

Title: Video analysis of tackles in professional rugby league matches by player position, tackle height and tackle location.

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Authors: Doug King,^{1,2} Patria A. Hume,² Trevor Clark,³

1. Emergency Department
Hutt Valley District Health Board
Lower Hutt, New Zealand
2. Sports Performance Research Institute New Zealand
School of Sport and Recreation
Faculty of Health and Environmental Science
AUT University, New Zealand
3. Institute of Food, Nutrition and Human Health
College of Science
Massey University Wellington
Wellington, New Zealand

Correspondence to:

Doug King
Emergency Department
Hutt Valley District Health Board
Private Bag 31-907
Lower Hutt
New Zealand
Tel: +64 4 569 7835
Email: douglas.king@huttvalleydhb.org.nz

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Abstract

This paper describes the nature, height, site and direction of tackles seen in professional rugby league. Retrospective observational analysis was conducted using videos of 80 rugby league matches from 2008. There were 50,019 tackles recorded representing 701 ± 64 tackles per match. Nearly 50% of tackles involved tacklers from behind the visual fields of the ball carrier, most tackles involved either two or three tacklers and most tackles involved contact with the mid-torso and hip-thigh region of the ball carrier. Significantly more players were involved in the tackle in the first, than the second half of matches. Significantly more tackles were recorded in the defence than the attack side of the field. Forwards were more commonly involved in the tackle than backs. Forwards were significantly more involved in tackle events than backs but when viewed in player groups, adjustables were involved in significantly more tackle events than outside backs and hit-up forwards. Coaches should focus on getting players to practice correct tackle technique during tackling with two or more players involved in the tackle and especially, when making a tackle in the ball carriers blind vision area.

Introduction

Originating in the north of England in the 1890's, rugby league is a full contact sport participated worldwide (Brewer and Davis, 1995, Meir et al., 2001b). The game is played over two halves of 30 to 40 minutes duration depending on whether the level is junior (Gabbett, 2008a), amateur (King and Gabbett, 2008), sub-elite (Estell et al., 1995), or elite (Gissane et al., 1997). Players compete in a challenging contest that typically involves bouts of high-intensity activities (e.g. sprinting, running, passing, and tackling) separated by short bouts of low-intensity activities (standing, walking, jogging) (Gabbett, 2004). The physiological demands of the game are complex and require players to have highly developed speed, agility, muscular strength and power, and maximal aerobic capacity (Gabbett et al., 2008).

Success in rugby league is dependent on the capacity of participants to tolerate physical collisions, and the ability to dominate in the tackle contest (Gabbett, 2008b). This is important for both attack and defence. The tackler must ensure that the ball carrier is slowed down in the 'play-the-ball', and conversely the ball-carrier tries to speed up the attacking phase to keep the defensive line moving backwards advancing the ball down the field towards the try line (Gabbett and Kelly, 2007). Research on tackles in rugby league have shown there is an association between several factors: (1) Anthropometric (stature, body mass, skinfold thickness, somatotype) and physiological (fast acceleration and change of speed) factors are associated with tackling ability with higher attributes associated with better tackling efficiency (Gabbett, 2009); (2) Fast defensive line speed reduces tackling proficiency (Gabbett and Kelly, 2007); and (3) There is a direct relationship between the physiological capacities of players and fatigue-induced decrements in tackling technique (Gabbett, 2008b). The tackle is the most common cause of injury in rugby league at all levels of participation (Gabbett, 2004).

Although there is an increasing body of information reporting these aspects of the tackle, no study has reviewed the characteristics of the tackle in rugby league in the match situation. In addition no studies have reported where the tackles most commonly occur, what side of the body and at what body height these occur. Basic tackle related information is available from various rugby league websites (e.g. www.nrlstats.com) for the number of tackles (including missed tackles) per half, per match and per player but

this information does not give specifics such as tackle height, direction, field location and number of tacklers involved in the tackle. This information would be beneficial to assist in development of tackle technique training programs and assist in future injury prevention programs.

Game sports analysis is an approach that has been used in rugby union to measure changes in matches over a 32 year period (Quarrie and Hopkins, 2007) and to report on tackle characteristics and inciting events associated with an injury in rugby union (Quarrie and Hopkins, 2008). More recently microtechnology (e.g. accelerometers, gyroscopes) analysis has been used to document the large number and intensity of physical collisions during the course of professional rugby league training sessions (Gabbett et al., 2010). No study has reported the characteristics of tackles in match situations and in particular what occurs during tackles that result in injury.

Aim

The aim of this study was to identify and describe the nature, height, site, field location and direction of tackles seen in professional rugby league matches via video analysis.

Methods

Ethical consent

Ethical consent for the research was obtained from the AUT University Human Ethics Committee.

Procedure

Retrospective observational analysis was conducted using videos of televised rugby league matches. A total of 80 rugby league matches played throughout the 2008 year (20 International Rugby League matches from the 2008 Rugby League World Cup, 30 randomly selected National Rugby League competition matches and 30 randomly selected National Youth Competition matches) were analysed by a single analyser with 10 years of rugby league coach and trainer experience.

Video data and definitions of tackles and related characteristics

Video analyses of televised coverage of matches allowed documentation of the nature of rugby league tackles. One analyst used *Sports Performer*[®] (Premier Concepts Pty Ltd, Sydney, Australia; <http://www.sportsperformer.com.au>) to code tackles noting the match date, venue, player number, number of tackle in the set, number of tacklers involved in the tackle, field location where the tackle occurred and whether the player was a ball carrier being tackled or was the tackler tackling a ball carrier. Slow time motion replay was used to further review the individual tackles and *ImageJ* (<http://rsb.info.nih.gov/ij/>) were used to measure the degree of approach from the face on direction (see Figure 1) of the tackler to the ball carrier. The use of one analyst ensured consistency in the application of the definitions for coding. At the end of the coding two matches were selected at random and were re-coded by an independent coder to assess the influence of coder reliability. Kappa (κ) coefficients (number of tackles = 1240 in each case) calculated for tackle height ($\kappa=0.81$; 95% CI: 0.76 to 0.85), direction ($\kappa=0.77$; 0.72 to 0.81) and field position ($\kappa=0.98$; 0.97 to 1.0) showed the inter-coder reliability was good to excellent.

Insert Figure 1 near here

Definitions for tackles and related characteristics included:

- a. *Tackle*: A successful tackle occurs when the ball carrier is held by one or more of the opposing players and either the ball or hand of the arm holding the ball makes contact with the ground or the ball carrier cannot make any further progress. Section 11 of the International Laws of Rugby League (http://admin.nrl.sportal.net.au/site/_content/document/00000682-source.pdf) was used to define a tackle in regards to how the ball carrier was held by the tackler(s) to complete the tackle.
- b. *Missed tackle*: Any unsuccessful attempt to complete a tackle where the tackler/defender has made contact with the ball carrier and they have broken from the tackle before it is completed.
- c. *Tackle number*: The team in possession of the ball is allowed five successive plays of the ball. The ball is handed over to the opposition after the fifth play of the ball or when the team in possession: (1) Is tackled a sixth time, commits an

- accidental breach (i.e. knock on, forward pass and possession changes team resulting in a 'zero tackle'); (2) Has a player held-up and unable to ground the ball in the opponents' in-goal; or (3) Kicks the ball directly into touch on the full.
- d. *Tackle height*: (Quarrie and Hopkins, 2008) Classified according to five different regions of the body: (1) Lower legs – from the player's knees to their toes; (2) Hip and thigh – from above the player's knees to the player's hip level; (3) Mid-torso – from above the player's hip level to the level of the player's arm pit; (4) Shoulder – from the player's arm pit to the level of the shoulder including the arm; and (5) Head and neck – above the shoulder with any connection with the head and/or neck during the course of the tackle. When the injured player was the ball carrier, all tacklers involved in the tackle were recorded for tackle height. When the injured player was the tackler, only the injured player was recorded for tackle height.
- e. *Tackle direction or orientation*: (Garraway et al., 1999) Classified as: (1) Tackler being head-on to the ball carrier (0°); (2) Tackler being in the ball carrier's side vision (left side: 330° to 359°; right side 001° to 030°); (3) Tackler being in the ball carrier's peripheral vision (left side: 300° to 329°; right side: 031° to 060°) or in the ball carrier's blind vision (between 061° to 299°) when the tackle occurred. All tacklers involved in the tackle were recorded for tackle direction or orientation relative to the ball carrier's view.
- f. *Field position*: Classified as either defence (the side in which the team must defend their own in-goal area in order to stop the opposition team scoring a try), or attack (the side in which the team must enter to score a try in the opposition in-goal area) halves of the field. A regulation field length is 100 metres with a maximum in-goal size of eight metres in depth. The field is divided into 10 metre sections marked from 0 (goal-line) to 50 (half-way) for both halves of the field.

Player position

Players were recorded by the position they were playing in when they were tackled. For further analysis player positional groups were also recorded:(Gabbett, 2007)

- *Adjustables*: Players in the hooker, halfback, five-eighth or stand-off and loose forward positions. The main role of players in the adjustables groups is to direct the ball in attack, co-ordinating the defensive effort in the forwards and be the team's main play-makers.
- *Hit-up forwards*: Players in the second row (n=2) and prop (n=2) positions. The main role of players in the hit-up forwards groups is to run directly into the opposition's territory to break the defensive line, tackle the opposition and offload the ball to a supporting player to switch the point of attack or create a gap to run through.
- *Outside backs*: Players in the fullback, centre (n=2) and wing (n=2) positions. The main role of players in the outside backs groups is to chase down and tackle any player who breaks the first line of defence, to breach the defensive line on their respective sides on attack and as a support player to take an offload and keep the ball alive, or to provide an overlap or a different angle of attack in the centre of the field.

Statistical analyses

Data were analysed with SPSS v.16.0 (SPSS Inc, Chicago, Illinois, USA) statistical software. Data were reported as means with 95% confidence intervals (CI) where appropriate (Twellaar et al., 1996, Hopkins et al., 2009). The Kurskal Wallis H test was used to compare the different levels of competition and the number of tackles recorded in the first and second halves of matches. The Friedman test was used to compare the tackle for tackle direction and the Wilcoxon test was used to compare the number of tackles recorded in the defence and attacking halves of the match fields. A one-sample chi-squared (χ^2) tests were used to determine whether the observed tackle frequency was significantly different from the expected tackle frequency. Significant p values reported in the text are less than 0.001 if they are not specifically stated.

Results

In the 80 matches analysed there were 50,019 tackles recorded representing 701 \pm 64 (mean \pm SD) tackles (625 \pm 60 completed; 76 \pm 16 missed tackles) per match (see Table

1). Players recorded a mean of 32 ± 15 tackles per match as the tackler and were tackled 21 ± 4 times per match as the ball carrier.

Insert Table 1 near here

Number of tacklers, tackle height, direction and degree of tackle position for tackles

For all levels of competition combined there were more tackles involving two tacklers than one ($H=3$, $df=1$, $p=0.083$), three ($H=1.33$, $df=1$, $p=0.248$), or more than three ($H=5.33$, $df=1$, $p=0.021$) tacklers (see Table 2). This was similar for the International Rugby League, National Rugby League and National Youth Competition levels.

Insert Table 2 near here

More tackles involved contact with the hip and thigh region than the lower limb ($\chi^2=9573$, $df=1$), mid-torso ($\chi^2=52$, $df=1$), shoulder ($\chi^2=12578$, $df=1$) and head and neck ($\chi^2=23225$, $df=1$) regions and these were significant (see Table 2). This was similar for International Rugby League and National Youth Competition levels of participation but not National Rugby League level of participation. There were more tackles involving the mid-torso region than the lower limb ($\chi^2=4157$, $df=1$), shoulder ($\chi^2=4644$, $df=1$) and head and neck ($\chi^2=10580$, $df=1$) regions. Although only 5% of total tackles involved the head and neck region, the percentage of tackles involving the head and neck at the International Rugby League level of competition (8%) was greater than National Rugby League (3%) and National Youth Competition (4%) levels of participation, but the differences were not significant.

More total tackles involved being tackled from the 060° - 300° direction from the tackler than the 300° - 330° ($\chi^2=4.0$, $df=1$, $p=0.045$), 330° - 360° ($\chi^2=8$, $df=1$, $p=0.018$), 000° - 030° ($\chi^2=2.3$, $df=1$, $p=0.178$), and 030° - 060° ($\chi^2=4.8$, $df=1$, $p=0.056$) directions (see Table 2). This was similar for International Rugby League, National Rugby League and National Youth Competition levels of participation. There was a higher percentage of tackles involving contact from the 300° - 330° degrees of the ball carrier at the

International Rugby League (19%) and National Rugby League (19%) levels of participation than the National Youth Competition (16%) and total (18%) tackles recorded, but these differences were not significant.

Match half, tackle number and field position of tackles

There were significantly more total tackles in the first, than the second half of matches ($H=6.83$, $df=1$, $p=0.009$) (see Table 3). There were significantly more tackles recorded at the National Rugby League level of participation for the first (National Youth Competition: $H=4.03$, $df=1$, $p=0.045$) and second (National Youth Competition: $H=10.12$, $df=1$, $p=0.002$) halves of matches but not significantly more when compared with the International Rugby League matches (first half: $H=0.083$, $df=1$, $p=0.773$; second half: $H=2.65$, $df=1$, $p=0.104$).

Insert Table 3 near here

The percentage of completed sets of tackles (tackles 1 to 5) for total matches was 37% (95% CI: 36% to 37%). This was similar for the National Rugby League (37%, 37% to 38%) and National Youth Competition (35, 34% to 35%) but less than International Rugby League competitions (39, 39% to 40%) (see Table 3). The National Youth Competition recorded significantly more missed tackles (15%) than International Rugby League (13%; $\chi^2=276$, $df=1$) and National Rugby League (9%; $\chi^2=209$, $df=1$) levels of participation.

There were more tackles in the defence than the attack side of the field for total matches ($z=8.0$, $p=0.688$), International Rugby League ($z=7.0$, $p=0.563$), National Rugby League ($z=5.0$, $p=0.313$) and National Youth Competition ($z=6.0$, $p=0.438$) levels of participation (see Table 3). The most common field area for total tackles to occur was the defence 30-40 m zone recording 14% of total tackles. This was similar for the National Rugby League level of participation recording 16% of tackles in the 30-40 m defence zone while International Rugby League recorded 14% of tackles in the defence 30-40 m and 20-30 m zones and National Youth Competition recorded 13% of tackles in the defence 20-30 m zone.

Player position and player group as tackler

The hooker (no. 9) recorded more involvement in the tackle as the tackler (147; 95% CI 144 to 151 per 1,000 tackles, 15%) for total tackles recorded (see Table 4) than any other player position. This was similar for International Rugby League (133; 127 to 139 per 1,000 tackles, 13%), National Rugby League (153; 148 to 158 per 1,000 tackles, 15%) and National Youth Competition (152; 146 to 157 per 1,000 tackles, 15%) levels of participation.

Insert Table 4 near here

Forwards were significantly more involved in the tackle than backs for total ($\chi^2=4050$, $df=1$), International Rugby League ($\chi^2=864$, $df=1$), National Rugby League ($\chi^2=1997$, $df=1$) and National Youth Competition ($\chi^2=1246$, $df=1$) levels of participation. Adjustables were significantly more involved in total tackles as the tackler than outside backs ($\chi^2=5630$, $df=1$) and hit-up forwards ($\chi^2=3280$, $df=1$) (see Table 4). This was similar for International Rugby League, National Rugby League and National Youth Competition levels of competition.

Player position and player group as ball carrier

The Fullback (No. 1) recorded more tackles as the ball carrier (53; 51 to 55 per 1,000 tackles, 10%) for total tackles (see Table 5) than any other player position. This was similar for International Rugby League (103; 96 to 111 per 1,000 tackles, 10%) and National Youth Competition (113; 106 to 120 per 1,000 tackles, 11%) levels of participation. The second row forward (No. 11) recorded the most tackles (117; 110 to 124 per 1,000 tackles, 12%) as the ball carrier than any other player position for the National Rugby League level of participation, but these differences were not significant.

Insert Table 5 near here

Backs were tackled significantly more than forwards for total ($\chi^2=166$, $df=1$), International Rugby League ($\chi^2=54$, $df=1$), National Rugby League ($\chi^2=30$, $df=1$) and

National Youth Competition ($\chi^2=91$, $df=1$) levels of participation. When comparing positional groups for tackled as the ball carrier the outside backs were tackled significantly more than adjustables ($\chi^2=2011$, $df=1$) and hit-up forwards ($\chi^2=269$, $df=1$). This was similar for International Rugby League, National Rugby League and National Youth Competition levels of competition.

Discussion

This study undertook to describe the nature, height, site, field location and direction of tackles seen in professional rugby league matches. As shown by this study the tackle in rugby league most commonly involved two tacklers with contact to the hip and thigh region from behind the ball carrier. There were more tackles in the first than the second half of matches and in the defensive 30-40 m zone than other parts of the rugby league field. Forwards were more commonly involved in the tackle than backs as the tackler with the hooker recording the most tackles. Backs were more commonly involved in the tackle as the ball carrier than forwards with the fullback more commonly tackled as the ball carrier than other playing positions.

Seen as arguably the most important skill in rugby league, the tackle is necessary for playing success and is dependent on players tackling ability, their capacity to tolerate the associated physical collisions and the ability to 'win' the tackle contest (Gabbett, 2009). Greater playing experience is associated with a better tackling technique; players with over 150 matches recorded superior tackling technique than players with less than 150 matches in the National Rugby League (Gabbett and Ryan, 2009). Additionally, players with a greater tackling technique were involved in more tackle events per match than players with poorer tackling technique (Gabbett and Ryan, 2009). No studies to date have reported on the tackle at the amateur, junior and semi-professional/sub-elite level of participation. These studies would assist in further understanding the tackle in rugby league and whether playing experience, tackle training and the anthropometric and physiological characteristics have the reported effects found at professional levels of participation.

Although more tackles were recorded in the second than the first half of matches during International Rugby League and National Rugby League levels of participation, this

differed with the National Youth Competition level of participation. This finding may be reflective of the participation level but there are no published studies on the characteristics of the tackle at the different levels of participation to enable further comparisons to be undertaken. Further studies comparing the tackle at the different levels of participation are warranted.

A possible explanation for the difference in the number of tackles by match halves may be the effects of fatigue on the National Youth Competition players. Players at this level of participation are under the age of 20 and their physiological capacities may not be fully developed. In a study (Gabbett, 2002) comparing junior and senior level rugby league participants there was a progressive improvement in the physiological capacities of rugby league participants as the playing level increased. This progressive improvement may be reflected in the differences reported in our study between the number of tackles recorded in the first and second half of matches between National Youth Competition and National Rugby League and International Rugby League levels of participation. More studies are warranted on the effects of level of participation on the characteristics of tackles.

Although our study reported a higher proportion of tackle involvement by players than previously reported (Gabbett and Ryan, 2009), the differences may be in the methodology utilised in this study. Gabbett & Ryan (2009) reported an average of 24 (range 7 to 39) tackle events per player per match compared to our study that reports an average of 54 (range 35 to 73) tackle events per player per match. Gabbett and Ryan's (2009) review used only one of the teams tackle events per match while our study reported both teams tackle events. When the numbers of players are taken into account the average tackle events per player (27; range 17 to 36) was similar to the previous study (Gabbett and Ryan, 2009).

Forwards were more commonly involved in tackle events than backs but when viewed in player groups, adjustables were involved in more tackle events than outside backs and hit-up forwards. When viewed by participation level, hit-up forwards recorded more involvement in tackle events at International Rugby League and National Rugby League levels of participation which was similar to the findings of a previous study (Gabbett

and Ryan, 2009). Hit-up forwards are predominantly in the middle of the defensive line and middle of the field (Gabbett and Ryan, 2009). The field space in which this group work is limited and they often perform tackles with the assistance of multiple defenders. (Gabbett and Ryan, 2009). Additionally, as previously reported, players with the higher playing experience and greater tackling technique are involved in tackle events more often (Gabbett and Ryan, 2009). No studies have been undertaken at other levels of rugby league participation to enable further analysis to be completed. As a result of this further studies are warranted to explore the tackle by player positions and positional groups at junior, amateur, semi-professional/sub-elite levels of participation are warranted.

The hooker (no. 9) was the most frequently player involved in the tackle as the tackler. Time-motion studies have reported that the hooker covering a greater total distance during matches than any other player position (Meir et al., 2001a). The hooker plays an important role in ball distribution to support players, supports the ball carrier in the attacking phase and defends in the middle of the ruck. The high involvement of the hooker in the defensive phases of match play often results in them being more directly in a position to tackle than any other player position (Meir et al., 2001a).

The fullback (no. 1) was the most commonly tackled player as the ball carrier over the duration of the study. Backs were more commonly tackled as the ball carrier and this was reflected in the positional groups with outside backs being tackled more than adjustables and hit-up forwards. Outside backs are typically required to perform more attacking plays in matches than defending. Interestingly more tackles occurred in the defensive than the attacking ends of the playing field with the 30-40 m zone the most common area to be tackled in. This may be reflective of the nature of rugby league as teams endeavour to defend this part of the field as the opposition tries to attack towards scoring a try.

Conclusion

The nature of tackles for professional rugby league players varied for ball carrier and tackler as well as by player position. Tackles occurred more in the defence 30-40 m zone, with contact to the mid-torso region, in the ball carriers blind vision and with two

or more tacklers in the first half of matches. Coaches should focus on getting players to practice correct technique during tackling with two or more tacklers and when tackling in the ball carriers blind vision area.

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Table 1: Observed and estimated tackles, exposure hours, completed missed tackles with 95% confidence intervals for level of competition (total, International Rugby League, National Rugby League and national youth).

	Total	International Rugby League	National rugby league	National youth competition
Tackles observed	50019	12412	19523	18084
Tackles expected	50019	12504.8	18757.1	18757.1
Number of games played	80	20	30	30
Exposure hours	2766.4	691.6	1037.4	1037.4
Completed tackles per game (95% CI)	625.2 (619.8 to 630.7)	620.6 (609.8 to 631.6)	650.8 (641.5 to 660.1)	602.8 (594.1 to 611.7)
Missed tackles per game (95% CI)	75.7 (75.0 to 76.3)	77.0 (75.7 to 78.4)	70.3 (69.3 to 71.3)	80.1 (78.9 to 81.3)

Table 2: Number of tackles (complete and missed) by number of tacklers, tackle height, tackle direction and degree of tackle, and rates per 1,000 tackles with 95% confidence interval and percentage of tackles recorded for level of competition (total, International Rugby League, National Rugby League and national youth).

	<u>Total tackles</u>		<u>International Rugby League</u>		<u>National rugby league</u>		<u>National youth competition</u>	
	No.	Rate (95% CI)	No.	Rate (95% CI)	No.	Rate (95% CI)	No.	Rate (95% CI)
Total	50019	1000.0 (991.3 to 1008.8)	12412 ^{bc}	1000.0 (982.6 to 1017.7)	19523 ^{ac}	1000.0 (986.1 to 1014.1)	18084 ^{ab}	1000.0 (985.5 to 1014.7)
Number of tacklers								
1 Tackler	8877	177.5 (173.8 to 181.2)	2271	183.0 (175.6 to 190.7)	3304	169.2 (163.6 to 175.1)	3302	182.6 (176.5 to 188.9)
2 Tacklers	22884	457.5 (451.6 to 463.5)	5556 ^b	447.6 (436.0 to 459.6)	8958 ^{ac}	458.8 (449.4 to 468.4)	8370 ^b	462.8 (453.0 to 472.9)
3 Tacklers	16372	327.3 (322.3 to 332.4)	4064 ^{bc}	327.4 (317.5 to 337.6)	6753 ^{ac}	345.9 (337.7 to 354.2)	5555 ^{ab}	307.2 (299.2 to 315.4)
4 or more	1886	37.7 (36.0 to 39.4)	521 ^b	42.0 (38.5 to 45.7)	508 ^{ac}	26.0 (23.9 to 28.4)	857 ^b	47.4 (44.3 to 50.7)
Tackle height								
Head/Neck	4499	46.9 (45.5 to 48.3)	1811 ^{bc}	77.2 (73.7 to 80.9)	1213 ^{ac}	31.8 (30.1 to 33.6)	1475 ^{ab}	43.0 (40.8 to 45.2)
Shoulder	10755	112.1 (110.0 to 114.2)	2169 ^{bc}	92.5 (88.7 to 96.5)	4582 ^{ac}	120.1 (116.7 to 123.7)	4004 ^{ab}	116.6 (113.0 to 120.3)
Mid torso	32788	341.8 (338.1 to 345.5)	6818 ^{bc}	290.7 (283.9 to 297.7)	13828 ^{ac}	362.5 (356.5 to 368.6)	12142 ^{ab}	353.6 (347.4 to 359.9)
Hip / Thigh	34654	361.2 (357.4 to 365.0)	8627 ^{bc}	367.8 (360.1 to 375.7)	13536 ^{ac}	354.9 (348.9 to 360.9)	12491 ^{ab}	363.8 (357.4 to 370.2)
Lower Legs	13241	138.0 (135.7 to 140.4)	4029 ^{bc}	171.8 (166.6 to 177.2)	4985 ^{ac}	130.7 (127.1 to 134.4)	4227 ^{ab}	123.1 (119.4 to 126.9)
Degree of tackler position								
300°-330°	16199	176.7 (174.0 to 179.4)	4484 ^c	190.0 (184.6 to 195.7)	6654 ^c	185.0 (180.6 to 189.5)	5061 ^{ab}	157.5 (153.3 to 161.9)
330°-360°	8549	93.2 (91.3 to 95.2)	3219 ^{bc}	136.4 (131.8 to 141.2)	2788 ^{ac}	77.5 (74.7 to 80.5)	2542 ^{ab}	79.1 (76.1 to 82.3)
000°-030°	9970	108.7 (106.6 to 110.9)	2718 ^{bc}	115.2 (110.9 to 119.6)	3792 ^{ac}	105.5 (102.1 to 108.9)	3460 ^{ab}	107.7 (104.2 to 111.4)
030°-060°	16890	184.2 (181.5 to 187.0)	3766 ^{bc}	159.6 (154.6 to 164.8)	6581 ^a	183.0 (178.6 to 187.5)	6543 ^a	203.7 (198.8 to 208.7)
060°-300°	40071	437.1 (432.8 to 441.4)	9407 ^{bc}	398.7 (390.7 to 406.8)	16145 ^{ac}	449.0 (442.1 to 456.0)	14519 ^{ab}	452.0 (444.7 to 459.4)

CI: Confidence Interval. Significant difference ($p \leq 0.05$) than: (a) = International Rugby League; (b) = National rugby league; (c) = National youth competition.

Table 3: Number of tackles (complete and missed) by match half, tackle number and field position and rates per 1,000 tackles with 95% confidence interval and percentage of tackles recorded for level of competition (total, International Rugby League, National Rugby League and national youth).

Match half	No.	Total tackles		International Rugby League		National Rugby League		National Youth Competition	
		Rate (95% CI)	No.	Rate (95% CI)	No.	Rate (95% CI)	No.	Rate (95% CI)	
First half	25334	506.5 (500.3 to 512.8)	6194 ^b	499.0 (486.8 to 511.6)	9748 ^{ac}	499.3 (489.5 to 509.3)	9158 ^b	506.4 (496.1 to 516.9)	
Second half	24685 ^d	493.5 (487.4 to 499.7)	6218 ^{bc}	501.0 (488.7 to 513.6)	9775 ^{ac}	500.7 (490.9 to 510.7)	8926 ^{ab}	493.6 (483.5 to 503.9)	
Tackle number									
Tackle 0	883	17.7 (16.5 to 18.9)	172 ^c	13.9 (11.9 to 16.1)	307 ^c	15.7 (14.1 to 17.6)	404 ^{ab}	22.3 (20.3 to 24.6)	
Tackle 1	12166	243.2 (238.9 to 247.6)	2895 ^c	233.2 (224.9 to 241.9)	4835 ^{ac}	247.7 (240.8 to 254.7)	4436 ^b	245.3 (238.2 to 252.6)	
Tackle 2	10382	207.6 (203.6 to 211.6)	2532 ^{bc}	204.0 (196.2 to 212.1)	4316 ^{ac}	221.1 (214.6 to 227.8)	3534 ^{ab}	195.4 (189.1 to 202.0)	
Tackle 3	8832	176.6 (172.9 to 180.3)	2183 ^{bc}	175.9 (168.7 to 183.4)	3667 ^{ac}	187.8 (181.8 to 194.0)	2982 ^{ab}	164.9 (159.1 to 170.9)	
Tackle 4	6874	137.4 (134.2 to 140.7)	1769 ^c	142.5 (136.0 to 149.3)	2731 ^c	139.9 (134.7 to 145.2)	2374 ^{ab}	131.3 (126.1 to 136.7)	
Tackle 5	4460	89.2 (86.6 to 91.8)	1135 ^c	91.4 (86.3 to 96.9)	1789 ^c	91.6 (87.5 to 96.0)	1536 ^{ab}	84.9 (80.8 to 89.3)	
Tackle 6	217	4.3 (3.8 to 5.0)	69 ^c	5.6 (4.4 to 7.0)	91 ^c	4.7 (3.8 to 5.7)	57 ^{ab}	3.2 (2.4 to 4.1)	
Incomplete	6205	124.1 (121.0 to 127.2)	1657 ^{bc}	133.5 (127.2 to 140.1)	1787 ^{ac}	91.5 (87.4 to 95.9)	2761 ^{ab}	152.7 (147.1 to 158.5)	
Field position									
Defence	In Goal	396	7.9 (7.2 to 8.7)	62 ^{bc}	5.0 (3.9 to 6.4)	128 ^{ac}	6.6 (5.5 to 7.8)	206 ^{ab}	11.4 (9.9 to 13.1)
	0-10	1620	32.4 (30.8 to 34.0)	454 ^c	36.6 (33.4 to 40.1)	638 ^c	32.7 (30.2 to 35.3)	528 ^{ab}	29.2 (26.8 to 31.8)
	Oct-20	5401	108.0 (105.1 to 110.9)	1205 ^b	97.1 (91.8 to 102.7)	2428 ^{ac}	124.4 (119.5 to 129.4)	1768 ^b	97.8 (93.3 to 102.4)
	20-30	6513	130.2 (127.1 to 133.4)	1673	134.8 (128.5 to 141.4)	2440	125.0 (120.1 to 130.0)	2400	132.7 (127.5 to 138.1)
	30-40	7084	141.6 (138.4 to 145.0)	1680 ^{bc}	135.4 (129.0 to 142.0)	3043 ^{ac}	155.9 (150.4 to 161.5)	2361 ^{ab}	130.6 (125.4 to 135.9)
	40-50	6156	123.1 (120.0 to 126.2)	1477 ^b	119.0 (113.1 to 125.2)	2392 ^a	122.5 (117.7 to 127.5)	2287	126.5 (121.4 to 131.8)
Attack	50-40	4720	94.4 (91.7 to 97.1)	1146 ^c	92.3 (87.1 to 97.8)	1607 ^c	82.3 (78.4 to 86.4)	1967 ^{ab}	108.8 (104.1 to 113.7)
	40-30	3989	79.7 (77.3 to 82.3)	1014	81.7 (76.8 to 86.9)	1437	73.6 (69.9 to 77.5)	1538	85.0 (80.9 to 89.4)
	30-20	3956	79.1 (76.7 to 81.6)	946 ^b	76.2 (71.5 to 81.2)	1565 ^{ac}	80.2 (76.3 to 84.2)	1445 ^b	79.9 (75.9 to 84.1)
	20-Oct	3754	75.1 (72.7 to 77.5)	1007 ^b	81.1 (76.3 to 86.3)	1529 ^c	78.3 (74.5 to 82.3)	1218 ^{ab}	67.4 (63.7 to 71.2)
	10-0	5966	119.3 (116.3 to 122.3)	1590 ^{bc}	128.1 (122.0 to 134.6)	2189 ^a	112.1 (107.5 to 116.9)	2187 ^a	120.9 (116.0 to 126.1)
	In Goal	464	9.3 (8.5 to 10.2)	158 ^{bc}	12.7 (10.9 to 14.9)	127 ^{ac}	6.5 (5.5 to 7.7)	179 ^{ab}	9.9 (8.5 to 11.5)

CI: Confidence Interval. Significant difference ($p \leq 0.05$) than **(a)** = International Rugby League; **(b)** = National rugby league; **(c)** = National youth competition; **(d)** = first half.

Table 4: Number of tackles (complete and missed) as the tackler by player position, positional group and rates per 1,000 tackles with 95% confidence interval and percentage of tackles recorded for level of competition (total, International Rugby League, National Rugby League and national youth).

Player Position	No.	Total tackles		International Rugby League		National rugby league		National youth competition	
		Rate (95% CI)	No.	Rate (95% CI)	No.	Rate (95% CI)	No.	Rate (95% CI)	
1. Fullback	1607	29.1 (27.7 to 30.5)	555 ^b	38.8 (35.7 to 42.2)	287 ^{ac}	14.1 (12.5 to 15.8)	765 ^b	37.2 (34.7 to 39.9)	
2. Wing	1292	23.4 (22.1 to 24.7)	472 ^{bc}	33.0 (30.2 to 36.2)	460 ^{ac}	22.5 (20.6 to 24.7)	360 ^{ab}	17.5 (15.8 to 19.4)	
3. Centre	2679	48.5 (46.7 to 50.4)	564 ^{bc}	39.5 (36.3 to 42.9)	1095 ^a	53.7 (50.6 to 56.9)	1020 ^a	49.6 (46.6 to 52.7)	
4. Centre	3895	70.5 (68.3 to 72.7)	1099 ^b	76.9 (72.5 to 81.6)	1241 ^{ac}	60.8 (57.5 to 64.3)	1555 ^b	75.6 (71.9 to 79.5)	
5. Wing	927	16.8 (15.7 to 17.9)	291 ^c	20.4 (18.2 to 22.8)	396 ^c	19.4 (17.6 to 21.4)	240 ^{ab}	11.7 (10.3 to 13.2)	
6. Stand Off	5891	106.6 (103.9 to 109.4)	1127 ^{bc}	78.9 (74.4 to 83.6)	2347 ^a	115.0 (110.5 to 119.8)	2417 ^a	117.5 (112.9 to 122.3)	
7. Half back	3858	69.8 (67.7 to 72.1)	1279 ^{bc}	89.5 (84.7 to 94.6)	1184 ^{ac}	58.0 (54.8 to 61.4)	1395 ^{ab}	67.8 (64.4 to 71.5)	
8. Prop	4824	87.3 (84.9 to 89.8)	1380 ^{bc}	96.6 (91.6 to 101.8)	1659 ^{ac}	81.3 (77.5 to 85.3)	1785 ^{ab}	86.8 (82.9 to 90.9)	
9. Hooker	8138	147.3 (144.1 to 150.5)	1904 ^{bc}	133.3 (127.4 to 139.4)	3119 ^a	152.9 (147.6 to 158.3)	3115 ^a	151.5 (146.2 to 156.9)	
10. Prop	4986	90.2 (87.8 to 92.8)	1514 ^{bc}	106.0 (100.8 to 111.4)	1567 ^{ac}	76.8 (73.1 to 80.7)	1905 ^{ab}	92.6 (88.6 to 96.9)	
11. Second row	3997	72.3 (70.1 to 74.6)	1134 ^c	79.4 (74.9 to 84.1)	1663 ^c	81.5 (77.7 to 85.5)	1200 ^{ab}	58.4 (55.1 to 61.7)	
12. Second row	6654	120.4 (117.6 to 123.3)	1495 ^b	104.6 (99.5 to 110.1)	2833 ^{ac}	138.8 (133.8 to 144.1)	2326 ^b	113.1 (108.6 to 117.8)	
13. Loose Forward	6509	117.8 (115.0 to 120.7)	1474 ^{bc}	103.2 (98.0 to 108.6)	2553 ^a	125.1 (120.4 to 130.1)	2482 ^a	120.7 (116.0 to 125.5)	
Forwards	35108	635.4 (628.7 to 642.0)	8901 ^{cd}	623.0 (610.2 to 636.0)	13394 ^{cd}	656.4 (645.4 to 667.7)	12813 ^{bd}	623.0 (612.4 to 633.9)	
Backs	20149	364.6 (359.6 to 369.7)	5387 ^{bc}	377.0 (367.1 to 387.2)	7010 ^{ac}	343.6 (335.6 to 351.7)	7752 ^{ab}	377.0 (368.7 to 385.4)	
Outside Backs	10400 ^{dg}	188.2 (184.6 to 191.9)	2981 ^{bcdg}	208.6 (201.3 to 216.3)	3479 ^{acd}	170.5 (164.9 to 176.3)	3940 ^{abdg}	191.6 (185.7 to 197.7)	
Adjustables	24396 ^{ed}	441.5 (436.0 to 447.1)	5784 ^{bced}	404.8 (394.5 to 415.4)	9203 ^{aed}	451.0 (441.9 to 460.3)	9409 ^{aed}	457.5 (448.4 to 466.9)	
Hit Up Forwards	20461 ^{ef}	370.3 (365.2 to 375.4)	5523 ^{bcef}	386.5 (376.5 to 396.9)	7722 ^{acef}	378.5 (370.1 to 387.0)	7216 ^{abef}	350.9 (342.9 to 359.1)	

CI: Confidence Interval. Significant difference ($p \leq 0.05$) than: **(a)** = International Rugby League; **(b)** = National rugby league; **(c)** = National youth competition; **(d)** = Backs; **(e)** = Outside Backs; **(f)** = Adjustables; **(g)** = Hit Up Forwards.

Table 5: Number of tackles (complete and missed) as the ball carrier by player position, positional group and rates per 1,000 tackles with 95% confidence interval and percentage of tackles recorded for level of competition (total, International Rugby League, National Rugby League and national youth).

Player Position	No.	Total tackles		International Rugby League		National rugby league		National youth competition	
		Rate (95% CI)	No.	Rate (95% CI)	No.	Rate (95% CI)	No.	Rate (95% CI)	
1. Fullback	2649	53.0 (51.0 to 55.0)	670	54.0 (50.0 to 58.2)	924 ^c	47.3 (44.4 to 50.5)	1055 ^b	112.5 (105.9 to 119.5)	
2. Wing	2180	43.6 (41.8 to 45.5)	583 ^c	47.0 (43.3 to 50.9)	827	42.4 (39.6 to 45.3)	770 ^a	82.1 (76.5 to 88.1)	
3. Centre	1996	39.9 (38.2 to 41.7)	486	39.2 (35.8 to 42.8)	740	37.9 (35.3 to 40.7)	770	82.1 (76.5 to 88.1)	
4. Centre	2049	41.0 (39.2 to 42.8)	568 ^c	45.8 (42.1 to 49.7)	801 ^c	41.0 (38.3 to 44.0)	680 ^{ab}	72.5 (67.3 to 78.2)	
5. Wing	2282	45.6 (43.8 to 47.5)	520 ^c	41.9 (38.4 to 45.7)	839 ^c	43.0 (40.2 to 46.0)	923 ^{ab}	98.5 (92.3 to 105.0)	
6. Stand Off	1350	27.0 (25.6 to 28.5)	378 ^c	30.5 (27.5 to 33.7)	545 ^c	27.9 (25.7 to 30.4)	427 ^{ab}	45.5 (41.4 to 50.1)	
7. Half back	1212	24.2 (22.9 to 25.6)	341 ^b	27.5 (24.7 to 30.5)	346 ^{ac}	17.7 (16.0 to 19.7)	525 ^b	56.0 (51.4 to 61.0)	
8. Prop	2365	47.3 (45.4 to 49.2)	574 ^c	46.2 (42.6 to 50.2)	806 ^c	41.3 (38.5 to 44.2)	985 ^{ab}	105.1 (98.7 to 111.8)	
9. Hooker	1220	24.4 (23.1 to 25.8)	276	22.2 (19.8 to 25.0)	479	24.5 (22.4 to 26.8)	465	49.6 (45.3 to 54.3)	
10. Prop	2108	42.1 (40.4 to 44.0)	576 ^b	46.4 (42.8 to 50.4)	727 ^{ac}	37.2 (34.6 to 40.0)	805 ^b	85.9 (80.1 to 92.0)	
11. Second row	2325	46.5 (44.6 to 48.4)	595 ^b	47.9 (44.2 to 51.9)	1110 ^{ac}	56.9 (53.6 to 60.3)	620 ^b	66.1 (61.1 to 71.5)	
12. Second row	2040	40.8 (39.1 to 42.6)	471 ^b	37.9 (34.7 to 41.5)	839 ^{ac}	43.0 (40.2 to 46.0)	730 ^b	77.9 (72.4 to 83.7)	
13. Loose Forward	1606	32.1 (30.6 to 33.7)	463 ^b	37.3 (34.1 to 40.9)	523 ^{ac}	26.8 (24.6 to 29.2)	620 ^b	66.1 (61.1 to 71.5)	
Forwards	11664 ^c	233.2 (229.0 to 237.5)	2955 ^{de}	238.1 (229.6 to 246.8)	4484 ^{cd}	229.7 (223.1 to 236.5)	4225 ^{abd}	450.7 (437.3 to 464.5)	
Backs	13718	274.3 (269.7 to 278.9)	35462	285.7 (276.4 to 295.3)	5022 ^a	257.2 (250.2 to 264.4)	5150	549.3 (534.5 to 564.5)	
Outside Backs	11156	439.5 (431.4 to 447.8)	2827 ^{fg}	434.9 (419.1 to 451.2)	4131 ^{fg}	434.6 (421.5 to 448.0)	4198 ^{fg}	447.8 (434.4 to 461.5)	
Adjustables	5388	212.3 (206.7 to 218.0)	1458 ^{bcef}	224.3 (213.1 to 236.1)	1893 ^{acg}	199.1 (190.4 to 208.3)	2037 ^{afg}	217.3 (208.0 to 226.9)	
Hit Up Forwards	8838	348.2 (341.0 to 355.5)	2216 ^{cef}	340.9 (327.0 to 355.4)	3482 ^{ceg}	366.3 (354.3 to 378.7)	3140 ^{abef}	334.9 (323.4 to 346.9)	

CI: Confidence Interval. Significant difference ($p \leq 0.05$) than: **(a)** = International Rugby League; **(b)** = National rugby league; **(c)** = National youth competition; **(d)** = Backs; **(e)** = Outside Backs; **(f)** = Adjustables; **(g)** = Hit Up Forwards

Figure 1: Tackle direction or orientation of tackler to ball carrier.

