GETTING STARTED WITH
INJURY AND ILLNESS SURVEILLANCE

A Practical Guide to Injury and Illness Surveillance and Prevention in Sports

By Francois Gazzano, B.Sc.
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Introduction

Sport-related health problems such as acute and overuse injuries, illnesses and burnout (aka overtraining) are widespread issues in competitive sports. While the cause of these issues is usually multifactorial, recent studies shows that evidence-based injury prevention programs, guided by accurate injury surveillance data, can be effective ways to minimize injury risk, while maintaining optimal performance.

The first part of this article will present key definitions, introduce a 6-step approach to implement an individualized injury prevention program. It will also outline the key role of injury surveillance and provide an overview of common injury surveillance systems, and introduce a new injury surveillance method: the Oslo Sports Trauma Research Questionnaire on Health problems.

The second section of the article will present a 6-step plan and practical recommendations you can use to implement your own injury surveillance program within your team, club or sport organization.
Health Problems
A health problem can be defined as any condition that an athlete considers to be a reduction in his/her normal state of full health, irrespective of its consequences on his/her sports participation or whether he/she has sought medical attention. This may include, but is not limited to, injury, illness, pain or mental health conditions (adapted from reference 8).

Injury
What represents a recordable injury is still debated between experts, but according to FIFA’s Medical Assessment and Research Centre an injury is: ‘any physical complaint sustained by an athlete that results from a competitive event or training activity, irrespective of the need for medical attention or time loss’.

There are two types of injuries:
1) Acute injuries: these are linked to a specific event (e.g. a fall or collision) such as concussions, ligament sprain, etc.
2) Overuse (aka repetitive) injuries: these are not linked to a specific event, and developed over time (e.g. tendonitis or a stress fracture)

Injuries that cause the athlete to fully or partially miss training or competition are considered ‘Time Loss’ injuries while injuries that require intervention from a medical practitioner are defined as ‘Medical Attention’ injuries.

Illness
According to International Olympic Committee Expert Group on Injury and Illness in Sports (IOC Expert Group), an illness is defined as

‘a new or recurring symptomatic sickness or disease, or the presence of sub-clinical immunological precursors of symptomatic illness, that was incurred during competition or training, and either receiving medical attention or was self-reported by athletes, regardless of the consequences with respect to absence from competition or training’.

Part 1 –Key Concepts
Definitions
An athlete’s injury risk fluctuates constantly, based on individual athlete characteristics and the sport demands\textsuperscript{19}. Designing, implementing and evaluating the effectiveness of an injury prevention program is a multi-step process\textsuperscript{17, 19}. The following table summarizes each step and associated tasks (adapted from reference 17).

### The 6 Steps to Individualized Injury Prevention

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td><strong>Identify Injury Trends</strong></td>
</tr>
<tr>
<td></td>
<td>Measure the type, number and frequency of health problems prior to the implementation of preventive measures</td>
</tr>
<tr>
<td></td>
<td>Injury/illness surveillance</td>
</tr>
<tr>
<td>02</td>
<td><strong>Identify Risk Factors</strong></td>
</tr>
<tr>
<td></td>
<td>Identify modifiable and non-modifiable factors that often increase the risk of health problems</td>
</tr>
<tr>
<td></td>
<td>Review of the scientific literature</td>
</tr>
<tr>
<td>03</td>
<td><strong>Understand Sport Demands</strong></td>
</tr>
<tr>
<td></td>
<td>Measure the physical and psychological demands of competition with objective and subjective measures</td>
</tr>
<tr>
<td></td>
<td>Review of the scientific literature and/or GPS/accelerometers data, time-motion analysis, RPE scales, questionnaires, athlete interviews, etc.</td>
</tr>
<tr>
<td>04</td>
<td><strong>Assess Individual Risk</strong></td>
</tr>
<tr>
<td></td>
<td>Evaluate athlete injury risk factors and current abilities to determine if the athlete can meet the physical demands of competition</td>
</tr>
<tr>
<td></td>
<td>Physical tests, internal/external load measures, medical history, athlete interviews, etc.</td>
</tr>
<tr>
<td>05</td>
<td><strong>Implement Preventive Measures</strong></td>
</tr>
<tr>
<td></td>
<td>Identify and implement interventions to prepare the athlete for the sport demands, without increasing the risk of health problem</td>
</tr>
<tr>
<td></td>
<td>Athlete monitoring, Individualized load management, activities to develop individual characteristics identified as risk factors (neuromuscular control, aerobic fitness, etc.)</td>
</tr>
<tr>
<td>06</td>
<td><strong>Evaluate Preventive Measures</strong></td>
</tr>
<tr>
<td></td>
<td>Measure the type, number and frequency of health problems after the implementation of preventive measures implemented in step 5</td>
</tr>
<tr>
<td></td>
<td>Injury/illness surveillance</td>
</tr>
</tbody>
</table>
The Role of Injury and Illness Surveillance

Injury and illness surveillance is the ongoing and systematic process of collecting and analyzing injury and illness data. This process is required to define the type, number and frequency of health problems, to measure injury trends and to objectively identify the effectiveness of preventive interventions (steps 1 and 6 of the individualized injury prevention program above).

Several sport organizations around the world have implemented an injury surveillance program. These include: the National Football League’s (NFL), the National Collegiate Athletic Association (NCAA), The Fédération Internationale de Football Association (FIFA), and the High School Reporting Information Online (RIO).

These injury surveillance programs have several common features:

• Health problems are recorded by health practitioners
• Only time-loss and medical-attention injuries are recorded
• Illnesses are not recorded unless they lead to medical-attention and/or time-loss
• The severity of injuries is defined by time loss duration

They also have key limitations:

• Health practitioners are not always available to record health problems, which often leads to underreporting
• Many athletes continue to train and compete despite being injured (this is particularly the case during overuse injuries and illnesses). As they do not fall under the categories of time-loss or medical-attention, these health problems, are often underreported, even though they impact participation and performance.
• Mental health issues and other illnesses are common in elite athletes. They often impact the ability to train and compete. These, however, are not recorded by traditional injury surveillance systems, unless they cause time-loss and are recorded by a health practitioner

In summary, while data entered by health practitioners may be very accurate, the restricted
definition of what constitutes a recordable health problem (time-loss, medical attention) and the fact that data collection relies on health practitioners are key limiting factors for these methods. As a result, the true burden of health problems are underestimated.

The OSTRC Questionnaire on Health Problems

To provide a better alternative to the injury surveillance models presented above, researchers from the Oslo Sport Trauma Research Center (OSTRC, https://www.ostrc.no/) have proposed a new approach: The Oslo Sport Trauma Research Center (OSTRC) Questionnaire on Health Problems. First published in 2013 by Clarsen et al.\textsuperscript{12}, the OSTRC questionnaire represent a paradigm shift in athlete health monitoring and injury surveillance: it places the athlete at the center of the data collection process and broadens the definition of recordable health problems to include any health problem that impacts the athlete’s ability to train or compete normally. Unlike other models, this new approach doesn’t require data to be recorded by a health practitioner, and is able to detect and monitor non time-loss injuries, illnesses, as well as other health problems which don’t require medical attention. Using the OSTRC Questionnaire approach is very simple:

1. Athletes complete a weekly 4-question validated survey on their smartphone, and record all health problems which have impacted their level of participation and/or performance in the past 7 days.
2. When a health problem is reported by an athlete, the medical team assigned to the athlete is automatically alerted by text messaging, which they can then review, correct and validate
3. Epidemiological statistics based on comprehensive high-quality data can be produced at any time, based on the recorded information.

Recent studies have demonstrated that the OSTRC Questionnaire on Health Problems can detect 10x more health problems than conventional methods\textsuperscript{12} and 6.5x more overuse injuries than a team physiotherapist during the course of a professional basketball season\textsuperscript{14}.

In summary, the OSTRC questionnaire is highly effective and easy to use:

1. It simplifies injury and illness data collection
2. It detects a broader spectrum of health problems
3. It standardizes diagnoses and provides more nuanced statistics than previous methods

The OSTRC questionnaire makes it easier for sport organizations of any size to implement their own injury surveillance program. They don’t have to rely on an extensive network of health practitioners to collect data anymore, and can generate epidemiological statistics in real-time, without the assistance of expert statisticians.

The IOC Expert Group recommends that on-going, scientific injury and illness surveillance systems be established in all sports\textsuperscript{20}. By using the OSTRC questionnaire, sports organizations of different sizes and budgets are able to implement this recommendation.
Part 2 – 6 Simple Steps to Implement Your Own Injury Surveillance Program

To implement your own injury surveillance program within your team, sport or research organization with the OSTRC Questionnaire, simply follow the steps below:

**Step 1 - Establish a relationship of trust with athletes, coaches and medical staff**

Since athletes are responsible to self-report health problems, they must understand that this information will help enhance medical care, facilitate their return to full training/competition and, ultimately, improve their performance. It is essential that athletes report their data on a regular basis and as honestly as possible and be assured that their information will be kept strictly confidential. It is also crucial that health practitioners respond as quickly as possible when health problems are reported, in order to provide adequate/timely feedback to both athletes and coaches, particularly regarding the athletes’ activity restrictions and availability to train or compete.

**Step 2 - Use a specialized OSTRC Questionnaire App**

Managing the OSTRC Questionnaire and related data via a specialized app integrated with a secure electronic medical record system, such as Athlete Monitoring Health (www.athletemonitoring.com) greatly simplifies data collection, accelerates analyze, and maximizes compliance and data security.

<table>
<thead>
<tr>
<th>Injury and Illness Data collection</th>
<th>OSTRC questionnaire</th>
<th>Traditional methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-report by athlete</td>
<td>Recorded by health practitioner</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Injury definition</th>
<th>OSTRC questionnaire</th>
<th>Traditional methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any health problem that impacts the athlete’s ability to train or compete normally</td>
<td>An injury that causes time loss and/or medical attention</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Severity definition</th>
<th>OSTRC questionnaire</th>
<th>Traditional methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of impact on the athlete’s participation and ability to train and compete</td>
<td>Duration of time loss</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Detection of non-time loss injuries/illnesses</th>
<th>OSTRC questionnaire</th>
<th>Traditional methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Detection of non-medical attention injuries/illnesses</th>
<th>OSTRC questionnaire</th>
<th>Traditional methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1 - Injury surveillance data collection app (courtesy of AthleteMonitoring.com)
Using a specialized app also streamlines the management of diagnoses, clinical notes, return to sport protocols by health practitioners, as well as the production of health reports and epidemiological statistics. The main advantages of using a specialized app for the management of the OSTRC questionnaire include:

- Easier and more secure delivery of the weekly questionnaire
- Improved athlete compliance with data collection
- Better communication between medical and performance teams
- Faster medical follow-up and seamless recording in the electronic medical record system
- Automated calculation of injury and illness surveillance indicators
- Ability to produce epidemiological statistics without the need of a data scientist and/or statistician
- Better data protection, privacy and security than free survey tools, emailed forms, or Excel-based systems

Step 3 - Organize an information seminar for your medical team
Endorsement from the medical team is crucial. They must understand why injury surveillance is needed, how the data will be used and kept confidential. The medical team must understand the important role and usefulness of the injury surveillance process and how this will help them, ultimately, improve athlete care without underpinning their medical authority.

During the first seminar, you will explain how the OSTRC questionnaire works. This includes the research behind the questionnaire, how and what information is collected, and how to record diagnoses and clinical notes once a problem is reported. You will also illustrate how to generate injury surveillance statistics and the meaning of these measures.

Finally, you will explain to performance staff where they can access medical recommendations for specific athletes, and how they can monitor and athletes’ availability status.

After the initial educational seminar, add your health practitioners to your AthleteMonitoring platform so they can monitor each athlete’s data.

Don’t forget to present positive results during subsequent meetings/seminars. Use tables, charts and graphs to demonstrate positive compliance rates, reduced injury rates, etc.

Step 4 - Organize an information seminar for your athletes
Organizing a formal app educational seminar for athletes (and parents if you work with youth athletes) is a proven way to boost compliance rates. Don’t forget / Be sure to reassure them regarding the privacy and security of the data. Encourage athletes to bring their mobile devices and present the app during an interactive tutorial.

Use a projector and large screen. Log in as an athlete online and show the athlete how to complete the ‘weekly health survey’ (a less intimidating term than OSTRC Questionnaire), report an injury and submit the weekly questionnaire. All this information must be explained clearly and in very simple terms.

Step 5 - Start the weekly injury and illness surveillance process

The injury and illness surveillance process starts when athletes begin to complete the weekly OSTRC questionnaire on their smartphone.

The survey includes 4 key questions and a few sub-questions. This can take anywhere between 30s and 5 minutes (depending on the number and type of health problems reported).

When an athlete reports a health problem, a comment or a new medication, the information is automatically transferred to the electronic record...
Step 6 - Analyze data
Once all data is collected, the key injury and illness surveillance indicators described below can be analyzed. Here is a description of these measures.

Compliance and diagnosis rates
These are important indicators of quality control. Athlete compliance to the weekly survey is measured by the completion rate. Health practitioner compliance to timely diagnose the athlete-reported health problem is represented by the diagnosis rate. Both are crucial parts to the successful implementation of the OSTRC questionnaire.

Incidence
Incidence is the number of new health problems that occur in a given population during a period of time. Incidence can be reported as number of injuries/1000h of match / competition exposure or injuries/1000h of training exposure. As incidence data is often difficult to compare between sports, it can be standardized as new health problems (cases) /athlete/year.

Prevalence
Prevalence is the number of athletes with a given health problem (i.e. the number of cases) in a defined population at any given point in time.

Minimizing prevalence of injuries ensure that more athletes are available to train and compete. A low prevalence of health problems also indicates the success of an injury prevention strategy.

Time loss
Time loss is the number of training and/or competition days missed, due to a health problem.

Severity
Traditionally, severity has been measured by the total number of time loss days. Severity can be slight (0-1 days), minimal (2-3 days), mild (4-7 days), moderate (8-28 days), or severe (>28 days).

With the OSTRC questionnaire, severity is measured by the impact of the health problem on...
the athlete’s participation, reduction in training volume, impact on performance, and symptoms. Weekly severity is based on the athlete’s responses to the four questions and ranges between 0 (full participation without health problem) and 100 (no participation at all).

**Burden**

Burden is the overall impact of each type of health problem (illness, acute injury, overuse injury). It is calculated by adding cumulative severity scores and the relative contributing percentage of illnesses, acute injuries and overuse injuries.

<table>
<thead>
<tr>
<th>Injury</th>
<th>Cases</th>
<th>Slight (0 days)</th>
<th>Mild (1-7 days)</th>
<th>Moderate (8-28 days)</th>
<th>Severe (&gt;28 days)</th>
<th>Total time loss</th>
<th>Severity score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>712</td>
</tr>
<tr>
<td>Knee</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>185</td>
</tr>
<tr>
<td>Shoulder</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>75</td>
</tr>
<tr>
<td>Elbow</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>84</td>
</tr>
<tr>
<td>Chest/ribs/upper back</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>117</td>
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<tr>
<td>Overuse</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>251</td>
</tr>
<tr>
<td>Knee</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>67</td>
</tr>
<tr>
<td>Elbow</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>75</td>
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<tr>
<td>Ankle</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>50</td>
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<tr>
<td>Shoulder</td>
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<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>59</td>
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<tr>
<td>Illness</td>
<td>8</td>
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<td>8</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>13</td>
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<tr>
<td>Gastrointestinal</td>
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<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>58</td>
</tr>
</tbody>
</table>

**Number of injuries per location, activity, mechanisms and common diagnoses**

These indicators provide insight into when and how most injuries occur, the body areas most affected and the most common diagnoses. They provide key information about potential risk factors and can be used to guide the development of effective injury prevention strategies.
Conclusion
Implementing an ongoing injury and illness surveillance program is the first step to an evidence-based and individualized injury prevention program. Using the OSTRC Questionnaire on health problems it is easy to implement and accessible to any sport organization, even those with limited budgets.

What you need to make it work:

1. Get familiar with the OSTRC Questionnaire on health problems
2. Establish a relationship of trust and collaboration between all stakeholders
3. Use a specialized app to streamline data collection, maximize athlete compliance and simplify data analysis
4. Measure incidence, prevalence, and burden of health problems before the implementation of any preventive strategies
5. Identify risk factors and implement prevention measures
6. Evaluate the effectiveness of your preventive strategies by comparing pre/post incidence, prevalence, burden, etc.

By implementing an evidence-based injury and illness surveillance program with the OSTRC Questionnaire on health problems, you’ll be able to obtain a completer and more accurate picture of your athletes’ health, detect early stages of overuse injuries, and measure the true impact of health problems on participation and performance.

You will also be able to establish regular communication between athletes, coaches and health practitioners, even when they are all working, training or competing in different locations.

The ultimate outcome will be healthier, fitter and happier athletes, ready to perform when it counts.
Francois Gazzano

is a performance coach and athlete monitoring specialist who graduated from the Université de Montreal with a degree in Exercise Science. As a full-time strength and conditioning coach and performance consultant in Europe and North America for more than 15 years, François has helped dozens of youth, elite and professional athletes across a wide range of sports reach their highest performance goals. François is the founder & CEO of AthleteMonitoring.com (http://www.athletemonitoring.com), an evidence-based athlete health management and workload optimization system used by elite sport organizations worldwide.

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