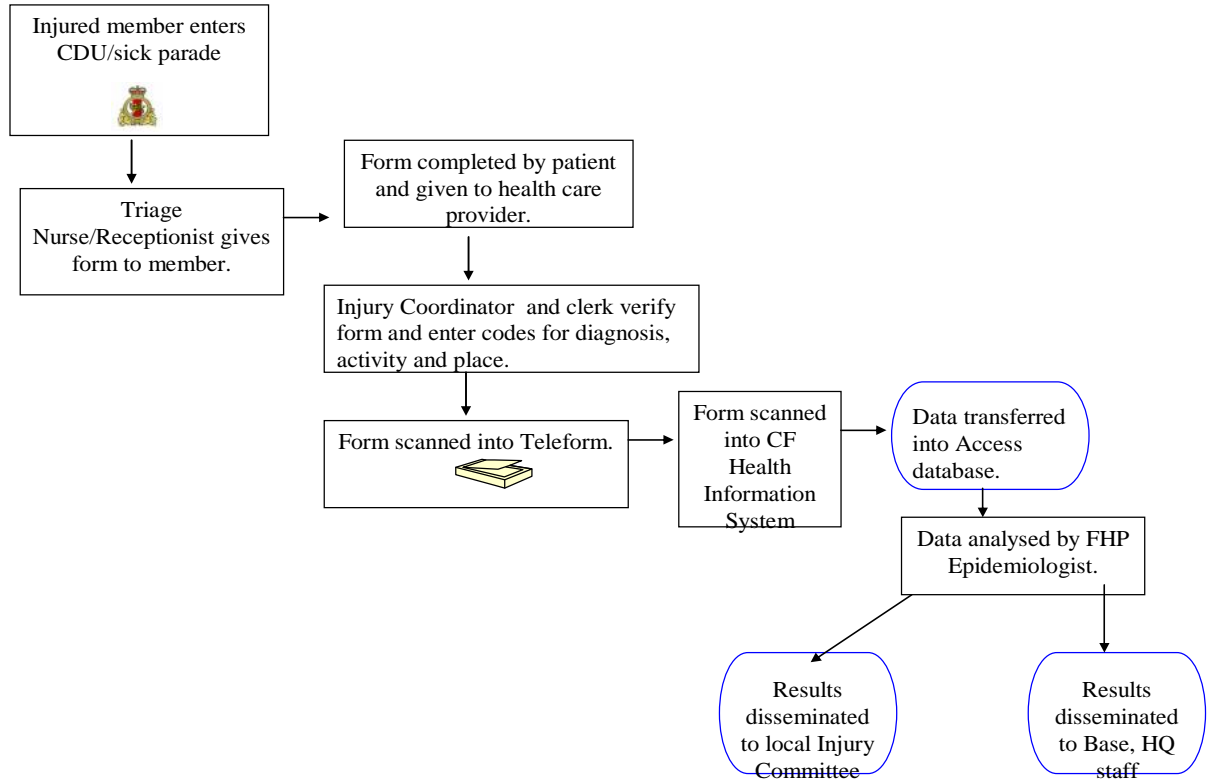
- by identifying the flow of data in the surveillance system itself
- by exploring the participants' opinions about the amount of data obtained using the form, about the process of collecting the information and
- by estimating the total time spent to process the Patient Questionnaire.

The flow of data in the system was described in a diagram (figure 3) at the Canadian Military and Veteran Health Research Forum in November 2010 (Carew, 2010), as follows:

- CF personnel suffering an injury were identified by clinic staff and received the data collection form.
- The form was completed while the patient waited to be invited to the examination room,
- Then the completed form was handed to the health care provider.
- Following the clinic visit, the project staff verified the form, and completed the diagnostic and disposition of patient coding
- The form was scanned into Teleform and the CF Health Information System.
- The next step was to transfer the data into an Access database.
- The Force Health Protection epidemiologist analyzed the data and
- Finally, the results were disseminated locally, to the injury committee, to the Base managers and health services chain of command

**Figure 3. CF Injury Surveillance Pilot Project: System Data Flow**

\*



\* Carew (2010). The Burden of Non-Battle Injuries: The Canadian Forces Perspective

Regarding the data collection questionnaire, all participants agreed that it was complete, balanced and simple:

“So far, it is good; starting January 2012 we are implementing CFHIS so, no more papers. I believe that the form for data collection will remain a paper form, to fill in by patient and this is the best way for the project.” (9269)

In particular, the ability to save time or collect information within a limited time period was seen to be an important characteristic:

“ It would be very difficult to ask people all the questions, as I have 3 minutes per patient, [...] it is very well done like this.” (6124)

The fact that this was also done during a period where patients were awaiting medical assessment and convenient for data collection was also of benefit:

“In my opinion what you are doing at Sick Parade is the best way to collect a good amount of information.” (8891)

Participants were satisfied with the amount of detailed information obtained with this form:

“ This tool is a balanced one, is self-reported by patient, we just miss diagnosis on it, I know we get it after from the file; it is quick, simple, does not take time from clinicians, and is giving us what we need.” (0712)

“With this tool we are able to better answer peoples’ questions; using HLIS data it was not possible to answer that type of info, so it is a relief to have this information.” (7154)

A couple of proposals were made to add a few more questions to the Patient Questionnaire:

“I am not sure if you are really able to capture what you want; maybe to add ‘*what do you think could have been done to avoid the injury*’, to allow them (injured personnel) to say how they believe it could have been prevent it.

Also, the form needs to be adapted when used to different base-air/army/navy.” (8571)

“[...] information about weight and height which may have impact on types of injuries, or mechanism.” (0649)

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“It would be interesting to find out the number of deployments in the past 3 years, because this could be an indirect indicator of other risk factors [...] to add a question related to work satisfaction, related to mental health, which may be correlated to the severity of injuries or specific types of injuries.”

(4941)

However, other participants were concerned that adding optional questions that were not directly related to the injury would reduce participation and affect the validity of the surveillance system:

“It is complete and if you would add more questions there is the risk to make it too long, and people will give up.” (4655)

“It is better not to add because if you get lost into details then it would be underutilised.” (0712)

The time spent to collect the information was estimated to be on average 21 minutes per Patient Injury Questionnaire, divided as follows:

30 seconds to 1 minute for the clinic staff to administer the questionnaire

“2 seconds per patient “(4655)

“1 - 2 minutes per patient [...] it feels that we have to explain the patient why the information is collected and what are the benefits for them.” (0444)

10 minutes for the patient to answer questions (personal communication with patients during interview, January 2012);

10 minutes for the project staff to review information, assign a code and scan the tool into Teleform (personal communication with M.N. Vallée, December 2011).

### ***Acceptability.***

The acceptability was estimated using the following methods:

- by exploring interviewees' opinions about the importance of participating in the surveillance system;
- by assessing their opinion about the most common health problems on a military base;
- by examining the participation in the data collection process and
- by identifying the perceived roles of the participants in the Injury Surveillance Pilot Project.

Central to this was the importance of surveillance for informing decision-making, guiding and evaluating injury prevention measures:

“To be able to assess what is the source of injuries, more specific information which will effectively help where to target the interventions.” (8980)

“To get some statistics about injuries [...] there was nothing before and this will give us the information about what is happening, so we do better interventions.” (0444)

Indeed some participants indicated that they were surprised that surveillance had not been undertaken previously. Indeed, benefits to such a system included the ability to identify effective interventions, with a secondary benefit of potential costs savings:

“I am very selfish about what we get out of that injury surveillance: another view of rates in CF, the types of injury in CF, the mechanism, the context in which they occur; the context is missing from other sources; [...] the leader of the army could look to see which units have problems [...] to be able to monitor interventions. Those are the basic things that I want to get from a selfish perspective; the injuries are costing CF so much money and you would think that you want to monitor to know more about it and then to be able to say if what you do is effective; if you don't have a surveillance system, you don't have a way to say it; if you don't get a bank statement you don't know how well you do [...] we just go *'everybody seems to be happy'* for now...”(4644)

“[...] to identify where the problems are in the training and to measure the impact of different prevention interventions [...] without surveillance we cannot know if there is amelioration.” (7045)

A different opinion was expressed by comparing the surveillance system products with HLIS survey and suggesting that doctors in the clinics should flag if they notice repeated injury events to the Base Surgeon, therefore there is no need for ISPP:

“[...] what I found is that provides same information as what we found with chart review and HLIS; we need more details to give directions and I did not

see that [...] from national perspective we need more details. The information reported from ISPP so far is similar with what we get from HLIS [...] The same questions could be asked in the HLIS and collect the same information [...] if you would develop a survey for collecting info about injuries you would get same information as with the surveillance system. This system cannot respond in weeks to address things [...] if clinicians would see many injuries of one kind, they can flag it to the base surgeon and to the units with problems and you don't need to have an injury surveillance project.” (8571)

Having local data was found to promote better awareness in the chain of command regarding the impact of injuries:

“Since they (managers) see data and the portrait regarding the loss of resources, the cost of lost working days [...] the money associated with this, makes them ready to recommend measures to reduce injuries. They appreciate information received from their own base, local data, the real information that brings strong arguments about improvements.” (9621)

However, this was contingent on data collection. In some instances the system did not appear to have complete coverage. As one participant noted, at times, the surveillance system was perceived as being an optional survey, minimizing the importance of this monitoring and potentially having a negative impact on data collection and data quality through incomplete coverage:

” I haven't given the form because I didn't feel that patients are benefited from this [...] for us is useful, another survey, but the patient doesn't have any gain from it.” (0444)

Several specific types of injury were singled out for discussion as common problems affecting the health of CF military personnel:

“Musculoskeletal injuries, obesity or overweight which are comorbid factors for injuries; operational stress impacting mental health, because there are not enough periods to recover after deployments, and this fatigue has an impact on injuries as well.” (4941)

The ISPP was seen to play a potential role in identifying such common problems or trends. In addition to this, participants identified other potential roles for the ISPP for the groups they represent, including support and advocacy for extending the Injury Surveillance Pilot Project to other bases (potentially at the national level) and to advocate for policies to regulate sports and physical training.

“I hope this surveillance system will go national [...] we have to push for policies to regulate sports and training; there is nothing, no recommendations, there is no plan about how to do it; they (military personnel) are looking for information from internet; military personnel and their commanders should have access to information about the good techniques for each type of training on how to reduce injuries [...]we need specific recommendations for navy - air - army [...] is not from the base commanders that this should come, it is a General who should make recommendations.” (9269)

The acceptability of such a system as ISPP was indicated in participants' comments on the willingness to engage with system:

“There are no duties for me, but I do help by increasing awareness and diffusion of information about project results, talking to base commanders as well as at the units' level.” (4655)

This fostered a collaborative environment to improve the ISPP performance and use of surveillance products:

“I bring my point of view regarding the findings from data collection.” (8891)

“We are giving as much information as possible and when I am aware that we are losing information I talk to project coordinator so we capture as much as possible.” (0712)

Ultimately, in some instances, interviewees expressed interest to be more involved with an interdisciplinary group dealing with injury prevention and surveillance planning:

“The steering committee having a Sergeant, a runner [...] a uniformed person who has the better understanding of what is happening in the field, knows the military life [...] would benefit, as this kind of inside only a military person could bring in a multidisciplinary group. “(6809)

***Timeliness.***

This attribute requires a few years of functioning of a surveillance system in order to allow enough time for actions to be taken as a response to identified trends or risk factors.

The medical management and injury prevention stakeholders were giving examples of working groups that examined measures to prevent different risk factors.

“A working group on the running issue will start work on January- February 2011.” (0649)

“A committee looking at measures or policy regarding snow removal in specific areas” (9621)

“A committee to address the heat related health events.” (8980)

***Flexibility.***

The example of operating the surveillance system in a different setting:

“ISPP was deployed in Camp Vimy, a reservist camp, during the summer of 2011.” (0847)

There were plans to deploy the system to a new setting: military training off base during the spring of 2012 (personal communication with M.N. Vallée, January 2012).

### ***Sustainability.***

Locally, the leaders in CF Base Valcartier were committed to support Injury Surveillance Pilot Project:

“There was always support and interest; Valcartier expressed interest in looking at injuries; at least on the health side they were supportive...also non-medical senior base commanders were supportive.” (2721)

The clinic personnel were supportive with data collection:

“There is support from clinic personnel [...] at times they need reminders, explanations, repeat messages about the importance of monitoring injuries and that is beneficial for patients.” (9027)

The funding was considered to be ongoing for the project:

“Initially it was supposed to be five years, but now is on-going.” (2721)

“Financing? Yes, it is permanent, but the project coordinator not yet.” (9027)

#### ***4.4.2.2. Usefulness***

Usefulness was assessed by examining the system’s ability to detect injury rates, trends and factors associated with injuries, as well as to influence injury prevention measures or policy changes to correct the risk factors.

All participants had confidence in the system's potential ability to detect injury rates, to identify trends and risk factors despite certain expected requirements from a surveillance system:

"[...] we miss a denominator, but we could see trends. The system would allow us to see changes if commanders would decide to do things differently."

(4644)

"Somewhat confident, because we are missing people; we are missing denominator and we know it is difficult to estimate." (0649)

"I am very confident: the patient questionnaire is quite comprehensive; we move beyond getting rates: we had an idea about how they look, but what we need to know is the mechanism, the context of injuries, and if you see changes [...] you could get things like this if you have a surveillance system."

(4644)

"I would be very confident with 2 conditions: if 75-80% of injury captured [...]. There is no system in CF- so far- to tell me the number of injuries. I need to know what is the problem and the amplitude of the problem, and to trust this I need good sensitivity; then important is to understand the severity of consequences, and the costs and to target what is more important." (4941)

Participants identified a few examples of trends and risk factors that were identified using the Injury Surveillance Pilot Project

” A team working on what could be done to reduce heat injuries in Camp Vimy and from hockey” (3938)

A few stakeholders referred to specific values for sensitivity:

“If there is less than 50% we don’t know what we are losing and this will limit our capacity to generalize the findings and to make decisions about interventions” (4941)

Several participants agreed that it was yet too early to have preventive measures or policy changes in support of the utility of the system.

“We will be able to detect patterns and trends but we are not able to pin point specific intervention opportunities, I think is too early to do that: the system needs more time to operate.” (7154)

Description of the analysis that are conducted by ISPP staff offered examples of the utility of the surveillance system:

“Every two weeks a frequency-check for severe injuries is performed, or anomalies, like concussion, ACL tear – these are the red flags [...] there is work in progress for establishing a base line for different injuries. Also, more detailed analysis is done based on different requests ad-hoc, for different injury events.” (7154)

The information resulting from data collection alone cannot be useful unless there is good communication between all the stakeholders:

“[...] these results should be discussed with all the stakeholders involved, like people from health services, operational commanders, injury prevention people, military personnel [...] in interpreting results we should not ignore confounding variables that we would find out from other people involved.”

(4941)

In summary, there are cost-benefits for CF as an organization and the long-term benefits for military personnel for having such a system in place, as one participant concluded:

“This is a very important initiative. It did cost some money, but it is a spit in the bucket when compared to how much money injuries and long term consequences cost Canadian Forces: not just taking the amount of time lost at work, but about the military personnel going to be released because of injuries; about people who need medications, braces, pensions, all these are enormous costs. Without a surveillance system you can't get the moving picture: we will be shooting in the dark. This could be a long term benefit for Canadian Forces and Canadian public. It would be nice to identify the problem, to train people as per changes that are happening, the physical constraints will change and only a surveillance system will give you real time ability to see what is going on in your organization. The Americans, UK, Australia are not doing it because is cute; we should to use our own Canadian data... not to extrapolate from others' data.” (4644)

#### ***4.4.2.3. False negatives: Potential sources of missing information***

The following were identified by participants at the interviews as encounters where injury events could be missed: booked appointments, ER visits, during exercises out of the base, or by no presentation:

“The patients who are booking appointments with the doctor; there are people who will never come to Sick Parade: generally higher ranks [...] or the people taken for assessment by MedTechs (medical technicians) or PAs (physician assistants) [...] the people on exercise out of base, which may take more than one day, they will see the MedTech if injured.” (1408)

“The Sick Parade model is designed for acute presentation. So, chronic conditions will present by appointment [...]” (0712)

“We are missing the patients who are presenting to booked appointments and this could be significant: up to 50%.” (4941)

“Everything that is done on a Friday will be missed. Already units’ staff know that heavy training should be done Friday to allow for recovery, so people will recuperate enough until Monday and we end up missing back, knee, ankle; they will present weeks later.” (8522)

“The emergency room visits; some do not seek care, or the people coming for booked appointments – probably we are missing the repetitive strain injuries.” (8157)

“A military personnel might not declare a symptom, would hide a problem because they don't want this to impact their military career.” (8571)

#### ***4.4.2.4. System improvements.***

Few participants pointed out that the ISPP is new:

“Other injury surveillance systems haven't been evaluated for the first 5 yrs. Connection between people matter and this is taking time. Is the communication that stimulates the work from data collection to prevention - we need to give it more time to mature.” (2721)

Presenting the results by unit, may lead to a different impact:

“Once the supervisor will be aware of the importance of the number of days missed from work because of preventable injuries, maybe the impact is bigger and they will be more sensible to injury prevention to prevent missing from work [...] we need to target Sergeant, Corporal since they are directly responsible for training. At times they are very demanding, they will push their staff at maximum because they have competitions with their peers, so they want to have the best team [...] maybe if we prove them showing the number of restrictions, limitations or sick leave days, maybe they will understand the impact of these preventable injuries.” (7803)

To support reporting the data, the higher chain of command needs to give directions regarding the use of data collection forms:

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“Data should be collected during exercises out of base.” (1408)

To make this form mandatory to be used with patients suffering from injuries the following was mentioned:

“Everybody to be asked if they got an injury [...] instead of having people making a favour to someone nice, to get a directive who says that this is a form that needs to be used on a regular basis, as a part of a daily job [...] nothing else would be feasible given the setting.” (7154)

The Injury Surveillance Pilot Project staff to educate the clinic staff especially when medical technicians were changing job responsibilities. Education was seen as a way to increase the usage of the data collection form:

“They (medical technicians) need to be aware about the program, to get a presentation, to see results, to hear about it.” (8980)

“When MedTechs change, to be invited by CDU and briefly show data [...] they will be more sensitive to support handing out the form [...] if they do not see the importance of the form, or the implication, they might not feel included.” (7803)

#### ***4.4.2.5. Limitations of the injury surveillance system.***

##### ***Clinic related problems.***

At the clinic level the following problems were identified:

The changes in staffing, especially medical technicians:

” Changing staff, inconsistent messages or lack of understanding of what is the purpose of the system [...] not everybody realise how important is to get people to fill in this form.” (2721)

The data collection form is not a standard part of the medical system (refer to page 75).

Missing injury events during the booked appointments (refer to page 73).

##### ***Limited use of surveillance system products***

It seems that the results provided by this system should be used in a more flexible manner when planning for prevention measures:

“It was a little lack of understanding about how we could use the results; there was an agenda to follow absolutely the way was designed, maybe we could incorporate our data into the designed program – it seems that there is some work around this issue and we learn how these things may articulate together.” (4941)

Lack of communication was another element identified as limiting the use of results:

“Health promotion office was not supported to move forward with the prevention program [...] maybe because of ISPP [...] maybe it was related to other situation [...] there is lack of communication” (8571)

Some perceived that the resistance may be due to existing work:

”A difficulty may be the reception of results by the people/educators responsible for developing injury prevention programs: they have strategies already in place which are based on science, but data that is from elsewhere, not from ours and at times the findings from our base are slightly different from what is in the literature, so the people should be flexible to say ‘maybe we need to keep into account our own Canadian information’ to make sure that these injury prevention strategies are really adapted to our own needs, our conditions [...] we don’t have same equipment, we are not training our people the same way as others.” (4941)

The fact that this is a pilot project can engender some limitations; there are some conflicting messages and requests:

“Being a pilot project is a limitation: the local authority has to say this are changes that we want to see here, is mandatory, but they have to justify themselves to other location on why they are doing those things.” (7154)

Several injury prevention stakeholders consider that all groups involved should find agreement among themselves about how they are going to collaborate:

“[...] we are trying to achieve the same thing but we are not on the same page about how we are going to do it; we are provided with the only detailed evidence about the nature of injuries in garrison; they have only data available from international research, different population groups, HLIS-which is cross-sectional, the chart review which is old and limited info. A challenge is to bring them along with us in the next phase in injury understanding in the CF; helping them understanding the results from the surveillance system how they can contribute in making recommendation more specific and tailor it to our population – it is work in progress, surveillance info is limited now, but we have to acknowledge that will develop and it can help them later.” (7154)

Moreover, not only the one way communication is needed, but also stakeholder engagement, specifically two –way discussions:

“Ottawa guidance: yes, a direction from Ottawa is needed, but the people on the bases need to feel they are a part of the planning and decision making; we have to involve them from the beginning [...] we should not impose things from Ottawa without involving local people – to prove flexibility, to adjust based on each unit needs.” (4941)

### ***Senior leadership.***

A variety of perceptions were identified with regard to leadership commitment for injury prevention.

When referring to the base leadership, it seems that they are fully engaged:

“[...] local leadership is engaged- since they see data and the portrait regarding the loss of resources, the cost loss of working days and the money associated with injuries, these makes them ready to recommend measures to reduce injuries. They appreciate information received from they own base.”

(9621)

“People there are very busy, they have many priorities on their agenda, but they open to listen to reports about injuries; of course they need their military personnel ready for operations.” (8980)

A majority of participants agreed that generally there is awareness, that the injury problem is recognized:

“It seems that there is support; it is about getting their attention, to commit the time to spend into injury prevention.” (2921)

“They are way better than they use to be. I believe is not just lip service. Leadership is recognizing that injury prevention is the way to go; we see attempts to make smarter training [...] To be able to train people intelligently, leadership needs to be on board.” (4644)

A few participants highlighted that other requirements may take priority:

“Partially: due to operational conditions everyone have to do 13K, or the Commander Challenge, so the priority for the unit is the training not the health of the person.” (8522)

“Yes, they are open, medical as well as operational commanders – in theory, but in practice we should see changes in the way that people are trained.”

(4941)

“At the highest level there is support, but other problems being in the media, are taking over now and attention is given to other priorities.” (2721)

While other participants expressed concerns about lack of leadership:

“Not yet: their priority is to have them move. First they have to see what needs to be done, than they have to understand that the training could be done differently, while achieving the same objective.” (8891)

“Even if changes are taking time, the medical leadership, the senior officers should take this more seriously; if they are supportive... it doesn't seem to be a priority. If it is a priority and the same is the surveillance program, than maybe is just lack of communication and we don't know about it; senior management have the ability to get others' attention. They are silent... This is the most common type of health problem and a significant proportion of military personnel are not deploying because of injuries...and nobody in senior leadership is mentioning it.” (2721)

#### ***4.4.2.6. Other themes that emerged from the interviews.***

Two common themes discussed by participants were: injury causes and injury prevention. Since the main objective of the thesis was to evaluate the system performance, the information collected during interviews is beyond the purpose of this study and it will not

be presented here. The amount of commentaries about injury causes and about injury prevention is suggesting the importance of the topics for all participants groups (the summary of the findings is available in Appendix H).

## Chapter 5

### Synthesis

Before focusing on the discussion section it is important to review a few important aspects of this complex evaluation process.

First, it is important to understand the circumstances for the evaluation of this surveillance system. It was anticipated that this complex study will be a process evaluation of the ISPP and will inform the steps to be taken for an improvement of the system performance.

In this context, consideration needs to be given to the periods of time between the full implementation of ISPP in November 2010 Valcartier and:

- the chart review time period (March-May 2011), which was only of 3 months in duration and conducted 6 months after the system was implemented.
- the interview was conducted with key stakeholders between December 2011 and January 2012 which was 12 -13 months post-implementation.

Secondly, it is important to remind ourselves of the case definition for this study: “an injury presented by one person for the first time”.

- Inclusion criteria: Unintentional injury resulting from an external factor  
Repetitive strain (includes blisters)

Back pain.

- Exclusion criteria: Intentional injury (e.g., suicide, homicide, assault)
- Combat injuries
- Injury sequelae
- An infection following an injury (e.g. cellulitis)
- Chronic poisonings;
- Food poisoning or food borne intoxication;
- Food allergies/food anaphylaxis;
- Poison ivy or other contact dermatitis;
- No injury (e.g., in motor vehicle crash but no injury);
- Emotional trauma;
- Adverse events in medical care (iatrogenic events);
- Back pain from pregnancy;
- Events that do not result in any physical harm but have the potential to cause injury (near misses).

Finally, to provide an overview of the evaluation results, I decided to introduce a table that summarizes the findings presented in Chapter 4 (Table 8).

**Table 7. Surveillance system characteristics - synthesis**

<b>Surveillance System characteristics</b>	<b>Results</b>
<p style="text-align: center;"><b>Data quality</b></p> <p>Completeness of data</p>	<p>Over 80% completeness for 72% of questions, as follows</p> <ul style="list-style-type: none"> <li>• over 90% for 10/14 questions</li> </ul>

<b>Surveillance System characteristics</b>	<b>Results</b>
<p>Sensitivity</p> <p>Representativeness</p> <p>Coding Reliability</p>	<ul style="list-style-type: none"> <li>• over 80% for 1/14</li> <li>• over 70% for 1/14</li> <li>• over 60% for 1/14</li> <li>• 0% for 1/14</li> </ul> <p>Average 0.36</p> <ul style="list-style-type: none"> <li>• CDU1: 0.21</li> <li>• CDU2: 0.52</li> <li>• CDU3: 0.11</li> <li>• CDU4: 0.45</li> </ul> <p>Missing cases of injuries:</p> <ul style="list-style-type: none"> <li>• Age over 35: OR= 3.70 (p=0.04)</li> <li>• Case seen first by MT: OR= 3.79 (p=0.018)</li> </ul> <p>Kappa coefficient:</p> <ul style="list-style-type: none"> <li>• Diagnosis: 0.85</li> <li>• Body parts: 0.85</li> <li>• Referrals: 0.93</li> <li>• Type of activity: 0.88</li> </ul>
<p style="text-align: center;"><b>Operational characteristics</b></p> <p>Simplicity</p> <p>Flexibility</p> <p>Timeliness</p>	<p>Described as a simple process:</p> <ul style="list-style-type: none"> <li>• Straight flow of data in the system</li> <li>• Participants very excited about the amount of detailed information obtained with this data collection form</li> <li>• No added burden to clinical staff</li> <li>• Time to collect &amp; enter data: 21 minutes/form</li> <li>• one potential intervention to improve data collection 100%</li> </ul> <p>Deployed successfully in another setting: Camp Vimy</p> <ul style="list-style-type: none"> <li>• at least 3 committees were developed to examine the preventive measures for identified clusters/trends: heat related health events, running, snow removal</li> <li>• More years of functioning required to see policies or programs in place and to</li> </ul>



## Chapter 6

### Discussion

Non-battle injuries are health events that affect many CF personnel and require large expenditures of resources, translated in direct health care costs, as well as indirect costs at a personal level. They also lead to disability and adversely affect CF operational readiness for deployment, retention and attrition.

It was well documented in a systematic review conducted by Moloughney in 2008 for the Department of National Defence that injuries are preventable and that injury surveillance systems developed for military populations serve the purpose of identifying injury trends and causes and help reduce the rates of injury by eliminating the risk factors.

To be able to develop targeted interventions to reduce the risk for injury the CF needs to collect good quality information regarding the injury mechanism and circumstances of the injury event, monitor injury trends in time, as well as assess preventive programs effectiveness. The best way to collect this type of information is through a surveillance system, capturing data at the point of medical contact such as the system implemented in Valcartier Quebec, Australia and with CHIRPP.

To ensure that the surveillance system is meeting its objectives ongoing evaluation is recommended. This evaluation focused on assessing the key surveillance system attributes and overall usefulness.

A strength of this study was the use of mixed methods to assess the injury surveillance system characteristics. Information obtained from the qualitative study was very useful in helping to explain the findings of the quantitative methods.

The interview included a broad participation of key stakeholders (patients to commanders) who had different areas of involvement in injury surveillance.

There are several limitations of this study. First of all this study is a process evaluation of a pilot project and the evaluation was completed shortly after the system was fully implemented in November 2010. Sensitivity was estimated only over 3 months, two random days per month. As well, the influence of season on sensitivity and representativeness could not be determined.

Identification of injury cases was limited to patients presenting with injuries (acute or repetitive strain injury) at Sick Parade.

The Positive Predictive Value was expected to very high (the form likely would not be completed for a non-injury event) and it was not included in this evaluation.

Due to missing information from medical charts on the circumstances or the types of activities when injuries occurred, the analysis of potential associations between different factors and the risk of missing cases of injuries was very limited. The interview limitations were that representatives were missed from other settings where the system was deployed and there were limited resources to use in analyzing data.

The discussion of the evaluation results will focus on three main areas: data quality, operational characteristics and practical characteristics.

***Data quality.***

The quality of Injury Surveillance Pilot Project data was assessed through an evaluation of sensitivity, representativeness, completeness of forms and a coding reliability study.

This study clearly identified from the chart review stage, either conducted in electronic or in paper medical charts, that the quality of information recorded in medical encounters around injury events are not sufficient to inform any measures to mitigate risk factors reinforcing the previous findings (Strauss, 2007) and reinforcing the need to establish an injury surveillance system at the point of medical contact where more detailed information about the injury can be collected.

***Sensitivity.***

The sensitivity study demonstrated a variation in capturing injury cases, ranging between 11 and 52 percent at four Care Delivery Units. Because the data collection form was given only to patients presenting with an injury, the positive predictive value (PPV) was thought to be high and it was not calculated in this study. The evaluation of the CHIRPP data confirmed this assumption where in their study, the PPV was 99.9% (Macarthur and Pless, 1999).

Demographic factors such as age, rank, type of military unit are known to be important in the epidemiology of injuries in military personnel. For the army element, personnel who are younger and belonging to junior ranks are more at risk for acute injuries (Whitehead, 2008). Older personnel and those of senior ranks are known to present more frequently with repetitive strain injuries (personal communication, M.-N. Vallée).

Military units may also influence injury rates. In Canadian Forces Base Valcartier, there are different types of military units: support units, school units and combat units, the last two ones having a greater exposure to injury risk factors.

The type of training when injuries occurred was considered important for several reasons. Physical training is done daily with regularity and consists of running and gym training, team sports are generally played competitively and military training might be done off base, as a consequence not captured at Sick Parade. One strategy frequently used by training supervisors was to organize hard training sessions during Friday to allow for recovery periods over weekends, which might have two consequences for data collection: patients presenting in emergency departments, or overcrowding at Sick Parade on Mondays. In both situations the chance to miss the military personnel who suffered injuries is higher.

Based on the knowledge about the Injury Surveillance Pilot Project implementation, CDU organizational factors were already suspected as having an impact on the collection of data. The injury surveillance system was a pilot project requiring voluntary participation and involvement of clinic personnel, therefore the internal CDU organization played an important role in data collection. Two of the four CDUs had a triage registered nurse (RN) responsible for triaging patients according to severity of diagnoses. Triage RNs are civilian

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personnel who have dedicated positions within the base. The remaining two CDUs did not routinely triage patients (unless the wait time exceeded 30 minutes) and patients were usually seen first by an RN or Medical Technician. Distribution of forms may have been affected in these CDU`s since there was no systematic method of assessing injured patients when they first arrived at the clinic and there was a higher turnover of staff (medical technicians would change frequently (every 6 months) as they were moved with their assigned military units.

This distribution of the form is most likely to happen if the nurses see the patient first and if medical technicians are also made aware of the form. It was determined through the evaluation that it is at the discretion of clinic personnel to hand out the forms and decide who receives them. At times, the Patient injury questionnaire was perceived by clinic staff as being an optional survey, minimizing the importance of this monitoring and this ultimately had a negative impact on data collection in certain CDUs. Participation was constantly encouraged by Injury Surveillance Pilot Project staff through reminders, weekly visits and discussion to clarify the different issues raised by clinical staff; however because the project staff were civilian and the use of the data collection form was not enforced throughout the chain of command, the Injury Surveillance Pilot Project personnel presence was rejected at times, especially at the beginning of the implementation.

The four Care Delivery Units were different not only by the method of triage at Sick parade but a significant difference was related to the type of unit assigned to each Care Delivery Unit. In CF Base Valcartier there were combat units, support units and training units for recruits. Of course, at any given time there were people visiting from other bases.

Since physical training and regular participation in sports are encouraged in the CF, anyone present on a military base is at risk of being injured. However, CF personnel from combat and training units were at more at risk due to intensity of training.

As some CDUs were seeing more patients from the last two categories of units, clinic staff may have been more sensitive to the utility of a surveillance system in injury prevention as well as being more familiar with injury cases. This was reflected in one of the four CDUs for which the sensitivity was high. In this case both positive factors were present: predominantly combat units were assigned to this CDU and the nurse at triage was the champion for the Injury Surveillance Pilot Project from the beginning of the implementation of the surveillance system in Valcartier. Although not formally studied, the variability in sensitivity by CDU might be correlated with local leadership.

Lastly, the body part and the type of injury onset were thought to have a potential role in capturing or missing cases. Based on CF staff experience, assumptions were made that back injuries, as well as injuries with gradual onset such as repetitive strain injuries might be missed.

Based on information obtained from interviews regarding improvements in the data collection process and the identification of factors that contributed to cases being missed during Spring 2011 (which were then corrected during Summer 2011), a second chart review involving 646 charts was conducted by Force Health Protection staff to examine the proportion of injuries captured by the Injury Surveillance Pilot Project during December 2011. This review revealed a dramatic improvement in sensitivity: the proportion of captured cases increased to 52% (personal communication with M.-N. Vallée, January 2012).

Unfortunately due to time constraints this second chart review was informally conducted by ISPP and the positive results showing improvement of sensitivity at levels expected by some stakeholders cannot hold the same credibility and validity as the formal evaluation results.

An important determinant for missed cases proved to be the person in first contact with the patient. Being seen by a triage nurse upon presentation at Sick Parade would increase the chance for that case to be captured by the surveillance system. On the contrary, if the first contact for the injured person was a medical technician, a physician or a physiotherapist, then the risk to be missed was higher.

The potential factors influencing missed cases at the clinic level were: 1) the fact that medical technicians were changing frequently and there were minimal opportunities to remind them to give injured patients the form; 2) it was difficult, especially at the beginning, for the civilian Injury Surveillance Pilot Project personnel to recommend the use of questionnaire to the regular CF personnel; and 3) the confusion regarding the purpose of the questionnaire among some triage staff. For some the injury reporting form was considered optional rather than a necessary component of the surveillance system and was inconsistently distributed to patients.

It was noted during the interview that another source of missing cases was due to a strong wish by some clinic personnel to help the Injury Surveillance Pilot Project staff by selecting a specific category of injury to be captured (selection bias).

It was also acknowledged following the interviews that there seemed to be differences between doctors and physiotherapists regarding the diagnosis of an injury, which

is another important data quality issue for an injury surveillance system. Also, if a military member is severely injured and in pain, one would think that the case might be missed. A similar situation can occur for persons presenting with a repetitive strain injury where injuries of gradual onset may be missed compared to acute injuries which are more obvious.

From the interview another potential cause for missing injuries relates to personnel seen in civilian emergency rooms (ED) during weekends. Despite the fact that military personnel should report any ED visit when they return to the base, cases might be missed at follow up and the lack of information recorded in the charts did not allow a further exploration of this aspect.

It was thought that an analysis to identify any predictors for missing cases would be done regarding the diagnosis, or the severity of the injury case, as well as the acute versus repetitive strain injury. However, the chart review did not provide enough information regarding the diagnosis to confirm this hypothesis.

A similar situation was the large number of cases for which there was no record of information about the history of activity or mechanism of injury in the medical chart. As a result, an analysis for predictors of missing cases by type of activity was not possible in this evaluation.

The sensitivity was estimated over a period of three months: March to May 2011, which did not allow for the assessment of seasonal variation of injury predictors or Injury Surveillance Pilot Project performance between winter, spring, summer or fall periods.

Mackenzie and Pless (1999) study conducted in civilian setting identified that an issue for emergency department (ED)-based injury surveillance systems was the resources available for data collection. When ED staff were under pressure to provide medical treatment data collection compliance was low. When injury information was not part of the minimum mandatory data collected for every individual, the quality of data collected was poor (Mackenzie and Pless, 1999; Shipton and Stone, 2008).

Comparing ED with Sick Parade, which may experience sometimes unpredictable work flow, data collection is not mandatory thus allowing clinic personnel to decide if they have time to hand out the form or if they consider it important to collect that information.

It appears that the systematic errors in data collection were related to the education of the clinic personnel and to the operation of the surveillance system itself rather than to characteristics of the CF personnel.

These systematic errors in capturing injuries are easily correctable, which actually happened as preliminary results have been discussed with Injury Surveillance Pilot Project staff. One easy measure would be to make the data collection form a mandatory form to be distributed to CF personnel presenting with injuries at Sick Parade.

There are two aspects related to the low system sensitivity. This leads to an underestimation of the injuries, which are very important health issues in military populations. Secondly, systematic errors in capturing injury cases may lead to an inefficient use of resources, as the target intervention may be directed to another factor, which could be less important. However, due to a lack of information in the medical charts regarding the

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circumstances in which injuries occurred, which in this study represents an important percentage: 25.9% of injury cases presented at Sick parade, it was difficult to comment on the representativeness of injuries captured by the Injury Surveillance Pilot Project related to mechanisms of injury.

***Representativeness.***

The representativeness study indicated that there are systematic errors in capturing injury cases at Sick Parade. Military personnel over the age of 35 were more likely to be missed. These cases of injuries might be missed because of several reasons: usually military personnel over 35 are also senior ranks and they might be identified and taken for triage by medical technicians, or they might be seen directly by doctors. In both cases more education about the importance of data collection for the injury surveillance system and the final objective, to help reduce the burden of injuries in military, should be considered.

In the study conducted by Macarthur & Pless, (1999) two issues were identified that negatively affected the representativeness of injury data collection within the ER environment: the injury type and the time of presentation.

The type of injury probably reflects the severity of the injury and the urgency of treatment required. Despite the fact that this information is essential when developing interventions, in the present study conclusions cannot be inferred about the representativeness of injuries captured by the Injury Surveillance Pilot Project regarding the type of injuries, due to lack of information in the medical charts.

*Completeness of forms.*

The overwhelming majority of stakeholders participating at the interview agreed that this data collection form was complete and simple, serving very well the purpose of collecting information regarding non-battle injuries.

Although the high rates of completeness of forms is reassuring for the data quality captured by the system, as well as regarding the user acceptability, there were few items under question #2 with low response rates: one was related to the onset on injury: acute or gradual onset and it appeared that the question created confusion. A second question was about the date and time of the injury.

The third area, lacking a response all of the time, was the consent to share the information with the Directorate of General Safety (D Safe G) in National Defence. The consent was not related to the ISPP but was for an external Directorate, which was optional and not required for the surveillance system itself.

Health Services analysed the injury data and provided reports for prevention and control purposes to a wide group of stakeholders including D Safe G. At that time D Safe G also requested individual level information. Health Services could not share individual level data with D Safe G without patient consent. Therefore in June 2011 at the request of D Safe G a question asking patients' consent was added in a very small section of the Patient Injury Questionnaire to a pre-existing statement regarding the purpose of data collection.

This question was at the end of the questionnaire and there are two possible explanations to the lack of answers: patients refused to give consent or they did not read the corresponding five lines paragraph.

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One of the strengths of the Patient Questionnaire form is the collection of narrative data, which allows the person suffering an injury to expand on the information collected and has the potential to provide a better understanding of the circumstances, sources or cause for injury to occur.

The response rate on this question was 96.2%, demonstrating the patients' interest in giving detailed information about the injuries they suffered. This type of unstructured text entry field is limited by the amount of text that can be entered but these qualitative information sources generate very valuable information (Driscoll et al., 2004).

***Coding reliability.***

It should be noted that in Valcartier the Injury Surveillance Pilot Project system uses their own developed coding for diagnosis and the fact that the project staff complete the coding likely reduces the possibility for errors and misclassification.

The coding reliability study demonstrated a good agreement between coders for all four categories investigated. For the purpose of this study it was considered that simple kappa would be enough.

Another strength of this surveillance system is the consistency of coding, easily achieved when only the project staff were coding for the diagnosis, body parts, activity and referrals. This aspect is very important, as evaluation studies demonstrated that the use of ICD codes in primary care is problematic, because clinic staff have to understand the overall structure of the system and the numerous specific codes from each stratum. Other studies

conducted in civilian settings have proved poor coding reliability scores, 40% (Nilsson et al, 2000), and for injury coding in a military setting 3% and 23% (Wilson, Carew and Strauss, 2002).

### ***Operational characteristics.***

The operational characteristics were evaluated through the assessment of simplicity, flexibility, timeliness and sustainability.

#### ***Simplicity.***

At a first sight, the ISPP flow chart may look simple, straight forward and with a logical sequence. However due to organizational circumstances the flow of data is complicated at the initial step: handing out the form. As was discussed in the previous section, the data collection form is not a standardized form. In this situation it was left for the clinic staff to decide to use or not the form for military personnel presenting with injuries. Even more, only nurses would use it as the medical technicians were not always informed about the existence of the surveillance system. The whole process could be simplified through more education for clinical personnel about the surveillance system's existence, objectives and uses, as the findings in the literature suggested or, being a very structured environment, by making the form mandatory to be used in clinics.

From the perspective of clinic staff workload, it seems to be very convenient to use this type of self-reported form at Sick Parade. Clinic personnel were spending from a few

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seconds to hand out the form, up to one minute to discuss it with injured patients. The rest of the time for answering questions, approximately 10 minutes, was spent by CF staff while waiting for consultation. The completed forms were collected at the end of the work day by ISPP staff who would finish data collection in 10 minutes, by collecting and providing codes for the following information: diagnosis (up to three), body part affected (up to three), number of days of occupational restrictions and limitations, medical referrals, the activity code, whether a follow-up visit is required and the code for the person who completed the form.

The next step was the scanning of the form into the Canadian Forces Health Information System and the data was entered into an Access database. Measures were in place to protect the privacy and confidentiality of information by using only a protected network to store the information.

***Flexibility.***

The flexibility of the surveillance system was demonstrated by using ISPP in Camp Vimy, a summer reservist camp. However, as several stakeholders mentioned in the qualitative interviews, this data collection form would need some modifications if deployed to other types of bases, such the Air Force and Navy, where the training requirements are not identical.

*Timeliness.*

An important aspect of an injury surveillance evaluation is to assess the data analysis and interpretation process. Two levels of monitoring data captured in Valcartier were identified. The first one, done with the purpose of identifying clusters or unusual events was done by the project coordinator a few times weekly and a simple descriptive data analysis was conducted bi-weekly by the Force Health Protection epidemiologist. This analysis allowed injury issues to be addressed as they occurred or emerged, rather than have military personnel suffer from preventable injuries.

The second, more complex analysis and reporting was conducted every 4 to 6 months by the Directorate of Force Health Protection epidemiologist and the information as well as the discussion and interpretation of results were discussed with the Injury Surveillance Pilot Project members in collaboration with local stakeholders.

Since the surveillance system was fully implemented for only 4–6 months at the time of the evaluation, key informants agreed that it was too early to expect to have preventive measures or policy changes in place to inform about the timeliness of the system.

However there was a working group established at the time of this evaluation, examining which measures were necessary to prevent recurrent heat injuries in the summer reservist training camp. Another steering committee had been initiated to examine, analyze, and recommend prevention measures for injuries caused by running.

***Sustainability.***

Multiple stakeholders agreed that at the medical leadership level there is a need for more open and strong support for injury prevention overall, even from outside of the system. Changes are taking time and commitment and perseverance is a requirement for success. This process may be comparable with civilian physicians' advocacy activities: physicians have taken a major role in Health Promotion activities and their interest has stimulated changes in policy for helmets and smoking, to mention only a couple.

The funding was ongoing for the project; however the project funding was terminated after this study was done, due to the Government of Canada's Deficit Reduction Action Plan—implemented in April 2012.

***Practical characteristics.***

The third important part of the evaluation of the Injury Surveillance Pilot Project aside from the quality of data and the operational characteristics was to assess the practical characteristics, described by the acceptability and the usefulness attributes of the surveillance system.

***Acceptability.***

All the interview participants identified musculoskeletal injuries as being a very important health problem for the Regular Forces, mental health problems also being a

significant issue. The amplitude of responses and suggestions and the richness of information about the causes of injuries and about injury prevention, presented in Appendix H, are proof of the interest for injury prevention in CF, and indirectly an indicator of acceptability of the surveillance system and commitment to collaborate, for improving data collection to inform prevention measures.

When military personnel are away from their jobs due to health problems, including injuries, which represent an important health-related event as was agreed on by all interview participants, the readiness of their units will be impacted (Bratt et al., 2010). In addition, this may result in the need to recruit and train new personnel.

The majority of participants agreed that an injury surveillance system is needed in the CF to guide mitigation measures for reducing injuries.

During the interviews I observed on a few occasions that there is confusion or lack of knowledge about injury prevention, about the objectives of surveillance systems and about the differences between surveillance monitoring systems and cross sectional studies. In another instance I noted that some stakeholders would count on CFHIS (electronic medical records) to provide the detailed information necessary to guide injury prevention, without considering the burden placed on clinic personnel to document in writing all what is required for Haddon's matrix utilization. As mentioned earlier in the results section, a significant percentage: 25.9% of the identified injury cases, are lacking information in the medical chart with regards to the circumstance of the accident.

Consideration may be given for educating CF stakeholders about the benefits of surveillance data for monitoring trends to inform injury prevention measures and then for

measuring effectiveness of interventions. Such intervention has the potential to foster support for collecting data, communication among stakeholders for injury prevention measures and advocacy for funds to implement and to maintain a surveillance system.

*Usefulness.*

Since the surveillance system was fully implemented for only 4–6 months at the time of the evaluation, key informants agreed that it was yet too early to have preventive measures or policy changes in support for the utility of the system.

However there was a working group examining which measures were necessary to prevent recurrent heat injuries in the summer reservist training camp. Another steering committee has been initiated to examine, analyze, and recommend prevention measures for injuries caused by running.

The Injury Surveillance Pilot Project staff description of the analysis work offered examples of the utility of the surveillance system: the bi-monthly analysis for checking on red flags as concussions or anterior cruciate ligament tears, the establishment of a baseline for different injuries, and based on data analysis and interpretation every four to six months, written reports and presentations were shared with stakeholders at the local level and the Directorate of Force Health Protection. Also, the ad-hoc reporting on different requests from stakeholders was mentioned as well.

All interview participants agreed that this type of communication was transparent and had an important impact in creating a sense of accountability and responsibility among

military personnel in charge of training, as well as stimulating clinic personnel participation in data collection.

Based on the opinion of several injury prevention stakeholders more work needed to be done with the national health promotion injury prevention working group since all were trying to achieve the same thing, but they can't find agreement among themselves about how they are going to do it.

There are different sources of data: at the base stakeholders are provided with detailed evidence about the nature of injuries in garrison; the national prevention stakeholders have data available from international research, different population groups, or from the Health and Lifestyle Information Survey which is a cross-sectional survey and the chart review which is old and offers limited information.

The challenge is to bring together local stakeholders in the next phase in injury understanding in the CF, because the national prevention working group could contribute in making their recommendations more specific and tailor them to our population. Since the work on this system was in progress, and the surveillance information from the Injury Surveillance Pilot Project was limited now, we have to acknowledge that the system had potential to develop and to help everyone later. This is not a short term strategy, but requires a period of investment before results will pay off.

To have an impact on the sustainability of injury prevention interventions, collaboration and coordination are needed to address the injuries and factors at different levels: personal, organizational and environmental levels.

Another important aspect is that data from the surveillance system in Valcartier, an Army military base, could only be partially used for the development of injury prevention interventions on the other bases, such as in the Air Force and Navy, because the training requirements are not identical.

In the context of limited resources (Canham-Chervak, M. et al., 2010) decision-makers must prioritize injury prevention interventions. This is a complex process that requires, aside from expert opinion, information about the injury rates, the mechanisms of injury and information on the effectiveness of prevention strategies. All of these could be provided by an effective surveillance system.

## Chapter 7

### Conclusions

In the present economic and financial context, limited budgets and resources require solid justifications for programs. Consequently, the development of health policy measures must be based on the best scientific evidence and best practices. As it is often said, “knowledge is power,” and this is very true for policy development and for a better use of limited resources.

Careful consideration should be given when interpreting the results of the present study for the following reasons: the period of time when the evaluation was conducted, specifically, the three months after full implementation in Valcartier as a *pilot* project, explains in part the low sensitivity and also to the fact that this evaluation was a process evaluation, conducted with the purpose of identifying the weaknesses and the gaps in data collection to help the system to improve its attributes.

Surveillance systems should be evaluated with regularity, but a system requires a few years of functionality before demonstrating benefits in terms of usefulness and timeliness.

Despite low sensitivity and representativeness which are justifiable in the context mentioned above and are easily correctable with more education of clinic personnel, I conclude that the Injury Surveillance Pilot Project has good potential to be used in a military context on CF bases for several reasons:

- Data collection did not require additional work by clinical staff.
- The Injury Surveillance Pilot Project was well accepted by stakeholders.
- The system proved its usefulness and timeliness in identifying injury trends.
- The response rates on the Patient Injury Questionnaire were high, indicating a strong willingness to participate.
- The sensitivity improved in December 2011— to 52% (for one CDU it was 63%).
- There was good agreement between coders.
- It provided detailed and timely information on patients presenting at Sick Parade.
- It identified specific injuries and circumstances associated with these injuries.
- It was easily deployed in different settings, including off base for exercise.
- Findings from the Injury Surveillance Pilot Project can help design and prioritize injury prevention interventions.

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# Appendix A: Patient injury questionnaire.

National Defence / Défense nationale	PROTECTED B (once completed) / PROTÉGÉ B (une fois rempli)		
<b>PATIENT INJURY QUESTIONNAIRE - QUESTIONNAIRE AU PATIENT SUR LES BLESSURES PHYSIQUES</b>			
<b>Patient's instructions:</b> If you are at the Sick parade for any physical injury (not a follow up visit), please complete this form and hand it in to the medical staff <b>Instructions au patient:</b> Si vous consultez à la parade des malades pour toute blessure physique (excluant les visites de suivi), complétez ce formulaire et remettez-le à un membre du personnel soignant (ex: infirmière, physiothérapeute, technicien médical, médecin, etc.)			
Print in capital letters. Avoid contact with the edge of the box. <span style="border: 1px solid black; padding: 0 2px;">A</span> <span style="border: 1px solid black; padding: 0 2px;">B</span> <span style="border: 1px solid black; padding: 0 2px;">C</span> Imprimer en majuscules. Évitez de toucher à l'encadré.			
Shade circles like this <b>Noircir les cercles comme ceci</b> Not like this <b>Pas de cette façon</b>			
<b>1. PATIENT IDENTIFICATION / IDENTIFICATION DU PATIENT</b>			
SURNAME - NOM DE FAMILLE	FIRST NAME - PRÉNOM	SEX - SEXE	RANK - GRADE
<input style="width: 100%; height: 20px;" type="text"/>	<input style="width: 100%; height: 20px;" type="text"/>	<input type="radio"/> M <input type="radio"/> F	<input style="width: 100%; height: 20px;" type="text"/>
DOB (DD/MM/YYYY) - DDN (JJ/MM/AAAA)	SERVICE NUMBER - MATRICULE	MOSID - ID SGPM	HOME UNIT - UNITÉ
<input style="width: 100%; height: 20px;" type="text"/> - <input style="width: 100%; height: 20px;" type="text"/> - <input style="width: 100%; height: 20px;" type="text"/>	<input style="width: 100%; height: 20px;" type="text"/>	<input style="width: 100%; height: 20px;" type="text"/>	<input style="width: 100%; height: 20px;" type="text"/>
COMPONENT/COMPOSANTE: <input type="radio"/> Reg <input type="radio"/> Res <input type="radio"/> Recruit / Recrue <input type="radio"/> Cadet/CIC/Rangers		ELEMENT/ÉLÉMENT: <input type="radio"/> Army/Terre <input type="radio"/> Navy/Mer <input type="radio"/> Air	
<b>CIRCUMSTANCES OF INJURY / CIRCONSTANCES ENTOURANT LA BLESSURE</b>			
<b>2a. REASON FOR VISIT / RAISON DE LA VISITE:</b> (Check only one / Cocher une seule case)	<b>2b. DATE OF INJURY (DD/MM/YYYY) / DATE DE LA BLESSURE (JJ/MM/AAAA)</b>	<b>2c. TIME OF INJURY (24 HR) / HEURE DE LA BLESSURE (24 HR)</b>	
<input type="radio"/> New Injury (First ever episode) / Nouvelle blessure (Premier épisode à ce jour)	<input style="width: 100%; height: 20px;" type="text"/> - <input style="width: 100%; height: 20px;" type="text"/> - <input style="width: 100%; height: 20px;" type="text"/>	<input style="width: 100%; height: 20px;" type="text"/> : <input style="width: 100%; height: 20px;" type="text"/>	
<input type="radio"/> Flare up of old injury / Réapparition d'une ancienne blessure	<input type="radio"/> Unsure of date / Incertain(e) de la date <input type="radio"/> Gradual onset / Apparue graduellement	<input type="radio"/> Unsure of time / Incertain(e) de l'heure <input type="radio"/> Gradual onset / Apparue graduellement	
<b>3a. Were you on Base / Étiez-vous sur la base?</b> <input type="radio"/> Yes / Oui <input type="radio"/> No / Non	<b>3b. Were you at work / Étiez-vous au travail?</b> <input type="radio"/> Yes / Oui <input type="radio"/> No / Non	<b>3c. Were you deployed / Étiez-vous déployé?</b> <input type="radio"/> Yes / Oui <input type="radio"/> No / Non	
<b>4. Where did the injury occur / Où est survenue votre blessure?</b>	<input type="radio"/> Indoors / À l'intérieur <b>Please specify the place:</b> <input style="width: 100%; height: 20px;" type="text"/>	<input type="radio"/> Outdoors / À l'extérieur <b>Précisez l'endroit:</b> <input style="width: 100%; height: 20px;" type="text"/>	
e.g.: gym, arena, obstacle course, oval track, pool, mess, road, trail etc. ex: gym, arène, parcours du combattant, piste ovale, piscine, mess, chemin, route etc.			
<b>5. Surface conditions at the time of your injury / Conditions du terrain-plancher lors de votre blessure:</b>			
<input type="radio"/> Unremarkable / Sans particularité	<input type="radio"/> Sand-Gravel / Sable-Gravier	<input type="radio"/> Snowy / Enneigé	(Check all that apply / Cochez toutes les cases appropriées) <input type="radio"/> Not applicable / Ne s'applique pas
<input type="radio"/> Muddy / Boueux	<input type="radio"/> Sudden drop / Dénivellation soudaine	<input type="radio"/> Slippery / Glissant	<input type="radio"/> Other (please specify) / Autre (spécifiez): <input style="width: 100%; height: 20px;" type="text"/>
<input type="radio"/> Rough-Rocky / Cahoteux-Rocailleux	<input type="radio"/> Hard / Dur	<input type="radio"/> Uneven / Inégal	<input type="radio"/> Other (specify) / Autre (spécifiez): <input style="width: 100%; height: 20px;" type="text"/>
<b>6. Environmental conditions at the time of your injury / Conditions environnementales lors de votre blessure: (Check all that apply / Cochez toutes les cases appropriées)</b>			
<input type="radio"/> Unremarkable / Sans particularité	<input type="radio"/> Cold / Froid	<input type="radio"/> Freezing rain-Hail / Verglas-Grêle	
<input type="radio"/> Rain-Humid / Pluie-Humide	<input type="radio"/> Snowing / Neige	<input type="radio"/> Not applicable / Ne s'applique pas	
<input type="radio"/> Hot / Chaud	<input type="radio"/> Strong winds / Vents forts	<input type="radio"/> Other (specify) / Autre (spécifiez): <input style="width: 100%; height: 20px;" type="text"/>	
<b>7. Tell us how the injury happened and what went wrong: (e.g. During the ruckoack march, I briefly slowed down to adjust the strap of my weapon. While I was running to catch up with my unit, I tripped over a rock and twisted my ankle inward. I completed the last KM of the march with increasing pain, while limping.)</b> <b>Comment la blessure est-elle survenue et qu'est-ce qui a mal tourné: (ex: Au cours de la marche forcée avec charge, j'ai ralenti afin d'ajuster le cangle de mon arme. Alors que je courais pour rattraper mon unité, j'ai trébuché sur une roche et ma cheville s'est tordue vers l'intérieur. J'ai terminé le dernier KM de marche en boitant.)</b>			
<input style="width: 100%; height: 100%;" type="text"/>			
<b>8. What was the actual cause of the injury / Quelle est la cause directe de la blessure: (Check only one / Cochez une seule case)</b>			
<input type="radio"/> Repetitive activity (gradual onset - non traumatic) / Activité répétitive (début graduel - non traumatique)	<input type="radio"/> Struck by-Collision with person or object / Frappé par-Collision avec personne ou objet	<input type="radio"/> Exposure to extreme hot-cold conditions / Exposition à la chaleur-au froid extrême	
<input type="radio"/> Ingestion-Absorption of toxic substance / Ingestion-Absorption de substance toxique	<input type="radio"/> Physical overexertion (e.g.: over training) / Épuisement physique (ex: surentraînement)	<input type="radio"/> Foreign object in eye / Corps étranger dans l'oeil	
<input type="radio"/> Lifting-Carrying a person or object / Soulèvement-Transport d'une personne ou un objet	<input type="radio"/> Cut-Piercing of skin / Coupure-Perforation de la peau	<input type="radio"/> Not applicable / Ne s'applique pas	
<input type="radio"/> Caught-Crushed-Jammed-Pinched between objects / Coincé-Écrasé-Pincé par des objets	<input type="radio"/> Slip-Fall-Stumble / Chute-Glisement-Trébuchement	<input type="radio"/> Other (specify) / Autre (spécifiez): <input style="width: 100%; height: 20px;" type="text"/>	
ADM-20 (05-2011)			
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**9a. What were you doing when the injury occurred / Que faisiez-vous lorsque la blessure est survenue:** (Check only one category / Cochez une seule catégorie)

<input type="radio"/> <b>ANNUAL FITNESS EVALUATION / ÉVALUATION MILITAIRE ANNUELLE</b> (Check one / Cochez l'activité) <input type="radio"/> 13 Km march / Marche forcée 13 Km <input type="radio"/> Fireman carry / Transport du pompier <input type="radio"/> Trench digging / Creusage de tranchée <input type="radio"/> Stretcher carry / Transport de la civière <input type="radio"/> CF EXPRESS (PT test) / EXPRESS FC (PT test) <input type="radio"/> Other (please specify) / Autre (spécifiez): <div style="border: 1px solid black; height: 20px; width: 100%;"></div>	<input type="radio"/> <b>MILITARY TRAINING / ENTRAÎNEMENT MILITAIRE</b> (Check one / Cochez l'activité) <input type="radio"/> Field exercise / Exercice en campagne <input type="radio"/> Parade-Drill / Parade-Exercice élémentaire <input type="radio"/> Handling of weapons-explosives / Manipulation d'armes-explosifs <input type="radio"/> Other (please specify) / Autre (spécifiez): <div style="border: 1px solid black; height: 20px; width: 100%;"></div>	<input type="radio"/> <b>SPORT-PT / SPORT-ENTR. PHYSIQUE</b> (Check one / Cochez une case) <input type="radio"/> Individual / Individuel <input type="radio"/> Unit training / Avec l'unité <b>WHICH ACTIVITY / QUELLE ACTIVITÉ?</b> <input type="radio"/> Running / Course <input type="radio"/> Ice hockey / Hockey <input type="radio"/> Floor hockey / Hockey balle <input type="radio"/> Soccer <input type="radio"/> Basketball <input type="radio"/> Weight Training / Poids et haltères <input type="radio"/> Other (please specify) / Autre (spécifiez): <div style="border: 1px solid black; height: 20px; width: 100%;"></div>	<input type="radio"/> <b>TRANSPORTATION RELATED INJURY / BLESSURE RELIÉE AU TRANSPORT</b> (Check one / Cochez une case) <b>YOU WERE/VOUS ÉTIEZ:</b> <input type="radio"/> Driver / Conducteur <input type="radio"/> Passenger / Passager <input type="radio"/> Pedestrian / Piéton <b>VEHICLE TYPE/ TYPE DE VÉHICULE:</b> <input type="radio"/> POMV / Personnel <input type="radio"/> Military / Militaire <input type="radio"/> Other (please specify) / Autre (spécifiez): <div style="border: 1px solid black; height: 20px; width: 100%;"></div>	<input type="radio"/> <b>OTHER ACTIVITY / AUTRE ACTIVITÉ</b> (Check one / Cochez l'activité) <input type="radio"/> Work with tools-machinery / Travail avec outils-machinerie <input type="radio"/> Using ladders-stairs-steps / Utilisation échelles-escaliers-marches <input type="radio"/> Not related to work-military training / Non relié au travail-entraînement militaire <input type="radio"/> Unsure, gradual onset / Inertain(e), apparue graduellement <input type="radio"/> Other (please specify) / Autre (spécifiez): <div style="border: 1px solid black; height: 20px; width: 100%;"></div>
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**9b. Who was supervising the activity / Qui supervisait l'activité:** (Check all that apply / Cochez toutes les cases appropriées)

Unit Member / Membre de l'unité       No supervision - NA / Pas de supervision - NA  
 PSP staff / Personnel PSP       Other (please specify) / Autre (spécifiez):

**10. Were you wearing any protective equipment when the injury occurred / Utilisiez-vous de l'équipement de protection?**

No - Non  
 Yes - Oui (Check all that apply / Cochez toutes les cases appropriées)  
 Helmet / Casque       Mouthguard / Protecteur buccal       Other (specify) / Autre (spécifiez):  
 Ankle brace / Chevillière       Seatbelt / Ceinture de sécurité  
 Gloves / Gants       Protective eyewear or mask / Masque ou lunettes de protection

**11. Were there other contributing factors to the injury? / Y a-t-il d'autres facteurs qui ont contribué à l'apparition de votre blessure?** (Check all that apply / Cochez toutes les cases appropriées)

<input type="radio"/> Fatigue	<input type="radio"/> Overexertion / Activité trop intense	<input type="radio"/> Inadequate planning-preparation / Planification-préparation inadéquate
<input type="radio"/> Stress	<input type="radio"/> Inadequate fitness level / Condition physique inadéquate	<input type="radio"/> Inadequate construction-material failure / Défaillance matérielle-construction inadéquate
<input type="radio"/> Vibration	<input type="radio"/> Alcohol use / Consommation d'alcool	<input type="radio"/> Not applicable / Ne s'applique pas
<input type="radio"/> Noise Exposure / Exposition au bruit	<input type="radio"/> Poor diet / Mauvaise alimentation	<input type="radio"/> Other (specify) / Autre (spécifiez):
<input type="radio"/> Peer pressure / Pression de la part des autres	<input type="radio"/> Low or limited lighting / Éclairage inapproprié	<div style="border: 1px solid black; height: 20px; width: 100%;"></div>
<input type="radio"/> Poor hydration / Mauvaise hydratation		
<input type="radio"/> Inattention-distraction		

I consent to the CFHS disclosing to the Director of General Safety the following personal information from this form to administer DND's occupational safety and health activities, including the investigation of occupational injuries and illnesses. Information to be disclosed: Name, rank, service number, unit, date of injury, injury occurred on base, at work or on deployment.  
 Je consens à ce que les SSFC divulguent certaines informations personnelles contenues dans ce formulaire au Directeur de la sécurité générale afin d'administrer des mesures de prévention de santé et sécurité au sein du DDN incluant des enquêtes sur les blessures et maladies survenues au travail. Les informations partagées seront: Nom, grade, numéro service, unité, date de la blessure, blessures survenue sur la base, au travail, en déploiement.

Yes/Oui  
 No/Non

DATE (DD/MM/YYYY) / DATE (JJ/MM/AAAA)

Patient's signature / Signature du patient:

**Please hand in the form to the medical staff ~ Veuillez remettre le formulaire à un membre du personnel soignant**

**Privacy statement/ Avis de confidentialité**  
 Personal information is collected on this form under the authority of the National Defence Act and the Queen's Regulations and Orders for the Canadian Forces (QR&Os). The information you provide is protected under the Privacy Act and is described in the Personal Information Bank (PIB), DND PPE 810 and Medical Records. Instructions for obtaining this information are outlined in the government publication entitled InfoSource. Les renseignements personnels recueillis dans le présent formulaire sont obtenus en vertu de la Loi sur la défense nationale et des Ordonnances et règlements royaux applicables au Forces canadiennes (ORFC). Les renseignements que vous fournissez sont protégés en vertu de l'énoncé relatif à la Loi sur la protection des renseignements personnels et sont décrits dans la base de données sur les renseignements personnels (BDRP), DND PPE 810 et Dossiers médicaux. La procédure pour obtenir ces renseignements est décrite dans la publication InfoSource.

**Pour usage interne seulement (sera complété par le personnel du PSB) - For internal use only (To be completed by the ISP staff)**

<b>12. Diagnosis / Diagnostique:</b> 1. <span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px;"></span> 2. <span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px;"></span> 3. <span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px;"></span>	<b>13. Body Parts / Partie du corps:</b> 1. <span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px;"></span> 2. <span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px;"></span> 3. <span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px;"></span>	<b>14. Referral to:</b> <input type="radio"/> None / Aucune <input type="radio"/> Hospital-ER / Hôpital-Urgences <input type="radio"/> MD Specialist / MD spécialiste <input type="radio"/> Physiotherapist / Physiothérapeute <input type="radio"/> Diagnostic svc / Svc diagnostique <input type="radio"/> Mental Health / Santé mentale <input type="radio"/> Other / Autre
<b>15. Activity code / Code activité</b> <span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px;"></span>	<b>16. Place code / Code de lieu</b> <span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px;"></span>	<b>17. FIU Civilian HC / Suivi soins au civil</b> <input type="radio"/> No / Non <input type="radio"/> Yes / Oui
<b>18. Restrictions/Limitations (# days /# jrs)</b> <input type="radio"/> Not specified / Non spécifié <input type="radio"/> No restrictions / Pas de restrictions <input type="radio"/> Light duty (Work) / Travaux légers (Travail) <input type="radio"/> Light duty (Military) / Travaux légers (Militaire) <input type="radio"/> Sick leave / Congé de maladie	<b>19. Loc code</b> <span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px;"></span>	<b>ISP ID/ ID PSB</b> <span style="border: 1px solid black; display: inline-block; width: 40px; height: 15px;"></span>

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## **Appendix B: Selection Criteria**

### ***Inclusion:***

CF personnel will be included if they sustain a(n):

- Unintentional injury resulting from an external factor. Includes:
  - Mechanical/Kinetic Energy (e.g., falls, motor vehicle crashes, accidental gun shot)
  - Thermal Energy (e.g., burns, scalds)
  - Electrical Energy (e.g., electrocution, lightning)
  - Chemical Energy (e.g., corrosion, acute poisoning by drugs, and biological substances, toxic effects of substances chiefly non-medicinal (e.g., alcohol, organic solvents, corrosive substances)
  - Radiation (e.g. sunburn, radiofrequency radiation)
  - Heat/absence of (e.g., hypothermia, frostbite, hyperthermia)
  - Absence of oxygen (e.g., near drowning, choking); or
- Repetitive strain (includes blisters); or
- Back pain.

### ***Exclusion:***

CF personnel will be excluded if they have a(n):

- Intentional injury (e.g., suicide, homicide, assault)
- Combat injuries
- Injury sequelae
- An infection following an injury (e.g., foot cellulitis following blisters);
- Chronic poisonings;
- Food poisoning or food borne intoxication;
- Food allergies/food anaphylaxis;
- Poison ivy or other contact dermatitis;
- No injury (e.g., in motor vehicle crash but no actual injury);
- Emotional trauma;
- Adverse events in medical care (iatrogenic events);
- Back pain from pregnancy;
- Events that do not result in any physical harm but have the potential to cause injury (near misses).

Intentional injuries were excluded from this surveillance system because of the difficulty in obtaining this type of data from personnel due to privacy legislation and the difficulty in obtaining valid data due to the stigma associated with these types of injuries.

## **Appendix C: Literature search strategy**

### Step 1. MeSH terms search

("wounds and injuries"[MeSH Terms] OR ("wounds"[All Fields] AND "injuries"[All Fields]) OR "wounds and injuries"[All Fields] OR "injury"[All Fields]) AND (("epidemiology"[Subheading] OR "epidemiology"[All Fields] OR "surveillance"[All Fields] OR "epidemiology"[MeSH Terms] OR "surveillance"[All Fields]) AND system[All Fields]) AND("evaluation studies"[Publication Type] OR "evaluation studies as topic"[MeSH Terms] OR "evaluation"[All Fields] ) AND ( ( free full text[sb] AND hasabstract[text] ) AND ( "1999/01/01"[PDat] : "2011/12/31"[PDat] ) AND Humans[Mesh] AND English[lang] AND ( child[MeSH:noexp] OR adolescent[MeSH] OR adult[MeSH] OR adult[MeSH:noexp] ) ) )

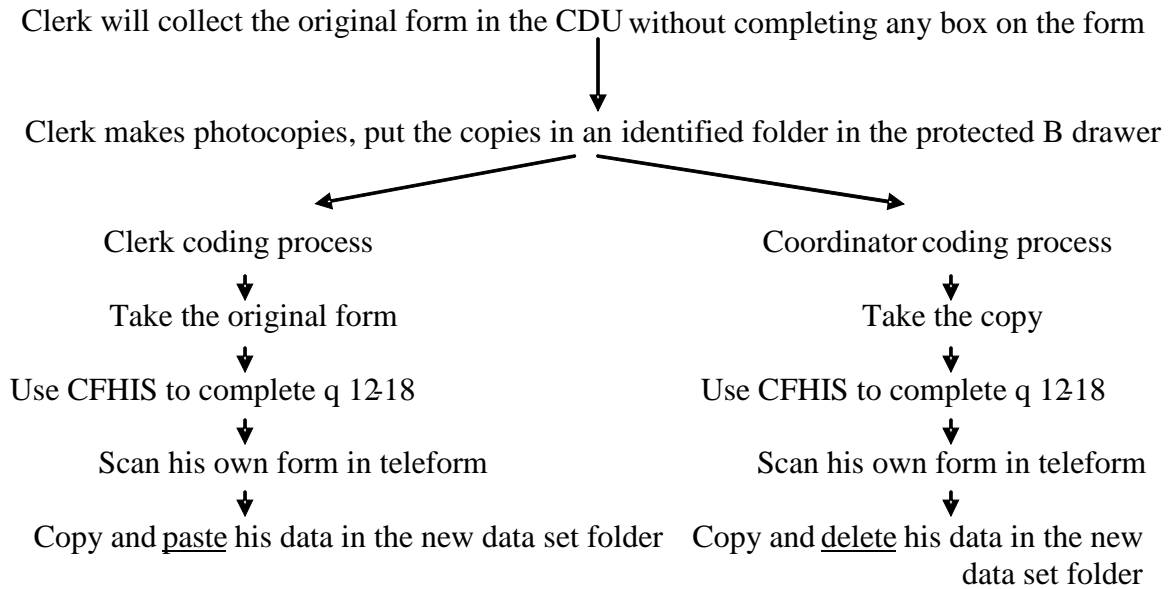
135 results and 1 study selected

### Step 2. Related Citation search

129 results and 14 studies selected

## Appendix D: Coding Reliability Study - flow chart

Flow chart for coding reliability



- All efforts will be made to not see the codes of each other
- Coding will be made on a daily base until the number of 100 forms is reached

## **Appendix E: Semi-structured interview questionnaire – underlying questions.**

Background questions for assessing the system attributes such as simplicity, acceptability, timeliness flexibility and overall the usefulness of the injury surveillance system.

a) *Simplicity. The simplicity of a public health surveillance system refers to both its structure and ease of operation. Surveillance systems should be as simple as possible while still meeting their objectives.*

The chart flow diagram helps to assess the simplicity.

What is the amount and type of data necessary to establish that an injury occurred?

What amount and type of other data is collected: demographics, behavioural and exposure/climate

Format: is the data collection in paper format acceptable; if an electronic system could be introduced how this system should be planned for/implemented

Number of departments receiving the reports

Level of integration with other systems

Methods of collecting the data

-number & types of reporting sources

-time spent in collecting data

What/is any kind of follow up necessary to update data on a case

What is the method of managing data and the time spent in: transferring, entering, editing, storing and backing up data

What are the methods of analysing data and the time spent in preparing data for dissemination.

What are the staff training requirements?

How much time is spent in maintaining the system?

b) *Acceptability. Acceptability reflects the willingness of persons and organizations to participate in the surveillance system.*

Would you consider it important to participate in this surveillance system?

What is the participation rate (from all CDUs?)

Are the forms complete?

What is the facility reporting rate?

Timeliness of data reporting

What do you think is the importance of injuries in your work?

Do you receive reports back?

What suggestions for improvement do you have?

Is the system able to protect confidentiality, privacy?

What would you see your role might be in this process of injury surveillance?

c) Usefulness. *A public health surveillance system is useful if it contributes to the prevention and control of adverse health-related events, including an improved understanding of the public health implications of such events.*

*Is the system able to identify that an event previously thought to be unimportant is actually important.*

Does the system detect injuries in a timely way to permit prevention?

Does the system provide an estimate of the magnitude of morbidity/mortality related to injuries.

Does the system identify the factors associated with the events?

Does the system detect trends that signal changes in the occurrence of injuries, adverse or protective exposure?

Does the system permit assessment of the effect of prevention and control programs?

Does the system lead to improved policy?

d) Timeliness. *Timeliness reflects the speed between steps in a public health surveillance system.*

How frequently is the data coded?

How frequently is data reported and what is the method used?

What is the time to identify trends or effect control and prevention measures?

e) Flexibility. *A flexible public health surveillance system can adapt to changing information needs or operating conditions with little additional time, personnel, or allocated funds.*

Would the system be easily adapted to capture a new form of injury?

Are you aware of a situation when the CFISS had to change in order to capture a new situation/event? Please describe

How is this surveillance system interacting with other systems that capture health events?

Is this possibility important?

## **Appendix F: Interview protocol - Consent.**

### Introduction

To reduce the burden of non-battle injuries in the Canadian Forces, a pilot injury surveillance system was developed and implemented in the Valcartier Garrison in Quebec in 2010. As a part of the evaluation of the pilot injury surveillance system a team from Force Health Protection is conducting interviews to better understand how the program is conducted in Valcartier. We are interested in obtaining feedback from key stakeholders about the effectiveness of the program, potential barriers in capturing important information and potential changes to improve the functioning of the program. Your participation is voluntary but will determine the utility of the injury surveillance system by assessing its ability to meet the intended objectives. The evaluation will provide recommendations to improve the quality and efficiency of the system.

The interview should take approximately 30 minutes. The responses will be recorded, transcribed and analysed by the evaluation team. All information provided will be kept confidential in compliance with the Privacy Act. The information will be stored and analysed using password protection. At no time will the identity of participants be disclosed. Personal information will be removed from the transcripts and will not appear in the dataset that will be used for the analysis and reporting. The evaluation report will include only summary information in order to protect the identity of individuals.

Having considered this information, are you interested in participating in this interview?

## **Appendix G: Interview protocol – Final questions by target group**

### **Patients**

1. In your own experience what health problems do you see most often affecting your friends, colleagues?
  - 1.1 Which injuries do you think are most common when you are training on the base?
  - 1.2. What do you think the CF could do to prevent injuries?
2. In your opinion is the patient injury questionnaire easy to complete?
  - 2.1. How much time does it take to complete?
  - 2.2. Did you find any question to be unclear?
  - 2.3. Can you think about any other information about injuries that we should be asking on this form?
  - 2.4. Do you have any suggestions on how this form could be improved?
3. Would you think that people around you and yourself are interested in finding out what are the most common injuries on the base, or to find out how to prevent injuries?  
If yes, what would be the more useful mechanism for sharing information: DWAN, internet, local journal etc?

### **Base management/command**

#### ***Base Surgeon, Brigade Surgeon, Commander of the 5th Field Ambulance***

1. In your opinion what are the most common health problems affecting personnel on your Base?
    - 1.1 Regarding injuries, which injuries do you think are most common?
    - 1.2. What do you think are the most important causes of injuries in Valcartier?
    - 1.3. What do you think could be done in order to prevent or minimize the number of injuries?
    - 1.4 Do you think the leadership on your base is committed to the prevention of injuries?
  2. What do you think is the purpose of Injury Surveillance Project?
  3. The System captures injuries for personnel presenting to Sick Parade. Do you think this system may be missing injuries that require medical attention?
  4. Are you aware of any problems associated with this system?
  5. Presently information about injuries is collected on paper and scanned into a database for analyses.
    - 5.1. Is this method of data collection generally acceptable?
-

6. How often do you receive written summary reports from the project coordinator of this Injury Surveillance Pilot Project?

6.1. Is this frequency acceptable?

7. How confident are you that the system could detect important injury trends and patterns on your base?

8. As far as you are aware, has information generated from the Injury Surveillance Pilot Project been used for any of the following:

- 8.1. Describing injury rates on your Base
- 8.2. Detection of any special injury trends or clusters
- 8.3. Injury prevention or control measures/programs
- 8.4. Policy development

9. Clinic staff will be interviewed about the system. Do you think this is important?

9.1. Are doctors using any of the information reported on injuries? In your opinion should doctors be interviewed about the Injury Surveillance Project?

## **Clinical Staff**

*nurses, medical technicians, physiotherapists*

1. In your opinion what are the most common health problems affecting personnel at your Base?

- 1.1 Regarding injuries, which injuries do you think are most common?
- 1.2. What do you think are the most important causes of injuries in Valcartier?
- 1.3. What do you think could be done in order to prevent or minimize the number of injuries?
- 1.4 Do you think the leadership on your base is committed to the prevention of injuries?

2. What do you think is the purpose of the Injury Surveillance Project?

3. How confident are you that the system could detect important injury trends and patterns on your base? (very confident, somewhat confident, not confident)

4. What are your current duties if any, for this project?

- 4.1. How long have you performed these duties?
- 4.2. How much of your time is spent on these tasks?
- 4.3. What is the impact on your work (team)?

5. Do you think the patient injury questionnaire is a useful tool for monitoring the occurrence of injuries and injury risk factors in the CF?

- 5.3. Can you think of a better way of collecting information?
- 5.4. Can you think of any information that is missing from this form?

6. Presently information about injuries is collected on paper and scanned into a database for analyses.

6.1. Is this method of data collection generally acceptable?

7. The Injury Surveillance System captures injuries for personnel presenting to Sick Parade. Do you think this system may be missing injuries that require medical attention?

8. What support is available to you when your duties are related to this project?

8.1. Are these helpful?

8.2. Are there other resources that you would like to access?

9. How often do you receive written summary reports from the project coordinator of this Injury Surveillance Pilot Project?

9.1. Is this frequency acceptable?

9.2. What kind of reports would you like to receive back (specify the format, the frequency)

## **Stakeholders**

***General Safety Officers, Health Promotion personnel, physical trainers, National Director of PT***

1. In your opinion what are the most common health problems affecting personnel at your Base?

1.1 Regarding injuries, which injuries do you think are most common?

1.2. What do you think are the most important causes of injuries in Valcartier?

1.3. What do you think could be done in order to prevent or minimize the number of injuries?

1.4 Do you think the leadership on your base is committed to the prevention of injuries?

2. What do you think is the purpose of the Injury Surveillance Project?

3. How confident are you that the system could detect important injury trends and patterns on your base? (very confident, somewhat confident, not confident)

4. What are your current duties if any, for this project?

4.1. How long have you performed these duties?

4.2. How much of your time is spent on these tasks?

4.3. What is the impact on your work (team)?

5. Do you think the patient injury questionnaire is a useful tool for monitoring the occurrence of injuries and injury risk factors in the CF?

5.3. Can you think of a better way of collecting information?

5.4. Can you think of any information that is missing from this form?

7. The Injury Surveillance System captures injuries for personnel presenting to Sick Parade. Do you think this system may be missing injuries that require medical attention?

8. As far as you are aware, has information generated from the Injury Surveillance Pilot project been used for any of the following:

8.1. Describing injury rates on your Base

- 8.2. Detection of any special injury trends or clusters
- 8.3. Injury prevention or control measures/programs
- 8.4. Policy development.

9. Are you aware of any problems associated with this system?

10. After the information has been sent through the chain of command do you receive feedback? Is this important?

- 10.1. What kind of reports would you like to receive back (specify the format, the frequency)?
- 10.2. Why do you think these reports would be helpful?

### **Injury Surveillance Pilot Project staff** ***data clerk, data analyst, project coordinator?***

1. In your opinion what are the most common health problems affecting personnel at your Base?

- 1.1 Regarding injuries, which injuries do you think are most common?
- 1.2. What do you think are the most important causes of injuries in Valcartier?
- 1.3. What do you think could be done in order to prevent or minimize the number of injuries?
- 1.4 Do you think the leadership on your base is committed to the prevention of injuries?

2. What do you think is the purpose of the Injury Surveillance Project?

3. How confident are you that the system could detect important injury trends and patterns on your base? (very confident, somewhat confident, not confident)

4. What are your current duties if any, for this project?

- 4.1. How long have you performed these duties?
- 4.2. How much of your time is spent on these tasks?
- 4.3. What is the impact on your work (team)?

5. Do you think the patient injury questionnaire is a useful tool for monitoring the occurrence of injuries and injury risk factors in the CF?

- 5.3. Can you think of a better way of collecting information?
- 5.4. Can you think of any information that is missing from this form?

6. Presently information about injuries is collected on paper and scanned into a database for analyses.

- 6.1. Is this method of data collection generally acceptable?

7. The Injury Surveillance System captures injuries for personnel presenting to Sick Parade. Do you think this system may be missing injuries that require medical attention?

8. As far as you are aware, has information generated from the Injury Surveillance Pilot project been used for any of the following:

- 8.1. Describing injury rates on your Base
- 8.2. Detection of any special injury trends or clusters
- 8.3. Injury prevention or control measures/programs
- 8.4. Policy development

9. Are you aware of any problems associated with this system?

10. Did you receive any training to assist you in performing your duties with the Injury Surveillance System?

- 10.1. What kind of training?
- 10.2. Where did you receive the training?
- 10.3. Was the training helpful?
- 10.4. What type of training do you think you need/other people need?

11. What resources are available to you when you are performing duties related to this project?

- 11.1. Are these helpful?
- 11.2. Are there other resources that you would like to access?

12. What type of back up and storage procedures exist?

13. What procedures are in place for privacy, confidentiality and system security at your location?

14. Which of the codes would you find problematic for grouping the injuries?

15. Describe what happens to the information after assigning the codes?

16. Do you do any analysis of data?

- 16.1. What types of data analysis are completed?
- 16.2. How frequently are analyses done?
- 16.3. Who checks the analysis and interprets data?

17. To whom do you present this information/report?

- 17.1. How frequently?

18. What policy, agreements or procedures regarding confidentiality of data/information are in place for reporting and/or accessing the compiled information that does not have identifying information?

19. As far as you are aware, has information generated from the Injury Surveillance Pilot project been used for any of the following:

- 19.1. Describing injury rates on your Base
- 19.2. Detection of any special injury trends or clusters
- 19.3. Injury prevention or control measures/programs
- 19.4. Policy development

20. How is this surveillance system interacting with other systems that capture health events?

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20.1. Is this important?

21. Are the clinic staff and CF command supportive?

22. What type of funding is available to support the Injury Surveillance Pilot Project – is it on-going?

## **Appendix H: Other themes emerged from interview: injury causes and injury prevention.**

***Injury causes.*** Everyone agreed that injuries were caused by physical training, sports, military training and repetitive movements. The same agreement was expressed by all groups regarding the necessity that military professionals train with regularity due to the nature of their work. The operational commanders emphasized that in the army, physical training is extremely important for their daily work and if the training is inconsistent during the year then an increased number of injuries are seen in the context of military exercises. Expanding more on the background of injury causes, operational management mentioned a few important factors: the observation that more injuries are happening when people are tired, the lack of each individual's discipline to train daily using the proper techniques, the level of fitness and that overweight/obese personnel will get more injuries because they are constantly carrying additional weight and consequently straining themselves more (the joints are particularly affected). Unit commanders acknowledged that it was very difficult to adapt the training to everyone's rhythm. Military culture is playing an important role: military personnel are seen as competitive people, type A personalities and they push themselves harder without taking into account the risk for injuries. Lastly, the military personnel responsible for unit training can be very demanding at times and they can push their staff to the maximum to get the best team for participation and to win competitions with their peers.

Interviewees involved in medical management mentioned the lack of readiness for training among personnel, the lack of knowledge about how to train properly, insufficient

knowledge about the equipment and the lack of adjustment of the training to the current level of fitness of military personnel.

Based on their clinical experience some staff involved in direct medical care considered that the following situations were aggravating factors for the risk of injuries: if CF members train excessively, the training is not adjusted for the actual level of fitness of personnel. As a result, CF members are tired and therefore more prone to injuries. The knowledge of training supervisors regarding proper training techniques was considered to be minimal and training supervisors who are in very good physical shape expect that new personnel are at the same level.

Injury prevention stakeholders were concerned about excessive training and improper training for new recruits without experience in PT. This may be a matter of them being in poor physical condition or overweight, with their bodies not being able to handle the level of training they are submitted to. An injury prevention professional mentioned: “by punishing them for presenting like that, you are exposing them to injuries”. Even more, the recommended training before annual physical fitness “exams” (for example the 13K march with weight) is not respected; there is an exercise prescription to prepare CF personnel for that challenge, but that exercise regimen recommended by the personal trainers is not followed. Military personnel are trained in force, without them having yet the required endurance. At the same time there are more injuries as a result of people training alone or with PT unit supervisors.

***Suggestions for Injury Prevention.*** Medical management suggestions referred to increasing awareness at the unit level. Valcartier is a military base and physical training is

expected; there is a need for more education about the causes and consequences of injuries and about prevention measures.

Operational management suggested that training supervisors need to be informed about the importance of days missed from work because of preventable injuries. This information could potentially make them more receptive to injury prevention when they know that interventions can prevent missing days from work. Commanders are already aware about the burden of lost work days and there is a need to inform persons such as Sergeants, Master Corporals and others, who are directly responsible for unit training or physical training. Two or three important key messages to target this group will be supported by the chain of command. Also, unit training supervisors may need some coaching to understand better the capabilities of their individual soldiers.

The opinion of the operational management representatives was that it might be difficult to accommodate the training at the level of each individual. Military personnel should be disciplined to work out and train every day and new recruits are not necessarily accustomed to training regularly. In mission and combat, good physical preparation is important. In order to prevent injuries during maneuvers or military exercises, proper physical training has to be done with regularity. The importance of improving the way supervisors are training their personnel was also recognized; at the present time the FSI are educating and training the Sergeants and Master Corporals. Operational commanders were looking at several healthy practices of their personnel: besides having an acceptable program with FSI or a training prescribed by physiotherapists, other aspects need to be taken into consideration such as: healthy eating, progressive training, a variety of physical training activities, maintaining recuperation periods and the reduction of impact sports.

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Also some of the interviewees expressed the desire to have massage therapy covered by benefits, as is the case with chiropractic care.

Clinic staff comments about injury prevention targeted the unit training supervisors, making them responsible to adapt the training to the needs of personnel while respecting the commander objectives.

Injured personnel referred to the adjustment of training intensity to the level of individuals until they built up, as well as to the equipment (boots).

Some of the injury prevention stakeholders also made many suggestions which included the following.

- During annual mandatory programs for base personnel, in which many other topics are covered, such as safe internet, harassment, alcohol or nutrition, they should also hear about injury prevention, about running technique, progressive training, appropriate equipment (shoes) etc.
- During Health Promotion days, organized 3-4 times every year, people from Health Promotion communicate messages about alcohol and nutrition. More information on injury prevention is needed in this format as well.
- Running, which is the foundation for physical training on the base, as well as other forms of training, should be done properly.
- The instructors or trainers assigned for each unit should go to visit their units to be more visible, offering the opportunity for the training supervisors to approach FSIs and to ask questions about training methods.

- It is important to educate, to explain in lay language how injuries occur, to commanders as well as to small groups of personnel.
- There is a need to invest time to get people ready; as one stakeholder said: *“we should not hold them responsible for getting fit.”*
- There are also problems specific to overweight people, such as not having a training program adapted to their physical condition which puts them at higher risk for injuries; they are the ones that would benefit most from progressive training.
- Military personnel are watching training videos on YouTube, and are trying to reproduce them without understanding the proper techniques; at the same time there is an underuse of services offered by FSIs or physiotherapists to support adequate training. At the unit level personnel are generally following their own established routine; generally the person in charge of physical training is physically fit and not adjusting for lower fitness levels.
- CF members should be educated to seek medical attention earlier after an injury.
- For stakeholders it appeared that there was an inadequacy between training and operational tasks. Individuals serving in the CF should be able to do the required operation without injuring themselves.
- Consideration should be given to training other body systems, such as the proprioception /somatosensory system (proprioception and accompanying neuromuscular feedback mechanisms provide an important component for the establishment and maintenance of functional joint stability).

The importance of having enough information to guide effective interventions was stressed. Information about injuries should cover the following criteria:

- anatomic, what body parts are most affected
- injury profile, what kind of lesion/severity
- personal factors like age, profession, co-morbidities, and
- environmental factors.

Injury Surveillance Pilot Project personnel supported the process of reviewing training policies. The importance of sports for increasing physical fitness is acknowledged but it is important to find a balance between participation in activities that allows people to increase fitness while at the same time avoiding a high risk of becoming injured.

As other stakeholders' mentioned, the importance of educating the training supervisors needs consideration. An important aspect mentioned is that all stakeholders should have the same message toward prevention, at the present time people make recommendations that are made without a proper understanding of which are the most frequent injuries identified at the local level; these recommendations should target the first two or three causes in order to be approved by the local chain of command.