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Manuscript Title: A international cross-sectional study examining knowledge and attitudes towards sport-related concussion in Touch.

Submission Type: Original Research

Author: Samuel W. Oxford[1✉], Neil D. Clarke[2], Nick Dobbin[3]

Affiliation:

[1]Centre for Physical Activity Sport and, Exercise Science, Institute for Health and Wellbeing, Coventry University, Priory Street, Coventry, CV1 5FB, UK

[2]College of Life Sciences, Faculty of Health, Education and Life Sciences, Birmingham City University, Edgbaston, Birmingham, B153TN, UK

[3]Department of Health Professions, Manchester Metropolitan University, Manchester, M15 6GX, UK.

Corresponding Author: Dr Samuel W. Oxford, Centre for Sport, Exercise and Life Sciences, Institute for Health and Wellbeing, Coventry University, Priory Street, Coventry, CV1 5FB, UK

Work Tel: 07968005773

Work Email: s.oxford@coventry.ac.uk

ORCID / Twitter

Samuel W. Oxford - https://orcid.org/0000-0003-2085-8277 / @DrSamuelOxford Neil D. Clarke - https://orcid.org/0000-0002-1909-329X

Nick Dobbin - https://orcid.org/0000-0001-7508-1683P141746)

Abstract

Objective: To determine the current level of knowledge and attitudes towards sport-related concussion (SRC) amongst key stakeholders in touch rugby.

Design: An international cross-sectional study. Participants n = 141 (male, *n* = 88; female, *n* = 53) from 15 Touch Associations:

Main Outcome measure: Online questionnaire including non-validated sections captured participant characteristics, first aid training, previous concussion, awareness of SRC guidelines, combined with Rosenbaum Concussion Knowledge and Attitudes Survey. Distributed online to Touch athletes internationally. Concussion knowledge index (CKI) and attitude index (CAI) scores were calculated. A linear regression was performed to determine whether awareness of concussion, previous concussion and role affected CKI and CAI scores.

Results: Median CKI and CAI scores were 21 ± 2.0 and 67 ± 6.3, respectively, across all key stakeholders. 39% of participants reported a previous SRC and 32% of respondents were aware of concussion guidelines form their Association. Regression analysis showed minimal influence of key contextual information on CKI and CAI.

Conclusions: Findings suggest that key stakeholders in Touch have high to very high knowledge and safe attitudes towards SRC. However, there were some areas where further improvement could be targeted by those involved in Touch such as individual associations at the direction of the sport's governing body.

Keywords: Traumatic brain injury, education, policy, behaviour

1. Introduction

Touch rugby (Touch) is played at regional, national, and international standards, and is growing in popularity globally [1] such that in the UK, this is now UK Sport approved. Touch is unique from other codes of rugby, with a tournament structure replacing weekly fixtures, mixed- and single-sex squads permitted, and a match format that is shorter and allows for unlimited interchanges [2]. Touch has a minimal-contact rule whereby a "touch" is deemed to be made when an individual places a single or both hands on the opponent; a penalty is awarded if force used is deemed excessive. Due to these rules, Touch has been suggested as a potential alternative to codes of rugby involving contact, with a perceived lower injury incidence and prevalence. However, injuries are not absent within Touch. Cropper et al. reported the type, location, and number of injuries during a European tournament. Results revealed a total of 135 injuries with most transient and isolated to the lower limb. Of particular interest were those injuries concerning the head, neck or face given these result in 'whiplash-like' movements of the head [3]. Twelve injuries were reported for the head/neck/face region with 6 (4%) being diagnosed as concussion by a physiotherapist or doctor [3]. Therefore, while Touch involves minimal contact, concussions can occur, and expanding these findings across the playing population at club, regional, and national levels suggest this is an area of worthy of consideration.

Sports-related concussion (SRC) refers to neurotransmitter, metabolic inflammatory, and blood flow changes that occur because of a direct or indirect impact to the head within a sporting context resulting in signs and symptoms [4]. Like many activities, sporting or otherwise, there are various actions within Touch that can occur that lead to concussion from direct impact with a ball or opponent to 'whiplash' during diving for a score or tripping. Despite the risk, guidance around concussion is hard to locate and access particularly via the sport's central federation resources, thus guidelines for roles and responsibilities, detecting and managing concussion, and returning athletes to work, education, exercise, training, and competition are unclear. That said, our own experience in the sport informs us

that guidance is often provided at an association level and requires an individual within the association to update these guidelines and disseminate. Whether these guidelines are known beyond medical personnel (e.g., doctor's, physiotherapists) is largely unknown despite coaches, referees, players, or other volunteers playing an important role, especially in the absence of trained medical professionals. It is also unknown if all associations adopt a similar approach to providing guidance on SRC.

Due to variances in medical support across levels and associations (e.g., none, first aid, local paramedics, physiotherapists, or doctor) and hard to find guidelines for key stakeholders (e.g., players, coaches, referee, event organisers, parents, support staff, and safeguarding officers), knowledge of, and positive attitudes towards, SRC is likely to be essential for all stakeholders involved in Touch training and competition [5]. Previous research into concussion knowledge and attitudes has been investigated across full contact modes of rugby [6-9]. Research has indicated that within the community game of rugby union, there is underreporting of concussion[10] where requirements for medical pitch-side support is variable, like Touch. This is a key consideration for Touch given its amateur status with training, competition and potential injuries coming at a considerable time(loss) and financial cost to the athlete due to absence from work commitments. Further, the amateur status means there is often smaller, loose, and non-centralised medical care available to amateur athletes, and due to the costs of travel, accommodation and fees, athletes may practice risk-taking behaviours around SRC.

Research on knowledge of concussion and attitudes towards concussion of key stakeholders in Touch (see above) using validated methods such as the Rosenbaum Concussion Knowledge and Attitudes Survey (RoCKAS) questionnaire to derived concussion knowledge index (CKI) and attitude index (CAI) [11] is needed to support policy, guidelines, education, and overall practice. Therefore, this study sought to answer the following research questions: 1). What is the current concussion knowledge and attitudes of

Touch players and key stakeholders, and 2). What factors are associated with greater CKI and CAI scores? Specifically, the objective was to use a cross-sectional study design with an online questionnaire to enable international participation.

2. Methods

A cross-sectional study design was used to determine CKI and CAI of Touch players, coaches, referees, parent / guardians, and support staff towards SRC. The study was carried out in accordance with the STROBE guidelines [12] for cross-sectional studies. Ethical approval was granted by X (P141746) and all participants provided informed consent before completing the survey.

A pilot study was conducted by selecting key stakeholders from Touch which included a referee, a coach, a player, and the President of the European Federation of Touch who were not part of the wider sample. They were asked to feedback on the language and logic of the questions, but not the questions themselves, before dissemination. Once amended, an introduction email was sent to all European Touch Nations via their publicly available email address to gauge their interest and willingness to support the research. Those that agreed to participate were provided with a link to the online survey and were free to share via any appropriate channels they chose (social media, email, website). The survey was open between November 2022 and May 2023. Google Trends shows two spikes in interest via general web searches early within the data collection period (i.e., November) whereas relative to this interest, it was considerably less between December until May.

Concussion knowledge and attitudes were measured using an amended version of the RoCKAS [11]. The RoCKAS questionnaire was transferred to JISC online surveys (Supplement 1). The questionnaire was made up of several sections. Section one including questions about the participants age, sex, and association membership. Section two allowed participants to answer the survey from the perspective of a player, referee, coach, medical

staff, support staff, events operators, administrator, or caregiver. Within each section there were additional questions related to level of qualification, number of years' experience and the level at which the participant was active with in Touch. Section three asked about first Aid qualifications and concussion training and education. Section 4 explored knowledge of concussion which comprised of 21 true/false questions which included 4 distractor questions. Sections five and six consisted of 18 questions to assess attitude towards concussion, each in a Likert Scale format ranging from "strongly disagree" to "strongly agree". These were used to classify participant's responses as "safe", "neutral" and "unsafe". Section five had three distractor questions. Section seven was checklist of eight common concussion symptoms and eight distracting symptoms. CKI was derived by summing the scores across sections, three, four and seven. Correctly answered items received one point and incorrectly answered items received no points. Possible scores on the CKI ranged from 0 to 25 [13]. CAI was derived by totalling the scores from 15 questions across sections five and six. Possible scores on the CAI ranged from 15 to 75 [13]. Scores for CKI and CAI were divided by the total possible score and interpreted as >80% very high, 60%–80% high, 40%–59% moderate, 20%–39% low, and <20% very low [14].

As the number of responses was anticipated to be low for medical staff, support staff, events operators, administrator, and caregiver, these were grouped into another category ("other") that reflects the support network around a player. Also, we allowed and included data from the same individuals from multiple perceptive; this is a key feature of Touch and whilst it might slightly under- or over-estimate the mean scores, our analysis suggest it would not alter the interpretation of the data. Descriptive statistics were derived and presented as median ± interquartile range as well as minimum, maximum and proportion of total responses. Data for CKI and CAI across the four groups was incompatible with the assumptions of normality based on a visual inspection of the data using a Q-Q plot. To estimate the effect of various fixed factors, a generalised linear regression for CKI and CAI was generated with absolute probability values presented alongside the point-estimate for

the effect and 95% confidence limits. Analysis of data was completed using Microsoft® Excel (Microsoft Corporation, Version 16.661) and SPSS (IBM SPSS Statistics, Version 28, Armonk NY).

3. Results

A total of 141 individuals completed the questionnaire (male *n*=88, female *n*=53) with 58 reflecting more than on category (e.g., player and coach), resulting in 200 participant-responses being analysed (Figure 1). Fifteen touch associations, all levels of the game, a wide range of age ranges (mean and SD = 44 ± 19 years, range = 14 - 68 years), and membership duration (1-2 to >10 years) are reflected in the responses analysed.

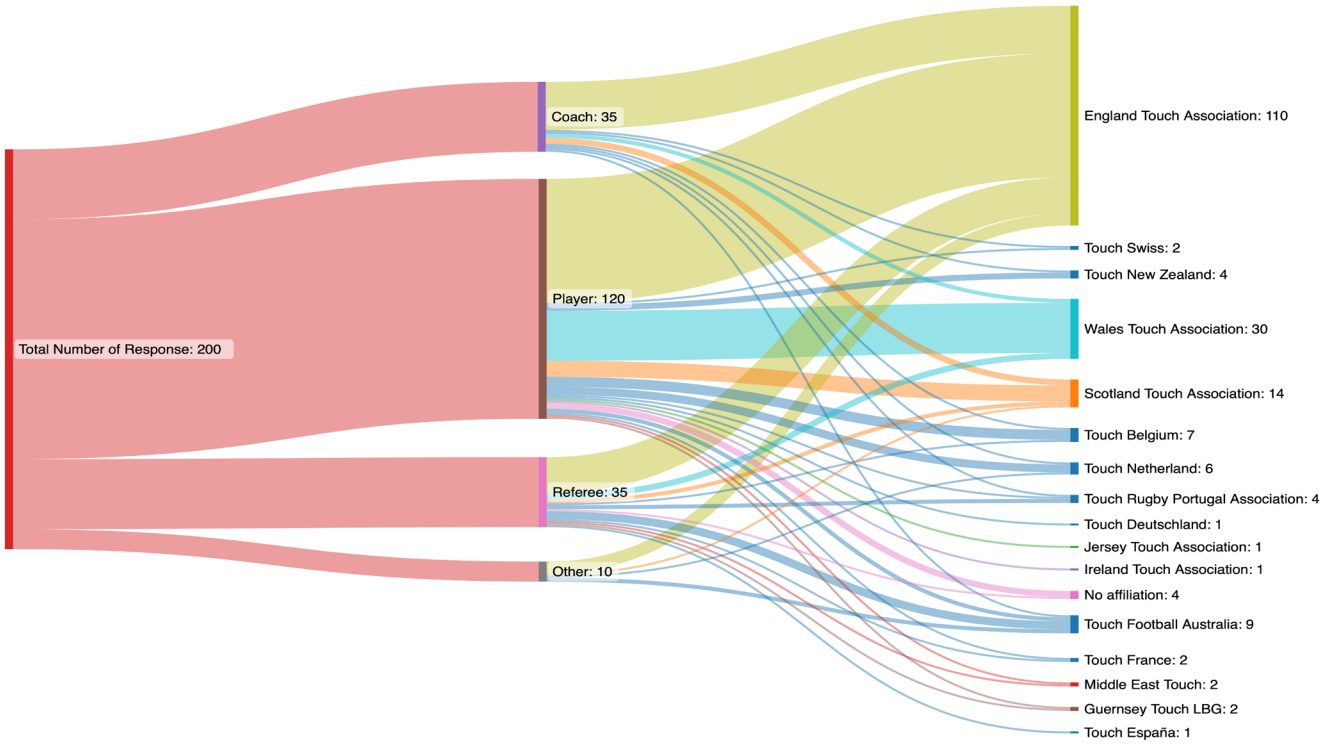

Figure 1. Distribution of respondents for coaches, players, referees and others, and their respected Touch Associations

A total of 147 (73.5% of all responses) responses indicated previously completing first aid training. Considering concussion education, 109 (54.5%) responses indicated education

being taken on the sign, symptoms and/or management of concussion, with 97 (48.5%) of all responses believing they could identify a player displaying signs of SRC. The types of education included that delivered through their occupation, first aid training courses, other sports governing bodies (e.g., RFU, WRU, FA and Netherlands Rugby Board), England Touch website and guidance, individual club guidance, Headcase website and toolkit, conversations with coaches and players, and online material (e.g., ACC SportSmart documents or social media posts). 53 participants had not undertaken any education, yet felt they could still identify a player displaying signs of SRC. 147 participants responded to the question about an awareness of their association's concussion guidelines of which 47 (31.9%) participants were aware of their association's guidelines, though 11 (23.4%) noted they had not read these guidelines. 12 (8.2%) participants indicated their association did not have concussion guidelines (*unconfirmed*) with these reflecting 7 associations. 88 (59.9%) participants were unaware of any guidelines. When asked about their own experience, 78 (39%) participant-responses indicated previous experience of a SRC with 11, 21, 34, 10 and 2 stating this resulted in a time-loss from their selected role of < 1 week, 1-2 weeks, 3-4 weeks, 5-12 weeks and > 12 weeks, respectively.

Median CKI score for the entire sample was 21.0 $\pm$ 2.0 (84.0 $\pm$ 8.0%) with a minimum and maximum score of 17 (68%) and 24 (96.0%), respectively. There was no difference in the median and IQR for CKI across categories with coaches scoring 21.0 $\pm$ 1.0 (84.0 $\pm$ 5.4%), players scoring 21 $\pm$ 2.0 (84.0 $\pm$ 8.0%), referees scoring 21.0 $\pm$ 2.0 (84.0 $\pm$ 8.0%), and other scoring 20 $\pm$ 0.8 (80.0 $\pm$ 3.0%), nor was there any influence of group in the regression when compared to 'other' (Coach - β = 0.031, p = 0.710, Player - β = 0.042, p = 0.586, referee - β = 0.052, p = 0.533 [Intercept = 2.952 AU]). When considering the cut-off values for high and low concussion knowledge, all participants were considered to have a high CKI (>15 or 60%). All coaches (100%), 101 players (84%), all referees (100%) and 7 (70%) within the "other" group were considered to have very high knowledge (> 80%). Across the four groups,

participants were at least 90% correct when answering true or false about concussion diagnosis, duration of symptoms concussion, memory/intelligence, emotional impact, and long-term implication (Figure 2). Incorrect answer largely centred around brain imaging, symptom resolution, memory, and behaviour, and relating concussion to a coma (Figure 2).

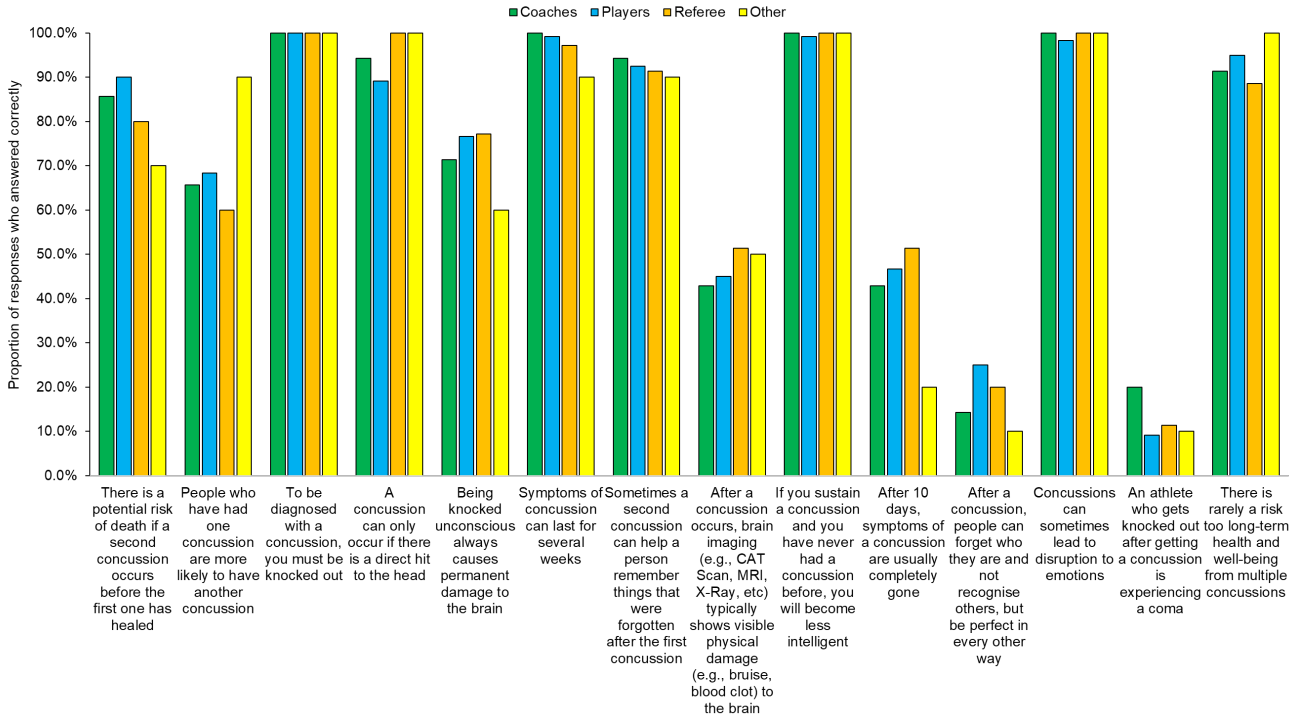

Figure 2. Percentage of coaches, players, referees, and other stakeholders' providing a correct response to the question.

In section 2 of the questionnaire, participants were provided with three questions relating to the long-term impact of previous SRC. 60-83% of participants correctly identified that a first instance of concussion (Player K in RoCKAS) is unlikely to affect their long-term health and wellbeing whilst 83-100% noted that a second concussion (Player F in RoCKAS) is likely to experience a long-term impact on their health and wellbeing. When asked about a player who suffered a concussion in a match but continued to play (Player A in RoCKAS), 96-100% of respondents correctly identified that Player A's performance would not be the same as before the concussion.

The median CAI score for the entire sample was 67.0 ± 6.3 (89.3 ± 12.0%) with a minimum and maximum score of 45.0 (60.0%) and 75.0 (100.0%), respectively. There was little difference in the median CAI across groups with coaches scoring 68.0 ± 7.5 (90.7 ± 10.0%), players scoring 65.5 ± 9.5 (87.3 ± 12.7%), referees scoring 66.0 ± 9.0 (88.0 ± 12.0%), and other scoring 67.0 ± 5.0 (89.3 ± 6.7%). The effect of group in the regression model was minimal on the intercept when compared to 'other' (Coach - β = 0.012, p = 0.788, Player - β = -0.016, p = 0.713, referee - β = -0.004, p = 0.925 [Intercept = 4.136 AU]). Most participants reported "safe" responses to the questions and scenarios posed with a median score of 91.4 ± 7.9% (range = 65.7-100%). Neutral responses and unsafe responses reflected 7.1 ± 7.5 (0-30%) and 3.9 ± 4.9 (0-20%), respectively (Figure 3). When asked about reporting a suspected concussion, 86.5% of responses indicated that the medical lead was "extremely important", and physiotherapists were "important" to "extremely important". Coaches were also considered "very important" and "extremely important", whilst there was an equal distribution for family members. 5% and 2.5% felt the medical lead and physiotherapist were not important at all, and 10 felt it was important to inform no one. A full summary is provided in Supplement 1.

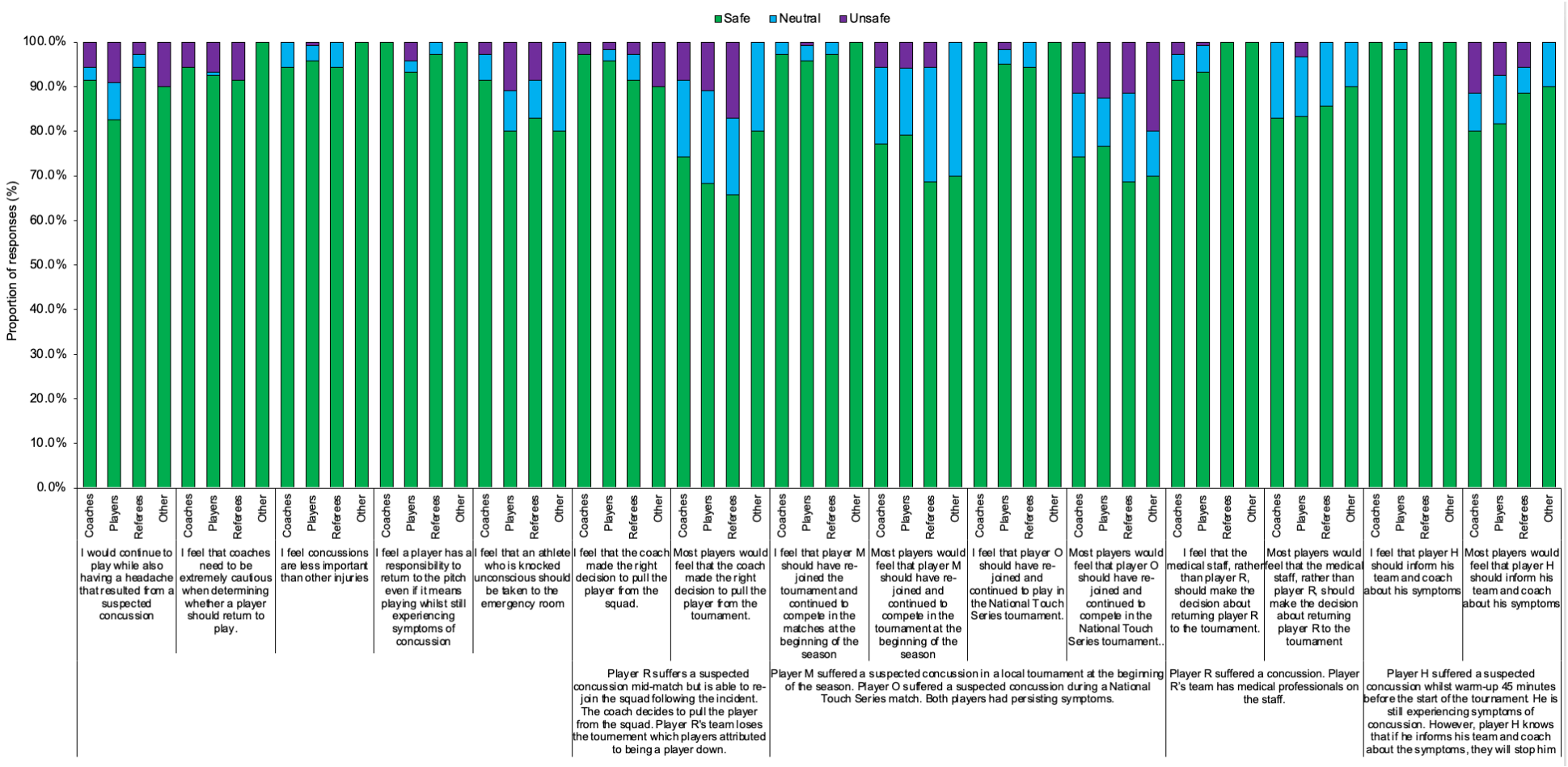

Figure 3. Percentage or safe, neutral and unsafe responses to CAI statements for coaches, players, referees and other stakeholders.

Signs and symptoms recognition revealed that participants identify the correct signs and symptoms with 94.5 to 100% accuracy. Participants correctly identified most sign and symptoms not associated with concussion (79.5 to 100%) except for panic attacks (84 or 42.0% incorrectly identified) and reduced breathing rate (83 or 41.5% incorrectly identified). A full break down of correct and incorrect symptoms can be found in Supplement 2.

Beyond group, there was minimal influence of sex, association, being first aid trained, having received education on concussion, perceived ability to recognise concussion, previous concussion, CAI score or age on CKI (β = -0.131 to 0.053, p = 0.502 to 0.996). Sex, association, first aid trained, received concussion education, perceived ability to recognise concussion, previous concussion and age has minimal effect on CAI (β = -0.312 to 0.049, p = 0.066 to 0.998). Age was positively associated with CAI (β = 0.003, p = 0.001). The full model output for CKI and CAI is presented in Supplement 3.

4. Discussion

This is the first study to provide insight into the knowledge and attitudes towards SRC of key stakeholders in Touch from 16 different Touch Associations. The English and Welsh Touch Associations were the most represented within the sample with some Touch associations only represented by 1-14 responses. Findings indicate that key stakeholders involved in Touch have high to very high knowledge and safe attitudes towards SRC. However, notable points include respondents' awareness of association guidelines, their responses to implications and attitudes regarding SRC, and the recognition of certain distractor questions related to signs and symptoms. Additionally, regression analysis revealed minimal factors influencing CKI and CAI, with only age showing an association with CAI.

In this study, 39% of participant-responses reported being diagnosed with a SRC, which given the amateur status and with athletes engaging in various other sports, cannot not be

isolated to Touch. However, with the slightly higher percentage compared to other studies involving football and Australian football [15-17], it is important to reflect upon the impact this might have had on the findings in this study. Involvement in Touch and experience of a SRC could have altered the response rate and the individual responses in this study. Those training or competing within Touch, as a code of rugby, are also aware of the ongoing issues and debate around SRC, thus are likely to be interested in the topic as well as have some understanding of socially desirable response to the questions presented. Prior experience of a SRC could also potentially alter CKI and CAI depending on the diagnosis, management, and advice received. It is possible that knowledge was high in this study as those who have experienced a SRC may have received correct advice and guidelines which has allowed them to gain knowledge through advice from a health professional or other sources of information. That said, we do note that our regression suggests that, if prior experience does impact CKI and CAI, it is of small magnitude and carries a high type I error rate. Similarly, experience of SRC is likely to alter one's attitudes given they have first-hand experience of the sign and symptoms [18], and potentially a greater understanding of the implications. While other factors could affect these, the substantial number of Touch players and stakeholders with SRC experience makes knowledge and attitudes regarding this injury important for the sport.

In this study, CKI results exceed those reported for coaches (72%) and players (80%) in community rugby in New Zealand [9], players (76%) in English community rugby union game [6], and higher than university standard rugby players from South African (75%) [19]. Concussion knowledge within the South African community game of rugby was around 76% on average which included players (67%), medical staff (79%) and referees (78%) [20]. In this study, all participants scored at least a "high" CKI score with many scoring very high. Several factors may account for these high scores. A growing interest, media attention, and awareness of SRC may have influenced CKI scores, with significant SRC exposure across the sample through various means, such as leaflets, advertisements, and associations which may have

influenced the findings. Our knowledge of the sport would indicate that the two most represented countries are supported by experienced medical professionals. Further, those who had experience a SRC have been reported to be at 1.67 times greater odds of higher concussion knowledge scores [20]. However, our regression analysis does not fully support this conclusion, limited by the homogeneity of our data. A second consideration is the influence of income and education on concussion knowledge. Due to the sport's amateur status and associated training, traveling and competition costs, it attracts participants with higher disposable income and greater educational attainment, aligning with previous research in rugby [21,22]. Specifically, research in Canada highlighted that income and education's impact on concussion knowledge amongst players, coaches, and medical professionals across a large and diverse population that included most of the sports community. [20] Indeed, those earning over $100,000 or holding a master's or doctoral degree had 1.25 to 1.40 times greater odds of possessing greater concussion knowledge compared to those with lower income or education levels.

The median score was high with minimal variability within and between groups in this study, though we do note some areas where future messaging or education can be directed and that the RoCKAS was never designed to be all-encompassing for SRC. Firstly, we highlight that awareness of Touch specific guidelines was limited across all groups, and only a few respondents reading the guidelines provided by their association. Specifically, only the England Touch Association, Wales Touch Association and Australian Touch Football had readership, representing 83%, 14% and 3% of those who read the guidelines. These findings contrast with the game of rugby where 63% of school New Zealand high school rugby players [23] were aware of concussion guidelines which were higher than those reported in similar age groups in South Africa (41 %) [18]. Whilst CKI is high, there is scope for Touch associations to improve access to guidelines and promote these to their stakeholders as well as for the governing federation to ensure consistency and equity across associations.

Regarding the questionnaire results, improving CKI can be achieved through education about scanning, the timescale for symptom resolution, memory and behaviours changes, and relating being knocked out after a concussion to comatose. Addressing incorrect responses related to symptom resolution time and memory or behaviour changes is essential to balance rest time and ensuring complete symptom resolution before returning to education, work, or sports. Therefore, whilst previous education efforts have proved beneficial for improving CKI [24,25], specific focus on these needs considering in Touch.

When considering the most recognised symptoms in this study, the results were higher than those previously reported in rugby union referees and rugby union players [5,26]. Participants showed reduced knowledge around panic attacks and reduce breathing rate which were associated with an SRC by ~42% of respondents which agrees with Salmon et al. We do acknowledge that the signs and symptoms used in this study have been updated [27] to those deemed more reasonable than hives, Arthritis, weight gain, hair loss, and excessive study. Because of this, we do acknowledge our CKI score might be greater than that previously reported. That said, panic attack and reduced breathing rate were also changed yet remained incorrectly answered by a large proportion of respondents.

In addition to CKI, understanding stakeholders' attitudes to SRC is essential, and arguably one of the most impactful areas to improve the recognition and management of SRC given their active role. Furthermore, Olanrewaju et al. and Nedimyer et al. demonstrated a degree of covariance between CKI and CAI suggesting knowledge and attitudes are related. In this study, CAI was high overall, ranging from high to very high, and when presented with various scenarios, the majority gave a "safe" response. These findings appear safer behaviours and attitudes to those previously reported [6,26]. For example, we note that 2.9 to 10.0% of players, coaches, referees and other stakeholders (Figure 3) would continue to play sport with symptoms of SRC which is much lower 29 to 33% previously reported in community rugby players [6] and 15.7 to 42.3% in soccer [13,28]. We also highlight that a consistently

358 greater proportion of responses consider neutral or unsafe when asked if they felt most
359 players feel the same compared to their own view, suggesting a lack of confidence others
360 would agree. That said, overall, the CAI across the groups was high and is a generally a
361 positive finding. Any future efforts should seek to reinforce these attitudes and address the
362 areas where some unsafe responses were detected, and potentially consider that age was
363 positively associated with safe attitudes, suggesting age-appropriate targeted approaches
364 might be required.
365
366 In addition to CKI from the RoCKAS, we also asked participants about who they thought it
367 was important to report a suspected SRC. Overwhelmingly, respondents noted the medical
368 lead as extremely and very important whilst telling no one was the least preferred option. For
369 all other results, they were mixed. The physiotherapist was deemed important to "extremely
370 important" by ~65 of respondents, with some suggesting "not important" or "slightly
371 important". That 35% did not deem the physiotherapist as "extremely important" is
372 concerning given physiotherapist are registered health care professionals, and those
373 working in sport can diagnose a concussion through an understanding of the observable
374 signs and evaluation of the athlete's background, symptoms, cognitive screening,
375 coordination and balance activities, and recall[29]. These findings also reflect a degree of
376 uncertainty in the responses with many associations having physiotherapists as the head of
377 medical despite participants seeing these as different roles. These findings are important to
378 consider moving forward in Touch and a key area of focus for future education resources.
379 Indeed, it has been reported that physiotherapists are knowledgeable regarding SRC, are
380 able to recognise the correct signs and symptoms, and have positive attitudes to all aspects
381 of management including return to sport[30]. Therefore, all within the game of Touch should be
382 aware of the importance of physiotherapists, and where possible, organisers should ensure
383 physiotherapists are present during training and competition. Where this is not possible, the
384 coach was deemed to be extremely and very important, meaning they could play an
385 important role in the recognising a SRC and directing to appropriate support services such

as a central medical area ('tent'), first aiders, or emergency departments. Interestingly, the importance of family members and teammates when reporting a suspected SRC were mixed with almost equal representation across all anchors. The mixed findings for family members likely reflect the age ranges included in this study which was 14 to 64 years. Younger individuals are likely to perceive their family as an important source of care and advice as well as requiring parent involvement[30] whereas older player can likely self-manage, and perceive older or younger family members to be less important. The variability in response for teammates is likely explained by various factors such as their relationship with teammates, trust, their standing within the team, and their network of support outside of the team. Indeed, some may feel that they can confide in teammates on the basis that 'they understand' and will provide support or advice (e.g., to seek help) that is aligned with concussion safety guidelines.[31] In contrast, others may feel that teammates are a source of pressure to continue to play-on due to their perceived win at all cost mentality and perceptions towards injured players.[32,33] It is therefore important to encourage teammates and family members to be a source of correct and appropriate advice, thus widening the support network for players who may have experiences a SRC.

5. Limitations

While this study offered valuable insights into SRC knowledge and attitudes in Touch, it has limitations. Firstly, it's important to note the study's cross-sectional nature, which means the results only represent a specific period and should be interpreted cautiously given this is a fast-evolving area of research and practice. Additionally, despite the involvement of multiple associations, we must acknowledge the relatively small sample sizes and suspected poor response rates (potential overall sample is unknown) when analysing data at the individual role (e.g., 'other') and country (e.g., Touch España) level. Furthermore, we recognize that CKI and CAI scores may be slightly affected by the fact that individuals could complete the questionnaire from multiple perspectives to better reflect the reality of Touch. It's worth

mentioning that including only one response did not significantly change the CKI median and only increased the CAI median by 1.0.

6. Conclusion

This study examines concussion knowledge, attitudes, and behaviours in the sport of Touch, involving stakeholders from multiple countries. It reveals generally high to very high knowledge and understanding of concussion across all stakeholders with only a few areas requiring improvement. Attitudes towards SRC were generally positive with a large proportion of safe responses given. There is room for improvement through increased awareness of SRC guidelines, centralised guideline development and dissemination, and education.

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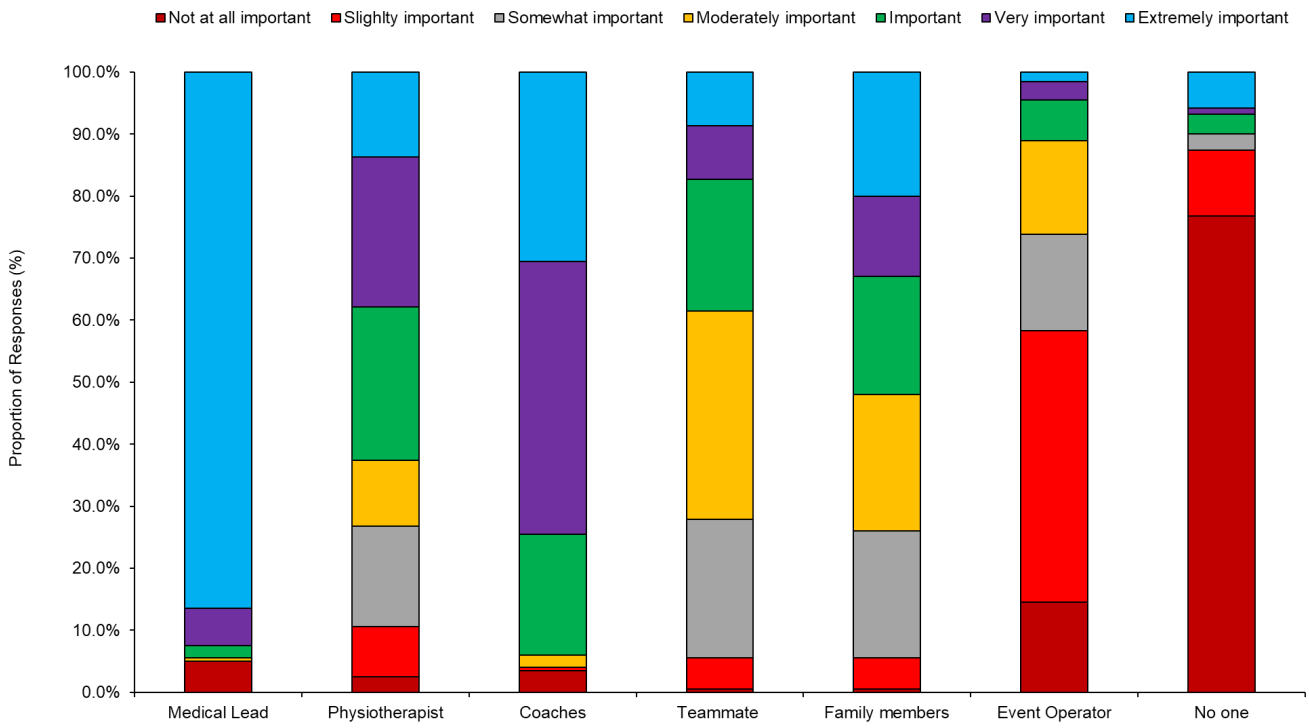
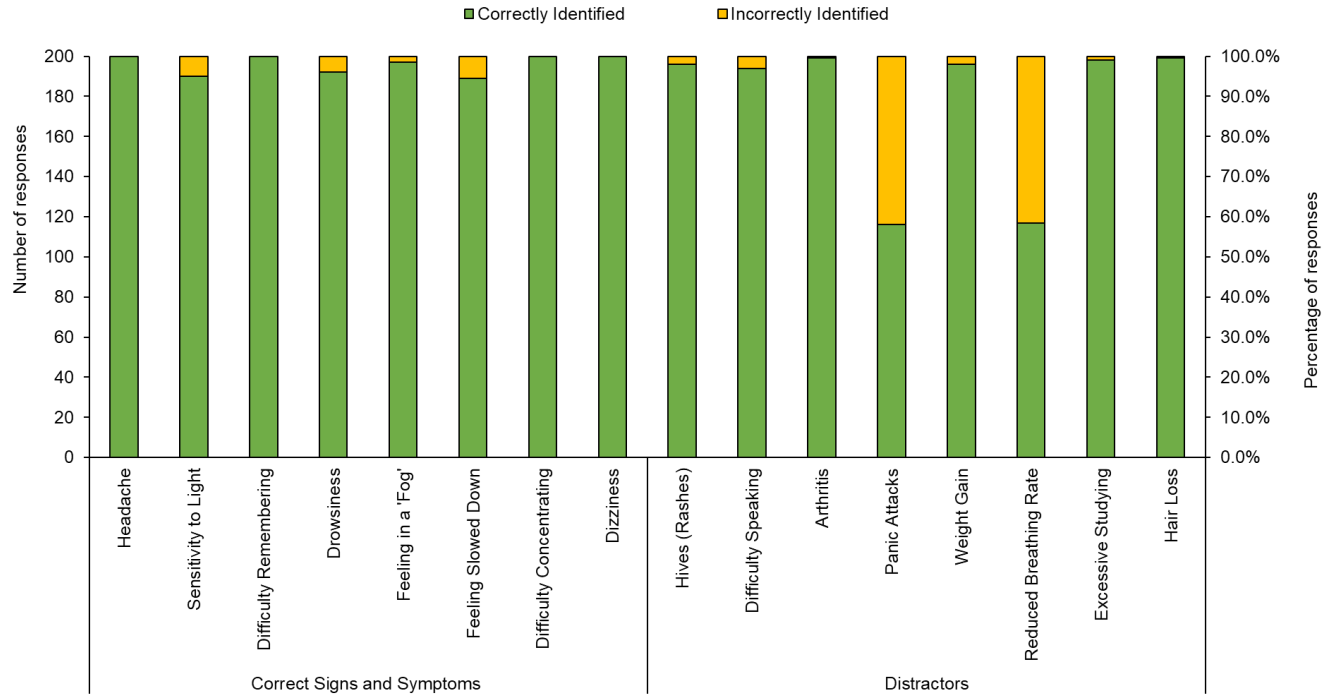
Supplement 1. Percentage of respondents reporting behaviours of SRC



Supplement 2. Frequency and percentage of responses identifies correct and incorrect SRC symptoms.



Supplement 3. Regression Analysis

Table 1. Impact of various fixed factors on Concussion Knowledge Index.

Fixed factor	β (95% CL)	p value
Role		
Coach	0.031 (-0.131, 0.192)	0.710
Player	0.042 (-0.110, 0.194)	0.586
Referee	0.052 (-0.111, 0.214)	0.533
Other	Ref	ref

Association		
England Touch Association	-0.007 (-0.446, 0.432)	0.975
Wales Touch Association	-0.014 (-0.456, 0.428)	0.950
Touch New Zealand	0.053 (-0.435, 0.541)	0.832
Touch Netherland	-0.008 (-0.476, 0.459)	0.972
Touch Swiss	0.040 (-0.487, 0.567)	0.882
Touch Football Australia	-0.030 (-0.497, 0.436)	0.899
Scotland Touch Association	-0.001 (-0.457, 0.455)	0.996
Touch Belgium	0.015 (-0.450, 0.480)	0.949
Touch Rugby Portugal Association	-0.131 (-0.629, 0.367)	0.606
No association	-0.001 (-0.489, 0.487)	0.998
Guernsey Touch LBG	-0.063 (-0.601, 0.476)	0.820
Ireland Touch Association	-0.017 (-0.643, 0.609)	0.958
Jersey Touch Association	-0.053 (-0.675, 0.570)	0.869
Middle East Touch	0.032 (-0.521, 0.585)	0.909
Touch France	-0.011 (-0.545, 0.523)	0.968
Touch Esaña	-0.016 (-0.641, 0.610)	0.961
Touch Deutschland	ref	ref
First Aid Trained		
Yes	-0.002 (-0.082, 0.078)	0.962
No	ref	ref
Received Education on Concussion		
Yes	-0.011 (-0.089, 0.067)	0.781
No	ref	Ref
Could Recognised Concussion		
Yes	0.029 (-0.055, 0.112)	0.502
No	ref	Ref
Previous Concussion		
Yes	0.011 (-0.060, 0.082)	0.765
No	ref	ref
Age	0.001	0.863
CAI	0.001	0.918

The estimated value of the dependent variable once all independent variables are set to 0 was 4.029 AU.

Table 2. Impact of various fixed factors on Concussion Attitude Index

Fixed factor	β (95% CL)	Probability
Role		
Coach	0.007 (-0.082, 0.096)	0.878
Player	-0.013 (-0.097, 0.071)	0.764
Referee	-0.008 (-0.098, 0.083)	0.870
Other	Ref	ref
Association		
England Touch Association	-0.002 (-0.253, 0.249)	0.988
Wales Touch Association	-0.045 (-0.298, 0.208)	0.726
Touch New Zealand	0.033 (-0.247, 0.312)	0.819
Touch Netherland	0.021 (-0.246, 0.288)	0.878
Touch Swiss	0.029 (-0.272, 0.331)	0.848
Touch Football Australia	-0.076 (-0.342, 0.190)	0.575
Scotland Touch Association	0.025(-0.235, 0.285)	0.852
Touch Belgium	-0.007 (-0.274, 0.259)	0.957
Touch Rugby Portugal Association	-0.045 (-0.328, 0.239)	0.758
No association	-0.016 (-0.294, 0.262)	0.909
Guernsey Touch LBG	-0.024 (0.329, 0.280)	0.876
Ireland Touch Association	0.049 (-0.303, 0.401)	0.786
Jersey Touch Association	-0.053 (-0.409, 0.302)	0.768
Middle East Touch	-0.312 (-0.646, 0.021)	0.066
Touch France	-0.109 (-0.420, 0.202)	0.491
Touch Esaña	0.037 (-0.312, 0.386)	0.836
Touch Deutschland	ref	ref
First Aid Trained		
Yes	0.012	0.596
No	ref	ref
Received Education on Concussion		
Yes	0.026	0.235
No	ref	Ref
Could Recognised Concussion		
Yes	-0.023	0.346
No	ref	Ref
Previous Concussion		
Yes	0.010	0.631
No	ref	ref
Age	0.003	0.001
CKI	0.003	0.688

The estimated value of the dependent variable once all independent variables are set to 0 was 4.029 AU.