 doi:10.20944/preprints202006.0064.v1

ORIGINAL RESEARCH

Victoria Waterworth, et al.

Why risk it? Athletes' return to sport decisions following concussion injuries: a pilot study.

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Abstract:

Purpose: To explore the influence of education and other factors on an athlete's decision to return to sport post-concussion injury, and whether general risk-taking tendencies are related to return to sport post-concussion decisions in these athletes.

Participants and methods: A self-administered electronic survey was designed to examine their decision-making process when faced with scenario-based questions regarding returning to sport post-concussion injury. Students from the Health Sciences and Medicine Faculty at Bond University were invited to participate. Participants were allocated to a concussion education or non-education group prior

 doi:10.20944/preprints202006.0064.v1

to commencement of questionnaire via the random generator on Qualtrics software function. The risk propensity scale was used to assess the risk aversion of each participant.

Results: Sixteen respondents were randomized evenly to education and non-education groups. Seven (43.8%) had previously received concussion education training prior to completing the questionnaire, with one (14%) choosing to return to sport in the scenario-based questions. The education group reported two (25%) respondents return to sport, while three (75%) respondents out of four returned to sport with no education or previous concussion training. Influential factors that impacted the decision whether to return to sport or not included: game importance, concussion severity and symptoms, and various internal and external factors. Finally, there was a divergence in results from the risk propensity scale when deciding to return to sport and general risk-taking propensities.

Conclusion: This study identified several influential factors including game importance, concussion severity and symptoms which play a significant role in the return to sport decisions post-concussion injury.

Keywords: Traumatic brain injury, return to play, risk aversion, choice behaviour, health

Introduction

Athletes are responsible for making split-second decisions to satisfy their team, coaches, fans, and most importantly, themselves, all while tolerating hits or tackles and enduring injuries. An athlete's perception can change how they make decisions. Their perspective and identity[1] is one of the most important factors to them in sport, which can impact their decision-making process if not well educated on the risks[2, 3]. This is particularly common when athletes are deciding to return to sport (RTS) or return to play (RTP) following an injury. As RTS and RTP are typically used interchangeably, for the remainder of this paper, RTS will be used.

Concussions are one injury that requires athletes' perception regarding the injury itself to change how they view their RTS management. There is currently limited research to show that athletes are aware of how serious concussion injuries can be to their health and what kind of risk they are taking by RTS prematurely[4]. There appears to be an inconsistency when it comes to concussion education or the lack

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thereof, which causes a large majority of athletes to defy medical advice and risk returning to sport too soon[4, 5].

Sport related concussions refer to a traumatic brain injury induced by an external force to the head, face, neck or elsewhere on the body, sending an impulsive force to the brain[6]. Common symptoms include headaches, nausea, dizziness, and may or may not include a loss of consciousness[6-8]. Athletes are encouraged to rest by medical personnel until they are symptom-free, which often requires removing themselves from play, avoiding any long-term post-concussion symptoms that can be further detrimental to an athlete's health[6]. Multiple concussions, specifically in a short time span, can lead to conditions like second impact syndrome (SIS) which causes abnormal diffuse cerebral swelling in the athlete's brain following consecutive concussions [9-11]. SIS can lead to further degeneration and negative effects to cognitive functioning, affecting an athlete's mental health and ability to RTS post-concussion, as well as the possibility of death[12, 13].

Despite recommendations from medical personnel to avoid play following a suspected concussion injury, athletes still decide to RTS in general, making them less risk-averse[14]. Risk aversion is the idea that human behaviour reduces uncertainty when faced with a decision of unknown parameters[4, 15]. This has been explored in the field of economics, but only to a limited extent in the health and medical field[16]. One way to explore how risk averse a person can be is through the risk propensity scale (RPS)[17].

Factors that influence athletes' decisions to RTS following a concussion injury include, but not limited to, game or situation importance, external or internal pressure to perform, and their knowledge of the injury itself[4]. In studies that observed these influencing factors, most focus on high school level competitive athletes in a wide range of different contact and non-contact sports[2, 3, 18]. Game importance has been shown to be influential in high school athletes, reporting that they would continue to play in an important game if faced with a concussion injury[2, 3, 19]. Internal pressures of losing their position on the team or letting their team down, combined with external pressure from teammates to compete in important games are often considered driving factors that lead to increased burden on an athlete's mind when deciding to RTS[2, 3, 20]. Of the paucity of studies that have explored the effect of education on decision-making relating to RTS following a concussion injury, those that have proven positive show athletes with a higher level of knowledge regarding concussions have a greater chance of reporting their symptoms

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compared to those with no history of education[18, 19]. However, some cohort and cross-sectional studies display that athletes from many different sports may withhold their concussion symptoms when making RTS decisions secondary to game importance[18, 19, 21]. Of all the studies that considered influencing factors, very few considered the risk of re-injury in returning to sport as a factor.

The Risk Propensity Scale (RPS) can be used to explore the propensity of risk that individuals take in life, differentiating between risk-seekers and risk-avoiders[17]. Comprised of seven questions, it is shown to provide good internal reliability and test-retest reliability based on a cohort study by Meertens et al (2008) when correlated against other risk and self-efficacy scales[17]. Despite the high reliability of this scale, only one study by Jalleh et al (2014) used the RPS in a cross-sectional survey of elite Australian athletes and their influential attitude towards performance-enhancing substance use[22]. Within their survey, they included the last question of the RPS, identifying if a person is a risk seeker or avoider and found that risk taking propensity did not differentiate athletes regarding their vulnerability to performance-enhancing substance use[22]. The ability to measure athletes' propensity towards risk could prove to be a valuable tool to better understand athletes' decision to RTS after injury, particularly after a head trauma.

There is a paucity of evidence that has explored decisions made by athletes when returning to sport following concussion injuries. Therefore, the purpose of this study is to explore the influence of education and other factors on an athlete's decision to RTS post-concussion injury, and whether general risk-taking tendencies are related to RTS post-concussion decisions in these athletes. The following research questions were explored:

1. What are the influential factors that may determine an athlete's decision to RTS post-concussion injury?
2. What is the influence of education on perceived decisions to RTS post-concussion injury?
3. Do athletes have the same general risk-taking tendencies in sport as they do everyday life?

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Material and methods

Experimental Design

The study was a 2 (message frame: sporting participation vs. non-participation post-concussion) x2 (message focus: concussion educational information provision vs. non-educational provision) randomised cross-sectional study. Ethics and gatekeeper approval from Bond University were granted on January 30th, 2019 (reference number: APO2702) prior to the distribution of the questionnaire.

Participants

All enrolled students from either undergraduate or postgraduate programs in the Health Sciences and Medicine (HSM) Faculty at Bond University in Gold Coast, Queensland, Australia were invited to participate. There was no incentive to complete the questionnaire, nor was there any detrimental impact to the participants' academic studies that elected not to participate within the study. Consent was obtained following the explanatory statement at the beginning of the questionnaire. If participants did not give consent, but still completed the questionnaire, consent was implied. The inclusion and exclusion criteria for the participants were as follows:

Inclusion Criteria: (a) enrolled in a program from the HSM Faculty at Bond University, and (b) over the age of 18 years. *Exclusion Criteria:* (a) were younger than 18 years of age and, (b) did not fully complete the questionnaire.

Questionnaire

A purposely designed questionnaire was developed by the two primary authors (AP & VW) to answer the three research questions, with revisions provided by the project team (SG, WH, & EC). The questionnaire consists of four sections: (1) demographics, (2a.) no education provided or (2b.) concussion education provided, (3) scenario-based questions (SBQ), and (4) RPS[17]. The explanatory statement introduced the topic prior to commencement of the questionnaire, and explained any risks associated with the study. Demographic questions consisted of gender, age, previous concussion history, sporting/activity history,

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and previous training or knowledge regarding concussions. Prior to any education or SBQ, participants were asked to determine if there were any factors that would influence them to continue playing and stop them from returning to sport immediately after a concussion injury. Participants were then randomly allocated to either a non-educational or an educational group by the Qualtrics software[23] function. The educational group was provided information on what a concussion is, common signs and symptoms, and potential complications of returning to sport prematurely following a concussion injury which featured evidence from peer-reviewed journals and NICE Guidelines (available from corresponding author)[8, 12, 24, 25]. SBQ were provided to both the non-educational and educational groups with eight supplementary questions that followed (available from corresponding author). Each question contained a closed-ended binary question, assessing RTS following the scenario, with a follow-up qualitative question for participants to provide reasoning for their answer to the closed-ended question. Finally, participants completed the RPS which contains seven questions asked on a 9-point Likert scale with the first six questions ranging from 1 (totally disagree) to 9 (totally agree) and the seventh question ranging from 1 (risk avoider) to 9 (risk seeker)[17].

The pilot of the questionnaire was completed by five participants, two students and three academics, from the Bond University Doctor of Physiotherapy program to ensure content validity and test the proposed methodology. Alterations to the questionnaire included revision of question order, layout, and grammatical clarification for questions 12, 15, 24, 27, and 30 based on recommendations from Qualtrics software[23] prior to circulation to the study population.

Procedure

The questionnaire was distributed via social media sites specific for Bond University HSM students for a period of two weeks. Reminders were advertised via social media on days four, eight, 11, and 14 after the initial provision of the link to enhance the response rate[26]. It was anticipated that the questionnaire would not cause any harm, however contact information for Bond University Ethics Committee and Lifeline Australia were provided if the questionnaire caused any psychological or familial stress to participants. Contact information for the primary authors was also provided to participants at the end of the questionnaire should additional information be required with regards to their answers or results.

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Data Analysis

Data was solely generated from responses to the questionnaire using Qualtrics software[23]. All data was extrapolated, and statistical analysis was performed using IBM SPSS Statistics[27]. For quantitative analysis, data was subjected to normality testing to determine normal distribution. Descriptive statistics (i.e., frequency, mean, standard deviation and percentages) were used to summarise the data prior to further analysis when necessary. Open-ended questions were analysed using content analysis for common themes by AP ad VW independently prior to collaboration. No a priori themes were utilised when analysing the data.

Results

Sixteen respondents completed the questionnaire. Of these respondents, eight (50%) were male and eight (50%) were female. All 16 respondents were undertaking postgraduate degrees with 15 (93.8%) studying physiotherapy, and one (6.3%) studying medical sciences. Table 1 presents the results for previous concussion history and sporting history. Other sports included Australian football league, bubble soccer, cricket, CrossFit, gymnastics, running and tennis. Non-sports related concussion incidents include falling off objects (e.g., chairs, workplace incidents) and fights.

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Table 1 Demographic, Concussion, and Sporting Participation Question Results

Question	Frequency (%)
Have you sustained a concussion before?	
Yes	N = 8 (50%)
No	N = 6 (37.5%)
Unsure	N = 2 (12.5%)
If yes, how many?	
One	N = 5 (31.3%)
Two	N = 2 (12.5%)
Three	N = 1 (6.3%)
How did your concussion(s) occur?	
Sporting event or training	N = 6 (75%)
Non-sports related incidents	N = 2 (25%)
Have you actively undertaken sports in last two years?	
Yes	N = 16 (100%)
No	N = 0 (0%)
If yes, what sports do you play?	
Other	N = 8 (50%)
Netball	N = 4 (25%)
Soccer	N = 4 (25%)
Swimming	N = 4 (25%)
Rugby (Union, League, Sevens)	N = 3 (18.8%)
Ice Hockey	N = 2 (12.5%)
Basketball	N = 2 (12.5%)
Volleyball (Beach, Indoor)	N = 2 (12.5%)
Wrestling/Boxing	N = 2 (12.5%)
Baseball	N = 1 (6.3%)
Field Hockey	N = 1 (6.3%)

When asked what factors would influence the respondents' decision to RTS, two themes of concussion severity and symptoms and game importance proved to be most prevalent. Eight respondents reported that concussion severity would guide their decision making, stating *"severity of concussion"* or *"symptoms of head injury, headaches, nausea, tinnitus, dizziness"* as factors they would consider prior to returning to play. Game importance was reported by seven respondents, specifically to time of season, as majority of the responses stated, *"if it was a championship game"* or depending if *"it was a regular game or final match"*. The *"need to win"* or *"state of play in the game"* was also reported by respondents.

Factors that would stop the respondents from returning to sport following concussion injuries had a consensus among them with 13 out of 16 mentioning concussion severity and symptoms as reasons they would stop playing. *"Dizziness"* was a common symptom described by three separate participants, as well as *"nausea", "balance issues", "headache", "memory" and "blurred vision".* Three respondents stated,

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"*loss of consciousness*" or *"blacked out",* and one stated *"if it would severely affect my health or potentially kill me"* as other potential symptoms. External factor of medical clearance was mentioned twice, while *"work"* and *"rules of play following a concussion"* fit the content analysis of external factors that would affect the respondent's decisions. Internal factors, including personal knowledge of concussion and risk of continuing was considered with one participant stating, *"I know the dangers of continuing"* and another participant expressing, *"the risk isn't worth to continue to play."* Only one respondent considered performance ability and being *"unable to compete at the needed level"* as a reason that they would not return, where another stated game importance, considering, "*as long as the game being played had no bearing*".

When provided with the SBQ, those who answered "*no*" in the eight different questions presented three different themes in their responses: internal factors (i.e., health risks, concussion knowledge, poor performance), external factors (i.e., medical advice) and game importance. Fourteen respondents answered with content related to health risk being, *"long-term healing", "unnecessary risk", "worsen symptoms,"* and *"exacerbation of symptoms"* mentioned. One respondent considered, "*concussions are a big deal. My health is more important for future games*." Concussion knowledge was mentioned by six respondents who demonstrated an understanding of the *"risk of further brain damage"*, with only one mentioning *"second impact syndrome"*. One respondent said, *"from past-experience I know [sic. returning to the game] is a bad idea"* demonstrating previous knowledge of a concussion injury, where another stated the *"... knowledge of concussion and impact makes me say no."* Four respondents, identifying their own performance values, considered how it would affect their team's performance, not wanting to be *"a crutch to the team"* or risk making a *"poor decision and causing my team to lose"*. The only external factor considered was medical advice prior to returning. Only one response reflected game importance and where they were in the season.

For the 6 participants that answered "*yes*" in at least one of the SBQ's to returning to play following a concussion injury, game importance and letting the team down was the only influential factors for these six respondents. One response in a championship scenario was, *"my knowledge of concussion would not be as persuasive in this instance and getting ahead in the game would become more important to me".* Other responses included, *"...I would want to win the game*", *"the team my need my help to win"*,

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or *"important game, want to help the team win"*. In a losing championship game scenario, a respondent explained that the reason they would RTS was, *"I would want to give it my all and if my symptoms are not dreadful...contribute to the chance of winning despite the increased chance of further injury to myself."*

Table 2 represents the quantitative results of the SBQ, and the results of which respondents have had previous concussion education training and those who received the education portion during the questionnaire. Of the seven that had previous concussion education training, only one (14%) would RTS following a concussion injury. The eight respondents that received concussion education saw two (25%) respondents that would RTS following a concussion. The remaining three (75%) respondents out of four that chose to RTS had neither previous concussion education training nor received education prior to the SBQ.

Results from the RPS[17] are documented in Table 3. When compared to the six respondents who chose to RTS following a concussion injury and whether they view themselves as a risk seeker or a risk avoider, two scored *"5"* and one scored *"6"* making them risk seekers. Conversely, two other participants scored "3" and one scored *"4,"* thereby making them risk averse. Of the remaining 10 respondents asked if they perceived themselves as a risk seeker or risk avoider, four scored *"5"* and two scored *"6"* making them risk seekers, while the remaining respondents scored *"4*," *"3"* and "*2*" making them risk avoiders. For the following questions within the RPS, the closer the score was to "*9*" showed the respondents agreement with the statement where the closer to "*1*" would show their disagreement. When asked if the six RTS respondents took risks with their health, three scored *"5"* and one scored *"8", "6"* and *"3"* respectively. Two of these respondents scored *"7"* when asked if they prefer to avoid risks, where the others chose *"8", "6", "5"* and *"4"*. For those that believed they took risks regularly of the six respondents, three scored *"3"*, and the rest scored *"7", "5"*, and *"4"* each. These results demonstrate the idea that general risk-taking capabilities in everyday life and within an athletic situation may vary depending on the individual and their perception of risk.

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Table 2 Concussion Education and Scenario based Questions

	Concussion Education		**Reason for RTS**							
	Previous concussion education training	**Received education**	**Preseason**	**Mid-season, guaranteed playoff**	**Mid-season, no playoffs**	**Playoffs, first game winning**	**Playoffs, first game losing**	**Championship game, winning**	**Championship game, losing**	**Championship game, tied**
Yes	n = 7 (43.8%)	n = 8 (50%)	n = 0 (0%)	n = 0 (0%)	n = 0 (0%)	n= 1 (6.3%)	n = 3 (18.8%)	n = 3 (18.8%)	n = 6 (37.5%)	n = 6 (37.5%)
No	n = 9 (56.2%)	n = 8 (50%)	n = 16 (100%)	n = 16 (100%)	n = 16 (100%)	n = 15 (93.8%)	n = 13 (81.3%)	n = 13 (81.3%)	n = 10 (62.5%)	n = 10 (62.5%)

Table 3 Risk Propensity Scale[17]

Risk Propensity Scale							
	Safety First*	**I do not take risks with my health***	**I prefer to avoid risks***	**I take risks regularly***	**I really dislike not knowing what is going to happen***	**I usually view risks as a challenge***	**I view myself as a…+**
Mean ± SD	7.88 ± 1.258 SD	6.94 ± 1.914 SD	6.50 ± 1.862 SD	4.31 ± 1.740 SD	6.69 ± 1.662 SD	4.63 ± 1.708 SD	4.31 ± 1.352 SD
Range:	6 - 9	3 - 9	3 - 9	2 - 8	2 - 9	2 - 7	2 - 6

Notes: *- scale 1 (totally disagree) to 9 (totally agree); +- scale 1 (risk seeker) to 9 (risk avoider)

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Discussion

This is the first study to explore the extent to which an athlete perceives the risk of RTS following a concussion and the influencing factors that affects their decision-making process.[4] An unpublished systematic review conducted by Waterworth et al. (2018)[4] concluded that there is a paucity of studies that examine risk aversion in athletes and how education may be overlooked when deciding to RTS post-concussion injury.

Influential factors that determine an athlete's decision to RTS post-concussion injury were explored in this study, finding several different themes based on respondents' decisions and responses. Game importance, concussion severity and symptoms, and various internal and external factors contributed to the overall decision-making process, corresponding with influential factors previously discussed in other cohort studies[2, 3, 19]. In the current study respondents reported that they would play through a concussion injury if the game importance outweighed the decision to stop, where other studies found athletes state game importance should not be a driving factor[2, 3, 19]. Pre-season games did not appear to carry the same weight, as lack of game importance and other external factors were common deterrents to RTS. However, finals and championship games would warrant RTS for some respondents, as they put greater value on the win or game and supporting their team. The idea that knowledge of concussions may not be persuasive enough to stop an athlete from returning to sport suggests the possibility that game importance may be an overriding situation as reported by Kurowski (2014)[28].

Previous studies have also highlighted that the severity of concussion symptoms may cause athletes to RTS if the game is deemed important enough, which was also reported by respondents in this study[3, 29]. Athletes may underplay their symptoms in order to return faster after a concussion injury[29]. However, over half of the respondents recognised the degree or severity of their symptoms would be an important factor in their decision-making process, with some stating that the risk of further brain damage or death would prevent them from RTS. Only one of the eight respondents that received education mentioned the risk of SIS as a reason to not return in the SBQ, suggesting that the education may not have had a profound impact on all

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participants receiving education. A proven understanding of the risks or post-concussion complications associated with this injury appears to still not be fully clear based on the respondents' answers following the educational portion.

Internal factors, such as athlete identity, long-term health, and poor performance of an athlete play a prominent role in their decision whether to RTS post-concussion injury as found in a review by Echemendia and Cantu (2003)[29]. If an athlete believes their spot on the team might be jeopardised based on their decisions, this might motivate them to RTS prematurely following a concussion injury[29]. In the current study, athlete identity did not play as an important motivating factor in RTS post-concussion injury. Whereas, Delahunty (2015)[3], reported that personal motivation to maintain athlete identity was the primary driving factor to RTS post-concussion injury compared to all other internal pressures. Respondents that were motivated to RTS post-concussion did so with a disregard for their own personal health, so long as they would be able to help their team win. Many respondents, though, still elected to not RTS due to their personal long-term health and the possibility of poor performance due to their concussion.

In the current study, respondents indicated external factors such as medical clearance would influence their decision to RTS, which could prove difficult as recreational athletes may not have the accessibility to immediate medical clearance if concussed during a game[31]. Financial security (i.e., being able to work) was also discussed and may be more significant for recreational athletes compared to professionals who may still receive pay if injured. One respondent even considered the rules of play as a reason to not RTS. Of those that provided external factors as reasons to not RTS, there seems to be no consensus on which external factor truly impacts an athlete's decisions. External pressures from coaches, teammates, or family members affecting the respondents RTS decisions was not formally reported as demonstrated in other cohort studies[2, 3, 30].

To increase the safety of athletes when returning to sport post injury, concussion education should be introduced early on[2]. In line with this, the effect of education on the perceived decisions to RTS post-concussion injury was conducted. A small percentage of the education group perceived to RTS following the SBQ, which was similar for those who had

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previous concussion education prior to completing the questionnaire. As no follow-up questions were provided to gauge the true understanding of the education provided, it was unclear if the education received affected the respondents' decisions. A previous cohort study found that concussion knowledge, self-reported behaviour, and attitudes regarding concussions were the highest immediately after the educational brief and declined in reporting as the season progressed[28].

Our findings suggest that the relationship between general risk-taking tendencies in everyday life and RTS post-concussion injury is still not fully understood. There was a lack of consistency of the respondents when electing to RTS in the SBQ if they viewed themselves as a risk seeker or avoider, while participants who chose not to RTS considered themselves to be more risk seekers. Recreational or everyday athletes, such as the current respondents, may evaluate risk of RTS post-injury differently compared to professional athletes, and ultimately choose to return due to their desire to participate in social, meaningful play or out of pure ignorance[14]. Although the results suggest a present discrepancy between general risk-taking tendencies in life and a sporting context, the number of respondents in the study and the inability to prove the respondents thorough understanding of each question may cause a lack of efficacy. Future studies are still needed to further differentiate the relationship between general risk-taking propensity in everyday life and RTS post-concussion injury in not only recreational athletes, but professional athletes as well.

We acknowledge the limited response rate, which limits the generalizability of our findings. Factors including distributing the questionnaire close to coursework assignment deadlines and gatekeeper restraints of dissemination to only via institutional social media; potentially limited the reach to all students within the Faculty. Additionally, our survey respondents only participated in recreational sporting activities, limiting the exploration of influential factors that a professional athlete may face when deciding to RTS post-concussion injury. Finally, we acknowledge that it was beyond the remit of this study to follow-up and determine respondents understanding of the education provided. Further research is required to adequately determine the relationship between the general risk-taking tendencies in everyday life

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and RTS post-concussion injury. Future studies utilizing larger sample sizes and access to a more diverse population for future surveys are required to determine the scope of influential factors athletes face when deciding to RTS post-concussion injury and the role that education and general risk-taking tendencies have in these decisions.

Conclusion

The purpose of the current study was to explore the influence of education and other factors on an athlete's decision to return to sport post-concussion injury, and whether general risk-taking tendencies are related to return to sport post-concussion decisions in these athletes. This study identified several influential factors including game importance, severity and symptoms of concussion, and internal and external factors which may contribute to an athlete's RTS decision-making post-concussion injury. Whether there is a relationship between the general risk-taking tendencies in everyday life and RTS post-concussion injury remains unclear. This study identified a discrepancy when recreational athletes choose to take risks in sport compared to everyday life. Further research is required to determine the impact that education has on athletes deciding to RTS post-concussion injury.

Acknowledgments

We would like to thank Kathy Waterworth and the participants of the survey for their contributions to the study.

Disclosure

No funding was received the undertake this study. The authors report no conflicts of interest in this work. The abstract of this paper was presented at the Australian Physiotherapy Association Conference, Transform 2019, as a hot topic presentation. The presentation abstract was published in the book of abstracts on the conference website: https://transform.physio/wp-content/uploads/2019/09/Abstract_Book_Adelaide_2019.pdf

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