

## Rationale and evidence for proposal to reduce the tackle height in England's community game

### 1. Introduction

- 1.1. A range of evidence including the 2016 World Rugby and RFU video analyses of risk factors for head injury in the tackle, the real-world evaluations of a lowered tackle height in South Africa, New Zealand and France along with RFU Championship Cup evaluation in 18-19 and the 22-23 season RFU U16 waist height tackle trial has been analysed extensively by the RFU and it is this that has led them to make their recommendation on lowering the tackle height to the navel.
- 1.2. These evaluations, along with other information, are explored in more detail below and referenced in Appendix A.

### 2. How the evidence and our approach to head injury and concussion prevention has developed since 2016

- 2.1. In 2016 World Rugby and RFU researchers, in two linked studies (**1-Tucker and 2-Cross**) using video analysis of tackles in the professional men's game that did and did not result in HIAs and concussion identified 6 aspects of the tackle (1. tackle height, 2. tackle type, 3. tackle direction, 4. ball carrier and tackler body position and 5. tackler speed and 6. acceleration) that were most associated with an increased risk of a concussion. Therefore, if modified, these six aspects have the greatest potential to reduce the likelihood of head injury and concussion.
- 2.2. These analyses also highlighted the important relationship between the actions of the ball carrier and the tackler(s) in the tackle and the need to consider the actions and specifically the body positions of the ball carrier and tackler(s) collectively rather than separately.
- 2.3. The 2016 Tucker HIA study showed that lower contact or proximity of the tackler's head on the ball carrier's body is safer than high contact.
- 2.4. The 2016 analyses have been repeated subsequently by World Rugby in elite rugby 2020, PRL and Super Rugby 2021/22, and elite women from 2017 to 2022 using more recent video footage of tackles and the results have been similar and consistent.
- 2.5. So the findings are quite clear - higher contact on the ball carrier and closer head proximity of players in relation to one another consistently increases concussion risk and the likelihood of a player requiring an HIA.
- 2.6. The data has also consistently shown that a) any head-to-head contact will result in the greatest probability of a player leaving the field for an HIA and b) the risk of concussion from a head-to-head contact is consistently significantly greater than the risk of concussion from contact with any other body part and specifically head to hip or a head to knee contact. This is true for both the tackler and the ball carrier. That is, the tackler is also more at risk from head-to-head contact than from head-to-knee or head-to-hip contact. This is important to understand when considering the matter of whether a lower tackle height on the ball carrier might actually increase the risk to the tackler. This data shows that we would expect the opposite to be the case.

2.7. The recommendation of the World Rugby Expert Working Group that reviewed the 2016 analysis was that to reduce the likelihood of an HIA, 29% of which occur to the ball carrier and 71% to the tackler, the game should focus on lowering the height of the tackler's head in relation to the ball carrier, which would be achieved by lowering the tackle height, and encouraging tacklers to bend in the tackle.

### 3. What are the options to lower the height of contact on the ball carrier?

3.1 The initial approach taken by World Rugby across the elite game to reduce the risk of an HIA/ concussion to both the ball carrier and the tackler was to lower the height of contact and encourage the tackler(s) to bend in the tackle by increasing sanctions for tackles above the line of the shoulder, without changing the permitted tackle height.

3.2 Professor Ross Tucker (Consultant to World Rugby) provides a detailed explanation of the rationale for this approach at <https://sportsscientists.com/2019/08/protecting-the-rugby-players-head-the-paradox-of-tackler-height-and-head-injury/> .

3.3 These attempts to lower the tackle height through sanction have been challenging and achieved mixed results. Realistically, they are only feasible in the elite game, given the requirements for video footage and technical personnel. These are unlikely to translate well to the community game.

3.4 The desire to reduce concussion risk in the community game has led to a small number of Unions working with World Rugby and exploring whether a reduction in the permitted tackle height should also be considered, and if so, what should the optimal permitted height of the tackle be?

### 4. What have we learnt from previous evaluations of a reduction in the permitted tackle height?

4.1 To date there have been four important real-world evaluations of a lowered tackle height:

- a) the RFU evaluation of an armpit tackle height in the group games of the Championship Cup in 2018-19 (3 - Stokes)
- b) the Stellenbosch evaluation of an arm-pit tackle height in South African University level competition in 2019 (4 - Van Zonder)
- c) an RFU/Bath University evaluation of the effect on concussion risk following a change to an arm-pit tackle height in all age-group rugby in England in 2021-22 that showed no significant change in concussion risk as measured by youth injury surveillance programme (Y-RISP).
- d) an FFR evaluation of a waist tackle height, combined with no assist tackler and no late dipping into contact by the ball carrier in the community game (5- FFR waist height trial evaluation).

4.2 All four were informed by the 2016 World Rugby video analysis that showed that the chances of either the tackler or the ball carrier receiving an HIA is 4.2 times more likely when the tackle occurs above the line of the sternum.

- 4.3 The Championship Cup arm-pit tackle height evaluation showed a number of promising results; including a 30% reduction in the number of tackles that resulted in contact to the ball carrier's head or neck. Whilst the overall combined concussion rate for the ball carrier and tackler did not increase, there was an increase in concussion risk for the tackler. This was a small-scale study where the impact of 12 concussions in a single week had a disproportionate effect on the overall concussion rate. Unlike our current proposal, there was no formal coaching of the tackle technique required and no attempt to influence the behaviour of the ball carrier. The study was not continued into the knockout rounds of the competition (which were to happen later in the season, after reverting to current laws for the league matches) as it was not deemed sensible for players to have to play with tackle height laws that differed from week to week to enable the collection of a small amount of additional data. Video review of cases of concussion to the tackler highlighted the technical challenge to the tackler when attempting to tackle a bent ball carrier front on. This technical challenge was recognised and addressed by the by the FFR in their law changes for their waist height evaluation.
- 4.4 The Stellenbosch evaluation of an arm-pit tackle height in 116 men's university level matches in 2019 also showed some promising results (a trend to a reduction in all injuries, head injuries and concussion) but also failed to show a significant reduction in the overall risk of concussion. As in the Championship Cup however, there was no formal coaching of the tackle technique required and no attempt to influence the behaviour of the ball carrier. Also noteworthy was that concussion rates only began to trend down three months after implementation, which suggests that adaptation times longer than three months may be required before results arising out of tackle behaviour change can be expected.
- 4.5 The FFR have been evaluating below the waist tackling combined with no simultaneous assist tackle and no late dipping by the ball carrier at contact since 2019. After an initial period of transition, during which penalty rates increased and concussion rates remained unaffected, they report a decline in the number of penalties awarded for illegal tackles and a reduction in blue cards issued by referees for suspected concussions. Their analysis of the game showed increased passing, offloads, line breaks and fewer kicks in open play, and a 63% reduction in head-on-head contacts. Subjective feedback has found that the game speeds up in a way that players and spectators find attractive and no unexpected consequences were reported after three seasons of the evaluation.
- 4.6 Similar to the Championship Cup and Stellenbosch evaluations, our evaluation of the effect on concussion risk following a change to an arm-pit tackle height in all age-group rugby in England in 2021-22 showed no significant change in concussion risk as measured with our youth injury surveillance programme (Y-RISP).
5. **So what have Head Injury Prevention and Management (HIPM) group concluded is the optimum tackle height for the community adult and age-group games?**
- 5.1 Based on all the available evidence and expert opinion, HIPM group believe that a navel height tackle height (rather than an armpit or sternum height) is the optimal height to necessitate a large enough change of behaviour in order to drive a meaningful reduction in the risk of contact between tackler's and ball carrier's heads (with an appropriate margin for error).
- 5.2 We recognised that New Zealand will introduce a higher tackle height at the level of the sternum for their community game in 2023.

5.3 This highlights differences in opinion on the ‘calibration’ of a law change required to produce the required risk reduction, and related to this, the size of any trade-offs for the change in game activities that result. We do not know for certain whether a height reduction to the sternum in New Zealand can achieve the same overall benefit as a height reduction to the navel in England. However, based on our experience of the arm-pit height in the Championship Cup and age group rugby in 2021-22, and the French experience we believe that a navel height is optimal. This is also supported by the fact that in the video studies assessing head injury risk, it is the position of the head that has been studied and identified as the risk factor, rather than shoulder contact height. A tackle at the upper limit of the hypothetical sternum height would still allow the high risk situation of head-to-head or head-to-shoulder impact to occur. Indeed, by definition, if shoulder contact is to the chest/sternum, the likelihood of head-to-head impacts will remain high. It is only by bringing contact height to the navel and below that the tackler’s head will be brought below that highest risk zone, and into an area of safest head proximity, near the ball carrier’s lower torso.

5.4 A positive of this variation in approach is that it will help us to understand how much behaviour changes in each setting, how much risk is affected by each height intervention, and the degree to which those different heights will affect the way the game is played (offloads, ruck speed, etc).

## **6. Is a change in tackle height alone all that is required?**

6.1 A key learning from the World Rugby 2016 analysis and from the Championship Cup and FFR evaluations is the challenge of the bent tackler safely tackling a bent ball carrier head-on. This particular tackler-ball carrier interaction can create head-on-head impacts that are known to be very high risk. Ideally, we would want to encourage the ball carrier to remain partially upright, in order to avoid a situation where the ball carrier dips head-first into contact at the last moment, given the tackler no access to the legal and safest tackle zone. This is the rationale for proposing to penalise a late dip by the ball carrier which reduces the options of the tackler to make a safe and effective tackle choice.

6.2 Furthermore, research on the community NRL game that is currently in review shows that when the ball carrier adopts no evasion technique or looks to shoulder bump the tackler, the risk of an HIA to both the tackler and the ball carrier are significantly elevated compared to tackles where ball carriers look to use footwork to evade contact. We want to encourage the ball carrier to at least try to be evasive, and a law that stops the ball carrier late dipping into contact may well achieve this too. It might be that penalising late dipping by the ball carrier reduces concussion risk because it increases evasive ball carriers, just as much as it reduces head on head contact.

## **7. What do we know about the effect of reducing tackle height on head acceleration exposure in the tackle?**

7.1 The introduction, over the past 18 months, of smart mouthguards to rugby that can reliably measure the number and magnitude of all head acceleration events (a term that captures both direct impacts to the head and indirect whiplash injuries) to the ball carrier and tackler has provided researchers with further insight into the risk of head injury in the tackle (over and above the risk of concussion).

7.2 The World Rugby NZRFU Otago University Orchid study which measures Head Acceleration Events (HAEs) in the community game shows that the greatest head impacts

happen in the tackle, affect both the call carrier and the tackler and that overall head acceleration (which is how impact is measured) increases linearly with tackle height.

7.3 These findings held true across all the samples, male and female and age grade and adult games.

7.4 In other words, we believe that a reduction in tackle height to the navel will also reduce overall average head acceleration exposure in addition to exposure to the higher magnitude head acceleration events.

## **8. Finally - we need to be patient**

The FFR maintained their commitment through a difficult transition period, which saw an increase in penalties before a reduction in concussions was evident. There may not be an immediate drop in reported concussions, while players adapt. We need to be prepared for up to two seasons of consistent messaging and implementation.

## **Appendix A**

### **Key source evidence used to support the RFU decision around lowering the tackle height.**

- 1. Injury surveillance studies** that report on the likelihood of sustaining a concussion and all other injuries along with the risk factors for injury by level of play in England
  - With respect to the community game, adult male, age-group male and male University populations are covered in specific reports. Adult female community surveillance started in 21-22 and has not reported yet and specific surveillance in age-group females started in 22-23
    - These reports are freely available and can be downloaded from <https://keepyourbootson.co.uk/rugbysafe-toolkit/research/>
  - Analysis of the Global Community game concussion and all injury risk for adult male and female and age group male and female players is led and co-ordinated by World Rugby and can be downloaded at <https://www.world.rugby/the-game/player-welfare/research/injury-surveillance> . The 2022 report is at <https://resources.world.rugby/worldrugby/document/2022/05/04/4005431b-5a3e-4e86-a877-841c504b1847/Global-injury-surveillance-research-in-community-rugby-union-2022.pdf>
- 2. Video analysis of risk factors for head injury and concussion in the tackle**
  - Risk factors for head injury events in professional rugby union: a video analysis of 464 head injury events to inform proposed injury prevention strategies – (1- Tucker) <https://pubmed.ncbi.nlm.nih.gov/28642222/> and full paper at [https://core.ac.uk/reader/161918051?utm\\_source=linkout](https://core.ac.uk/reader/161918051?utm_source=linkout)
  - Tackling concussion in professional rugby union: a case-control study of tackle-based risk factors and recommendations for primary prevention – (2- Cross)

full paper at <https://bjsm.bmj.com/content/53/16/1021>

- Prof Russ Tucker has repeated this analysis in a number of different cohorts of tackles: Under 20 rugby at two world cups, in professional rugby in 2020, again in professional rugby in 2021/22, in women's rugby in 2022. The initial set of 464 tackles has grown to over 1,000 injury tackles and about 10,000 non-injury tackles. This later work has been presented in conferences but is not currently available to download.

### 3. Real-world evaluations of an altered tackle height

- Does reducing the height of the tackle through law change in elite men's rugby union (The Championship, England) reduce the incidence of concussion? A controlled study in 126 games – (3- Stokes) full paper at <https://bjsm.bmj.com/content/55/4/220>
- Tackling sport-related concussion: effectiveness of lowering the maximum legal height of the tackle in amateur male rugby – a cross-sectional analytical study – (4-Van Tonder) full paper at <https://injuryprevention.bmj.com/content/29/1/56>
- FFR evaluation of a waist tackle height, combined with no assist tackler and no late dipping into contact by the ball carrier in the community game
  - This evaluation (5 – FFR Evaluation of a waist tackle height) was presented at the World Rugby Medical Commission Conference in Amsterdam in Nov 2022 but is not currently in a format that is available for general review
- RFU/Bath University evaluation of the effect on concussion risk following a change to an arm-pit tackle height in all age-group rugby in England in 2021-22 that showed no significant change in concussion risk as measured by youth injury surveillance programme (Y-RISP).
  - This will form part of the 2021-22 CRISP report that will be published when finalised in April 2023 at <https://keepyourbootson.co.uk/rugbysafe-toolkit/research/>

### 4. Commentary piece on the evidence

- Professor Ross Tucker's recent thread at <https://www.patreon.com/posts/lowering-legal-77489775>