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Measuring heterogeneity of reinjury risk assessments at the time of clearance to return to play: A feasibility study

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ABSTRACT

Objectives: Different individuals may make different return to play (RTP) decisions due to different risk assessments or risk tolerances. Our objectives were to determine the feasibility of eliciting reinjury risk assessments with Bayesian methods, and risk tolerance with questionnaires, from clinicians and athletes in a real-world RTP setting.
Design: Feasibility study with a descriptive prospective case-series.
Methods: We recruited the athlete, sport physician and physiotherapist caring for an athlete ("triplet") within on-going groin and hamstring injury studies. We applied Bayesian methods to elicit estimates for reinjury risk over the next 2 months, based on the available clinical knowledge, and projected activity level. We used a standardized questionnaire to elicit factors affecting risk tolerance.
Results: Although our methods appeared feasible in general, there were important challenges that included language, time availability of practicing clinicians, and general work-flow issues related to embedding our study within an on-going larger study. We did obtain valuable data from more than one person on 10 of the 15 eligible athletes recruited. Despite the limited number of cases, there were clinically meaningful differences in risk estimates in some cases. In one triplet, participants estimated the reinjury risk between 1–10%, 20–50% and 30–40% for the same athlete. The most common factors modifying risk tolerance were "timing and season", "pressure from athlete", and "external pressure".
Conclusions: Bayesian methods for risk elicitation in clinical sport medicine are feasible, and large differences in both risk estimation and risk tolerance sometimes occur.

1. Introduction

Return to play (RTP) decisions are an integral part of everyday practice in sports medicine. Despite the fact they are made in every athlete (and any active person) who returns to activity, little is known about how clinicians and athletes arrive at these decisions. We originally developed a model that was based on a decision-theoretic approach to RTP decision making[1] following similar principles proposed by others,[2] but provided additional detail on how to structure relevant factors when making the decision. Based on feedback, the model was recently updated[3] to improve clarity. In brief, the Strategic Assessment of Risk and Risk Tolerance (StARRT) model proposes that clinicians first assess risk of an outcome (e.g., injury, osteoarthritis) based on a balance of tissue health and stress due to activity, and then make a decision based on their tolerance of risk (which is a value judgment). Risk tolerance itself may be affected by the context of the particular athlete, injury and other factors (Risk Tolerance modifiers). Preliminary validation work[1,4,5] suggests the model is consistent with how physicians perceive they make RTP decisions.

Our previous validation studies were limited because they were based on simulated data where clinical information was limited to short vignettes, and only measured the final decisions but did not measure clinician's perception of risk. RTP decisions could differ because either the risk assessment is different, or risk tolerance is different. Therefore, the objectives of this study were to illustrate (1) the feasibility of a method that elicits risk perceptions, which can then be converted into a probability distribution for analysis, (2) variability in risk assessment from different clinicians assessing the same athlete, and (3) variability in factors affecting risk tolerance. The study was conducted in Doha, Qatar. The senior author in

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Doha left in June 2015. This report includes all ten cases that were evaluated by more than one participant.

2. Methods

We recruited participants from studies that were already in progress and collecting clinical data. This allowed us to focus on our objectives to assess risk, and minimize costs associated with injury surveillance. The in-progress studies were an observational Acute Groin Injury Study (Aspetar Qatar), and a randomized trial on rehabilitation of acute hamstring strains (NCT02104258 clinicaltrials.gov; Aspetar Qatar). Our methods are general and although the exact results might differ for different types of injuries, the feasibility of the methods should not. These two studies included professional and competitive athletes registered in one of the National Sports Federations in Qatar, most of whom participated in football, basketball, handball and volleyball. Included athletes were between 18–50 years, and had presented at the hospital within (1) one week of any acute groin strain, or (2) 5 days of an acute hamstring strain that excluded complete tears and avulsions. All athletes underwent an initial clinical examination by one of the sport medicine physicians followed by an MRI scan.

All included athletes received supervised rehabilitation by a physiotherapist at the hospital's rehabilitation department according to the respective study protocols above. Once the treating physiotherapist and athlete agreed it was reasonable for the athlete to RTP, the athlete was approached to participate in this feasibility study and completed the study forms. For all participating athletes, the sport medicine physician was also approached to participate, and completed the study forms after re-examining the athlete. In all cases, the sport medicine physician agreed the athlete could RTP. The current study was approved by the Research Ethics Committee of the Jewish General Hospital, McGill University, Montreal Canada. Informed consent was obtained and the rights of subjects were protected.

For risk elicitation, we invited all clinicians (physiotherapists and sport medicine physicians) to participate as long as they were treating athletes in one of the two studies providing potential participants. We also invited the corresponding athletes. When the treating physiotherapist considered an athlete ready to RTP, the athlete, physiotherapist and physician completed a series of questionnaires on the same day or shortly after the athlete was assessed for discharge (see Appendix in Supplementary material). The athlete, physiotherapist and clinician were blinded to each others' responses.

The first questionnaire gathered data on the athlete, the injury and the clinician. Next, we elicited perceptions of risk for a subsequent injury to the same location (e.g., same muscle)/same type (e.g., muscle strain), and/or an injury to any body location over the subsequent two months after RTP. We used validated elicitation methods to assess risk that have been successfully implemented in other contexts.[6,7] One particular challenge with risk elicitation is that respondents from a wide variety of fields have difficulty estimating very small risks (e.g., <5%).[6] The injury risk to a male soccer player in the National Collegiate Athletic Association was approximately 2% per game (20 per 1000 athlete exposures) and 0.5% per practice.[8] Therefore, we chose a 2-month period because the cumulative risk over the games and training during this period should generally exceed 5%.

In our first step, we asked participants to provide the range of risks (i.e., a minimum and a maximum) for injury that they believed was applicable for the respective case over the subsequent two months. Second, we divided the range of the estimated risk (maximum–minimum) provided by each participant into 10 approximately equal-sized bins (or categories) arranged as columns. The last page of the Appendix in Supplementary material provides an example from one of our participants. The minimum risk was 5% and the maximum risk was 30%. The columns (bins) were therefore labeled ≤5%, 6–8%, 9–11%, 12–14%, 15–17%, 18–20%, 21–23%, 24–26%, 27–29% and ≥30%. Third, the participant "deposited coins" into each bin according to how likely they believed that particular bin represented the risk of reinjury. There were 20 coins, each representing 5% probability. Therefore, the participant in the example on the last page of the Appendix in Supplementary material example believed that there was a 20% probability that the risk of injury was 9–11% (four coins in the third column), and only a 10% probability that the risk of injury was 6–8% (two coins in the second column). Although participants would be expected to share information during clinical treatments, participants provided their risk estimates in a blinded fashion without knowledge of other participants' responses. Fourth, we used a standardized form to elicit the RTP decision, and any underlying risk tolerance modifiers by providing them with a predetermined list (Question 4 in Appendix in Supplementary material). We also allowed them to specify additional factors within an Other option. Finally, we obtained 2-month follow up re-injury data on all participating athletes through phone calls.

We present descriptive data on the logistical challenges associated with our risk elicitation. In addition, we describe background information on our participants, and the heterogeneity of the within-athlete risk assessments (i.e., athlete, physiotherapist and physician assessments of the same injured athlete). Results for continuous data are presented as mean with ranges. More detailed quantitative analyses exploring context specific effects are beyond the scope of this feasibility study.

3. Results

We encountered a few logistical challenges during this feasibility study. After participants identified a minimum and maximum risk, the research assistants needed to create 10 approximately equal size bins bounded by whole numbers (17% vs. 17.8%) to ensure the format was as easy to use and understandable as possible. This can be sometimes challenging (e.g., 10 bins for the range 22–35%). Therefore, we developed an algorithm that helped the research assistants more easily create reasonable bins using only pen and paper. Our questionnaires were also completed using pen-and-paper and the results transcribed into an electronic database. Larger studies would benefit from computer generated bin ranges, and computer entry directly by the participant where the coins are "deposited" into the bins on the screen. One advantage of direct computer data entry is that the coins can easily be moved.

Of the 15 eligible athletes approached, five cases were excluded. Three cases were excluded because we considered the data from the player to be unreliable, in addition to missing physician data. We only had English questionnaires for this feasibility study. We believe these participants did not speak English well enough to understand the study's concept, but this only became evident once they started to complete the forms. Other work-flow challenges resulting in exclusions were (1) one participating physiotherapist was away when the athlete was ready to return to play, and the physician refused to participate, and (2) one questionnaire was simply forgotten among the many priorities of the larger study that served as the source for our patient population.

In the remaining 10 cases, we obtained risk estimates from triplets in seven cases, risk estimates from the physiotherapist and player in two cases, and risk estimates from the physiotherapist and physician in one case.

The average age of the 10 injured athletes (9 football, 1 basketball) was 26.7 years (range: 22–37). There were five different

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