

Active & Safe Central: Injury Prevention for Sport and Physical Activity

The Development and Evaluation of Active & Safe Central

November 2018



Final Report

Prepared by the BC Injury Research and Prevention Unit for the BC Alliance for Healthy Living

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The British Columbia Injury Research and Prevention Unit (BCIRPU) was established by the Ministry of Health and the Minister's Injury Prevention Advisory Committee in August 1997. BCIRPU is housed within the Evidence to Innovation research theme at BC Children's Hospital (BCCH) and supported by the Provincial Health Services Authority (PHSA) and the University of British Columbia (UBC). BCIRPU's vision is to be a leader in the production and transfer of injury prevention knowledge and the integration of evidence-based injury prevention practices into the daily lives of those at risk, those who care for them, and those with a mandate for public health and safety in British Columbia.

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Introduction and Rationale

Injuries related to sports and recreational activities have a substantial cost in terms of reduced productivity, impact on the health care system, and overall quality of life. Despite the associated risk, physical activity in the form of sport and recreation participation has substantial health benefits and should not be avoided. Physical activity is one of the recommended strategies for maintaining a healthy weight and the prevention of a number of health-related conditions including cardiovascular disease, diabetes, and certain types of cancer. Although there are evidence-based interventions that support the reduction in injury risk across different sports,^{1,2,3} access to this information can be challenging, and guidance is often required to apply it appropriately.

Objectives

Active & Safe Central addresses the need for easily accessible and translated evidence-based information to reduce the risk for sport and recreation-related injuries among children and youth ages 6-19 years, and adults. The long-term outcomes of this initiative are expected to be a reduction in the number and rate of serious injuries related to sport and recreational activities.

This report encompasses the development and evaluation of Active & Safe Central:

- Describing the methods used to develop the Active & Safe Central online platform.
- Summarizing the results from the post-launch promotion and evaluation.

Initiative

Active and Safe Central is an online resource providing injury prevention information for over 50 sports and recreational activities. The development of this resource involved a six-phase strategy informed by the project team members and key stakeholders, including: SportMedBC, viaSport British Columbia, Parachute, the Sport Injury Prevention Research Centre, University of Calgary and BC Recreation and Parks Association. This project was funded through the BC Ministry of Health's Physical Activity Strategy (administered by the BC Alliance for Healthy Living), and led by the BC Injury Research and Prevention Unit.

Phase 1: Prioritizing Sport and Recreational Activities and Recruitment for Conducting the Synthesis of Evidence

During the first phase, the project team and advisory members met to discuss the recreational activities and sports that were to be included in the Active & Safe resource. The original plan was to use a preliminary literature review and modified Delphi to

prioritize 10 target sports and 10 target recreational activities to be the focus for 20 comprehensive reviews on prevention strategies. However, at the request of the BC Alliance for Healthy Living and Ministry of Health, the plan for Phase 1 was modified to identify a way to be able to be inclusive of all sporting and recreational activities relevant to BC children and youth.

Over 60 sports and recreational activities were identified for inclusion in the Active & Safe Central resource (Appendix A). For the purposes of conducting the evidence reviews, the identified sports and recreational activities were grouped into 15 categories based upon similar movement mechanisms (e.g., racquet sports). In addition, a preliminary search of each sport by outcome was conducted to assess the volume of literature.

Evidence reviews and summary reports were completed by trainees from the Canadian Injury Prevention Trainee Network (<http://ciptn.org/>). This network was established in 2013, building upon the working model of the CIHR Team in Child & Youth Injury Prevention (2010-2016, <http://childinjuryprevention.ca/>), in order to provide professional development and employment opportunities to graduate students with an interest in injury prevention. Under close supervision, 18 graduate students from across Canada worked independently or in pairs to develop search strategies in consultation with a university librarian, and review the evidence.

Phase 2: Completion of the Reviews and Summary Tools

An evidence synthesis framework was used for the collection and synthesis of injury prevention evidence for all identified sports and recreational activities.⁴ The outcomes for the reviews included injury incidence, risk/protective factors, interventions, and information on the implementation or evaluation of interventions.

Searches began using a hierarchy of evidence approach⁵ for all sports and recreation activities identified (Appendix B). Evidence summaries were searched to provide a comprehensive review of the incidence, risk and protective factors, and interventions to reduce the impact of injury. Where evidence summaries were not found, systematic reviews published within the past 10 years (2007 – 2017) were then searched, by outcome. In the absence of a systematic review(s), or where reviews were published before 2007, primary studies were then searched by outcome.

In addition to reviews of published literature, a search of relevant grey literature sites/organizations that publish best practice recommendations for injury prevention was completed. Such organizations included injury-prevention organizations (e.g., Sport

Injury Prevention Research Centre), health-related government sites (e.g., Public Health Agency of Canada), non-governmental organizations (e.g., Parachute) and sport-specific organizations (e.g., Hockey Canada).

Data from identified studies were extracted and critically appraised using various tools, as appropriate:

- Health Evidence Quality Appraisal Tool⁶ (systematic reviews—risk factor and intervention studies)
- Downs and Black Critical Appraisal Tool⁷ (primary studies)
- MORE Tool⁸ (systematic reviews and primary studies— incidence/prevalence studies)

For each sport and recreational activity, information from the review was synthesized into an evidence synthesis tool as well as a summary report. Due to gaps in the literature for certain sports and recreation activities, a total of 51 sport-specific evidence synthesis tools and summary reports were completed and shared with experts to identify potential gaps in the synthesized evidence.

Figure 1. Excerpt from Soccer Evidence Review

(https://activesafe.ca/wp-content/uploads/2018/04/Soccer_Final.pdf)

| Evidence Synthesis Tool | | | | |
|---|--|--|--|--|
| SPORT: | Soccer | | Target Group: | Male and Female Players |
| Injury Mechanisms: | Common injuries: Ankle injuries, knee injuries, concussions, hamstring injuries and groin injuries Common injury Mechanisms: Contact and non-contact; Running; Overstretched muscles during active/dynamic movements; forced inversion or eversion trauma/movement to the ankle; forced valgus or varus trauma to the knee; direct impact on the body | | | |
| Incidence/Prevalence | Risk/Protective Factors | Interventions | Implementation/Evaluation | Resources |
| All Injury Male Elite Youth <ul style="list-style-type: none"> • Overall (range) = 2.0 to 19.4 injuries/1000h • Game = 9.5 to 48.7 injuries/1000h • Practice = 3.7 to 11.4 injuries/1000h.¹ Male Professional Adult Overall (range) = 2.5 to 9.4 | Modifiable Risk Factors Male: <i>Ankle Injuries</i> <ul style="list-style-type: none"> • Lower extremity Power Output Score < 30W/kg: OR = 9.2 (95% CI; 1.13 to 75.09)¹ • Poorer Balance Scores: OR = 0.43 (95% CI; 0.21 to 0.89).¹ Female: <i>Ankle Injuries</i> <ul style="list-style-type: none"> • Lower Knee Valgus Angle (in a | There is extensive evidence (including level 1 evidence) that exercise-based interventions in the form of neuromuscular training programs are effective in reducing all soccer-related injuries (acute and overuse) across all levels of participation. <ul style="list-style-type: none"> • An injury risk reduction of 30% to 70% was reported for the 11+ Warm-up Program;^{1,4} • 50% to 66% for the Knee Injury | Evaluation Frameworks Literature relating to implementation research for effective interventions such as the 11+ and other NMT programs is still sparse (no systematic review), ^{2,6} however, only 1 study reported using an implementation framework in the evaluation of an NMT program for knee/ACL prevention. ³ In this study, the RE-AIM SSM was used | Program Delivery To run the 11+ programs, a soccer coach would need to be trained either through an organized coach-workshop or self-training using freely available resources online: https://goo.gl/rJDUKN Most NMT programs do not require the use of equipment, e.g. 11+, however, some might |
| Works Cited: 1. Pfirrmann et al. (2016). Analysis of injury incidences in male professional adult and elite youth soccer players: A systematic review. <i>Journal of Athletic Training</i> 51(5): 410–424 | Works Cited: 1. Henry et al. (2016). Risk factors for noncontact ankle injuries in amateur male soccer players: A prospective cohort study. <i>Clinical Journal of Sport Medicine</i> , 26(3), 251-258 | Works Cited: 1. Barengo et al. (2014). The impact of the FIFA 11+ training program on injury prevention in football players: A systematic review. <i>International Journal of Environmental Research in Public Health</i> 11: 11986-12000 | Works Cited: 1. Steffen K, Meeuwisse WH, Romiti M. (2013). Evaluation of how different implementation strategies of an injury prevention programme (FIFA 11+) impact team adherence and injury risk in | Works Cited: 1. Bizzini M, Junge A, Dvorak J. (2013). Implementation of the FIFA 11+ football warm up program: How to approach and convince the Football associations to invest in |

(See Appendix C for a full sample Evidence Review and report)

Phase 3: Knowledge Transfer Strategy and Digital Marketing Plan

The Active & Safe project team held a meeting with key stakeholders in order to develop a knowledge transfer strategy regarding the content and target audiences for the online

resource. Using the evidence reviews and summary reports for five sports as examples, the team discussed which content would be included as part of the website. It was suggested that the presentation include targeted messaging for specific user groups. The end result of the meeting was the development of a scoping document (outlined in Phase 4).

A digital marketing plan was developed to include social media, a media release, and other messaging; refined throughout Phases 3-6. It was decided that:

- All Active and Safe social media be communicated through the BC Injury Research and Prevention Unit's Facebook and Twitter accounts.
- A media release announcing the launch of the website be distributed on Thursday, May 10, 2018 through the research institute at BC Children's Hospital.
- The public, project partners, and interested parties be asked to visit the website via email, social media, and the BC Injury Research and Prevention Unit newsletter
- Project partners be asked to amplify the message to their contacts.
- The website to contain links to share sport-specific content via social media.

Phase 4: Scoping Document for Central Online Resource

A scoping document outlining the content and delivery strategy for Active & Safe Central was developed, describing the organization, a detailed outline of the digital sports and recreation activities content pages, and other considerations (Appendix D). This vision was refined during the digital translation design process, guided by input from focus group participants including student athletes, parents, coaches, athletic therapists, provincial sports organizations, and injury prevention stakeholders and researchers.

The first focus group (n=10), at the build and mock-up phase collected information on:

- Previous experiences with injury prevention resources.
- Feedback on the proposed design, perceived usefulness and suggestions for the tool on use and content.

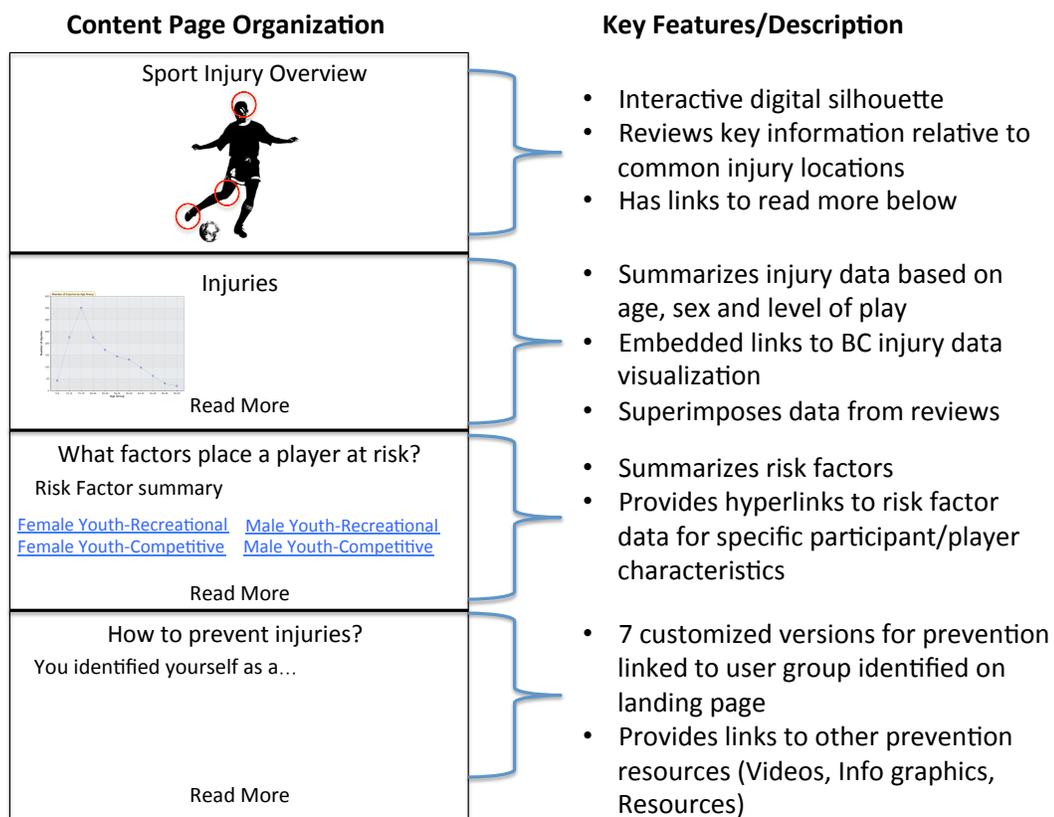
The result of this focus group was clear design feedback that validated many of the decisions made at that time, as well as some intriguing suggestions on minor revisions to various sections, in particular:

- Layout considerations and colour variation for the overview section
- Reconfiguration of call-to-action prompts on the data section
- Additional filters throughout the sport landing pages for age, sex, etc.

The discussion on age and sex filtering was later reconsidered due to limitations in the evidence across all sports.

The second focus group (n=14) collected information on the interactivity of the beta version of the digital platform. Participants provided feedback on the functionality, visual appeal and usefulness of the site. An initial iteration of the sport- or recreation activity-specific page is presented in Figure 2.

Figure 2. Sport- or recreation activity-specific page organization and key features.



Phase 5: Content for Training Modules for Target Audiences

Goals of the Active & Safe Central resource included increasing users' access to evidence-based sport and recreation injury information and to support the implementation of injury prevention strategies. Rather than duplicate the efforts of other sport injury groups, Active & Safe Central provides links to available evidence-informed injury prevention digital material, including:

- Neuromuscular training modules for the prevention of sport injury in basketball physical education contexts developed by the Sport Injury Prevention Research Centre at the University of Calgary

- The *Get Set* training app from the International Olympic Committee (<https://itunes.apple.com/ca/app/get-set-train-smarter/id894609112?mt=8> and <https://play.google.com/store/apps/details?id=org.olympic.app.getset&hl=en>)
- The *Fit to Play* resource by the Oslo Sport Trauma Research Centre (<http://fittoplay.org/>)
- The 11+ Warm-up (<https://www.youtube.com/watch?v=RSJlp7e7fyY&list=PLAPyvPaEZQXmX02V78z-je7e92iLfvD-G>)

Phase 6: Development of Active and Safe Central Resources, Launch and Evaluation

After completing the evidence reviews, it was noted that evidence for prevention was somewhat limited when attempting to tailor the information for different users (see Appendix E detailing user groups with no specific recommendations). Sport landing pages were amended to provide four groupings for customized prevention messages: participants & parents, coaches & teachers, officials & administrators, and health professionals. It was also decided that kayaking and canoeing had similar prevention recommendations; therefore, the recommendations were merged into the same section of the website, resulting in 50 sports and recreational activity pages.

Content from the evidence reviews was translated into clear messaging for use in a digital format. This included information on injury incidence, common areas of the body that are injured, risk factors for injury, prevention strategies, as well as any information gathered on the implementation or evaluation of prevention strategies. Digital sport and recreation content pages were populated with sport- and recreation activity-specific injury prevention information together with visually engaging messages.

In the prevention section of the resource, sport- and recreation activity-specific evidence-based prevention strategies are provided; however, for some sports and recreation activities, there was limited evidence supporting specific programs to prevent injury. In these cases, recommendations for the prevention of injury were made based upon activities that have similar movement mechanics and patterns, or those that have similar types of injury. In addition, an “Other Considerations” section was developed to include useful information found in the grey literature search. This information, although not found in the research literature, was supported by experts in each sport or activity (e.g., local organizations, health experts).

Phase 7: Development of Additional Active and Safe Central Videos

Early in the development of Active & Safe Central, needs were identified by the stakeholder team to develop additional resources to address research gaps identified in

the evidence synthesis. The topic areas determined by our project team included: 1) neuromuscular training, 2) physical literacy, 3) training load and, 4) sleep health. We aimed to develop education/informational resources that best supported the translation of knowledge and the uptake of injury prevention initiatives and evidence-based messaging supported through Active & Safe Central.

We used a knowledge exchange methodology to co-create four knowledge products. Our project team included a subset of the Active & Safe team, in addition to new project members recruited by content area (i.e., neuromuscular training, physical literacy, training load and, sleep health). We began by scoping each video; including collecting information from the target audiences to better understand the specific needs for each resource. We then consulted on the delivery methods and styles with the digital design company and developed course outlines including specific objectives for each video.

Scripts for each resource began with the development of 5-6 key messages. Key messages were developed from content experts and vetted through and confirmed by the entire project team before script development began. The content for each video script was then developed, corresponding to both the key messages and objectives of each video, working iteratively with team members to increase messaging and content relevance. Final scripts were approved by the project team leadership (Appendix F).

The digital design company was used for consultation and development of all four videos. All four videos were developed using an iterative process with the stakeholder and digital team, ensuring the content and imaging was in line with the key messages and objectives for each video.

Dissemination of the Resource

Active & Safe Central was launched at activesafe.ca on May 10, 2018 in alignment with International Move for Health Day. A media release was distributed through the research institute of BC Children's Hospital and links were shared through social media and the BC Injury Research and Prevention Unit website and newsletter (www.injuryresearch.bc.ca). The project partners also disseminated the resource to their networks throughout Canada.

Evaluation and Impact

The development of Active & Safe Central involved an iterative process where evaluation occurred throughout the creation of the resource. As described above, stakeholders from local and national organizations who work in the area of physical activity promotion and injury prevention, as well as subject matter experts, were

recruited as project team members. The feedback from these stakeholders was crucial to the development of the strategy. Focus groups were designed to be 60 minutes in duration and used a semi-structured format, led by a trained facilitator, to collect specific information on the design, use and information contained in the tool. The focus groups were both audio and visually recorded, with one project team member taking notes to supplement data collection.

After the launch of Active & Safe Central, participants completed an online survey using the online feedback form that was added to the site. The online feedback form was created in consultation with experts in evaluation from the digital team as well as injury prevention researchers. Users were invited to participate through a pop-up window on activesafe.ca, and if they completed the survey, were given the option to enter in a draw to win an Apple Watch. Google Analytics data and a post-launch evaluation were used to track site usage and collect feedback 40 days from launch (May 10, 2018 to June 18, 2018; see Appendix G for full evaluation strategy). All the feedback was compiled, reviewed and prioritize by the project team to determine which changes should be implemented to the site.

Results

Description of Active & Safe Central

Active and Safe Central is an evidence based online platform that provides injury prevention recommendations for over 50 sports and recreational activities. Sport content pages were created to provide sport-specific injury prevention information with visually engaging messages, customized for parents, athletes/participants, coaches, teachers, administrators, and health professionals.

Media Coverage

The [media release](#) resulted in 10 news articles in news outlets across British Columbia.

Reach: Google Analytics

Google Analytics data from May 10 to November 10, 2018 tracked 2,962 people visiting activesafe.ca a total of 4,153 times. The majority of visitors are new visitors (87.9%), as compared to returning visitors (12.1%). This high proportion of new users suggests that many people are interested in activesafe.ca, but getting users to return is a bit of a challenge.

The average number of pages per visit is 2.77, and people are spending an average of 2 min 41 sec on the website.

Information on gender and age is not known, but we do know the location of visitors to activesafe.ca. Over half (66.0%) of visitors to the website were from Canada, and 12.4% were from the USA. Other countries, including Peru, United Kingdom, Australia, India, and Ireland, made up the rest of the visits.

With regards to Canadian provinces, 65.9% of website visits (sessions) originated from British Columbia. Below is a chart of the number of users and visits (or sessions) to activesafe.ca by province.

Users and visits to activesafe.ca, by province

| Region ? | Acquisition | | | Behavior | | |
|------------------------------|--|--|--|--|---|---|
| | Users ? | New Users ? | Sessions ? ↓ | Bounce Rate ? | Pages / Session ? | Avg. Session Duration ? |
| | 1,966 % of Total: 66.37% (2,962) | 1,948 % of Total: 66.12% (2,946) | 2,965 % of Total: 71.39% (4,153) | 50.69% Avg for View: 56.95% (-10.98%) | 3.28 Avg for View: 2.77 (18.20%) | 00:03:21 Avg for View: 00:02:41 (24.53%) |
| 1. British Columbia | 1,312 (65.86%) | 1,288 (66.12%) | 2,039 (68.77%) | 49.68% | 3.77 | 00:03:59 |
| 2. Alberta | 255 (12.80%) | 246 (12.63%) | 396 (13.36%) | 51.26% | 2.26 | 00:01:38 |
| 3. Ontario | 273 (13.70%) | 266 (13.66%) | 340 (11.47%) | 58.82% | 2.02 | 00:01:58 |
| 4. Quebec | 59 (2.96%) | 56 (2.87%) | 79 (2.66%) | 40.51% | 2.68 | 00:03:13 |
| 5. Saskatchewan | 33 (1.66%) | 32 (1.64%) | 44 (1.48%) | 40.91% | 2.34 | 00:03:17 |
| 6. Manitoba | 23 (1.15%) | 23 (1.18%) | 25 (0.84%) | 56.00% | 1.92 | 00:02:28 |
| 7. Nova Scotia | 18 (0.90%) | 18 (0.92%) | 21 (0.71%) | 66.67% | 1.38 | 00:01:35 |
| 8. New Brunswick | 7 (0.35%) | 7 (0.36%) | 9 (0.30%) | 22.22% | 2.56 | 00:01:25 |
| 9. Newfoundland and Labrador | 8 (0.40%) | 8 (0.41%) | 8 (0.27%) | 62.50% | 1.62 | 00:00:22 |
| 10. Prince Edward Island | 2 (0.10%) | 2 (0.10%) | 2 (0.07%) | 0.00% | 2.50 | 00:01:29 |

During this six-month period, there were 11,509 pageviews to the website. 68% (7,867) of these pageviews are unique views, suggesting that different users are visiting the same pages.

The following table outlines the top 10 sport landing pages by number of pageviews.

Top 10 Sport Landing Pages

| Sport Landing Pages | Pageviews (100%) (Total=11,509) |
|----------------------------|--|
| 1. Soccer | 379 (3.3%) |
| 2. Badminton | 273 (2.4%) |
| 3. Ice Hockey | 225 (2.0%) |
| 4. Basketball | 189 (1.7%) |
| 5. Playground | 183 (1.6%) |
| 6. Running | 177 (1.5%) |
| 7. Dodgeball | 174 (1.5%) |
| 8. Wakeboarding | 165 (1.4%) |
| 9. Rowing | 155 (1.4%) |
| 10. Mountain Biking | 137 (1.2%) |

There were 608 pageviews to the Resources page, and individuals are sorting the resources based on the following categories. It is interesting to note that the sports clicked in the Resources are different from the top 10 sports.

- Boxing and Kickboxing
- Evidence [Evidence Summaries]
- Canoeing and Kayaking
- Scuba
- Track and Field
- Snowboarding
- Soccer
- Water Skiing
- Figure Skating

Bounce Rate and Exit Rate

Considering that most users of activesafe.ca are new visitors, we could examine which pages users are exiting the website from. However, these measurements do not answer the question of “why”—they only offer description.

The bounce rate of a website, expressed in a percentage, is when a user enters and exits a website from the first and only page they visited when they began their website session. Generally speaking, a high bounce rate could be due to a multitude of factors: not interested in the content, site quality is low, site loads too slowly, only interested in that one page, arrived at it from a Google search, etc.^{9,10}

However, bounce rate is not a particularly telling statistic for Active & Safe Central, as each sport page acts as a standalone element and therefore users might only be navigating to those sports they wish to learn about or were prompted to visit those pages by clicking through from external sites (i.e., email, Twitter, Google search). The pages in which bounce rate is highest (above 80%) include sport- or activity-specific pages such as Hiking, Diving, Gymnastics, Skiing, Softball, Playground, Dodgeball, Soccer, and Badminton. Indeed, the average time spent on these pages is 1:31, suggesting that users might only be visiting one page on activesafe.ca, but they are engaging with the content on that page.

Bounce rates (%) by page

| Page | Pageviews | Unique Pageviews | Avg. Time on Page | Entrances | Bounce Rate |
|--|---|---|---|---|---|
| | 11,509 % of Total: 100.00% (11,509) | 7,867 % of Total: 100.00% (7,867) | 00:01:31 Avg for View: 00:01:31 (0.00%) | 4,148 % of Total: 100.00% (4,148) | 56.95% Avg for View: 56.95% (0.00%) |
| 1. /playground/ | 183 (1.59%) | 155 (1.97%) | 00:02:12 | 116 (2.80%) | 87.93% |
| 2. /dodgeball/ | 174 (1.51%) | 157 (2.00%) | 00:02:01 | 120 (2.89%) | 81.67% |
| 3. /wakeboarding/ | 165 (1.43%) | 135 (1.72%) | 00:05:13 | 112 (2.70%) | 75.89% |
| 4. /soccer/ | 379 (3.29%) | 280 (3.56%) | 00:02:04 | 81 (1.95%) | 80.49% |
| 5. /ringette/ | 131 (1.14%) | 105 (1.33%) | 00:03:18 | 80 (1.93%) | 76.25% |
| 6. /badminton/ | 273 (2.37%) | 128 (1.63%) | 00:01:56 | 43 (1.04%) | 83.72% |
| 7. /mountain-biking/ | 137 (1.19%) | 122 (1.55%) | 00:02:49 | 38 (0.92%) | 86.84% |
| 8. /ice-hockey/ | 225 (1.95%) | 185 (2.35%) | 00:01:53 | 50 (1.21%) | 78.00% |
| 9. /five-new-sports-for-2020-tokyo-olympics/ | 57 (0.50%) | 52 (0.66%) | 00:00:48 | 29 (0.70%) | 89.66% |
| 10. /running/ | 177 (1.54%) | 137 (1.74%) | 00:01:17 | 45 (1.08%) | 75.56% |

By contrast, the exit rate of a website, also expressed in a percentage, is the percentage of visits that were last in any one session. Generally, pages with high exit rates can help you decide if you need to try to stop people from leaving that website at that particular page.^{9,10}

Sports pages have higher exit rates than non-sports pages (i.e., Home, About, Resources). Again, the nature of Active & Safe Central is designed as such that sports pages are standalone pages and might only interest specific people or interest groups.

Exit rates (%) by page

| Page | Exits | Pageviews | % Exit |
|-------------------|---|---|---|
| | 4,148 <small>% of Total: 100.00% (4,148)</small> | 11,509 <small>% of Total: 100.00% (11,509)</small> | 36.04% <small>Avg for View: 36.04% (0.00%)</small> |
| 1. / | 1,681 (40.53%) | 4,445 (38.62%) | 37.82% |
| 2. /soccer/ | 177 (4.27%) | 379 (3.29%) | 46.70% |
| 3. /about/ | 158 (3.81%) | 463 (4.02%) | 34.13% |
| 4. /resources/ | 146 (3.52%) | 533 (4.63%) | 27.39% |
| 5. /dodgeball/ | 126 (3.04%) | 174 (1.51%) | 72.41% |
| 6. /playground/ | 119 (2.87%) | 183 (1.59%) | 65.03% |
| 7. /wakeboarding/ | 111 (2.68%) | 165 (1.43%) | 67.27% |
| 8. /ice-hockey/ | 93 (2.24%) | 225 (1.95%) | 41.33% |
| 9. /ringette/ | 81 (1.95%) | 131 (1.14%) | 61.83% |
| 10. /running/ | 71 (1.71%) | 177 (1.54%) | 40.11% |

Incoming Traffic

Visitors arrived at activesafe.ca through a variety of ways. 30.7% of users visited the website by entering or clicking on the URL directly (Direct), while 27.6% found the website through Organic Search. 14.7% came from social media, 11.2% arrived from Paid Search, 10.7% from Referral and 3.6% from Email.

Paid Traffic

In June 2018, we ran Facebook ads through the BC Injury Research and Prevention Unit Facebook Ads account to raise awareness of the new website and encourage visitors to fill out the evaluation survey for a chance to win an Apple Watch.

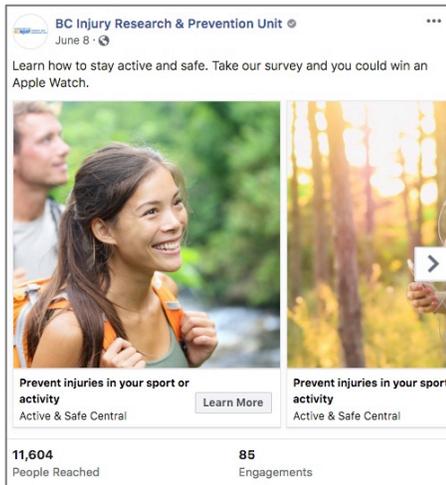
Ads ran from June 10 to June 16, 2018 with a total cost of \$479.31. Ads were targeted at the following groups:

- Official/Coach (20-55)
- Teacher (20-55)
- Parents (20-55)
- Youth Athletes (13-19)
- Adult Athletes (20-55)

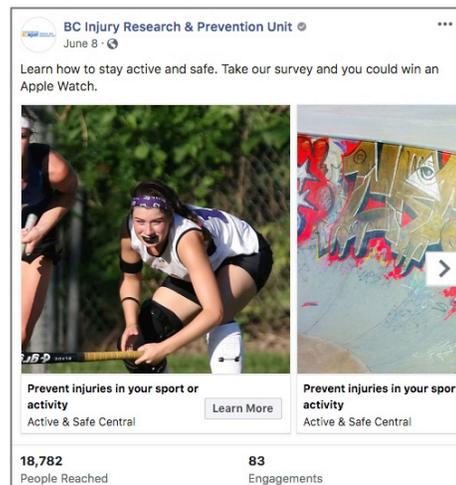
We reached 54,912 people with the campaign and generated 88,431 impressions (number of times ads were on screen). Ads resulted in 383-461 visits to Active & Safe Central.*

The top four performing ads, in terms of link clicks, were those targeted at adult athletes, youth athletes, parents (specifically around playground injuries), and coaches/officials, respectively.

In terms of engagement with the ads, we received a total of 91 reactions, 3 comments, and 5 post shares. Ads targeted at youth athletes contributed to 78% of the reactions on the ads, while ads targeted at teachers shared the ad the most (4 out of a total of 5 shares).



Target Group: Adult Athletes



Target Group: Youth Athletes

(* Web traffic varies because of the differences in reporting between Facebook and Google Analytics.)

Post-Launch Online Evaluation

Access to an online evaluation was available through activesafe.ca from May 10 until June 18 (40 days), 2018. A total of 87 respondents completed the survey. Survey feedback informed improvements to Active & Safe Central.

Demographics

Respondents were asked to indicate the type(s) of Active & Safe Central persona with which they identified. Well over half (62%) indicated that they participated in sports and recreational activity (participant/athlete), while nearly one-third indicated that they are a parent of a participant/athlete (31%).

Which of these best describes you? (select all that apply) (n=87)*

| Persona | N | % |
|-------------------------------|----|------|
| Participant/Athlete | 54 | 62.1 |
| Parent of Participant/Athlete | 27 | 31.0 |
| Health Professional | 20 | 23.0 |
| Coach | 17 | 19.5 |
| Club/Activity Administrator | 15 | 17.2 |
| Teacher/School Administrator | 6 | 6.9 |
| Other | 9 | 10.3 |

* Health Professionals included: kinesiologist, public health nurse, sports physician, firefighter, paramedic, OT, RMT. Other included: student, researcher, fitness instructor, recreation instructor, writer for sports product blog.

Nearly two thirds (62%) of participants self-identified as female and over one-third (36%) self-identified as male. Participants between the ages of 25 and 44 years accounted for 38% of respondents, while 23% were between 45 and 64 years, 16% were between 19 and 24 years, and 14% were between 15 and 18 years of age. Fewer than five respondents were 10 to 14 years of age.

The majority of respondents (70%) had not experienced a sport or recreation-related injury severe enough to require medical attention within the past 12 months. Among those who did experience an injury (n=26), 38% experienced a recovery period of 1-12 weeks, 38% experienced a recovery period of 1-12 months, and 23% were still in their recovery period.

Common activities engaged in at the time of injury included soccer, basketball, running and general exercise. Other activities included ringette, floor hockey, ball hockey, softball, rugby, rowing, skiing, cheerleading, skateboarding and pole waking.

Common injuries included sprained ankle and concussion. Other injuries included ACL tear, hip flexor issue, shoulder muscle issue, rib issue, knee issue, and fracture.

Engagement

When asked how they heard about Active & Safe Central, over half (58%) of participants noted that they heard about the website through social media, suggesting that the Facebook ads were successful in getting people beyond the BC sports injury prevention community to visit activesafe.ca. Other media included family/friend at 20%, and email/newsletter at 14%.

How did you hear about Active & Safe Central? (select all that apply) (n=87)

| Medium | N | % |
|---|----|------|
| Social Media (Twitter, Facebook, etc.) | 50 | 57.5 |
| Family/Friend | 17 | 19.5 |
| Email/Newsletter | 12 | 13.8 |
| Media (news, newspaper, magazine, etc.) | 7 | 8.0 |
| Internet Search | 3 | 3.4 |
| Blog Post | 0 | 0.0 |
| Other* | 4 | 4.6 |

*Other included: "Google alert" and "Colleague."

Respondents reported browsing 257 pages on Active & Safe Central related to 46 specific sports and recreational activities over the 40-day period. The top five pages with

the highest number of visits as reported by the survey respondents included: running (21), soccer (18), basketball (16), ice hockey (16), and volleyball (13). Pages not reported as visited included: inline skating, racquetball, waterskiing. and windsurfing.

**What sport(s) or recreational activity(ies) did you look at on Active & Safe Central?
(check all that apply) (n=85)**

| Sports/Activity Page | # of Views | Sports/Activity Page | # of Views |
|----------------------|------------|----------------------|------------|
| TOTAL | 257 | | |
| Running | 21 | Boxing | 3 |
| Soccer | 18 | Dodgeball | 3 |
| Basketball | 16 | Football | 3 |
| Ice Hockey | 16 | Figure Skating | 2 |
| Volleyball | 13 | Lacrosse | 2 |
| Playground | 12 | Skateboarding | 2 |
| Swimming | 10 | Snowshoeing | 2 |
| Yoga | 10 | Surfing | 2 |
| Field Hockey | 9 | Wrestling | 2 |
| Rugby | 9 | Cheerleading | 1 |
| Track & Field | 9 | Diving | 1 |
| Canoe/Kayaking | 7 | Fencing | 1 |
| Dance | 7 | Gymnastics | 1 |
| Hiking | 7 | Horseback Riding | 1 |
| Snowboarding | 7 | Longboarding | 1 |
| Baseball | 6 | Scuba | 1 |
| Climbing | 6 | Squash | 1 |
| Golf | 6 | Tennis | 1 |
| Martial Arts | 6 | Trampoline | 1 |
| Rowing | 6 | Wakeboarding | 1 |
| Badminton | 5 | Water Polo | 1 |
| Mountain Biking | 5 | Inline Skating | 0 |
| Skiing | 5 | Racquetball | 0 |
| Ringette | 4 | Waterskiing | 0 |
| Softball | 4 | Windsurfing | 0 |

Highest visits
Top on Google

Respondents were asked to indicate their level of agreement for a series of statements using a 4-point scale: strongly disagree, disagree, agree, and strongly agree.

Overwhelming, respondents “agreed” or “strongly agreed” that:

- Injuries are a problem in the sports or recreational activities that they are interested in (89%)
- Active & Safe Central is a helpful resource (94%)
- They learned something new on activesafe.ca (90%)
- The website is easy to use (90%)
- The site increased their awareness of injury prevention recommendations (91%)
- They feel comfortable using the injury prevention recommendations (90%)

Furthermore, respondents “agreed” or “strongly agreed” that they will take action by:

- Using the injury prevention recommendations on activesafe.ca (87%)
- Sharing what they learned with others (86%)
- Recommending this website to others (94%)

Open responses to the question “How will you use what you learned on this site to improve safety?” included:

- Increase personal knowledge
- Identify common injuries and employ prevention strategies
- Share information with respondent’s children, other parents, friends, co-workers, colleagues
- Share with sports community via social media
- Refer clients to the activesafe.ca resource
- Increase knowledge among sport club participants/athletes
- Increase knowledge among teammates
- Increase parental knowledge among sports club members
- Increase knowledge among sport club coaches
- Increase knowledge among sport club board members
- Use guidelines to help connect theory and practice
- Improve form and technique as an injury prevention strategy
- Use strength training as an injury prevention strategy
- Inform participant/athlete warm-up prior to activity
- Inform training methods to include injury prevention lens
- Inform sport-specific skill development program with injury prevention lens
- Inform sport-specific safety program
- Inform a physical literacy program
- Work with public health to spread information via school staff
- Foster a long-term focus on chosen sport and recreation activity
- Incorporate into sports camp staff training, and information for campers
- Incorporate information into first aid classes
- Coordinate community workshop
- Recommend sports physicals

Suggestions for additions to the website included the site search function, formats, other sport and recreation topics, and content ideas.

Access, searching, questions

- Better mobile access

- Better search tool - didn't work in app
- Make the search function actually bring you to a page or show similar results when you hit enter
- I feel that there should be a question tab that allows customers or viewers to be able to ask questions and be more aware easily

Format

- More images
- Gifs of stretches and exercises
- Embedded videos
- Scenario-based videos, e.g., simple biomechanics videos showing how injuries occur OR videos showing how to PREVENT injuries

Topics

- Stages of children's ages and likelihood of injury
- Risk versus hazards; role of risky play in child development
- Source out women's/girl's specific research/resources. Their bodies and hence injuries & rates are different in sports like baseball
- Expand beyond organized sports, e.g. recreational skating, walking
- Aerobic/Cardio classes
- Ball hockey as a sport
- Cycling
- Gym equipment use and safety (weight machines and cardio equipment)
- Nature Play - children playing in forest, risky play, etc.
- Walking
- Weightlifting and other training related activities

Content

- Myths and truths - Quick quiz to identify what you don't know
- Ranking sports by level of safety
- Updates as progress in injury prevention comes up
- There are a lot of statistics that are difficult to relate to, maybe try explaining more or including more detail
- The stats for ringette concussions were strange -- the range was very large and there wasn't a reference to get more information
- More specifics, a lot of the climbing stuff was generic and common sense if you are a climber

- Stronger recommendations regarding safety equipment (especially FH - helmets and gloves, like Field Lacrosse should be mandatory)
- More stress on equipment fittings as particularly, from a recreational stance, can be a contributor to injury (e.g., skates that aren't tied up properly).
- Provide resources on where to find more info on how to get fitted/ensure equipment fits properly based on the sport as improperly fitted equipment could also contribute to poor form and injury
- Sport tape techniques
- For concussions some information on the value of baseline testing particularly for sports where concussion is one of the most common injuries
- Give examples of neuromuscular training, or some call to action for where to obtain information about what neuromuscular exercises we should be doing

Local/External information

- Information on how to join the sport for people who may be interested
- Link to where to find certified exercise advice in each province, i.e., COKO in Ontario
- A list of playgrounds in the area that are approved
- More local events on preventing sports injuries
- Looking for an inexpensive system/program for baseline and on hill testing of our athletes.

Additional comments provided at the conclusion of the survey included:

- Great job! This type of site is long overdue!
- The site is very simple to use, yet provides significant information.
- Excellent reference source for injury and prevention
- I see sites like this as valuable resources. I'll be back to look at more sports as I work in a field that sees many youth being coached in many sports.
- Great to see this initiative. Ensuring that children in particular can participate in physical activity and remain injury free is so important for long term health outcomes.
- Great job! I hope it expands beyond where it is currently because it could be an excellent resource for all sports and physical activity, not just organized sport.
- I am glad you are on social media
- This is a very useful resource, both for those working in injury prevention and for parents.
- Thank you for bringing this site to the attention of many young athletes
- It was great to see the connections to the official sport resources.

- This is an amazing website and an amazing resource! It is easy-to-use and empirically-based, and I like the fact you have made it easy for users to find the actual research papers you have utilized. The site is very clear and easy to navigate; this will make it useful for users who do not have a lot of background medical knowledge. I appreciate that athletes from any age group will find useful information here. Thanks for producing this website!!!
- My children are often getting injured. I feel that it is better to play and get hurt than to not play but I also like to encourage time for rest and recovery. Too many kids return to sport too soon after injuries, especially concussions. Thanks for your suggestions.
- This is an awesome resource that I can utilize in the classroom (I am studying Kinesiology), in the gym, and when I teach others. This resource has a lot of potential, but can be tailored more to an average consumer by using layman-friendly terms (e.g., avoiding words like "neuromuscular").

Additional recommendations included:

- While the injury prevention ideas are important, I would prefer to see them alongside suggestions on how to keep kids active and safe. I mostly just found the statistics made me feel as if my kids should quit all sports because they were too dangerous.
- I was confused by the front page. I kept expecting the labels "common injuries" "prevention" "injury statistics" and "risk factors" around the circle to be clickable because the drop-down text said "read about the parts of the body most at risk for injury"
- I was surprised about two things about my sport (ringette): 1) skating development (agility and control) wasn't listed a preventative measure for collisions. LTAD calls for small area games however currently children are skating full ice for games which puts a disproportionate emphasis on forward stride resulting in acquisition of speed and little use of edge control (agility) skills. Adding take skating lessons to the parent section would be good. 2) Mouth guards help concussions that are caused by the lower mandible colliding with the skull. Most ringette concussions are caused by falling backward (weak skaters) or body to body collision. I would have thought there would be more information about choosing a helmet and ensuring it is fitted correctly with the facemask.

- CATT is one tool but NCCP also has another Making Headway. Both should be listed for coach development.

Post-Launch Updates

Changes that were made to Active & Safe Central responding to feedback collected include:

- Mobile menu updated to display all available sports pages
- News feed displays the correct date
- FAQ accordion sections only collapse when clicked to close
- Basketball, horseback riding, and rowing silhouettes have been updated
- “03 Risk Factors” section has been updated for better flow on sports pages
- Videos embedded on sports pages
- Names on About page stay on the same line instead of word-wrapping
- Improved search results, (e.g. both Field Hockey and Ice Hockey are prioritised when searching for “Hockey”)

Other updates made to the resource include:

- Updated analytics to provide clearer understanding of user clicks on search bar, audience segments, and silhouette key points on sports pages
- YouTube and Vimeo videos can now be embedded on sports page simply by including the URL in the content

Summary and Discussion

Initial post-launch results suggest that Active & Safe Central is a useful resource for providing Canadians with injury prevention information for sport and recreation activities. During the first 40 days after launch, there were 2,306 visits to the Active & Safe Central website 6,340 pages viewed, and 87 people participated in an evaluation of the site. Overall, 94% of respondents agreed that Active & Safe Central is a helpful resource, 90% agreed that they learned something new, and 90% agreed that the website is easy to use. Furthermore, 87% of respondents agreed that they will use the recommended injury prevention strategies, 86% plan to share what they learned with others, and 94% agreed that they would recommend this website to others.

Ongoing work on Active & Safe Central includes continued promotion of the resource by the BC Injury Research and Prevention Unit using social media, conference presentations, the development of informative prevention resource videos (physical literacy, training load, neuromuscular training, and sleep hygiene), and manuscript development. Emerging sports and recreational injury prevention evidence will be

reviewed twice a year, and the resource will be updated as new information becomes available.

The Active and Safe Central resource was developed using an integrated knowledge translation approach with evaluation indices embedded throughout the process. The process engaged injury prevention trainees across the country to conduct systematic reviews in a condensed timeline. Information collected through focus groups and project meetings with stakeholders was critical in the initial development and subsequent iterations of the on-line tool. This user friendly, web and mobile-accessible tool can increase the reach, awareness and implementation of prevention programming in sport and recreational activity. Initial post-launch results suggest that Active & Safe Central is a useful resource for providing Canadians with injury prevention information for sport and recreational activity.

Challenges and Limitations

The early decision to include over 60 sports in the initial search strategy resulted in several challenges that permeated through the different phases of development. First, it increased the amount of literature that needed to be reviewed; therefore, Phases 2 and 6 of the project took longer than originally anticipated. Utilizing injury prevention trainees allowed for the completion of multiple simultaneous reviews guided by the research coordinator Amanda Black and project team member Sarah Richmond. However, different skill levels of the different trainees led to delays in certain sport groupings, requiring additional assistance in the synthesis of the evidence. The quality and availability of evidence for certain sport and recreational activities made it difficult to provide recommendations for all activities. This resulted in the merging of personas as explained in Phase 6, and the exclusion of certain sports as well as exclusion of information on special populations. For example, overall, there is a limited amount of published research on sport and recreational activity-related injury among individuals with disabilities. Furthermore, of these, there is a large amount of variability in study methodology and in the definition of disability. For these reasons, the project team did not feel confident in including injury prevention information on adapted sports from the available data.

Lessons Learned

The most challenging aspect in the development of Active & Safe Central was the work required to conduct evidence reviews on an extensive number of sports and recreational activities concurrently. This challenge was met by grouping like activities together, assigning topics based upon the amount of literature retrieved from preliminary searches, and partnering with the Canadian Injury Prevention Trainee

Network. The lesson learned is that the Canadian Injury Prevention Trainee Network is capable of conducting multiple related evidence reviews concurrently and efficiently, and this partnership was crucial to the success of the project.

Future Directions

Future work on Active & Safe Central includes manuscript publications, conferences, and the current development of instructional videos. Specifically, four videos are in development, including: volleyball neuromuscular training warm-up video, physical literacy and injury prevention; training load on sport injury risk; and sleep hygiene and the effects on sport injury outcomes. The videos are being developed using knowledge translation planning principles including creating effective messaging and communication and behaviour change strategies, and will be evaluated using knowledge product and service indicators including reach, usefulness, use, collaboration and capacity building. We are currently seeking funding for the sustainability of the Active & Safe Central resource to ensure that it is updated and reviewed in a timely manner as new and emerging evidence becomes available in the sport domain. Further funding will also allow to support any changes and enhancement needed to keep the resource current and up-to-date.

References

1. MacKay M, Scanlan A, Olsen L, Reid D, Clark M, McKim K, Raina P. Looking for the evidence: a systematic review of prevention strategies addressing sport and recreational injury among children and youth. *Journal of Science and Medicine in Sport*. 2004 Mar 1;7(1):58-73.
2. Emery CA, Cassidy JD, Klassen TP, Rosychuk RJ, Rowe BH. Effectiveness of a home-based balance-training program in reducing sports-related injuries among healthy adolescents: a cluster randomized controlled trial. *Canadian Medical Association Journal*. 2005 Mar 15;172(6):749-54.
3. Emery CA, Roy TO, Whittaker JL, Nettel-Aguirre A, Van Mechelen W. Neuromuscular training injury prevention strategies in youth sport: a systematic review and meta-analysis. *Br J Sports Med*. 2015 Jul 1;49(13):865-70.
4. Chambers A, Richmond SA, Logan L, Macarthur C, Mustard CA. The development of a framework to integrate evidence into a national injury prevention strategy. *Journal of Public Health*. 2014 Oct 1;37(4):671-7.
5. National Collaborating Centre for Methods and Tools. Evidence-Informed Public Health. Search: Efficiently search for research evidence. 2014. Retrieved from: <http://www.nccmt.ca/eiph/search-eng.html>

6. Health Evidence. Quality Assessment Tool – Review Articles. 2018. Retrieved from: <https://www.healthevidence.org/documents/our-appraisal-tools/quality-assessment-tool-dictionary-en.pdf>
7. Downs SH, Black N. The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *Journal of Epidemiology & Community Health*. 1998 Jun 1;52(6):377-84.
8. Shamliyan T, Kane RL, Dickinson S. A systematic review of tools used to assess the quality of observational studies that examine incidence or prevalence and risk factors for diseases. *Journal of clinical epidemiology*. 2010 Oct 1;63(10):1061-70.
9. CXL. Bounce Rate vs. Exit Rate: What's the Difference? (November 26, 2018). Accessed <https://conversionxl.com/guides/bounce-rate/bounce-rate-vs-exit-rate/>.
10. Megalytic. Identifying Drop-off Points on Your Website with Google Analytics (November 26, 2018). Accessed: <https://www.megalytic.com/blog/identifying-drop-off-points-on-your-website-with-google-analytics>.

Appendices

Appendix A – Sport Groupings

Active and Safe BC: Proposed Sport Groupings for Systematic Reviews

| Proposed Groupings | Sports Included | Citations | Reviews |
|--|--|-----------|---------|
| Group 1: Hockey, Lacrosse, Ringette | Ice Hockey | 291 | 29 |
| Medline References: 349 | Field Hockey | 44 | 6 |
| Review articles: 40 | Ball Hockey | 0 | 0 |
| | Lacrosse | 65 | 9 |
| | Ringette | 5 | 0 |
| Group 2: Football | Football | 798 | 93 |
| Medline References: 796 | | | |
| Group 3: Rugby | Rugby | 519 | 56 |
| Medline References: 519 | | | |
| Group 4: Soccer | Soccer | 660 | 71 |
| Medline References: 660 | | | |
| Group 5: Snow Sports | Snow Sports [Mesh] | 463 | 48 |
| Medline References: 526 | Skiing (Cross-Country, Alpine) | 426 | 46 |
| Review article: 57 | Snowboarding | 205 | 33 |
| | Snowshoeing | 13 | 1 |
| Group 6: Wheels and Skates | ice skating/Skating [Mesh] | 175 | 20 |
| Medline References: 206 | figure skating | 19 | 5 |
| Review articles: 22 | inline skating | 24 | 1 |
| | skateboarding | 47 | 6 |
| | long boarding | 3 | 0 |
| Group 7: Combat and duelling sport | Boxing | 80 | 16 |
| Medline References: 260 | Wrestling | 32 | 7 |
| Review articles: 46 | Martial Arts(Taekwondo, Judo, Karate, MMA, Boxing, Kickboxing) | 79 | 9 |
| | Fencing | 79 | 14 |
| Group 8: Water Recreation Part 1 | Canoeing/Canoe | 13 | 3 |
| Medline References: 146 | Kayaking | 18 | 5 |
| Review articles: 27 | Rowing | 40 | 13 |
| | Surfing | 49 | 9 |
| | Wind-surfing | 7 | 0 |
| | Water skiing | 13 | 1 |
| | Wakeboarding | 23 | 2 |

| | | | |
|--|---|-----|----|
| Group 9: Water Recreation Part 2 | Swimming [Mesh] | 652 | 95 |
| Medline References: 716 | Scuba | 89 | 21 |
| Review articles: 108 | Diving | 91 | 22 |
| | Snorkelling | 6 | 0 |
| Group 10: Fitness and Recreation | Aerobic Classes (references not relevant) | 7 | 3 |
| Medline References: 822 | Machine (Weight Lifting) | 28 | 10 |
| Review articles: 131 | Walking [Mesh] | 167 | 11 |
| | Running | 288 | 59 |
| | Weight Training | 27 | 7 |
| | Yoga | 13 | 4 |
| | Pilates | 7 | 1 |
| | Cycling | 313 | 41 |
| Group 11: Mountaineering and horseback (rodeo was not on list, verify addition) | Rock Climbing | 42 | 5 |
| Medline References:334 | Bouldering | 23 | 4 |
| Review articles: 38 | Hiking | 41 | 5 |
| | Mountain Biking | 20 | 4 |
| | Horseback Riding | 143 | 26 |
| Group 12: Team Ball Sports | Baseball | 161 | 35 |
| Medline References: 395 | Softball | 86 | 8 |
| Review articles: 59 | Basketball | 164 | 15 |
| | Volleyball | 33 | 4 |
| | Water polo | 14 | 4 |
| Group 13: Racquet Sports | Racquet Sports[Mesh] | 126 | 23 |
| Medline References: 183 | Tennis[Mesh] | 55 | 17 |
| Review Articles: 26 | Squash | 56 | 3 |
| | Raquetball | 8 | 1 |
| | Badminton | 36 | 2 |
| Group 14: Acrobatic and individual performance sports | Track & Field | 58 | 6 |
| Medline References: 389 | Trampoline | 65 | 11 |
| Review Articles:77 | Gymnastics | 87 | 18 |
| | Dance | 101 | 20 |
| | Cheerleading | 33 | 6 |
| | Golf | 56 | 19 |
| Group 15: Playgrounds and play spaces | Playgrounds | 93 | |
| Medline References: 99 | Dodge Ball | 6 | |
| Review articles: 2 | | | |

Appendix B – Search Strategy Recommendations

Recommended Databases for peer-review literature

MEDLINE
 PsycINFO
 CINAHL
 SPORTDiscus

Recommendations for Grey Literature

Google Scholar
 Sport Specific Association websites

Search Terms Suggestions (Medline)

Incidence/prevalence data (The Burden of the Injury)

| Concept A (Outcome) | Concept B (prevalence) | Concept C (Sport) |
|--|---|--|
| exp Athletic Injuries/ injur*.mp. | exp Prevalence/ exp Incidence/ "cost of illness"/ Cost.mp. | [insert all the terms for your sport here] |
| exp "Wounds and Injuries"/ exp Brain Concussion/ [Note: if there are specific injuries that are known for your sport add key words here] | Costs.mp. | |
| | exp Epidemiology/ epidemiology.mp. | |
| | exp Morbidity/ exp Mortality/ | |

Risk and protective factors

| Concept A (Outcome) | Concept B (Risk and Protective) | Concept C (Sport) |
|---|--|--|
| exp Athletic Injuries/ injur*.mp. | exp Risk/ exp Risk Factors/ exp Risk Assessment/ Prevent*.mp. | [insert all the terms for your sport here] |
| exp "Wounds and Injuries"/ exp Brain Concussion/ exp Athletic Injuries/ | exp Primary Prevention/ exp Protective Factors/ protective.mp. exp Sports Equipment/ equipment.mp. | |

Effective interventions, Cost effectiveness, Implementation, Evaluation

| Concept A (Outcome) | Concept B (Interventions) | Concept C (Sport) |
|----------------------------|----------------------------------|--|
| exp Athletic Injuries/ | exp Primary Prevention/ | [insert all the terms for your sport here] |
| injur*.mp. | exp Program Evaluation/ | |
| exp "Wounds and Injuries"/ | exp Accident Prevention/ | |
| exp Brain Concussion/ | Prevent*.mp. | |
| | Implement*.mp. | |
| | exp Education/ | |
| | exp Patient Education as Topic/ | |
| | Adapt*.mp. | |
| | exp Evaluation Studies as Topic/ | |
| | Evaluat*.mp. | |
| | policy.mp. | |
| | policies.mp. | |
| | rules.mp. | |
| | facilitator.mp. | |
| | barrier.mp. | |
| | Fidelity.mp. | |
| | Sustainab*.mp. | |

Tips: Use limits where available

1. English language
2. Human research studies only

Sample in Medline

Search History (60)

| # ▲ | Searches | Results | Annotations |
|-----|--|---------|---|
| 1 | exp Athletic Injuries/ | | 25899 |
| 2 | injur*.mp. | | 1032521 |
| 3 | exp "Wounds and Injuries"/ | | 890099 |
| 4 | exp Brain Concussion/ | | 6831 |
| 5 | 1 or 2 or 3 or 4 | | 1420047 |
| 6 | exp Prevalence/ | | 254109 |
| 7 | exp Incidence/ | | 234529 |
| 8 | "cost of illness"/ | | 23746 |
| 9 | Cost.mp. | | 438781 |
| 10 | Costs.mp. | | 240357 |
| 11 | exp Epidemiology/ | | 26664 |
| 12 | epidemiology.mp. | | 206607 |
| 13 | exp Morbidity/ | | 492586 |
| 14 | exp Mortality/ | | 349607 |
| 15 | 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 | | 1484444 |
| 16 | 5 and 15 | | 89690 |
| 17 | rugby.mp. | | 2740 |
| | | | Note: if you have more than one sport. You should run them separately |
| 18 | rugby union.mp. | | 753 |
| 19 | rugby sevens.mp. | | 67 |
| 20 | 17 or 18 or 19 | | 2740 |

| | | | |
|----|--|---------|---|
| 21 | 5 and 15 and 20 | 315 | |
| 22 | limit 21 to yr="2000 -Current" | 254 | Date limiter |
| 23 | limit 22 to "review articles" | 31 | Check review articles for export you can include reviews in the last 10 years, primary articles in the last 5 |
| 24 | exp Risk/ | 1095752 | |
| 25 | exp Risk Factors/ | 741796 | |
| 26 | exp Risk Assessment/ | 235101 | |
| 27 | Prevent*.mp. | 1340164 | |
| 28 | exp Primary Prevention/ | 146161 | |
| 29 | exp Protective Factors/ | 1381 | |
| 30 | protective.mp. | 292684 | |
| 31 | exp Sports Equipment/ | 1357 | |
| 32 | equipment.mp. | 300063 | |
| 33 | 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 | 2868467 | |
| 34 | 5 and 20 and 33 | 487 | |
| 35 | limit 34 to yr="2000 -Current" | 381 | |
| 36 | limit 35 to "review articles" | 53 | |
| 37 | exp Primary Prevention/ | 146161 | |
| 38 | exp Program Evaluation/ | 70226 | |
| 39 | exp Accident Prevention/ | 76466 | |
| 40 | Prevent*.mp. | 1340164 | |
| 41 | Implement*.mp. | 378908 | |
| 42 | exp Education/ | 705672 | |
| 43 | exp Patient Education as Topic/ | 83412 | |
| 44 | Adapt*.mp. | 625023 | |
| 45 | Evaluat*.mp. | 3350859 | |
| 46 | exp Evaluation Studies as Topic/ | 980474 | |
| 47 | policy.mp. | 243060 | |
| 48 | policies.mp. | 76853 | |
| 49 | rules.mp. | 54675 | |
| 50 | facilitator.mp. | 5259 | |
| 51 | barrier.mp. | 160302 | |
| 52 | Fidelity.mp. | 23985 | |
| 53 | Sustainab*.mp. | 42437 | |
| 54 | 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 | 6643380 | |
| 55 | 5 and 21 and 54 | 168 | |
| 56 | limit 55 to yr="2000 -Current" | 148 | |
| 57 | limit 56 to "review articles" | 21 | |
| 58 | 21 or 34 or 55 | 617 | This is to allows you to see the amount of references in Medline across the 3 strategies |
| 59 | limit 58 to humans | 542 | Human limiter |
| 60 | limit 59 to english language | 529 | English limiter |

Note: This search strategy can be adapted for other databases.

TIP: Export final search into Mendely/Endnote, create folders for the different questions and as you screen the studies place the papers in the appropriate folder. A single paper may fit in more than one folder.

Appendix C – Sample EST and Report



**Evidence Summary:
Soccer**

Oluwatoyosi Owoeye, BPT, MSc, PhD
Version 1
February 2018

BC INJURY research and prevention unit

The British Columbia Injury Research and Prevention Unit (BCIRPU) was established by the Ministry of Health and the Minister's Injury Prevention Advisory Committee in August 1997. BCIRPU is housed within the Evidence to Innovation research theme at BC Children's Hospital (BCCH) and supported by the Provincial Health Services Authority (PHSA) and the University of British Columbia (UBC). BCIRPU's vision is to be a leader in the production and transfer of injury prevention knowledge and the integration of evidence-based injury prevention practices into the daily lives of those at risk, those who care for them, and those with a mandate for public health and safety in British Columbia.

Author: Oluwatoyosi Owoeye

Editors: Sarah A Richmond, Amanda Black

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Evidence Synthesis Tool

| | | | | |
|--|---|---|--|---|
| SPORT: | Soccer | Target Group: | Male and Female Players | |
| Injury Mechanisms: | Common injuries: Ankle injuries, knee injuries, concussions, hamstring injuries and groin injuries Common injury Mechanisms: Contact and non-contact; Running; Overstretched muscles during active/dynamic movements; forced inversion or eversion trauma/movement to the ankle; forced valgus or varus trauma to the knee; direct impact on the body | | | |
| Incidence/Prevalence | Risk/Protective Factors | Interventions | Implementation/Evaluation | Resources |
| <p>All Injury</p> <p>Male Elite Youth</p> <ul style="list-style-type: none"> Overall (range) = 2.0 to 19.4 injuries/1000h Game = 9.5 to 48.7 injuries/1000h Practice = 3.7 to 11.4 injuries/1000h.¹ <p>Male Professional Adult</p> <p>Overall (range) = 2.5 to 9.4 injuries/1000h, Game = 8.7 to 65.9 injuries/1000h, Practice = 1.4 to 5.8 injuries/1000h.¹</p> <p>Female Youth and Adult</p> <p>Game = 12.5-30.3 injuries/1000h, Practice = 1.2-3.8 injuries/1000h.²</p> <p>Most Common Injuries^{1,2}</p> <ul style="list-style-type: none"> Thigh/Hamstring injuries Ankle injuries Knee injuries Groin injuries <p>Concussion</p> <p>Male youth</p> <p>Overall = 0.19 (0.16 to 0.21)</p> | <p>Modifiable Risk Factors</p> <p>Male:</p> <p><i>Ankle Injuries</i></p> <ul style="list-style-type: none"> Lower extremity Power Output Score < 30W/kg: OR = 9.2 (95% CI; 1.13 to 75.09)¹ Poorer Balance Scores: OR = 0.43 (95% CI; 0.21 to 0.89).¹ <p>Female:</p> <p><i>Ankle Injuries</i></p> <ul style="list-style-type: none"> Lower Knee Valgus Angle (in a drop jump): OR = 0.64 (95% CI; 0.41 to 1.00).² <p><i>Hamstring Injuries</i></p> <ul style="list-style-type: none"> Greater BMI: OR=1.51 (5%CI; 1.08 to 2.11).² <p>Non-Modifiable Risk Factors</p> <p>Male:</p> <p><i>Hamstring Injury</i></p> <ul style="list-style-type: none"> Increasing Age: HR = 1.1 (95% CI; 1.0 to 1.2).⁴ OR = 1.4 (95%CI; 1.2 to 1.4).⁵ <p>Female:</p> | <p>There is extensive evidence (including level 1 evidence) that exercise-based interventions in the form of neuromuscular training programs are effective in reducing all soccer-related injuries (acute and overuse) across all levels of participation.</p> <ul style="list-style-type: none"> An injury risk reduction of 30% to 70% was reported for the 11+ Warm-up Program;¹⁻⁴ 50% to 56% for the Knee Injury Prevention Program (KIPP);⁴ 78% for the HarmoKnee Program;⁴ and 19% to 44% for other unnamed NMT programs specific for all injuries, knee (ACL) and ankle injury reduction.^{4,7} <p>Cost-Effectiveness</p> <p>An healthcare cost reduction of 43% was reported in the NMT group (-\$689/1000 player hours) (95% CI; -\$1741 to \$234) - NMT program similar to the 11+ but with additional use of wobble board -</p> | <p>Evaluation Frameworks</p> <p>Literature relating to implementation research for effective interventions such as the 11+ and other NMT programs is still sparse (no systematic review),^{1,2} however, only 1 study reported using an implementation framework in the evaluation of an NMT program for knee/ACL prevention.³ In this study, the RE-AIM SSM was used.</p> <p>Best Practice</p> <p>Current literature concludes that:</p> <ol style="list-style-type: none"> Coaching workshops can effectively increase coach attitudes, perceived behavioral control, and intent to implement an injury prevention program. However, high levels of behavioral determinants do not appear to translate to high levels of implementation compliance.^{1,2} Coach-led delivery of the 11+ was equally successful with or without the additional field | <p>Program Delivery</p> <p>To run the 11+ programs, a soccer coach would need to be trained either through an organized coach-workshop or self-training using freely available resources online: https://goo.gl/UDUKN</p> <p>Most NMT programs do not require the use of equipment, e.g. 11+, however, some might require wobble boards or pads for balance training</p> <p>Soccer associations and organizations at the federal, provincial and community levels will need to enact policies that would empower and drive coaches to adopt and use the 11+, especially at the youth and amateur levels of participation.^{1,2} This may be aligned with ongoing implementation research evaluating the real-world effectiveness (including healthcare cost) of</p> |

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| <p>concussions/1000AE</p> <p>Female youth Overall = 0.27 (0.24 to 0.30) concussions/1000AE</p> | <p><i>Knee Injuries</i></p> <ul style="list-style-type: none"> • Older Age (>14years): HR = 1.97 (95 % CI; 1.30 to 2.97).³ • Knee Complaints at the Start of the Season: HR = 1.98 (95 % CI; 1.30 to 3.02).³ • Familial Disposition of ACL Injury HR = 1.96 (95 % CI; 1.22 to 3.16).³ <p>Male and Female: <i>All Injuries</i></p> <ul style="list-style-type: none"> • Workload: Load can be both a risk or protective factor in youth soccer. Current evidence is sparse.⁶ Few primary studies recently published have been systematically synthesized (on DET) and summarized on report. • Game Exposure (vs. Practice): RR = 2.89 (95% CI; 1.69 to 5.21).⁷ • Previous Injury: OR = 1.23 to 11.6, for all injuries and specific lower extremity injuries (e.g. hamstring, knee, ankle).^{2,4,5,7-9} | <p>compared with the control group.⁸</p> <p>Only two studies^{8,9} were found to evaluate the cost-effectiveness of NMT programs in aligned RCTs (although cost-effective, one of such program – FIFA 11 (now revised to 11+) did not reduce injuries). There is need for more data on cost-effectiveness, especially relating to the 11+ program.</p> | <p>involvement of a physiotherapist.³</p> <p>3.Implementation/performance was reported to low to moderate for programs evaluated.^{4,5}</p> <p>4. To maximize program effectiveness, coaches will need to ensure quality delivery in their teams - exercise fidelity as prescribed (e.g. proper technique), and adequate adherence to program (2x weekly recommended).^{6,9}</p> <p>Implementation Facilitators³</p> <ul style="list-style-type: none"> • Focus on performance enhancement • High coaching experience • Pressure from parents • Awareness of data • ACL injuries in people related to individuals <p>Implementation Barriers⁴</p> <ul style="list-style-type: none"> • Ignorance of the program • Already doing similar exercises • Not having enough time • Other priorities (unspecified) | <p>interventions and strategies for improving program delivery and sustenance in the future. Such example includes the two countrywide campaigns in Switzerland and New Zealand.^{3,4} A similar approach is currently being used in an ongoing nationwide implementation and evaluation of the 11+ in Canada.^{5,6}</p> |
| <p>Works Cited:</p> <p>1. Pfirrmann et al. (2016). Analysis of injury incidences in male professional adult and elite youth soccer players: A systematic review. <i>Journal of Athletic Training</i>, 51(5), 410–424.</p> | <p>Works Cited:</p> <p>1. Henry et al. (2016). Risk factors for noncontact ankle injuries in amateur male soccer players: A prospective cohort study. <i>Clinical Journal of Sport Medicine</i>, 26(3), 251-258.</p> | <p>Works Cited:</p> <p>1. Barengo et al. (2014). The impact of the FIFA 11+ training program on injury prevention in football players: A systematic review. <i>International Journal of Environmental Research in Public Health</i>, 11, 11986-12000.</p> | <p>Works Cited:</p> <p>1. Steffen K, Meeuwisse WH, Romiti M. (2013). Evaluation of how different implementation strategies of an injury prevention programme (FIFA 11+) impact team adherence and injury risk in Canadian female youth football</p> | <p>Works Cited:</p> <p>1. Bizzini M, Junge A, Dvorak J. (2013). Implementation of the FIFA 11+ football warm up program: How to approach and convince the Football associations to invest in prevention. <i>British Journal of</i></p> |

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| <p>2. Junge A. Epidemiology in Female Football Players. In Volpi P, <i>Football Traumatology: New Trends</i> (pp. 21-27). Springer.</p> <p>3. Pfister T, Pfister K, Hagel B, et al. (2016). The incidence of concussion in youth sports: A systematic review and meta-analysis. <i>British Journal of Sports Medicine</i>, 50, 292–297.</p> | <p>2. Nilstad et al. (2014). Risk factors for lower extremity injuries in elite female soccer players. <i>American Journal of Sport Medicine</i>, 42(4), 940-948.</p> <p>3. Hagglund M, Markus Walden M. (2016). Risk factors for acute knee injury in female youth football. <i>Knee Surgery, Sports Traumatology, Arthroscopy</i>, 24, 737–746.</p> <p>4. Hagglund M, Walden M, Ekstrand J. (2006). Previous injury as a risk factor for injury in elite football: A prospective study over two consecutive seasons. <i>British Journal of Sports Medicine</i>, 40, 767–772.</p> <p>5. Arnason A, et al. (2004). Risk factors for injuries in football. <i>American Journal of Sport Medicine</i>, 32(1), 5-16S.</p> <p>6. Gabbett TJ, Whyte DG, Hartwig TB, Wescombe H, Naughton GA. (2014). The relationship between workloads, physical performance, injury and illness in adolescent male football players. <i>Sports Medicine</i>, 44, 989–1003.</p> <p>7. Emery CA, Meeuwisse WH, Hatmann SE. (2005). Evaluation of risk factors for injury in adolescent soccer: Implementation and validation of an injury surveillance system. <i>American Journal of Sport</i></p> | <p>2. Thorborg K, Krommes KK, Esteve E et al. Effect of specific exercise-based football injury prevention programmes on the overall injury rate in football: a systematic review and meta-analysis of the FIFA 11 and 11+ programmes. <i>Br J Sports Med</i> 2017;51:562–571.</p> <p>3. Al Attar et al. How Effective are F-MARC Injury Prevention Programs for Soccer Players? A Systematic Review and Meta-Analysis. <i>Sports Med</i> (2016) 46:205–217</p> <p>4. Herman et al. The effectiveness of neuromuscular warm-up strategies, that require no additional equipment, for preventing lower limb injuries during sports participation: a systematic review. Herman et al. <i>BMC Medicine</i> 2012, 10:75</p> <p>5. Grimm et al. Anterior Cruciate Ligament and Knee Injury Prevention Programs for Soccer Players: A Systematic Review and Meta-analysis. <i>Am J Sports Med</i> 2014;43(8):2049-2056</p> <p>6. Grimm et al. Ankle Injury Prevention Programs for Soccer Athletes Are Protective: A Level-I Meta-Analysis. <i>J Bone Joint Surg Am</i>. 2016;98:1436-43</p> <p>7. van Beijsterveldt et al. (2013). How effective are exercise-based injury prevention programmes for</p> | <p>players. <i>British Journal of Sports Medicine</i>, 47, 480–487</p> <p>2. Owøeye OBA, Bulat M, McKay CD, Hubka T, Palacios-Derflingher LM, Emery CA. (2017). Evaluating the association between psychosocial factors and FIFA 11+ implementation intention in youth soccer coaches. <i>British Journal of Sports Medicine</i>, 51, 284.</p> <p>3. Frank et al. (2015). High levels of coach intent to integrate an ACL injury prevention program into training does not translate to effective implementation. <i>Journal of Science & Medicine in Sport</i>, 18, 400–406.</p> <p>4. Joy et al. (2013). Factors Influencing the implementation of anterior cruciate ligament injury prevention strategies by girls' soccer coaches. <i>Journal of Strength & Conditioning Research</i>, 27(8), 2263-2269.</p> <p>5. Junge et al. (2011). Countrywide campaign to prevent soccer injuries in Swiss amateur players. <i>American Journal of Sports Medicine</i>, 39(1), 57-63.</p> <p>6. Soligard et al. (2010). Compliance with a comprehensive warm-up programme to prevent injuries in youth football. <i>British Journal of Sports Medicine</i>, 44, 787–793.</p> | <p><i>Sports Medicine</i>, 47, 803–806.</p> <p>2. Bizzini M, Dvorak J. (2015). FIFA 11+: An effective programme to prevent football injuries in various player groups worldwide—a narrative review. <i>British Journal of Sports Medicine</i>, 49, 577–579.</p> <p>3. Dick R, Gaulet C, Gianotti S. (2009). Implementing large-scale injury prevention programs. In: Bahr R, Engebretsen L, eds. <i>Sports Injury prevention</i>. Chichester: Wiley-Blackwell, 197–211.</p> <p>4. Junge A, Lamprecht M, Stamm H, et al. (2011). Countrywide campaign to prevent soccer injuries in Swiss amateur players. <i>American Journal of Sports Medicine</i>, 39, 57–63.</p> <p>6. Owøeye OBA, Bulat M, McKay CD, Hubka T, Palacios-Derflingher LM, Emery CA. (2017). Evaluating the association between psychosocial factors and FIFA 11+ implementation intention in youth soccer coaches. <i>British Journal of Sports Medicine</i>, 51, 284.</p> <p>7. Owøeye OBA, Bulat M, McKay CD, Hubka T, Palacios-Derflingher LM, Emery CA.</p> |
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| | <p>Medicine, 33(12), 1882-1891.</p> <p>8. Owoeye OBA, Palacios-Derflingher LM, Emery CA. (2017). Prevention of ankle sprain injuries in youth soccer and basketball: Effectiveness of a neuromuscular training program and examining risk factors. <i>Clinical Journal of Sport Medicine</i>, DOI: 10.1097/JSM.0000000000000462 [Epub ahead of print].</p> <p>9. van Beijsterveldt AMC, van de Port GL, Vereijken AJ, Backx FJG. (2013). Risk factors for hamstring injuries in male soccer players: A systematic review of prospective studies. <i>Scandinavian Journal of Medicine and Science in Sports</i>, 23, 253-262.</p> | <p>soccer players? A systematic review. <i>Sports Medicine</i>, 43, 257-265.</p> <p>8. Marshall DA, Elina L, Lacny S, Emery CA. (2016). Economic impact study: Neuromuscular training reduces the burden of injuries and costs compared to standard warm-up in youth soccer. <i>British Journal of Sports Medicine</i>, 50, 1388-1393.</p> <p>9. Krist et al. (2013). Preventive exercises reduced injury-related costs among adult male amateur soccer players. <i>Journal of Physiotherapy</i>, 59, 15-23</p> | <p>7. Hagglund et al. (2013). Superior compliance with a neuromuscular training programme is associated with fewer ACL injuries and fewer acute knee injuries in female adolescent football players: Secondary analysis of an RCT. <i>British Journal of Sports Medicine</i>, 47, 935-936.</p> | <p>(2017). Impact of a comprehensive FIFA 11+ workshop on youth soccer coaches' task self-efficacy for program implementation. <i>British Journal of Sports Medicine</i>, 51, 369-370.</p> |
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Review of Sport Injury Burden, Risk Factors and Prevention

Soccer

Incidence and Prevalence

The incidence of injuries in soccer players vary across levels of participation, type of exposure, and sex. Table 1 provides information on the incidence of soccer injuries (all injuries) by specific populations (Junge 2015; Pfirrmann et al. 2016). The incidence of injuries is higher in male participants (vs. females) and during games (vs. practice). Further, injury incidence is higher in training in male elite youth (vs. male professional adult), however, the reverse is the case for games (Junge 2015; Pfirrmann et al. 2016).

The prevalence of concussion in youth soccer appears to be low with an incidence of 0.19 (95%CI 0.16 to 0.21) concussions/1000AE and 0.27 (95%CI 0.24 to 0.30) concussions/1000AE in male and female athletes respectively (Pfister et al. 2016); a higher concussion incidence has been consistently reported in females (Junge 2015; Pfister et al. 2016).

Table 1: Incidence of Injuries in Soccer

| Type of Exposure | Category of Participation | | |
|------------------|--|---|-------------------------------------|
| | Male Elite Youth (Pfirrmann et al. 2016) | Male Professional Adult (Pfirrmann et al. 2016) | Female Youth and Adult (Junge 2015) |
| Overall (Range) | 2.0 to 19.4 injuries/1000h | 2.5 to 9.4 injuries/1000h | |
| Game (Range) | 9.5 to 48.7 injuries/1000h | 8.7 to 65.9 injuries/1000h | 12.5 to 30.3 injuries/1000h |
| Practice (Range) | 3.7 to 11.4 injuries/1000h | 1.4 to 5.8 injuries/1000h | 1.2 to 3.8 injuries/1000h |

Mechanism of Injury

Overall, about two-thirds of soccer injuries are traumatic in origin; about a third (27% to 33%) are caused by overuse (Bizzini and Dvorak 2015; Pfirrmann et al. 2016). Further, about two thirds of traumatic injuries are caused by player contacts (contact injuries), and 12 to 28 % of all of such injuries are caused by foul play (Bizzini and Dvorak 2015; Junge and Dvorak 2004). Noncontact injuries (e.g. from running, overstretching, twisting, cutting, landing from a jump) account for 26% to 59% of all injuries (Bizzini and Dvorak 2015; Junge and Dvorak 2004).

Location and Type of Injury

In male players, the most common injuries affect the hamstring muscles followed by the ankle, knee and groin (Junge and Dvorak 2004; Pfirrmann et al. 2016). In female players, knee (particularly ACL injuries) and ankle injuries are the most common, followed by thigh/hamstring injuries (Junge 2015; Junge and Dvorak 2004).

The most common injury types are strains, sprains and contusions in both male and female players (Junge 2015; Bizzini and Dvorak 2015; Junge and Dvorak 2004; Pfirrmann et al. 2016).

Limitations in this Report and Current Literature

A major strength of this report is that the reviews synthesized included high quality prospective studies; however, most of these studies are from Europe and North America. Little is currently known about the incidence of injuries in other parts of the world. For instance, only one study was cited from Asia and none from Africa. This may be due to paucity of literature from these regions of the world. One very recent prospective study from this region suggests that the incidence of injuries is a lot higher in Africa (Owoeye et al. 2017).

Another limitation in current literature is the possibility of grossly under-reporting overuse injuries. Recent studies on overuse injury surveillance in various sports, including soccer suggest that current literature underestimates the prevalence of overuse injuries due to the insensitivity in the injury surveillance method that has been used in reporting such injuries so far (methods originally designed for traumatic injuries) (Bahr 2009). The burden of overuse injuries in soccer may be more than what is currently reported.

Risk and Protective Factors

Risk factors for injuries can be divided into modifiable risk factors (factors that can be adjusted or changed) and non-modifiable risk factors (factors that cannot be adjusted but individuals can be identified and targeted for interventions). Current literature has mainly provided information on risk factors for soccer injuries (no information on protective factors were found except for workload). Risk factors have been specifically described for the most common injuries based on body location and are described in Table 2. Previous injury (either as all previous LE or specific LE injury) appears to be the strongest and most consistent risk factor for any new injury (Arnason et al. 2004; van Beijsterveldt, van de Port, et al. 2013; Clausen et al. 2016; Engebretsen et al. 2010; Hägglund, Waldén, and Ekstrand 2006).

Table 2: Risk Factors for Injuries in Soccer

| Injury by Location | Male | | Female | |
|--------------------|------------------------------|-----------------------------|-------------------------------|-----------------------------|
| | Modifiable Risk Factors | Non-Modifiable Risk Factors | Modifiable Risk Factors | Non-Modifiable Risk Factors |
| Ankle Injuries | Lower extremity Power Output | Previous Ankle Injury | Lower Knee Valgus Angle (in a | |

| | | | | |
|--------------------|---|--|--|--|
| | <p>Score (< 30W/kg) OR = 9.2 (95% CI 1.13 to 75.09) (Henry et al. 2016)</p> <p>Poorer Balance Scores OR = 0.43 (95% CI 0.21 to 0.89) (Henry et al. 2016)</p> | <p>OR = 1.23 (95% CI 1.06 to 1.41) (Engebretsen et al. 2010)</p> | <p>drop jump OR = 0.64 (95% CI 0.41 to 1.00) (Nilstad et al. 2014)</p> | |
| Hamstring Injuries | | <p>Increasing Age HR = 1.1 (95% CI 1.0 to 1.2) (Hägglund, Waldén, and Ekstrand 2006) OR = 1.4 (95%CI 1.2 to 1.4) (Arnason et al. 2004)</p> <p>Previous LE Injury HR = 3.5 (95%CI 1.9 to 6.5) (Hägglund, Waldén, and Ekstrand 2006)</p> <p>Previous Hamstring Injury OR (range) = 2.19 to 11.60 (van Beijsterveldt, van de Port, et al. 2013)</p> | <p>Greater BMI OR = 1.51 (5%CI 1.08 to 2.11) (Nilstad et al. 2014)</p> | |
| Knee Injuries | | <p>Previous LE Injury HR = 3.1 (95%CI 1.3 to 7.6) (Hägglund, Waldén, and Ekstrand 2006)</p> | | <p>Older Age (>14years) HR = 1.97 (95%CI 1.30 to 2.97) (Martin Hägglund and Waldén 2016)</p> <p>Knee Complaints at the Start of the Season HR = 1.98 (95%CI 1.30 to 3.02) (Martin Hägglund and Waldén 2016)</p> |

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| | | | | Familial Disposition of ACL Injury HR = 1.96 (95%CI 1.22 to 3.16) (Martin Häggglund and Waldén 2016) |
| | | | | Previous LE Injury IRR = 3.65 (95%CI 1.73–7.68) (Clausen et al. 2016) |

Furthermore, load (a modifiable factor) appears to be both a risk and protective factor in youth and adult soccer. Table 3 presents a breakdown of the relationship between workload in soccer and overall injury risk based on very recent high quality primary studies.

Table 3: Workload as a Risk and Protective Factor for Injuries in Soccer

| Male | | Female | |
|--|--|--|--------------------|
| Risk Factors | Protective Factors | Risk Factors | Protective Factors |
| Poor Aerobic Fitness Levels OR = 4.50 (95%CI 3.98 to 5.50) (Malone et al. 2016) | In-Season Acute:Chronic Workload Between 1 to 1.25 OR = 0.68 (95%CI 0.08 to 1.66) (Malone et al. 2016) | High Daily Training Load OR = 1.98 (95%CI 1.43 to 2.78) (Watson et al. 2016) | |
| High Pre-Season Workload OR (Range) = 1.95 to 5.11 (Malone et al. 2016) | Low Amount of Accumulated Load (Different Measures of Load): Overall, RR (Range) = 0.27 to 0.31 (Bowen et al. 2016) Non-Contact, RR = 0.21 to 0.31 (Bowen et al. 2016) | High Prior Day Load OR = 1.38 (95%CI 1.01 to 1.88) (Watson et al. 2016) | |
| High Amount of Accumulated Load (Different Measures of Load) Overall, RR (Range) = 1.65 to 3.84 | | | |

| | | | |
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| (Bowen et al. 2016) Non-Contact, RR = 2.2 to 5.11 (Bowen et al. 2016) | | | |
| High and Very High Acute:Chronic (over 1.41 and 1.76 respectively) Overall, RR (Range) = 2.55 to 4.98 (Bowen et al. 2016) | | | |

Finally, game exposure (vs. practice) [RR = 2.89 (95%CI; 1.69 to 5.21)] predisposes both male and female players to a higher risk of having a new injury (i.e. all injuries) (Emery, Meeuwisse, and Hartmann 2005) and low mood [OR = 0.12 (95%CI; 0.02 to 0.66)] has been identified as a risk factor for all injuries in female youth soccer players (Watson et al. 2016).

Limitations

This report is based on data extraction from primary studies, as there was no review level studies on the topic. However, data were synthesized from primary studies that meet an inclusion threshold based on a critical appraisal.

Generally, it appears that the current literature has not examined risk and protective factors for soccer-related injuries, despite their importance in developing appropriate countermeasures for injury incidence. To date, only a few studies have investigated modifiable risk factors as predictors of injuries in a prospective cohort design. Further, workload has been identified lately as the single most important factor for injury risk; acting either as a direct predictor or as an effect modifier (Gabbett et al. 2014). However, just like other potential risk factors, only a few studies currently exist on this topic and no systematic is currently available.

Opportunities for Prevention: Effective Interventions, Cost-Effectiveness, Implementation and Evaluation

There is extensive evidence (including level 1 evidence) that exercise-based interventions in the form of neuromuscular training programs are effective at reducing all soccer-related injuries (acute and overuse) in male and female amateur and elite youth/young adult players. Specifically, an injury risk reduction of 30% to 70% was reported for the 11+ Warm-up Program formerly known as FIFA 11+ (Al Attar et al. 2016; Barengo et al. 2014; Herman et al. 2012; Thorborg et al. 2017); 50% to 56% for the Knee Injury Prevention Program (KIPP) (Herman et al. 2012); 78% for the HarmoKnee Program (Herman et al. 2012); and 19% to 44% for other unnamed NMT programs specific for all injuries, knee (ACL) and ankle injury reduction (van Beijsterveldt, van der Horst et al. 2013; Grimm et al. 2015; Herman et al. 2012; Grimm et al. 2016).

Cost Effectiveness

A healthcare cost reduction of 43% was reported in an NMT group (-\$689/1000 player hours) (95% CI; -\$1741 to \$234) -NMT program similar to the FIFA 11+ but with additional use of wobble board- compared with a standard of practice control group (Marshall et al. 2016).

Implementation/Evaluation of Interventions

Literature relating to implementation research for effective interventions such as the 11+ and other NMT programs is advancing but no reviews currently exist on the topic (Frank, Register-Mihalik, and Padua 2015; Martin Häggglund et al. 2013; Joy et al. 2013; Junge et al. 2011; Owoeye et al. 2017a, 2017b; Soligard et al. 2010; Steffen et al. 2013). Of all the studies currently available, only one study reported using an implementation framework in the evaluation of an NMT program for knee/ACL prevention (Frank, Register-Mihalik, and Padua 2015). In this study, the RE-AIM SSM was used. Implementation/performance of NMT components range between low and moderate (Joy et al. 2013; Junge et al. 2011).

Best Practices

The following conclusions have been reached based on existing literature:

1. Coaching workshops can effectively increase coach attitudes, perceived behavioral control, and intent to implement an injury prevention program (Owoeye et al. 2017b; Steffen et al. 2013). However, high levels of behavioral determinants do not appear to translate to high levels of implementation compliance (Steffen et al. 2013).
2. Coach-led delivery of the FIFA 11+ was equally successful with or without the additional field involvement of a physiotherapist (Frank, Register-Mihalik, and Padua 2015).
3. To maximize program effectiveness, coaches will need to ensure quality delivery in their teams - exercise fidelity as prescribed (e.g. proper technique), and adequate adherence to program (2x weekly recommended) (Martin Häggglund et al. 2013; Soligard et al. 2010).

Implementation Facilitators reported in current literature (Frank, Register-Mihalik, and Padua 2015) include the following:

- Injury prevention
- Performance enhancement
- High coaching experience
- Pressure from parents
- Awareness of data
- ACL injuries in people related to individuals

Implementation barriers reported in current literature (Joy et al. 2013) include the following:

- Ignorance of the program

- Already doing similar exercises
- Not having enough time
- Other priorities (unspecified)

Directions for Program Delivery

Resources

To run the 11+ programs, a soccer coach would need to be trained either through an organized coach-workshop or self-training using freely available resources online:

<https://goo.gl/tJDUKN>

Most NMT programs do not require the use of equipment, e.g. 11+, however, some might require wobble boards or pads for balance training.

Partnership Supports

Soccer associations and organizations at the federal, provincial and community levels will need to enact policies that would empower and drive coaches to adopt and use the 11+, especially at the youth and amateur levels of participation (Bizzini and Dvorak 2015; Bizzini, Junge, and Dvorak 2013). This may be aligned with ongoing implementation research evaluating the real-world effectiveness (including healthcare cost) of interventions and strategies for improving program delivery and sustenance in the future. Such example includes the two countrywide campaigns in Switzerland and New Zealand (Bizzini, Junge, and Dvorak 2013; Junge et al. 2011). A similar approach is currently being used in an ongoing nationwide implementation and evaluation of the 11+ in Canada (Owoeye et al. 2017a, 2017b).

Limitations in Current Literature

Although the effectiveness of preventive interventions for soccer injuries have been demonstrated through data synthesized from systematic reviews and meta-analysis, little is currently known about the cost of interventions and their implementation. For example, only two studies (Krist et al. 2013; Marshall et al. 2016) were found to evaluate the cost-effectiveness of NMT programs in aligned RCTs, of which one evaluated the FIFA 11 (which did not reduce injuries, albeit cost-effective) – now revised to 11+. There is need for more data on cost-effectiveness and implementation/evaluation of proven injury prevention interventions currently available, especially ones relating to the 11+ program. Moreover, current evidence on prevention strategies in soccer directly relates to amateur and elite youth and young adult, generalizability of results to male professional adult players in which a considerable number of participants exit remains unclear.

Appendix D – Scoping Document

Active and Safe Central Online Resource Scoping Document

Overview

The Active and Safe injury prevention platform will be a web-based content management tool customized by: 1) person/group, 2) sport/recreational activity, 3) sex, 4) age group, and 5) level of play. The tool aims to provide injury prevention information based on novel information from recently completed comprehensive literature reviews and links to currently available prevention material. Guided by the evidence synthesis framework, information regarding the incidence of injuries, risk factors and prevention was collected and will be translated into clear messages for specific populations.

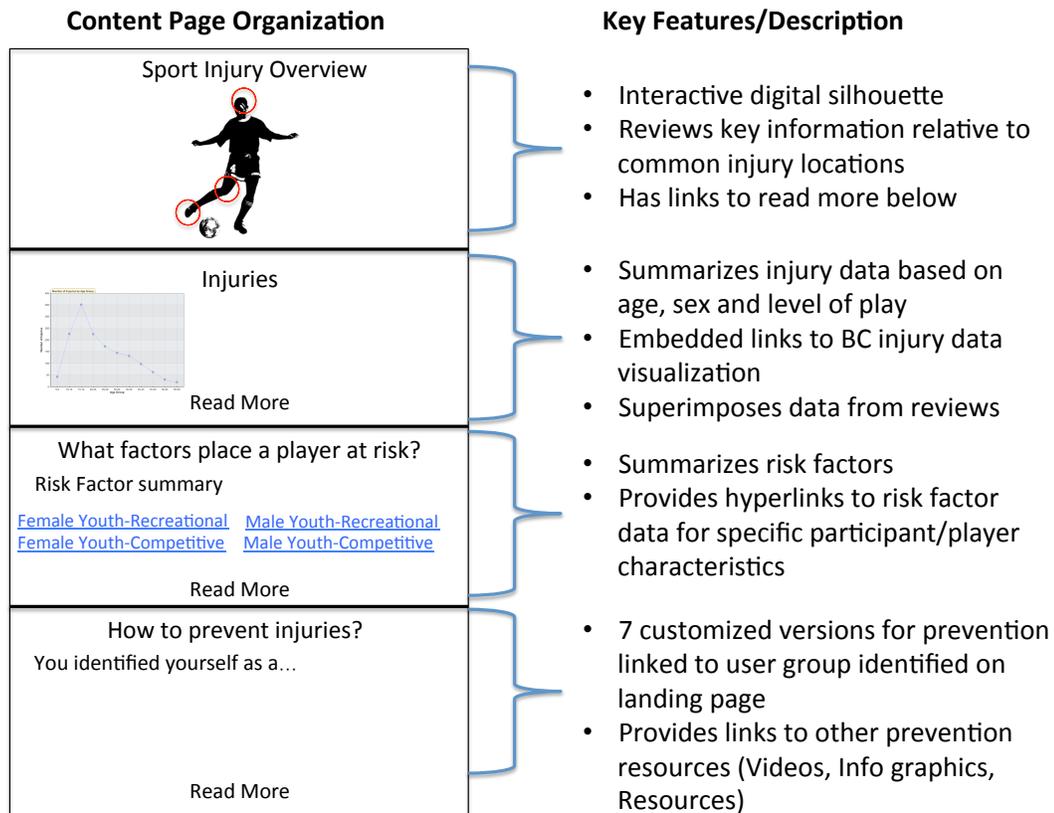
Digital Organization

Navigation through the tool will be customized to optimize the user experience. When a user arrives at the landing page of the digital tool, they will be asked to identify themselves as one of 7 user groups: 1) parent, 2) coach, 3) player/participant, 4) teacher, 5) referee, 6) administrator/board member/club organizer, or 7) medical professional. The user will then be asked to identify the sport or recreational activity in which they are interested from a list of approximately 60 activities. This will bring them to a content page that is specific to the sport and user group identified. The landing page will also provide a tab where policy makers or researchers can access the raw material (review reports) generated from the review of the literature.

Content Page

Navigation through the tool based on user group and sport will bring the user to a sport specific content page subdivided into 4 sections: 1) sport injury overview, 2) injuries (Incidence), 3) what factors place an player/participant at risk, and 4) how to prevent injuries? These sections will be on a horizontal split screen with an option to read more so that all sections are visible when you first arrive at the content page (See Figure 1). Each sport would have common content for each user group for the summary, incidence and risk factor sections with the language level catered to a grade 8 reading level. The prevention piece will be catered to the user group selected at the beginning.

Figure 1: Sport-Specific Content Page



Section 1: Sport Injury Overview

The sport injury overview section will include an interactive display silhouette of a participant engaged in the sport or activity identified through the navigation features. The user will be able to scroll over particular body parts of the silhouette and get a high level summary of the injury and prevention recommendations for that body region. There will be hyperlinks that a user can click on to advance to the more detailed prevention information lower on the screen.

Section 2: Injuries

The injury section will review the common injuries in the sport. There will be an embedded link to an injury dashboard, specific to the selected activity, containing British Columbia (BC) specific sport and recreational activity hospitalization data (<http://injuryevidence.ca/visualizations/sports-related-hospitalization-data/>). This data will be supplemented with information from the comprehensive reviews that can overlay the dashboard visual to have unique displays of the data. For example, a trend line for the injury rates in professional soccer players can be added to the graph displaying injury rates from soccer players in BC. The data can also be provided in the form of text.

Section 3: What risk factors place a player/participant at risk?

The risk factor section will begin with summary introductory information about risk factors for sport specific injuries. The upper section will include hyperlinks that navigate the user down that section of the page to risk factors specific for age, sex, and level of play. The size of the visible section when the user arrives at the main content page will be limited to allow all 4 sections to be seen and a “read more” feature provides the user access to all information on risk factors for that sport.

Section 4: How do I prevent injuries in my sport?

The prevention section will be customized based on the user group identified during navigation through the tool. Seven unique prevention messages will be generated for each user group, designed to identify the most relevant prevention material and provide strategies for implementation. The information will be embedded within the tool and highlighted using links to outside resources. Prevention recommendations will be based off of the evidence and fall within 3 categories: Education (e.g. equipment fit, neuromuscular training programs, Engineering (e.g. playing surface considerations), and Enforcement (e.g. rules and regulations) and will be written for the user group. For example, soccer players would be educated on the importance of preparing their body for competition and be provided with a link containing information on when and how often they can do neuromuscular training programs. They will also be provided with a video that will be embedded containing the core exercises in a neuromuscular training program. The video will be complemented with a PDF that they can print out or view on their mobile devices.

Additional Considerations

The active and safe web-based content management tool will be designed to be both user-friendly and mobile accessible. Integration of a twitter feed including tweets from established injury prevention centres (British Columbia Injury Prevention Research Unit, Sport Injury Prevention Research Centre, Oslo Sport and Trauma Centre, Parachute, etc.) will be considered. The possibility of identifying newly published papers using database search alerts and having them populate a new research tab, will be examined.

Appendix E – User Groups with No Specific Recommendations

| Sport | Parent | Player | Coach | Referee | Club Administrator | Teacher | Medical |
|------------------|-----------------------------|--------|------------------|-------------|--|--|------------------|
| Badminton | | | | No Evidence | | | |
| Baseball | | | | | | | |
| Basketball | | | | | | Could be adopted (add ophea resource) | |
| Boxing | | | | | | N/A | |
| Canoeing | Could be adopted from coach | | | N/A | No Evidence | No Evidence | |
| Cheerleading | | | | N/A | | N/A (Could get coach info) | |
| Dance | | | | N/A | N/A (But an argument can be made for dance a dance school section) | | Could be adopted |
| Diving | | | | N/A | | | Could be adopted |
| Dodgeball | | | No Evidence | No Evidence | N/A | Could be adopted/ note: banned in many schools though | No Evidence |
| Fencing | | | | | | | |
| Field Hockey | | | | | | | |
| Figure Skating | | | | N/A | | N/A | |
| Football | | | | No Evidence | Concussion education could be added | | |
| Golf | | | | N/A | No evidence | No evidence | No Evidence |
| Gymnastics | Not Missing | | | | | | |
| Hiking | | | N/A | N/A | N/A | | No Evidence |
| Horseback Riding | | | | N/A | No evidence (concussion education) | N/A | |
| Ice Hockey | | | | | | | |
| Inline Skating | | | Could be adopted | N/A | N/A | | |
| Kayaking | | | | N/A | No evidence | No evidence | |
| Lacrosse | | | | | | | |
| Longboarding | | | | N/A | No evidence | | |
| Martial Arts | | | | | | N/A | |
| Mountain Biking | | | N/A | N/A | N/A | N/A | |
| Playgrounds | | | | | | | |
| Racquetball | | | | N/A | | | |
| Ringette | | | | | | | |
| Rowing | | | | N/A | No evidence | No evidence | |
| Rugby | | | | No Evidence | | | |
| Running | | | | N/A | Could get coach information | N/A | |
| Scuba | | | | N/A | | N/A | |
| Skateboarding | | | N/A | N/A | N/A | N/A | |
| Skiing | | | | N/A | | | |
| Snowboarding | | | | N/A | | | |
| Snowshoeing | | | | | | | |
| Soccer | | | | | | | |
| Softball | | | | | | | |
| Squash | | | | No Evidence | | | |
| Surfing | | | No Evidence | N/A | No Evidence | N/A | |
| Swimming | | | | N/A | No Evidence | | |
| Tennis | | | | No Evidence | No Evidence | | |
| Track and Field | | | | | Could get coach information | | |
| Trampoline | | | | N/A | | Not a typical school activity but sometimes used in adaptive programs could get coach info | |
| Volleyball | | | | No Evidence | | | |
| Wakeboarding | | | | N/A | N/A | N/A | |
| Water Polo | | | | No Evidence | | | |
| Water Skiing | | | N/A | N/A | N/A | N/A | Could be adopted |
| Wind Surfing | | | N/A | N/A | N/A | N/A | |
| Wrestling | | | | | | | |
| Yoga | | | | | No Evidence | | Could be adopted |

Appendix F – Video Scripts

1. Volleyball Neuromuscular Training Warm-up

Aerobic Training:

The program will begin with athletes demonstrating a short aerobic warm up that includes running and agility type exercises such as skipping, zig zag running, and speed runs. These exercises will be demonstrated in a one-two minute clip, with voice over instruction.

- Kati's videos include: skipping (forward, backward, sideways), zigzag running (backward zigzag shuffles & backward zigzag carioca), speed run

Knee Exercises:

Knee exercises include dynamic lower extremity strength and balance exercises. Begin at the first level of exercises, and progress through levels II and III when the athlete has successfully mastered the previous level. Correct form, technique and execution of exercises including proper landing techniques are a very important part of the warm up program. Athletes must be aware of the correct landing, body positioning, and technique in execution to avoid injury.

Level I Exercises (3x 8-16 repetitions): Rubber band squat, backwards lunge, side lunge, two-foot jump and block, nordic hamstring.

Level II Exercises: Single leg jumping (forward and block), walking lunge, jumping lunge, squat with rubber band on wobble board, nordic hamstring.

Level III Exercises: Two legged jump and land on balance pad, single-leg squat, single-leg side hop, sideways jumping and landing, nordic hamstring.

LEVEL I

Rubber Band Squat **Kati's videos**

Explanation: Using a rubber exercise band placed just over your knees, stand with your feet, hip-width apart. Starting the movement with your hips, bend your knees and push your glutes back into a squat position, as if you are sitting in a chair. Make sure that your knees do not come over the top of your toes and that your back is straight. Press the band away from your midline, ensuring your knees do not come inward. Stand back up, pushing from the back of your heels.

Backwards Lunge **Kati's videos include somewhat similar exercise**

Explanation: Standing with feet about hip width apart, take a large and controlled step backward, with your left foot, leading with your toes. Keeping your back straight, trunk upright, lower your body toward the floor with your right knee positioned directly over your ankle. The left knee should be at 90 degrees toward the floor, and your right knee at 90 degrees, parallel to the floor. Repeat with the right leg, alternating for the entire set.

Side Lunge **Kati's videos include somewhat similar exercise**

Explanation: Standing with feet about hip width apart, shift your body weight to the right, taking a large and controlled step sideways with your right foot, leaving your left foot firmly planted on the floor. Keeping your back straight, trunk upright, lower your body toward the floor with your right knee positioned directly over your ankle. The right knee should be at about 90 degrees to

the floor, and your left leg extended out beside you. Repeat with the left leg, alternating for the entire set.

Two Foot Jump and Block

Explanation: Stand with your feet, hip-width apart. Starting the movement with your hips, use your arms to create momentum to jump off the floor with two feet. Use your arms to create a two arm blocking motion at the peak of your jump height. When landing, ensure that you land on softly with your knee bent and aligned over your toes.

Eccentric (Nordic) Hamstring [Kati's videos](#)

Explanation: Kneel on a gym mat with your arms bent at 90 degrees. For this exercise, you need a partner to stabilize your legs. As your partner holds your legs to the mat (not at the ankle joint), lower your upper body slowly towards the ground. As much as you can, try to resist falling toward the mat by using your hamstrings muscles. Once you cannot hold this position longer, fall to the mat and push yourself back to start position.

LEVEL II

Single Leg Jump with Forward Block

Explanation: Stand with your feet, hip-width apart. Starting the movement with your hips, use your arms to create momentum to jump off the floor with two feet. Use your arms to create a two arm blocking motion at the peak of your jump height. When landing, land on one leg, ensuring that you land on softly with your knee bent and aligned over your toes.

Walking Lunge [Kati's videos include somewhat similar exercise \(forward-backward\)](#)

Explanation: Standing with feet about hip width apart, hands on your hips. Raise your left knee to take a normal but controlled step forward with your left foot, leading with your heel, and landing heel-toe so that your left knee lands at a 90 degree angle to the floor. Your right foot, stays in place while the left leg is in motion, ending in a position close to the floor, but not resting on it. Keeping your back straight, trunk upright, lead from your hips to walk your right leg forward, again landing heel-toe. Continue this walking lunge movement for 3 sets of 8-16 repetitions per leg. Be sure to have your lead knee over your ankle, so that it is not above your toes.

Jumping Lunge

Explanation: Standing with feet about hip width apart, take a large and controlled step backward, with your left foot, leading with your toes. Keeping your back straight, trunk upright, lower your body toward the floor with your right knee positioned directly over your ankle. The left knee should be at 90 degrees toward the floor, and your right knee at 90 degrees, parallel to the floor. From this position, jump upwards, switching your left leg position with your right, landing softly, making sure that your lead knee does not draw in front of your toes. Repeat with the right leg, alternating for the entire set, performing 3 sets of 8-16 jumps per leg.

Squat with Rubber Band on Wobble Board

Explanation: Place a rubber exercise band just over your knees, walk yourself over to a wobble board, and stand on it, with your feet hip-width apart. Once you have your balance, begin to perform a squat by moving your hips to bend your knees and push your glutes back, as if you are sitting in a chair. Make sure that your knees do not come over the top of your toes and that your

back is straight. Press the band away from your midline, ensuring your knees do not come inward. Stand back up, pushing from the back of your heels.

Eccentric (Nordic) Hamstring [Kati's videos](#)

Explanation: Kneel on a gym mat with your arms bent at 90 degrees. For this exercise, you need a partner to stabilize your legs. As your partner holds your legs to the mat (not at the ankle joint), lower your upper body slowly towards the ground. As much as you can, try to resist falling toward the mat by using your hamstrings muscles. Once you cannot hold this position longer, fall to the mat and push yourself back to start position.

LEVEL III

Two Legged Jump on Balance Pad with Block

Explanation: Stand with your feet, hip-width apart on a balance pad. Starting the movement with your hips, use your arms to create momentum to jump off the floor with two feet. Use your arms to create a two arm blocking motion at the peak of your jump height. When landing, ensure that you land on softly with your knee bent and aligned over your toes.

Single-Leg Squat [Kati's videos include somewhat similar exercise with a partner](#)

Explanation: Stand with your feet, hip-width apart. Stand on your right leg, and start the movement with your hips, pushing your glutes back into a squat position, as if you are sitting in a chair. Make sure that your right knee does not come over the top of your toes and that your back is straight. Stand back up, pushing from the back of your heels. Switch legs and perform the single-leg squat for 3 sets, of 8-16 repetitions per leg.

Single-Leg Side Hop [Kati's videos include somewhat similar exercise](#)

Explanation: Standing with feet about hip width apart, shift your body weight to the right, taking a large and controlled hop sideways, landing with your right foot, followed by your left. Keeping your back straight, trunk upright, keep hopping side to side, landing with your lead leg, without placing that knee, over your toe line. Repeat for 3 sets, 8-16 hops per leg.

Sideways Jumping and Landing [School video](#)

Explanation: Using your arms for momentum, jump sideways, raising your arms above your head in a blocking motion. When landing, land on both feet simultaneously and make sure that your knees are aligned with your toes. Do not allow your knee to come above the toe line.

Eccentric (Nordic) Hamstring [Kati's videos](#)

Explanation: Kneel on a gym mat with your arms bent at 90 degrees. For this exercise, you need a partner to stabilize your legs. As your partner holds your legs to the mat (not at the ankle joint), lower your upper body slowly towards the ground. As much as you can, try to resist falling toward the mat by using your hamstrings muscles. Once you cannot hold this position longer, fall to the mat and push yourself back to start position.

Ankle Exercises:

Ankle exercises include balance exercises. Begin at the first level of exercise, and progress through levels II and III when the athlete has successfully mastered the previous level. Core stabilization while on the wobble board or balance pad surfacing is important (isometric contraction of abdominal and gluteal muscles).

Correct form, technique and execution of exercises including proper positioning on the board is a very important part of the warm up program. The knee must never come over the toe, while on the balance pad or wobble board. Athletes must be aware of the correct body positioning and technique in execution to avoid injury.

Level I Exercises (3x 10-15 seconds): Single leg balance, single leg balance on balance pad.

Level II Exercises (3x 10-15 seconds): Single leg balance eyes closed, single leg balance on wobble board, double leg balance wobble board with setting.

Level III Exercises (3x 10-15 seconds): Single leg balance wobble board eyes closed, single leg balance with setting.

LEVEL I

Single Leg Balance

Explanation: Stand on one leg, keeping a slight bend in the knee. Find your balance by crossing your arms in front of your chest, or out to the sides. Hold this position for 10-15 seconds for three sets, each leg. Try not to rest your free leg onto the standing leg to increase difficulty.

Single Leg Balance on Balance Pad [School video](#)

Explanation: Take position on the balance pad with both feet. Find your balance on one leg, keeping a slight bend in the knee. You can help keep your balance by crossing your arms in front of your chest, or out to the sides. Hold this position for 10-15 seconds for three sets, each leg. Try not to rest your free leg onto the standing leg to increase difficulty.

LEVEL II

Single Leg Balance Eyes Closed on Balance Pad [School video](#)

Explanation: Position yourself on the balance pad. Stand on one leg, keeping a slight bend in the knee. Find your balance by crossing your arms in front of your chest, or out to the sides. Once you have your balance, close your eyes and try to hold this position for 10-15 seconds for three sets, each leg. Try not to rest your free leg onto the standing leg to increase difficulty.

Single Leg Balance on Wobble Board [School video](#)

Explanation: Take position on the wobble board with two feet, positioning one foot to the centre of the board. Once you find your balance and each side of the board is off the floor, raise the foot not in the centre of the board so you are standing on one leg, keeping a slight bend in the knee. Find your balance by crossing your arms in front of your chest, or out to the sides. Hold this position for 10-15 seconds for three sets, each leg. Try not to rest your free leg onto the standing leg to increase difficulty.

Double Leg Balance on Wobble Board with Setting

Explanation: Find a partner. Take position on the wobble board with two feet, keeping a slight bend in the knees. Once you find your balance and each side of the board is off the floor, begin a setting exercise with your partner while holding your balance. Hold this position for 10-15 seconds for three sets.

LEVEL III

Single Leg Balance Eyes Closed on Wobble Board

Explanation: Take position on the wobble board with two feet, positioning one foot to the centre of the board, keeping a slight bend in the knees. Once you find your balance and each side of the board is off the floor, raise the foot not in the centre of the board so you are standing on one leg, keeping a slight bend in the knee. Find your balance by crossing your arms in front of your chest, or out to the sides. Once you have your balance, close your eyes and try to hold this position for 10-15 seconds for three sets, each leg. Try not to rest your free leg onto the standing leg to increase difficulty.

Single Leg Balance on Wobble Board with Setting

Explanation: Find a partner. Take position on the wobble board with two feet, positioning one foot to the centre of the board, keeping a slight bend in the knees. Once you find your balance and each side of the board is off the floor, raise the foot not in the centre of the board so you are standing on one leg, keeping a slight bend in the knee. Once you have found your balance on one leg, begin a setting exercise with your partner. Hold this position for 10-15 seconds for three sets. Try not to rest your free leg onto the standing leg to increase difficulty.

Shoulder and Back Exercises:

Shoulder and back exercises include upper extremity and thoracic strengthening and stretching exercises. Begin at the first level of exercise, and progress through levels II and III when the athlete has successfully mastered the previous level. Shoulder stability and flexibility are fundamental to reduce shoulder-related injury in volleyball. Due to the significant amount of overhead activity in volleyball, internal and external rotation, and scapular muscle strength are core components of the shoulder exercises. In addition, to reduce lumbar-related injuries, increasing thoracic rotation can decrease the amount of flexion and extension through the lumbar spine which can cause lumbar-related injuries.

Level I Exercises (3x 8-16 repetitions): Side plank from the knees, standing rubber band two arm shoulder flexion, standing external rotation, thoracic rotation from knees, prone leg cross.

Level II Exercises (3x 8-16 repetitions): Side plank (feet) with upper body rotation with ball, plank with ball pass, standing rubber band two arm shoulder flexion, thoracic rotation from knees, prone leg cross, supine partner shoulder stretch.

Level III Exercises (3x 10-15 seconds): Standing rubber band one arm shoulder flexion, thoracic rotation from knees, prone leg cross, kneeling one arm backwards throw with ball, sleepers stretch.

LEVEL I

Side Plank from the Knees **Kati's videos include somewhat similar exercise**

Explanation: Take position on a mat on your side, anchoring your body on your elbow that is 90 degrees to the floor. Place one knee on top of the another, with your feet pointed behind you. Using your elbow as support, push yourself up leading with your hips towards the ceiling. Lift your hips as high as you can, making sure that your body remains in straight line, from shoulders to hips. Hold this position for 20 seconds.

Standing Rubber Band Two Arm Shoulder Flexion

Explanation: This exercise is performed with a partner. Have one player hold the middle of a rubber band with two hands around the waist, across the mid-lower portion of the glutes. The

player performing the exercise holds the rubber band at its ends. Keeping your arms straight, elevate the arms in a Y-pattern, up and over your head. Be sure to keep your shoulders down, and not up toward your ears. In the end position, pull your shoulder blades back and down, holding this position for a few seconds before relaxing the band to the starting position.

Standing External Rotation

Explanation: The starting position for this exercise is to grasp a small ball in your right hand, with your shoulder elevated and your elbow at 90 degrees. Rotate your upper arm toward the floor so that your end position is when your forearm is parallel to the floor. For progression of this exercise, you can move to a smaller, weighted ball and/or release the ball at the starting position, catching it at the end position.

Thoracic Rotation from Knees [Kati's video](#)

Explanation: Take a prone position on a mat with your elbows and knees in a 4-point position. Rotate your left arm from the resting position by reaching your left hand toward the ceiling, with a straight arm. Keep your right elbow firmly on the mat. Allow your head to move with the direction of your body, with your end position looking toward your feet. Rotate back toward the starting position and swing your left hand through the gap made between your elbow and your body. Perform this exercise for both right and left arms.

Prone Leg Cross

Explanation: Lie on a mat in the prone position with your arms out to your side, so that your hands are at about hip level. Take your left foot and move it towards your right hand so that your right hip comes off the mat, at the same time, bringing your knee to reach your hand. Keep both of your shoulders firmly on the mat, rotating your back. Alternate legs for 2-3 sets, with 6-8 repetitions per leg.

LEVEL II

Side Plank from the Feet [School video](#)

Explanation: Take position on a mat on your side, anchoring your body on your elbow that is 90 degrees to the floor. Place one foot on top of the other, with your body in a straight line. Using your elbow as support, push yourself up leading with your hips towards the ceiling. Lift your hips as high as you can, making sure that your body remains in straight line, from shoulders to hips. Hold this position for 20 seconds. Repeat this for 3 sets.

Plank with Ball Pass

Explanation: This is a partner exercise. Place a volleyball between the two players. Each player should take a prone position on a mat, placing their hands underneath the shoulders, with the hands facing forward and ankles in the flexed position with the toes on the mat. With your body in a straight line – shoulders, hips and ankles, push yourself straight up to a push up position. Make sure that your body remains in straight line, from shoulders to hips to ankles and that you are not flexing at the hips, or allowing your shoulders to come to your ears. Your head should be in a neutral position. Try and rotate your shoulder blades toward each other, leading the movement with your shoulders. Once balanced in this position, roll the ball between the two players, catching and releasing with the same hand, changing hands each time the ball is passed.

Standing Rubber Band Two Arm Shoulder Flexion

Explanation: This exercise is performed with a partner. Have one player hold the middle of a rubber band with two hands around the waist, across the mid-lower portion of the glutes. The player performing the exercise holds the rubber band at its ends. Keeping your arms straight, elevate the arms in a Y-pattern, up and over your head. Be sure to keep your shoulders down, and not up toward your ears. In the end position, pull your shoulder blades back and down, holding this position for a few seconds before relaxing the band to the starting position.

Thoracic Rotation from Knees [Kati's video](#)

Explanation: Take a prone position on a mat with your elbows and knees in a 4-point position. Rotate your left arm from the resting position by reaching your left hand toward the ceiling, with a straight arm. Keep your right elbow firmly on the mat. Allow your head to move with the direction of your body, with your end position, looking toward your feet. Rotate back toward the starting position and swing your left hand through the gap made between your elbow and your body. Perform this exercise for both right and left arms.

Prone Leg Cross

Explanation: Lie on a mat in the prone position with your arms out to your side, so that your hands are at about hip level. Take your left foot and move it towards your right hand so that your right hip comes off the mat, at the same time, bringing your knee to reach your hand. Keep both of your shoulders firmly on the mat, rotating your back. Alternate legs for 2-3 sets, with 6-8 repetitions per leg.

Supine Partner Shoulder Stretch

Explanation: This is a partner exercise. Have the player lie supine on a mat with the knees flexed at 90 degrees, feet flat on the floor. Flex your elbow at 90 degrees, up and over your body, placing your hand just above your opposite shoulder. Have your partner place his/her hand on your elbow and press the upper arm gently toward the player's chest. Be sure to support and stabilize the shoulder being stretched by placing your hand on the player's shoulder blade. Repeat this exercise for both shoulders.

LEVEL III

Standing Rubber Band One Arm Shoulder Flexion

Explanation: This exercise is performed with a partner. Have one player hold the middle of a rubber band with two hands around the waist, across the mid-lower portion of the glutes. The player performing the exercise holds the rubber band in one hand, at its end. Keeping your arm straight, elevate the arm out to the side of your body, up and over your head. Be sure to keep your shoulders down, and not up toward your ears. In the end position, pull your shoulder blades back and down, holding this position for a few seconds before relaxing the band to the starting position. Perform this exercise for both arms.

Thoracic Rotation from Knees [Kati's video](#)

Explanation: Take a prone position on a mat with your elbows and knees in a 4-point position. Rotate your left arm from the resting position by reaching your left hand toward the ceiling, with a straight arm. Keep your right elbow firmly on the mat. Allow your head to move with the direction of your body, with your end position, looking toward your feet. Rotate back toward the starting position and swing your left hand through the gap made between your elbow and your body. Perform this exercise for both right and left arms.

Prone Leg Cross

Explanation: Lie on a mat in the prone position with your arms out to your side, so that your hands are at about hip level. Take your left foot and move it towards your right hand so that your right hip comes off the mat, at the same time, bringing your knee to reach your hand. Keep both of your shoulders firmly on the mat, rotating your back. Alternate legs for 2-3 sets, with 6-8 repetitions per leg.

Sleepers Stretch

Explanation: Lie on a mat, on your side with your knees bent, head resting on the mat in a neutral position. Starting with the arm closest to the mat, flex your shoulder and elbow to 90 degrees. Use your opposite hand to rotate your shoulder towards the mat. Hold this position for 30 seconds, for 3 sets and repeat this exercise for both shoulders.

2. Physical Literacy and Injury Prevention

[Animation images of kids, youth and adults and older adults participating in sport or PA]

All generation in the park: kids, adult - yoga / youth - biking / older adults - golf etc.



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Physical literacy is defined as the motivation, confidence, and physical competence to be physically active. It is also valuing and take responsibility for being engaged in physical activities for life.

A person who is physically literate is better able to sustain participation in sport and physical activity across the lifespan. Many people think that concept of physical literacy is relevant only to children, but, being physically literate is important to being active and preventing injury at every age.

[TEXT Animation: Animation of words crossing screen: motivation and confidence, physical competence, knowledge and understanding, and engagement]

Developing and maintaining competencies from child to adulthood is important, but as we get older, the specific competencies change to meet the demands of our sport participation.

[Animation of playing sport/being active over the ages – very important here to depict all ages being active!]

All generation family - baseball



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Whether you play at an elite or recreational level of sport, being physically literate gives you the choice to participate in the type of physical activity that you want; it also reduces your chances of being injured—being competent in your movement is what it is all about!

[Children playing sport]

Children - swimming



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IMAGE ID: 110419124
www.shutterstock.com

[Youth playing sport]

Youth - skateboarding



shutterstock

IMAGE ID: 110419124
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[Children with disabilities playing sport]

This video should depict able bodied and disabled people



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IMAGE ID: 110419124
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[Text: You can find more information on training load and its relationship to injury in another video on Active and Safe Central]

Developing fundamental movement skills can help youth to play at their highest performance level, and reduce the risk of injury. (See 11+ program for NMT in soccer found here: <https://www.youtube.com/watch?v=dyeV-K5wmQA>) For example, if you play soccer, participating in an appropriate neuromuscular warm-up program can increase your competence to participate, and reduce your risk of a lower-limb injury.

[Youth participating in a skill building warm up for soccer]

Youth - soccer/ warming up



[Adults playing sport and being physically active]

Adult - mountain biking



Playing sport as an adult has been shown to increase many health outcomes. Whether you play at a high performance level or for recreational purposes, playing sport and being active prevents functional health declines that can start earlier due to obesity, injury and a sedentary lifestyle.

Being physically literate helps you play and move with competence and confidence. Just as with youth, adults need the correct level of challenge, support, and settings across all sport experiences.

Adult-volleyball



Adults should connect with their local community centre to sign up for group physical activity or a community sports team— being active with others makes it more enjoyable and increases rates of participation.

If you are already playing sport, be sure to participate in exercises that can decrease your risk of injury. For example, if you are a volleyball player, you should participate in a warm-up that increases your lower body strength, but also exercises that strengthen your back and shoulder muscles.

[Text: You can find sport-specific warm-up videos on Active and Safe Central that will give you the instructions on how to complete a 10 minute warm-up to prevent injury]

[Older Adults playing sport]

Older adults – badminton



Being active for life is the best way to be healthy and happy as an older adult, but also the best way to stay mobile and be more independent.

[People playing sport]
All family - inline skating



[Text: You can find more information on sleep, and its relationship to injury in a video on Active and Safe Central]

3. Training Load and Sport Injury Risk

[Animation of Elite Sport – Youth Playing or Training in Sport]

Question Across the Screen: How much is too much?

[Talking head]

“Athletes playing elite levels of sport, really play a lot”

[Old-timey looking video of people playing sport with voice over]

And now-a-days, they play more on the field, and off, compared to before

[Animation of charts and numbers – things that look like evidence with voice over and back to Talking Head]

According to research – from the International Olympic Committee Expert Group [animation over talking head highlighting text SMART PEOPLE!] managing your training load – or how much you do, how and when, is a major risk factor for injury [show clip of injury in sport – could be fun here and show a “fake” injury from soccer]

[Talking Head]

So, what does the IOC say? Really, it comes down to this: [Animation of four key points] the load sweet spot, monitoring training load, scheduling your training and stress.

[Animation with voice over – “NUMBER ONE” – then Talking Head]

What exact is the training load sweet spot? This is a good question. [animation of the acute: chronic load ratio]

And the exact answer is, it is different for everyone [animation over his/her head shows the following: stress in the athlete’s life, sport type, in developing athletes, the overall health of the athlete]. BUT, essentially, it is the place where adding training load has positive effects on performance and a reduction in injury risk. In research, this is known as the acute:chronic load ratio. This ratio describes the training load of the last week (acute) and the 4-week rolling average load (chronic). If the chronic load is slowly increased to high levels (i.e., athlete getting fitter) and the acute load is low (ie, athlete not super tired), then the athlete is considered well prepared. HOWEVER, if the athlete goes over the chronic load (meaning the acute loads are too high and the athlete is fatigued, or his/her training over the last 4 weeks has not developed fitness), then the athlete is not in the sweet spot, and likely at an increased risk of injury.

Overall though, smaller increases over large increases in loading, is better. Many sport leagues [animation over head reading Aussie Football, cricket and rugby] recommend limiting increases in training load to less than 10% per week.

What is also really important, is that athletes and coaches include things like neuromuscular training exercises, active recovery periods, nutrition, and sleep for injury prevention. [animation comes up at bottom signalling to click here on NMT and Sleep videos]

[Animation with voice over “NUMBER TWO” - then Talking Head]

Monitoring your training. What can you do to monitor yourself in your sport? [Talking head pointing to images of examples of training load monitoring – apps] Track your play (how much

and what kind) AND your symptoms and injuries, at the same time. Key points here? Track it individually, frequently, and using subjective measures that also including stress, diet, sleep, injury and any other symptoms. AND ALWAYS talk to your coaches about your signs and symptoms of injury – we know you want to play through, but this will only keep you away from the game, longer. [talking head points to bottom screen to link on how to calculate subjective measures].

[Animation with voice over “NUMBER THREE” - then Talking Head]

Scheduling your training WITH your competition training is a really important part of reducing your injury risk. Although more research is needed on the exact relationship between training and competition and injury, we know that competition calendar congestion and rapid change in load can increase the risk of injury.

[Animation with voice over “NUMBER FOUR” - then Talking Head]

The last and also very important predictor of injury in athletes is stress. [animation of lightning bolts from talking head]

Stress from negative life events, daily hassles, and a lack of good nutrition and sleep, can SIGNIFANTLY increase your risk of injury. When you are feeling stressed, across any of these common areas, tell your coach so that your training load at that time, can be reduced. And for all you coaches out there, it is good practice for you to implement regular stress assessments with all of your athletes.

[Talking Head]

So, what have we learned? Training load is a really important risk factor for injury. Click on the Resource Section of this site to read more about the research in training load and how you can prevent injury [animation points to link to Active and Safe Resource Page]

4. Sleep, Vigilance and the Effects on Sport Injury Outcomes

[Talking Head – Ian Pike]

Across the Screen: Optimizing Sleep for Performance in Sport

[Talking Head]

Athletes strive to optimize their performance in sport. This includes not only improving skills such as reaction time and attention, but also reducing the risk of injury.

According to researchers, being able to sustain attention for longer periods of time is also known as VIGILANCE.

[Talking Head – with animation box in top right corner with vigilance definition]

[feature definition of “vigilance” on screen –]

vigilance

noun *vig·i·lance* |

: the quality or state of being wakeful and alert : degree of wakefulness or responsiveness to stimuli

www.merriam-webster.com

Good vigilance can be achieved through proper rest—and proper rest includes getting a good night’s sleep. Sleep plays a role in helping your body recover and retain what was achieved during training.

Despite the importance of sleep, we are sleeping a lot less than before. We live in an age of technology and juggle pretty hectic lives. According to the National Sleep Foundation, only 15% of high school students get an adequate amount of sleep. With varying practice times, jet lag from travelling to tournaments and games, on top of family, school, and work schedules, athletes tend to get less sleep compared to non-athletes.

Lack of sleep or having poor quality sleep can decrease your vigilance and cause you to perform poorly; for example, having a bad night’s sleep can lead to slower reaction time and have similar effects of having one too many alcoholic drinks. Research suggests that getting less than 8 hours of sleep a night can increase your risk of injury by up to 70 percent!

So, how can you tell if you have low vigilance?

[Many faces showing signs of low vigilance]

[Talking Head – with animation box in top left corner with text of the signs of low vigilance]

The signs of low vigilance include facial and behavioural cues such as squinting and narrowing of the eyes, drooping of the eyelids, dark circles under the eyelids, and lowering the corners of the mouth.

Being able to identify when you have low vigilance, in addition to increasing vigilance across specific sporting activities, can not only significantly improve your performance, but decrease your risk of injury.

[Talking Head – with corner picture of famous athlete (Usain Bolt) and talking head discussing what the athlete says]

Professional athletes know the importance of a good night's rest. According to ESPN, Usain Bolt, Steve Nash, Roger Federer, and Venus Williams try to get up to 10 hours of sleep a day.

[Talking Head]

How do you achieve good vigilance?

Here are three ways you can increase your vigilance:

ONE: Get a good night's sleep. Adolescents ages 13 to 18 should get at least 8 – 10 hours of sleep per night. Sleep is essential for your physical recovery after an intense game or practice, helps with memory processing, and helps you bounce back faster from an injury.

TWO: Don't take shortcuts. Despite what many people believe, the use of "stimulants" such as energy drinks and caffeine supplements do not replace good sleep.

[Images of energy drinks – not brand specific]

THREE: Look for signs of low vigilance and try not to practice or play at those times.

[Talking Head]

You also should try and keep track of how much and how well you are sleeping. This information can help you with your training schedule and is just as important as paying attention to how much and how intensely you train. Training too much or too intensely can also negatively affect your performance and increase your risk of injury.

[Talking Head – pointing to links to other videos]

Check out these other videos for more information on training load, and specific exercise you can do, to reduce your risk of injury.

Appendix G - Evaluation Summary

| Evaluation activity | Objective | Indicators, questions |
|---------------------|---|--|
| Focus groups | To collect initial impressions of Active and Safe resource, and perspectives on the future use of the tool. | <p>What type of end-user identity do you most closely identify with - do you identify with more than one? What information is most important to you, based on what you heard in the description - what are the problems you face today in obtaining the information.</p> <p>Does the problem we are trying to solve by developing this tool resonate with you? Will prompt for further challenges currently faced by end-users, based on their identification.</p> <p>Walk through the digital mock ups</p> <p>A request for initial impressions.</p> <p>Based on your understanding of the resource we are trying to build, do you think it is something you would use? Why or why not? Please describe your circumstances of use.</p> <p>Targeted questioning on the following:</p> <ul style="list-style-type: none"> - user flow; initial navigation - priority resources and areas of interest - ease of finding desired information - ideal pathway (brainstorm) - user interface design preferences - length and frequency of use |
| Beta Testing | To test usability of Active and Safe tool. | |
| Google Analytics | To assess reach and use of Active and Safe. | <ol style="list-style-type: none"> 1. How many people are coming to the site, from where, how long are they staying and how many clicks they make on the site 2. Which sport landing pages are being visited 3. Which resources are individuals clicking 4. Tracking shares via social media (Facebook, Twitter, blogs, other sites) |

| | | |
|--|--|--|
| | | |
| Embedded feedback section on Active and Safe website | | See cover page and questions below |
| Follow-up interviews | To examine any changes to create safe PA opportunities over time | To discuss – feasibility, relevance, and usefulness. |

Feedback Section Cover Page and Questions:

Thank you for your interest in Active & Safe Central.

The BC Injury Research and Prevention Unit at the research institute of BC Children's Hospital invites you to complete this brief evaluation about your experience using this website.

Your responses will be used to inform improvements and changes to the website. The survey should take 5-10 minutes to complete and will be closed on Friday, June 15, 2018. All participant data will be aggregated (combined) and individual responses will not be linked back to you. Your participation in this survey is voluntary and there will be no consequences to you if you choose not to participate.

If you complete the survey, you will be prompted to enter your email address for a chance to win an Apple iWatch.

Your personal information is subject to protections under the BC Freedom of Information and Protection of Privacy Act (FIPPA). The collection of your individually identifiable information is authorized by section 26 (e) of FIPPA. The identifiable information collected through the survey will only be used for the purposes listed on this form. To participate in this study as a survey respondent, you are being asked to provide the following information:

Personal views/opinions as expressed in the survey. These views and opinions are considered personal information.

Gender

The first 3 digits of your postal code

You will be invited to provide your email address if you would like to be entered into the prize draw for a chance to win an [Apple iWatch](#). Your email address will not be shared with others. It will be kept separate from your survey responses and will only be used to enter you in the draw. The contest is open to Canadian residents only. One entry per person.

For open ended responses, we encourage you not to provide any information that might identify you or another individual. In reporting the results of the survey, we will not include any individually identifiable responses.

Access to your information is limited to the survey administrator and the technical support team at the research institute of BC Children's Hospital. The survey administrator will maintain the survey, and analyze the results. You will not be identified in any reports, presentations, or publications that describe these results. You will not be provided with survey results. The information you choose to provide in this survey will be stored on a secure server at the research institute of BC Children's Hospital, electronically for no more than 3 years.

Questions about your information and this survey may be directed to the Principal Investigator: the BC Injury Research and Prevention Unit (bcinjury1@cw.bc.ca). Because this survey collects responses anonymously and cannot link them back to you, it will not be possible to withdraw your consent after you participate.

Thank you again for helping us to improve this resource.

Consent

I have read and understand the consent for collection, storage and use of participant information. I voluntarily consent to the research institute of BC Children’s Hospital collecting, using and disclosing the information I provide as a participant in this survey. Your consent is implied through completion of this survey.

I consent (proceed to survey) I do not consent (please exit from survey)

1. Which of these best describes you? (select all that apply) (Required)

- Participant/Athlete
- Parent of Participant/Athlete
- Coach
- Teacher
- Official
- School Administrator
- Club/Activity Administrator
- Health Professional
- Please specify: _____
- Other
- Please specify: _____

2. How did you hear about Active & Safe Central? (select all that apply) (Required)

- Email/Newsletter
- Media (news, newspaper, magazine, etc.)
- Blog post
- Family/Friend
- Internet Search
- Social Media (Twitter, Facebook, etc.)
- Other: _____

3. What sport(s) or recreational activity(ies) did you look at on Active & Safe Central? (Check all that apply) (Required)

(List all sports with tick boxes, with an option at the end that says “I did not browse any sports pages”)

We would like to ask you some questions about your experience using Active & Safe Central. Please respond to questions 4-11 using a scale of 1 to 4, where 1 is “Strongly Disagree” and 4 is “Strongly Agree.” (Required for all, with “Not Applicable” option)

4. I believe injuries are a problem in the sport(s)/recreational activity(ies) that I am interested in. (N/A)

5. Active & Safe Central is a helpful resource.

6. I learned something new.

7. The site is easy to use.

8. The site increased my awareness of injury prevention recommendations.

9. I feel comfortable using the injury prevention recommendations. (N/A)

10. I will use the injury prevention recommendations. (N/A)

11. I plan to share what I learned with others. (N/A)

12. I would recommend this website to others.

13. How will you use what you learned on this site to improve safety? (Optional)
[TEXT FIELD]

14. Please describe anything you would like to see added to the website.
[TEXT FIELD] (Optional)

15. Have you personally experienced a sport or recreation-related injury severe enough to require medical attention in the past 12 months (clinic, emergency department, hospitalization)? (Required)

Yes

No

Prefer not to answer

If yes:

What was the activity?

What was the injury?

How long were you/have you been off activity? (please select one)

___ weeks or ___ months

Not yet returned

Recovered, but did not return to activity

Don't know/prefer not to answer

16. What is your age group? (Required)

< 9 years old

10-14 years old

15-18 years old

19-24 years old

25-44 years old

45-64 years old

65-74 years old

75-84 years old

85 + years old

Prefer not to answer

17. How do you self-identify? (Required)

Male

Female

Other (e.g., non-binary, agender, gender fluid, etc.)

Prefer not to answer

18. What are the first 3 letters of your postal code? (Optional)

19. Additional Comments? (Optional)

[TEXT FIELD]

20. Please enter your email if you would like to be included in further evaluation of this site and its impact. (Optional)

21. Please enter your email if you would like to be entered in a draw to win an Apple iWatch. (Optional)

Thank you for your time. [SUBMIT BUTTON]