
**An assessment of the World Rugby law
application guidelines for the breakdown on
sanctioning and player adherence**

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Abstract

World Rugby's law application guideline for the breakdown was developed to make the breakdown safer, fairer, and simpler to understand. The aim of this study was to use video analysis to assess the impact of these guidelines by comparing player adherence from the 2019 Rugby World Cup (pre-guidelines) to the 2020 Autumn Nations Cup (post-guidelines) as well as the rate of sanctioning by match officials. 1444 contested breakdowns were individually analysed by coding any infringement that occurred as well as the sanctioning outcome. The Rate Ratios (RR), 95% Confidence Interval (CI) and probability (p) values were calculated to compare proportions before (pre) and after (post) the law application guidelines. No change in the rate of infringements was observed (RR =1.04; 95% CI =0.98-1.11; p =0.188), though the rate of infringements penalised increased (RR =1.54; 95% CI =1.19-1.99; p =0.001). Reductions in the rate of two of the five offences targeted by the guidelines were observed; "offside" (RR =0.60; 95% CI =0.41-0.87; p =0.008) and "remains on feet" (RR =0.15; 95% CI =0.08-0.28; p <0.001). All dangerous play infringements reduced; "charged in" (RR =0.26; 95% CI =0.14-0.47; p <0.001), "contact above shoulder" (RR =0.20; 95% CI =0.11-0.35; p <0.001), "intentional collapse" (RR =0.04; 95% CI =0.00-0.63; p =0.023). Despite no significant reduction in the rate of total infringements between the tournaments, the reduction in the rate of dangerous play offences show a potential shift in player behaviour surrounding attitudes towards head injuries. Further, the accuracy of referee decision making did improve, suggesting that the law application guideline was successful in providing a clearer picture for match officials, which should lead to more uniform refereeing at the elite level of the sport.

Table of contents

1	Introduction	1
2	Literature review	2
2.1	Demands of Rugby Union	2
2.1.1	Modern day Rugby Union	2
2.1.2	The Breakdown	2
2.1.3	Referee Decision Making	3
2.2	Injuries in Rugby Union	4
2.2.1	Injury Incidence and Severity	4
2.2.2	Incidence of Concussion	5
2.3	Law Amendments	5
2.3.1	Law Modification in Sport	5
3.3.2	Law change in Rugby Union	6
3.3.3	Technological Advancements	7
2.4	Conclusion and Aims	7
3	Methodology	9
3.1	Protocol	9
3.2	Statistical Analysis	10
4	Results	12
5	Discussion	15
5.1	Conclusion	18
6	References	19

Tables and Illustrative Material

Figure 1. Proportion that each of the twelve breakdown infringements were committed in relation to the total number of contested breakdowns at the 2019 RWC (pre-guidelines), compared to the 2020 ANC (post-guidelines). Twenty-nine breakdown infringements were categorised as 'Other' (e.g., any attempt to kick the ball out of the ruck.) 13

Figure 2. Proportion that each of the twelve breakdown infringements were penalised by the referee in relation to the total number of breakdowns containing one or more infringement, at the 2019 RWC (pre-guidelines), compared to the 2020 ANC (post-guidelines)..... 14

Table 1. Breakdown laws in accordance with WR's 2021 Laws of the game..... 11

Table 2. The rate ratio (RR) of infringements from pre to post law application guidelines with 95% confidence interval (CI) and p-value..... 22

Table 3. The rate ratio (RR) of penalised infringements from pre to post law application guidelines with 95% confidence interval (CI) and p-value..... 23

1 Introduction

Rugby union is a team sport played across the world, with World Rugby, the governing body of rugby union, encompassing 120 national unions.¹ It is characterised by short bouts of high intensity activity combined with repeated high-impact collisions between 30 players.² The game's objective is to score as many points as possible against an opposing team by carrying, passing, kicking and grounding the ball, in accordance with the laws of the game.³ The ball must be passed laterally or backwards. Forward passing (throwing the ball ahead to another player) is not allowed. There are a number of ways a team can score points: a try, scored by grounding the ball between the goal line and dead-ball line, is worth 5 points and a subsequent conversion kick scores 2 points. A successful penalty kick or drop goal each score 3 points.³ Games are contested over two forty-minute halves, with no break for offense and defence. The aim of the defending side is to stop the attacking player with the ball by bringing them to ground, known as a tackle. The short period of play after a tackle and before a ruck has formed is called a breakdown. A ruck may be formed when one or more players from opposing teams are in contact, on their feet, and competing over the ball which is on the ground, in order to retain (attacking team) or regain (defending team) possession.³ The physical nature of the ruck often means that players find themselves in vulnerable positions with their head and necks exposed to high impacts from opposing players and as a result, are at increased risk of sustaining musculoskeletal or head injuries.⁴ World Rugby's recent law application guidelines for the breakdown was introduced to make the breakdown safer, fairer and simpler to understand. From a player welfare standpoint, it is crucial players, coaches and trainers are adopting the messages set out by the guidelines, by using correct ruck cleanout technique. It is the responsibility of match officials to detect and sanction illegal play at the breakdown appropriately to 'clean up' this facet of play which is currently regarded as a grey area in the sport.

2 Literature review

2.1 Demands of Rugby Union

2.1.1 Modern day Rugby Union

Rugby union is a physically demanding sport requiring bouts of walking, jogging and running, interspersed with sprinting, static exertions and contact events.⁵ The demands of the game at the elite level are continually changing due to the development in match analysis, equipment, technology and player training, alongside law amendments.⁵ The rapid evolution of the sport since turning professional in 1995 has had a large impact on the way the game is played.

McCormick⁶ explains how the heightened physical capabilities of modern-day players can impact a match. One of the most significant changes identified is the increase in 'ball in play time', (the amount of time the game is being played excluding stoppages) which increased from 25 minutes 45 seconds at the 1995 Rugby World Cup (RWC) to 34 minutes 21 seconds at the 2019 RWC. This has led to an increased number of contact events in a game, further testing the durability and conditioning of players. In 2019, teams averaged 82 rucks per game and 129 tackles, compared to 25 and 48 in 1987.⁶ Due to the advancement in sports science and professionalism, modern players have greater fitness and skill levels, allowing for higher intensity games with longer periods of continuous play, which has a direct knock-on effect on the product seen on the pitch. The reduction in the number of set pieces within a match (scrums and lineouts), is an indication of the improvement in skill level as less errors are being made. For example, dropping the ball and knocking it forward leads to the game being restarted with a scrum. In the 1987 World Cup there were 32 scrums in a game on average, compared to just 14 in 2019.⁶

2.1.2 The Breakdown

A breakdown is a term used for the short period of play after a tackle and before a ruck has formed.⁷ A ruck is formed when one or more players from opposing teams are in contact, on their

feet, and competing over the ball which is on the ground, in order to retain (attacking team) or regain (defending team) possession.⁸ A 2018 study analysed 7,393 physical interaction events in the Championship and Six Nations competitions and determined that 65% of collisions resulted in a ruck.⁹ The importance of retaining possession at a breakdown and turning the ball over has been found to be a key performance indicator associated with team success.^{10,11} The breakdown is one of the most technical aspects of rugby union, accounting for 47% of all penalties committed during the 2015 Super Rugby season.⁷ The refereeing of the breakdown can therefore have a significant impact on the outcome of a match, making it essential that referee decision-making is accurate and uniform.

2.1.3 Referee Decision Making

Nazarudin et al.¹² believe refereeing a professional rugby match is a substantial challenge. A breakdown may occur up to 200 times in a single match,⁸ where the referee must interpret and apply the laws of the game instantaneously. A single misjudgement could affect the outcome of the match.¹² Governing bodies place focus on the physiological and fitness training of their referee's meaning structured training in decision-making is rare.¹² Mascarenhas et al.¹³ found implementing a video-based training program combined with informed knowledge from experts improved the accuracy of on-field decision-making by 17%. They concluded that shared mental model training is an appropriate means for improving refereeing performance and may have significant implications for consistent and accurate refereeing.

Despite this, the findings of Mitchell and Tierney⁸ suggest there is a discrepancy in the accuracy of referee decision making even at the elite level of the game. Analysis of 898 breakdowns from the knockout stages of the 2019 RWC revealed that 37.7% of breakdowns involved illegal play, and that 79.9% of these illegal breakdowns were not sanctioned appropriately by the on-field officials. Furthermore, only 5.6% of "dangerous play" offences were penalised, raising concerns for player welfare. Kraak et al.¹⁴ examined the rate of sanctioning of illegal and dangerous ruck cleanouts throughout the 2018 Super Rugby competition. Eight separate illegal ruck cleanout

techniques were identified and coded, revealing that 9% of all ruck cleanouts were illegal, 93% of which were not sanctioned by the match referee. Similar findings have also been observed surrounding refereeing of the tackle area. Analysis from the 2011-2015 Craven Week, a schoolboy rugby tournament used by referees to improve their refereeing skills and status, reported 59% of illegal tackles, predominantly high tackles (65%) and dangerous charging tackles (67%) were not sanctioned.¹⁵ This is concerning as illegal tackles have the highest propensity for injury in comparison to any other contact event.¹⁵ Failure to penalise such incidents in a youth setting may increase the risk of players continuing to carry out the same techniques into senior rugby where collisions are much greater, and risk of injury may increase.¹⁶

2.2 Injuries in Rugby Union

2.2.1 Injury Incidence and Severity

Contact events are integral to rugby union which can increase the risk of injury.² When comparing injury incidence to other team sports, elite senior men's Rugby Union is amongst the highest for match injuries with a reported 88 injuries per 1000 hours in 2019, compared to 7.7 injuries in professional football and 9.4 injuries in professional hockey, though the training incidence compares favourably.^{5,17,18} Data from The England Rugby Injury Surveillance Project (ERISP) 2019/20 season report state that the match injury incidence was almost identical to data from the previous 18 seasons (2002-2019) mean of 87 injuries per 1000 hours.¹⁹ Whilst the injury incidence has remained constant, it is the severity of injuries that has seen the clearest change. In 2002, injury resulted in an average of 16 days absent, which rose to 21 days in 2010 and 38 days in 2017, suggesting the impact of injuries has become more severe.^{19,20} However, it could be argued that medical teams are now taking further precautions before returning athletes to play, due to the increased understanding of such injuries.

Moreover, Williams et al.⁵ highlight that the demands of the game are continually changing alongside law amendments and developments in player preparation and as such, conducted an updated meta-analysis of injury data within elite-level rugby union, the first since 2013. In a meta-

analysis of injuries between 2012 and 2020 at the elite level, encompassing a total of 11,620 injuries, the overall match and training incidence rates were comparable to the 2013 meta-analysis and is also conducive with the ERISP report. The mean days missed per match injury in this meta-analysis was 7 days higher than the previous findings (20 compared to 27 days), which is also consistent with the ERISP, supporting the notion that injuries may be becoming more severe over time.

2.2.2 Incidence of Concussion

In many settings,^{19,21} concussion has emerged as the most common match injury, and this is supported by the head being the most common injury location within the meta-analysis (17% of all match injuries.)⁵ The overall rate of match concussions was 12 per 1000 hours. However, this does not portray the changes in concussion reporting over time. In the English Premiership concussion rates have risen from around 5 per 1000 hours in 2012/13 to around 20 per 1000 hours in 2019/20.²¹ Several factors such as the changing demands of the game e.g., increased tackle and ruck frequency as well as the introduction of processes to better identify and manage head impacts during matches may explain this increase. The concern around potential long-term problems (e.g., neurodegenerative diseases) associated with concussions is recognised by medical populations and therefore governing bodies should continue to develop strategies to lower the risk of concussion in elite senior men's rugby union. This may include law amendments and limiting contact exposure in training.

2.3 Law Amendments

2.3.1 Law Modification in Sport

Law amendments are integral to the progression of any sport in order to keep up with the dynamics of the modern game. The need for such rule modifications may be due to a number of reasons such as safety, game attractiveness, and fair play.²² In 2006, the International Football Association Board altered the law of the game so that direct and deliberate 'elbows to head' were

punished with a red card (the player must leave the field and is unable to return for the remainder of the match.) Researchers reported a reduction in head injuries by 29% following the rule change.²³ Similarly, a 56% reduction in injury rate was reported in non-elite Bantam ice hockey, following policy change disallowing body checking (when a defensive player crashes into the opponent who's handling the puck, leading with the hip or shoulder.)²⁴

3.3.2 Law change in Rugby Union

As rugby union is a relatively 'new' sport, the game is constantly evolving to make the sport safer for participants at all levels. This encourages WR to review the laws annually and make amendments where they see fit. This means that players and coaches must adapt their tactics and styles of play to take advantage of any freedom or restriction brought about by these changes.³ Cross et al.,²⁵ reveal that over 50% of concussions occur in the tackle. In 2019, World Rugby investigated whether legislation to lower maximum tackle height would change tackle behaviour and reduce concussion incidence rate.²⁶ Over the course of the 2018/19 season, The Championship (90 games) retained standard laws for the tackle, while the Championship Cup (36 games) used revised laws where the maximum tackle height was lowered from the line of the shoulders on the ball carrier to the line of the armpits. Findings show that the law change did influence player behaviour as the number of tackles in which the ball carrier and tackler were upright reduced, limiting the risk of the two player's heads clashing which was a primary target of the trial.²⁶ Despite a desired change in player behaviour, a 30% increase in concussion incidence was identified during the intervention. Even though the number of head contacts to tacklers did not change, the propensity for concussion was greater for tacklers in all tackles, and as a result, the concussion incidence rate for tacklers during the lowered tackle height period was twice that in the standard tackle height period. This shows that law amendments can have unintended consequences, making surveillance and monitoring essential. The study also shows how law amendments can impact the behaviour of match officials. During the standard tackle height period there were 1.1 high tackle penalties awarded per match, compared to 4.3 during

the lowered tackle height, indicating the use of cues and emphasis on specific laws can improve the accuracy of referee decision making.²⁶

3.3.3 Technological Advancements

The advancement of technology within sport can also help to aid referee decision making. Within rugby union, the television match official (TMO) has access to replays and multiple camera angles of incidents and can pass on information to the referee to help make accurate decisions.²⁷ The TMO can intervene during two crucial areas of play: the scoring of a try, including any infringement in the build-up as well as the grounding of the ball, and most importantly possible foul play.²⁷ This is to ensure any act of illegal play that the referee may not have seen is sanctioned appropriately, as penalties, yellow and red cards have potential to change the outcome of a match, as teams concede an average of 7 points during the ten minutes a player must leave the field after being shown a yellow card.²⁸

2.4 Conclusion and Aims

WR's breakdown law application guidelines became operational in 2020 following recommendations by a specialist breakdown working group comprising of players, coaches, referee's and medical staff, following reports from match officials that this area of play had become increasingly difficult to referee - coupled with the fact it is responsible for 9% of match injuries.²⁹ Despite considering law changes, the group decided to strictly reinforce the existing laws focussing specifically on laws 14 and 15, comprising of 5 key elements:

- Tackler – greater emphasis on rolling away from the contact zone immediately after completing the tackle, allowing for the ball to be played. Infringement targeted: *“rolled away”*.
-

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- Ball carrier – Once the ball carrier is brought to ground, they are allowed one dynamic movement before presenting the ball. This is to stop the ball carrier buying seconds on the ground before support arrives. Infringement targeted: *“holding on”*.
 - Jackaler – The jackaler (the first defensive player at the breakdown, competing for the ball) must be on their feet and in control of their own body weight. Players elbows must be off the ground and must show the referee they are trying to turn over the ball by getting their fingers under the ball and lifting immediately. Infringement targeted: *“off feet”*. Previously, jackalers were in vulnerable bent over positions with their necks exposed, bracing for impact or being cleared out.
 - Arriving players – Must stay on their feet, not sealing off the ball by diving on top of the ball carrier. Emphasis on staying on feet and *“drive not dive”* into rucks. Infringement targeted: *“off feet”* and *“remains on feet”*.
 - Entry – Players must join the ruck from behind their offside line and enter *“through the tunnel”*. Infringement targeted: *“offside”*.

The law application guidelines have been developed to make the breakdown safer, fairer, and simpler to understand.³⁰ They aim to reduce the risk of injury, while promoting a fair contest for the ball at the breakdown. It aims to give referees a clearer picture on a complex facet of the game, which should lead to more uniform decision-making. The aim of this study is to use video analysis to assess the impact of these guidelines by comparing player adherence from the 2019 RWC (pre-guidelines) to the 2020 Autumn Nations Cup (ANC) (post-guidelines) as well as the rate of sanctioning by match officials. It is hypothesised that the implementation of WR's law amendment guidelines for the breakdown will see a shift in player behaviour when competing in breakdown events and as such, the rate at which players commit the targeted infringements will decrease. Conversely, the simplification of the laws using specific cues should create a clearer picture for match officials. This should lead to infringements becoming more easily identifiable and therefore the rate at which match officials sanction these infringements will increase, similar to the findings of Stokes et al.²⁶

3 Methodology

3.1 Protocol

Televised video recordings of matches from the 2020 ANC were analysed in this study. The ANC comprised of eight international teams, six from Europe as well as Georgia and Fiji. Teams were placed in to two groups of four, each playing the other three teams in their group. The teams in first place in each group then played each other, as did the teams in second, third and fourth to determine the overall standings³¹, resulting in a total of 13 games played within the competition, all of which were individually analysed. Kinovea video software was used to analyse the match footage, allowing frame-by-frame viewing by the author, a sport-scientist and rugby video analyst with two years' experience. The video had a minimum frame rate of 25 fps and could be watched as many times as necessary. Analysis was conducted using Mitchell and Tierney's⁸ protocol. In brief, contested breakdowns during the knockout matches of the 2019 RWC were individually analysed and coded into a Microsoft excel database to provide information on each infringement being committed and breakdown outcome (turnovers and penalties) for both the attacking and defending team. A binary coding system was employed to identify the specific breakdown infringements that had been committed during each breakdown. A '0' was used to indicate no infringement whilst a '1' indicated an infringement had been observed. Given that the video data was in the public domain, ethical approval was not required, similar to previous rugby union video analysis studies.³²⁻³⁴ The results data from Mitchell and Tierney's³⁵ study was used to compare the rates at which infringements were committed and penalties were awarded at international tournaments before and after the law application guidelines became operational.

Statistic providers MatchStats³⁶ were used to cross-reference the total breakdowns in each fixture and illustrated consistency though certain breakdowns were excluded from the current analysis where the defending team were not on their feet and actively engaged, trying to regain possession of the ball. World Rugby state 'a ruck is formed when at least one player from each team are in contact, on their feet and over the ball which is on the ground.'³ Breakdowns included

in this study had to adhere to this definition. Table 1 shows the ruling and sanction for each infringement, aligned with WR's laws of the game.³

3.2 Statistical Analysis

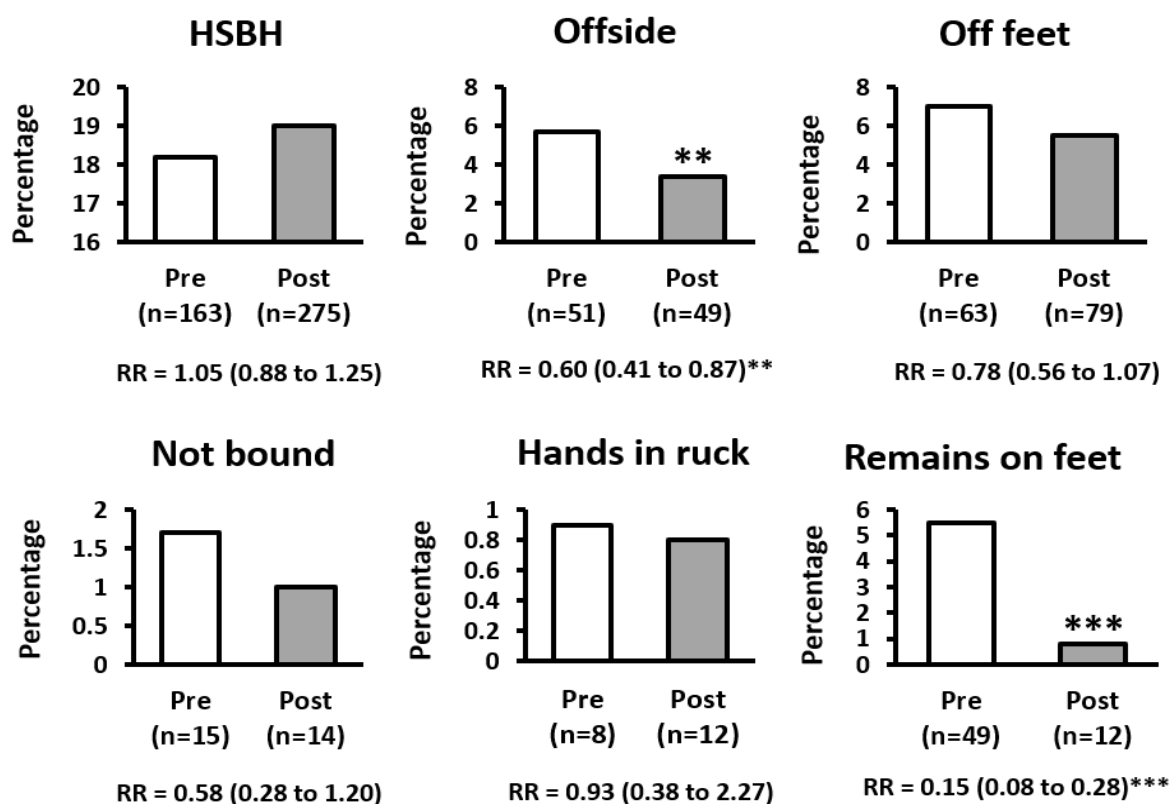
For infringements and penalty variables, rate ratios (RRs) and 95% confidence interval (CI) were calculated from the pre and post guideline data.³⁷ The RRs were calculated by comparing the frequency of occurrence for the various breakdown variables (legality, penalties, turnovers) collected before (pre) and after (post) the application guidelines becoming operational. Differences were considered significant if the 95% CI for the RR did not include the value 1.00, and the p value was <0.05. To overcome observer bias, an external reviewer (sport-scientist and Tier 3 international rugby player), with no further involvement with the study, conducted analysis on the same 25 cases as the main reviewer. Intra-rater reliability was assessed following the main reviewer's re-analysis of the original 25 cases one month after the initial review. Cohen's Kappa values of 0.823 and 0.841 were calculated for inter-rater and intra-rater reliability, respectively. A Cohen's Kappa value greater than 0.8 indicates a near perfect agreement.³⁸

Table 1. Breakdown laws in accordance with WR's 2021 Laws of the game.

Infringement	Definition
Head/shoulders below hips	<i>Players involved in all stages of the ruck must have their heads and shoulders no lower than their hips. Sanction: Free kick.</i>
Offside	<i>Each team has an offside line that runs parallel to the goal line through the hindmost point of any ruck participant. If that point is on or behind the goal line, the offside line for that team is the goal line. Sanction: Penalty.</i>
Off feet	<i>An arriving player must be on their feet and join from behind their offside line. Sanction: Penalty.</i>
Bound	<i>A player must bind onto a team-mate or an opposition player. The bind must precede or be simultaneous with contact with any other part of the body. Sanction: Penalty.</i>
Hands in ruck	<i>Once a ruck has formed, no player may handle the ball unless they were able to get their hands on the ball before the ruck formed and stay on their feet. Sanction: Penalty.</i>
Remaining on feet	<i>Players must endeavour to remain on their feet throughout the ruck. Sanction: Penalty.</i>
Rolled away	<i>Players on the ground must attempt to move away from the ball and must not play the ball in the ruck or as it emerges. Sanction: Penalty.</i>
Use within 5 seconds	<i>When the ball has been clearly won by a team at the ruck, and is available to be played, the referee calls "use it", after which the ball must be played away from the ruck within five seconds. Sanction: Penalty.</i>
Other	<i>Players must not:</i> <ul style="list-style-type: none"> -Pick the ball up with their legs. -Intentionally collapse a ruck or jump on top of it. -Intentionally step on another player. -Fall over the ball as it is coming out of a ruck. -Kick, or attempt to kick, the ball out of a ruck. Sanction: Penalty. <ul style="list-style-type: none"> -Return the ball into the ruck. -Take any action to make opponents believe that the ruck has ended when it has not. Sanction: Free kick.
(DP) Charged in	<i>A player must not charge into a ruck or maul. Charging includes any contact made without binding onto another player in the ruck or maul. Sanction: Penalty.</i>
(DP) Contact above shoulder	<i>A player must not make contact with an opponent above the line of the shoulders. Sanction: Penalty.</i>
(DP) Intentional collapse	<i>A player must not intentionally collapse a ruck or a maul. Sanction: Penalty.</i>
(Tackle) Holding on	<i>Tackled players must immediately make the ball available so that play can continue by releasing, passing or pushing the ball in any direction except forward. Sanction: Penalty.</i>

4 Results

A total of 1444 contested breakdowns were analysed from the ANC, of which 65.0% were deemed legal compared to 62.2% observed in 2019 (RR =1.04; 95% CI =0.98-1.11; p =0.188). No change in the rate of breakdowns leading to a turnover was observed (RR =1.13; 95% CI =0.84-1.53; p =0.421). “*Head and shoulders below hips*” (HSBH) make up the largest proportion of infringements pre and post-guidelines, totalling 18.2% and 19.0% respectively (Figure 1). “*Offside*”, a particular target of the amendment guidelines, had a lower rate of 3.4% from 5.7% in 2019 (RR =0.60; 95% CI =0.41-0.87; p =0.008), as well as “*remain on feet*” (RR =0.15; 95% CI =0.08-0.28; p <0.01). “*Holding on*” was the only offence that had a higher rate of 4.6% from 2.0% (RR =2.28; 95% CI =1.36-3.81; p =0.002). All dangerous play infringements reduced in the Autumn Nations Cup in comparison to the Rugby World Cup. No change in rate of infringements for “*off feet*” (RR =0.78; 95% CI =0.56-1.07; p =0.128) or “*rolled away*” (RR =1.40; 95% CI =0.83-2.35; p =0.206) was observed. The contribution of infringements made by the attacking team was similar in both tournaments, 73.3% at the ANC compared to 70.0% at the RWC.



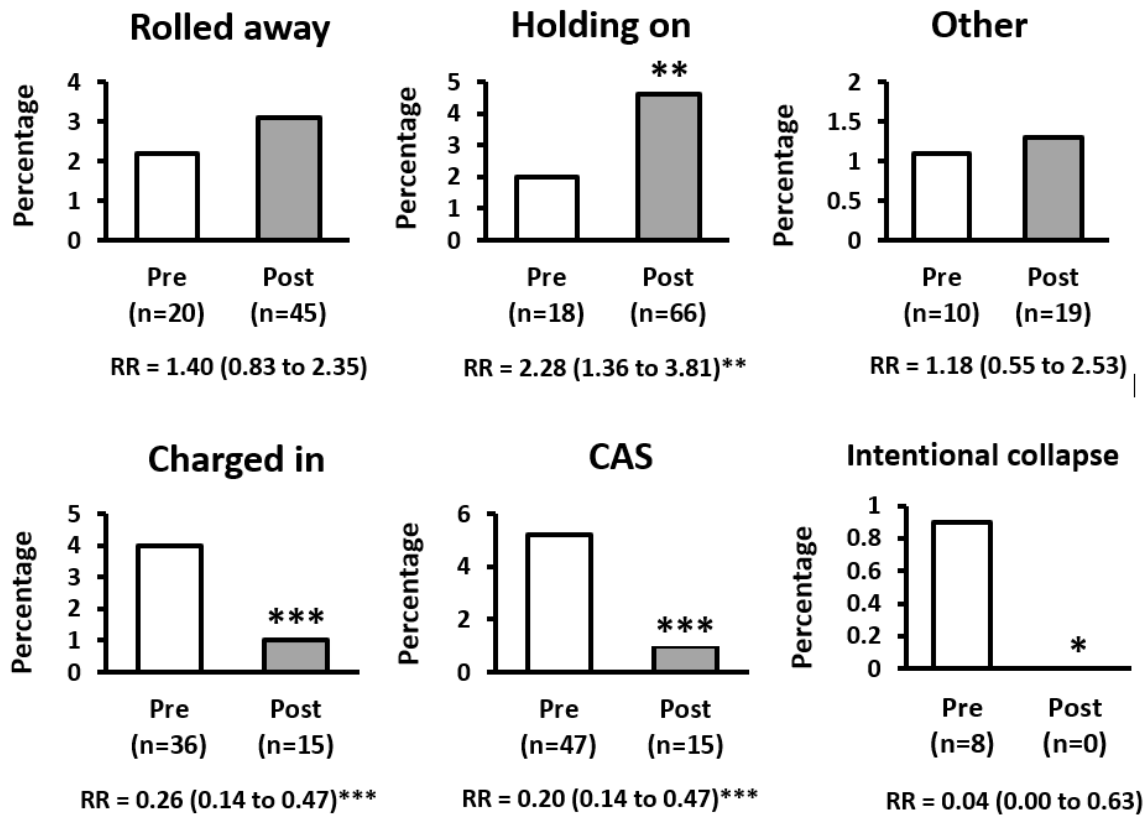


Figure 1. Proportion that each of the twelve breakdown infringements were committed in relation to the total number of contested breakdowns at the 2019 RWC (pre-guidelines), compared to the 2020 ANC (post-guidelines). Twenty-nine breakdown infringements were categorised as ‘Other’ (e.g., any attempt to kick the ball out of the ruck.)

Indicates significant difference ($p < 0.050$), **($p < 0.010$), *** ($p < 0.001$).

HSBH, Head and shoulders below hips; CAS, Contact above shoulder.

The post-guidelines results show an increase in the rate of infringements penalised from 18.9% to 29.1% (RR = 1.54; 95% CI = 1.19-1.99; $p = 0.001$). The rate of penalties awarded for the “off feet” infringement increased from 1.8% to 6.1% (RR = 3.21; 95% CI = 1.35 to 7.67; $p = 0.009$) as well as “holding on” from 5.3% to 10.9% (RR = 1.90; 95% CI = 1.12-3.21; $p = 0.017$) (Figure 2). No change in the rate of penalties awarded for infringements “offside” (RR = 0.48; 95% CI = 0.21-1.09; $p = 0.078$) or “rolled away” (RR = 1.20; 95% CI = 0.63-2.27; $p = 0.578$) was observed. Results in tabulated format can be found in appendix 1.

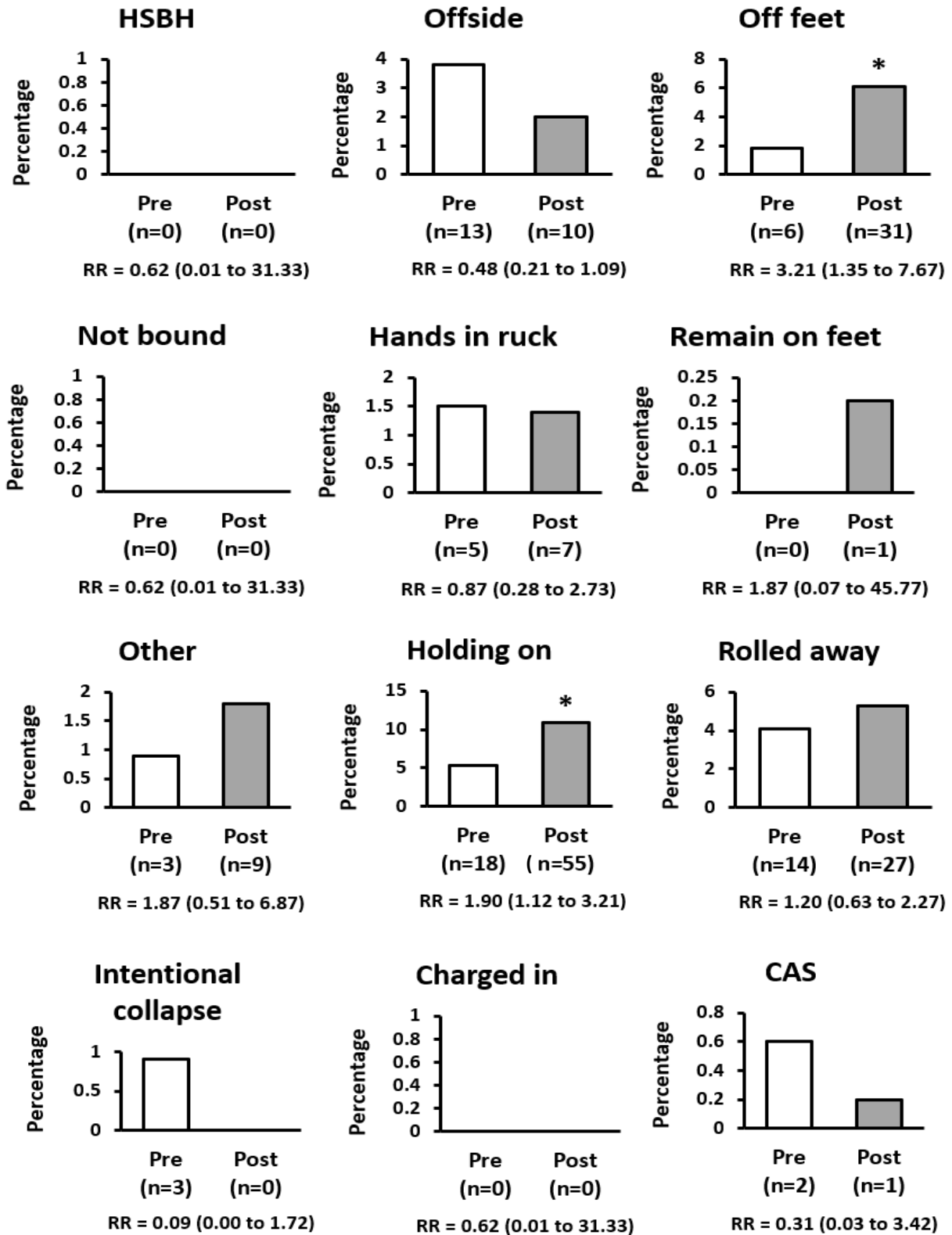


Figure 2. Proportion that each of the twelve breakdown infringements were penalised by the referee in relation to the total number of breakdowns containing one or more infringement, at the 2019 RWC (pre-guidelines), compared to the 2020 ANC (post-guidelines).

5 Discussion

The current study assessed the impact of WR's law application guidelines for the breakdown on sanctioning rates and player adherence. Since the guidelines became operational, no change to the mean number of breakdowns in a match was observed (pre =112, post =111), showing the overall pattern of the game was not altered. No significant reduction in the total number of infringements was observed as a result of the amendments, whilst only two of the five targeted offences reduced (offside and remains on feet). However, significant reductions in all three of the "dangerous play" offences were observed, suggesting a potential shift in player behaviour surrounding attitudes towards head injuries. Results also show an increase in the number of infringements that were penalised by the referee, indicating an improvement in refereeing performance following the guidelines. This may be due to the simplification of existing laws, providing a clearer picture for the referee to make correct decisions.

One of the aims of the guidelines was to improve player safety during breakdown events. The reduction in the rate of "dangerous play" infringements is a positive finding which may be due to growing emphasis on player safety, as well as refereeing guidelines on head collisions during contact events. The guidelines indicate that a referee is entitled to issue yellow or red cards for any contact made to an opponent's head.³⁹ The emphasis on entry angle into the ruck was to eliminate players contacting jackalers from the side. Knee injuries are one of the most common and severe injuries in rugby union and can often occur when a player gets their entry angle wrong, placing considerable force through their opponents exposed, planted leg.⁴⁰ By entering the ruck 'through the tunnel' which has been reinforced in the new guidelines, impacts are more likely to occur front-on rather than side-on. The current study found a reduction in the rate of "offside" infringements from 5.7% to 3.4% suggesting a potential shift in player behaviour. Furthermore, research has shown reductions in average time spent at a ruck (3.1 to 2.7 seconds) since the guidelines came into effect, with evidence that shorter breakdowns lead to fewer injuries.³⁰

In the Super Rugby Aotearoa's (New Zealand) competition, the penalty count dropped from 31 to 22 per match, across nine rounds of matches which is consistent from the data from Australia, revealing penalties awarded at the breakdown reduced from 20 to 13 in the opening nine rounds.³⁰ This reduction in penalty count across both competitions shows early signs of behaviour change from players, coaches, and referees in the southern hemisphere. However, without post-match reviews of these matches, it remains unclear whether the reduction in penalties was due to improvements in player compliance or referee's failing to penalise infringements. The findings of the current study do not support the data from New Zealand and Australia - recording an average of 11 breakdown penalties per match during the ANC compared to 8 at the RWC. However, the relatively low sample size as well as the varying skill level between competitions may account for these discrepancies. A larger scale study would therefore be necessary to identify the effects of these variables.

There is also data to suggest there has been a fairer competition for the ball at the breakdown following the amendments. Previously, jackalers were in vulnerable bent over positions with their necks exposed, bracing for impact or being cleared out. Following the amendments, if a jackaler is first to the ball and is showing positive signs to lift the ball, the referee should reward the jackaler. This is demonstrated by the rate of penalties that were awarded for "*holding on*", which more than doubled from 5.3% to 10.9%, rewarding the jackalers positive intent. WR has reported further research from New Zealand suggesting that the guidelines have also had an impact on the split of ruck penalties between attack and defence.³⁰ WR's data from previous seasons of Super Rugby had shown the attacking side to be penalised less at the breakdown, responsible for 44% of total penalties. After 9 rounds of the 2020 season, this figure has risen to 51%, evidence of fairer competition.³⁰ This is consistent with the findings of Mitchell and Tierney⁸ who reported that despite committing a larger number of breakdown infringements, the attacking team was penalised less (43.8%) than the attacking team (56.2%), pre-guidelines. The current research has also observed a shift in the distribution of penalties, showing that 48.9% of penalties were awarded against the attacking team during the ANC, although the rate

of infringement for the attacking team is still higher than for the defending team, contributing to 73.3% of all infringements.

The final aim of the guidelines was to make the game easier to referee and simpler to understand. In order to achieve this, WR provided a comprehensive visual guide, including video explanations on the laws.³ The specialist breakdown group recommend short phrases such as 'entry through tunnel', 'drive not dive', 'one dynamic movement' which are simple, effective messages that provide a clear cue for what a referee is looking for in these situations. Cue simplicity ensures applicability at all levels of the game. However, the current study has shown that 35.0% of all contested breakdowns post-guidelines involved at least one infringement, 70.9% of which were not sanctioned appropriately by match officials. Whilst this percentage seems high, "*head and shoulders below hips*" accounted for 19.0% of all infringements, despite not being penalised at all, and may need further exploration by WR.

It is important to consider that although the amendment guidelines have provided clarity towards certain aspects of the breakdown, the on-field officials still have many fundamental ruck laws to interpret and apply within a matter of seconds, in a highly pressurised situation. Research conducted by Spitz et al.⁴¹ may explain why the rate at which infringements 'holding on' and 'off feet' were penalised more compared to 'offside'. It is reported that that elite football referees spend significantly more time fixating the contact zone and less time fixating the non-contact zone. Within rugby union, the contact zone during a breakdown predominantly focuses around the ball. This stresses the huge challenge to rugby referee's as it is necessary to focus on the contact zone (for example, making sure players are on their feet), as well as the non-contact zone with players entering the ruck in the referee's periphery. This may account for some offside infringements not being appropriately sanctioned and raises the question as to whether the referee should be given further support in these situations, either through the assistant referee's or the TMO. Some studies have suggested psychological skills training to improve the decision-making of officials, however it is unclear how beneficial these methods can be within a match

setting.⁴² Due to the high degrees of freedom during a breakdown, Mascarenhas and Collins,¹³ suggest a decision-making accuracy of around 50% may be appropriate. However, this may not be appropriate for tightly contested matches with small winning margins.

A potential way to eliminate these errors from happening could come in the form of a “captains challenge” allowing each team the chance to make the TMO review certain incidents they feel the referee may have got wrong. This is currently being trialled in a number of competitions including Super Rugby Aotearoa and the Pro 14 Rainbow Cup, which has potential to ensure the right outcomes are achieved more often.^{43,44} World Rugby are also currently trialling the new 50:22 law.⁴⁵ If an attacking team kicks the ball from anywhere in their own half and it bounces inside the opposition 22 before going into touch, the kicking team gets the throw at the resultant lineout.⁴⁵ The aim of this new law is for teams to add attacking variability to their game and to make use of any potential space that becomes available where teams are having to drop players out of the defensive line to cover tactical kicks. A potential knock-on effect of this could be seeing fewer numbers involved in rucks as they will be needed to cover space elsewhere on the pitch, reducing the variability and potentially the number of collisions experienced.

5.1 Conclusion

When comparing player adherence and sanctioning of breakdown infringements after the issuing of law application guidelines, the findings indicate that the guidelines have had a marginal influence on overall player adherence to the breakdown rules but a considerable positive influence on adhering to the rules surrounding dangerous play. A total of 35.0% of all contested breakdowns post-guidelines involved at least one infringement, 70.9% of which were not sanctioned appropriately by match officials. “Head and shoulders below hips” accounted for 19.0% of all infringements and may need further exploration by WR. All dangerous play infringements reduced in the ANC in comparison to the RWC which may be due to growing emphasis on player safety as well as refereeing guidelines on head collisions during contact

events. The law application guidelines aimed to reinforce and provide clarity on 5 particular infringements. Results show a reduction in the rate of “offside” and “remain on feet” offences, however the rate of “holding on” offences increased. The rate of “off feet” and “holding on” offences penalised by on-field referee increased, perhaps due to the simplification of the existing laws. The current study provides an early indication of the influence the law application guideline for the breakdown has had at the first international tournament since becoming operational. There is still a need to improve player adherence and sanctioning of infringements at the breakdown, such that they protect players, ensure fair play and are in keeping with the dynamics of the modern game.

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Appendix 1

Table 2. The rate ratio (RR) of infringements from pre to post law application guidelines with 95% confidence interval (CI) and p-value.

	2019 World Cup Pre-guidelines	2020 Nations Cup Post-guidelines	Rate Ratio (95% CI)	Significance Level
Contested breakdowns	n = 898	n = 1444		
Legal	n = 559 (62.2%)	n = 938 (65.0%)	1.04 (0.98 to 1.11)	p = 0.188
Breakdown with one or more infringement	n = 339 (37.8%)	n = 506 (35.0%)	0.98 (0.83 to 1.04)	p = 0.183
HSBH	n = 163 (18.2%)	n = 275 (19.0%)	1.05 (0.88 to 1.25)	p = 0.591
Offside	n = 51 (5.7%)	n = 49 (3.4%)	0.60 (0.41 to 0.87)**	p = 0.008
Off feet	n = 63 (7.0%)	n = 79 (5.5%)	0.78 (0.56 to 1.07)	p = 0.128
Not bound	n = 15 (1.7%)	n = 14 (1.0%)	0.58 (0.28 to 1.20)	p = 0.141
Hands in ruck	n = 8 (0.9%)	n = 12 (0.8%)	0.93 (0.38 to 2.27)	p = 0.878
Remain on feet	n = 49 (5.5%)	n = 12 (0.8%)	0.15 (0.08 to 0.28)***	p = < 0.001
Rolled away	n = 20 (2.2%)	n = 45 (3.1%)	1.40 (0.83 to 2.35)	p = 0.206
Holding on	n = 18 (2.0%)	n = 66 (4.6%)	2.28 (1.36 to 3.81)**	p = 0.002
Other	n = 10 (1.1%)	n = 19 (1.3%)	1.18 (0.55 to 2.53)	p = 0.668
Dangerous Play Infringements	n = 91	n = 30		
Charged in	n = 36 (4.0%)	n = 15 (1.0%)	0.26 (0.14 to 0.47)***	p < 0.001
Contact above shoulder	n = 47 (5.2%)	n = 15 (1.0%)	0.20 (0.11 to 0.35)***	p < 0.001
Intentional collapse	n = 8 (0.9%)	n = 0 (0.0%)	0.04 (0.00 to 0.63)*	p = 0.023

* Indicate significant difference p<0.050, **p<0.010, ***p<0.001.

Table 3. The rate ratio (RR) of penalised infringements from pre to post law application guidelines with 95% confidence interval (CI) and p-value.

	2019 World Cup Pre-guidelines	2020 Nations Cup Post-guidelines	Rate Ratio (95% CI)	Significance Level
Breakdown with one or more infringement	n = 339 (37.8%)	n = 506 (35.0%)	0.98 (0.83 to 1.04)	p = 0.183
Infringements Penalised	n = 64 (18.9%)	n = 147 (29.1%)	1.54 (1.19 to 1.99)**	p = 0.001
HSBH	n = 0 (0%)	n = 0 (0%)	0.62 (0.01 to 31.33)	p = 0.812
Offside	n = 13 (3.8%)	n = 10 (2.0%)	0.48 (0.21 to 1.09)	p = 0.078
Off feet	n = 6 (1.8%)	n = 31 (6.1%)	3.21 (1.35 to 7.67)**	p = 0.009
Not bound	n = 0 (0%)	n = 0 (0%)	0.62 (0.01 to 31.33)	p = 0.812
Hands in ruck	n = 5 (1.5%)	n = 7 (1.4%)	0.87 (0.28 to 2.73)	p = 0.813
Remain on feet	n = 0 (0%)	n = 1 (0.2%)	1.87 (0.07 to 45.77)	p = 0.702
Rolled away	n = 14 (4.1%)	n = 27 (5.3%)	1.20 (0.63 to 2.27)	p = 0.578
Holding on	n = 18 (5.3%)	n = 55 (10.9%)	1.90 (1.12 to 3.21)*	p = 0.017
Other	n = 3 (0.9%)	n = 9 (1.8%)	1.87 (0.51 to 6.87)	p = 0.349
Dangerous Play Penalties	n = 5	n = 1		
Charged in	n = 0 (0%)	n = 0 (0%)	0.62 (0.01 to 31.33)	p = 0.812
Contact above shoulder	n = 2 (0.6%)	n = 1 (0.2%)	0.31 (0.03 to 3.42)	p = 0.340
Intentional collapse	n = 3 (0.9%)	n = 0 (0%)	0.09 (0.00 to 1.72)	p = 0.109

* Indicate significant difference p<0.050, **p<0.010, *** p<0.001.