

Sports Injury Mobile Application

Michael Hayes, BESC & Candace Gibson, PhD, CHIM

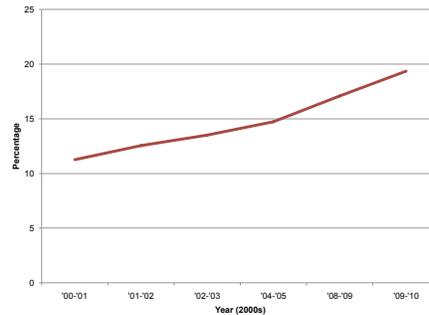
Department of Electrical and Computer Engineering, Department of Pathology

University of Western Ontario, London, Ontario, Canada

PURPOSE

- Concussions in sports have become a growing issue in both amateur and professional leagues.
- Data collected by the Hockey Development Centre of Ontario (Figure 1) detail the increasing trend of concussions in the ten registered amateur hockey leagues in Ontario².
- The increase in injuries due to concussions has brought forward questions of how to prevent, monitor or facilitate recovery.
- With the majority of the population connected using smart phones or mobile devices, an easy to use, diagnostic support phone *app* seems like a good step towards providing assistance to amateur trainers and coaches and countering the trend.
- The problem? Very few such apps exist and those that do rarely cater to the amateur sports trainer with little to no medical background.

Figure 1: Percentage of Reported Cases Involving Concussions



FUNCTIONALITY

This is a short case study outlining the different functionalities of the application. Screen shots (Fig 2 – 7) are depicted to the right and an explanation of the figures is given below.

1. The main screen (Figure 2) gives two options: find a new diagnosis or retrieve a saved diagnosis.
2. The next selection screen (Figure 3) lets the trainer narrow down the players' injuries by selecting a body section: head, arms, torso, chest or legs. Also from this screen, the user can also choose to view and edit the list of current symptoms (seen in Figure 6) or proceed to diagnosis (seen in Figure 5). If there are no current symptoms, Figure 6 simply reads "No Current Symptoms".
3. Once a body part is selected, in this case, the head (Figure 4), symptoms are entered from a pre-defined list encompassing head-related symptoms (Figures 7). When choosing symptoms, users can refine certain selections (such as increased blood rate) to include quantitative information using drop-down menus. From here the user may proceed to the diagnosis screen (seen in Figure 5) or enter in new symptoms for different body parts (returning to Figure 3).
4. Once the user has defined symptoms, the application will form a diagnosis based on the given data. This is shown in Figure 5, which displays the following information:

- The formed diagnosis, the diagnosis probability and a recommendation to the user.
- A list of symptoms used and not used in the diagnosis.
- A list of other symptoms not entered but commonly found in the diagnosis.
- A list of other relevant diagnoses with lower probability



REFERENCES

1. "Injury Data Collection". *Hockey Development Centre of Ontario*. Web. 2 Jan 2012. <http://www.hdco.on.ca/web_pages/safety_injury_data.html>.
2. *Sports Injury Clinic*. Web. 22 Nov 2011. <<http://www.sportsinjuryclinic.com>>.

INTRODUCTION

- This Sports Injury Mobile Application (*app*) aims to fill the knowledge gap between amateur team trainers and professional, diploma-certified trainers by providing amateur trainers (most of the time just a father of a child on the team) with access to a medical knowledge base to quickly identify and diagnose symptoms.
- The app's main focus is on early concussion diagnosis but also provides symptoms and diagnoses for other common sports injuries. The app also provides suggestions on how the trainer should react to the given diagnosis, as well as a list of alternate diagnoses.
- Ideally with this app in the hands of all trainers for teams registered in the Ontario hockey system, coaches and trainers will be able to identify injuries early reducing recovery time, track patterns of injuries, and hopefully reduce the number of injuries all together.

DIAGNOSIS FORMATION

- In version 1, each symptom in a diagnosis is given a numerical weighting based on factors from the Sports Injury Clinic¹ as well as opinions gathered from medical science students at the University of Western Ontario.
- When formulating a diagnosis, the application goes through pertinent diagnoses and determines the probability factor (**pf**);

$$pf = \frac{\sum(\text{symptomsFoundWeighting} - [\text{symptomsNotFoundWeighting} / 2])}{\sum(\text{totalSymptomsInDiagnosis})}$$
- The "Symptoms not found" factor is used to negatively weight those symptoms which are found in *other* diagnoses but not the diagnosis being currently calculated. This is because it is less likely that a diagnosis is correct if it is missing several other given symptoms.

- The application then compares any diagnosis with $pf > 0$. These diagnoses are listed with the top ranking diagnosis displayed in detail on the diagnosis page and the subsequent diagnoses listed in the "Other Diagnoses" tab (Figure 5).

FURTHER WORK

- Version 2 is currently underway. In this version, the knowledge base is being developed with professionals at the Fowler-Kennedy Sports Medicine Clinic. This will create a more objective, sound, weighting system. Included in this future work will be real-world case studies to test the precision of the expected diagnosis with the actual diagnosis.
- Version 2 will also include best-practice tests such as the Ottawa Knee Rules and Ottawa Ankle Rules. Currently, demographics such as age are not included but will be considered moving forward.
- Other further work includes: developing a more robust "Saved Diagnosis" database and adding legal documentation explaining when and in what situations this app should be used.