Performance indicators that discriminate winning and losing in the knockout stages of the 2011 Rugby World Cup

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Abstract

The identification of performance indicators critical for success will allow the development of effective tactical approaches suited to the modern game. The aim of this study was to investigate the performance indicators that discriminate winning and losing teams in the knockout stages of the 2011 Rugby World Cup. Winning and losing teams from the eight knockout matches of the 2011 Rugby World Cup were compared based on several performance indicators previously associated with match success. A Wilcoxon test revealed statistical differences between only two performance indicators with winning teams conceding a higher percentage of their penalties between 50m and the opposition 22m than losing teams (P = 0.036) and winning teams kicking the ball out of hand more than losing teams (P = 0.040). Trends were noted in other indicators which supported the notion that winning teams adopted a more territory based strategy rather than a possession based approach to the game. Discipline in reducing the penalty count when defending in your own half was also found to be key in minimising potential scoring opportunities for the attacking team. At the 2011 Rugby World cup, a territory based approach appeared to be the most effective strategy for game success.

Key words: Notational analysis, Knockout rugby, Match success*.*

1. Introduction

Professionalism in rugby union has resulted in the need for improved scientific and analytic support aimed at maximising performance (Vaz *et al*., 2011). Research has traditionally focused on the physiological demands of the sport, as well as the physical characteristics of elite level performers (Cunniffe *et al*., 2009; Austin, *et al*., 2011). A further area of interest has been the analysis of patterns of play and how they have developed over time (Eaves and Hughes, 2003; Eaves *et al*., 2005). Much of this work has sought to identify performance indicators at the elite level of the game (Hughes and

Bartlett, 2002; James *et al.*, 2005). These indicators define different aspects of the game and allow coaches to recognise key elements that are critical for success (Csataljay *et al.*, 2009).

There has been a clear progression in several areas of Rugby Union from amateur rugby during the 1980's to the modern-day professional era (Eaves and Hughes, 2003; Eaves *et al.*, 2005; IRB, 2003, 2005, 2007). Amongst these have been significant changes due to the laws of the game and a clear development in the tactical approaches used by teams. For example, ball-in-play time has increased from an average of 21-23 minutes per game in the 1980's (IRB, 2005), to 35 minutes in the 2007 World Cup (IRB, 2007). The increased ball-in-play time has resulted in an increase in the number of game actions. The number of rucks per game has increased from an average of 69 per game in 1995 to 144 per game in 2007 (IRB, 2003, 2007), suggesting a more possession-based approach in the modern game (Eaves and Hughes, 2003). These differences are likely due to the introduction of laws that meant teams gain no territory from kicking the ball directly into touch from outside their 22m line. This is supported by Eaves *et al.* (2005) who reported a 22.5% decrease in the number of kicks out of hand from the amateur to professional era. A further development in the game has seen a decrease in the number of scrums from 31 per game in the 1980's to 19 per game in the 2000's, this suggests fewer handling errors in the modern game (IRB, 2005). Lineout frequency has also diminished from 52 per game in the 1980's to 31 per game at the 2007 World Cup (IRB, 2005, 2007). In addition to the development of the game in the professional era, law changes have also been introduced with the aim of influencing how teams play. The most recent of these has been the introduction of the Experimental Law Variations in 2008 (IRB, 2008). Of the thirteen laws introduced, three of them were designed to influence how teams play. These laws sought to encourage teams to play a faster game with ball-in-hand and promote counter-attacking rugby.

With the aim of informing tactical approaches to Rugby Union, much previous research has focused on identifying performance indicators that discriminate winning and losing (Ortega *et al.*, 2009; Van Rooyen *et al.*, 2010; Vaz *et al.*, 2010). Lago-Ballesteros and Lago-Peñas (2010) suggest that in order for identified performance indictors to be useful, they must be associated with success. Among those indicators previously related to winning include, lineout success (Ortega *et al.*, 2009; Vaz, *et al.*, 2010; Jones *et al.*, 2004a), turnovers conceded (Ortega *et al.*, 2009; Vaz et al., 2011) and number of kicks out of hand (Stanhope and Hughes, 1997; Ortega *et al.*, 2009; Vaz *et al.*, 2011). In addition, winning teams have been found to miss fewer tackles (Ortega *et al.*, 2009; Vaz *et al.*, 2011) and make more line breaks (Ortega *et al.*, 2009) than losing teams. Given the rapid development of the professional game and the introduction of laws aimed at influencing patterns of play, performance indicators that determine winning and losing may also have developed in recent years. Van Rooyen *et al.* (2010) suggested that in the 2011 Rugby World Cup, findings for ruck frequency would differ from the 2007 tournament due to these changes in modern game. It is not known whether the performance indicators that determine success at the 2011 Rugby World Cup differed from those previously documented. Knowledge of these indicators will allow coaches to develop tactical approaches to suit the modern game.

A further point for consideration is the format of the competition in which teams are competing. Studies to date have reported findings from a mixture of international and domestic competitions, some of which are league based and others that are knockout competitions (Stanhope and Hughes, 1997; Jones *et al*., 2004a; Ortega *et al*., 2009; Vaz *et al*., 2010, 2011; Van Rooyen, *et al*., 2010). It is likely that teams will adopt different styles of play depending on the level and format of the competition. The study from Van Rooyen *et al*. (2010) into ruck frequency is the only one to look at knockout matches in the World Cup as a separate entity to the pool stage matches. They found 100% of the knockout matches were won by teams with a lower ruck frequency, while a higher ruck frequency was associated with success during pool matches. This supports the notion that the format of the competition may have an influence on a team's tactical approach and which performance indicators are most important for success.

The aim of this study was to identify the performance indicators that discriminate winning and losing in the 2011 Rugby World Cup knockout matches. An understanding of these factors will help provide a basis for the development of tactical approaches to the modern game.

2. Method

2.1. Design and Sample
The study was an independent groups design using all knockout matches of the 2011 Rugby World Cup as a basis for comparing the eight winning teams with the eight losing teams in the competition. Performance indicators were compared between groups in an attempt to identify those factors which distinguish winning and losing teams.

2.2. Performance indicators
A coding template was designed using performance indicators identified following a review of previous Rugby Union literature (Stanhope and Hughes, 1997; Jones *et al.,* 2004a; Eaves *et al.,* 2005; Ortega, *et al.,* 2009; Van Rooyen, *et al.,* 2010; Vaz, *et al.,* 2010, 2011; Wheeler, *et al.,* 2010). Performance indicators included were; lineout success, turnovers conceded, kicks out of hand, passes, carries (divided into types of carry; pick and go, one out drive, other carry, support carry and kick return), ruck frequency, tackle completion, attempted tackles, initial breaks and penalties conceded. Clear operational definitions were assigned to each performance indicator to ensure a more reliable coding procedure.

2.3. Procedure
Knockout matches were individually uploaded into the Rugby Union DVD 11 (Opta Sports Data, Leeds, United Kingdom) analysis software. The primary analyst undertook all of the match analysis. Each match was observed using an analysis template which allowed for the coding of selected performance variables. These were recorded onto a timeline, which gave the time the occurrence took place as well as the pitch co-ordinates. This procedure was completed for both teams in all matches. Following coding, all data were exported to Microsoft Excel (Microsoft Corporation, Washington, USA) for further analysis.

2.4. System Reliability

Both intra-observer and inter-observer reliability were assessed using percentage error. Intra-observer reliability was assessed by the principle analyst re-analysing three random matches to ensure a sufficient degree of test-retest reliability. Re-analysis was completed two weeks after the original data were collected. Inter-observer reliability was assessed by re-analysis of all matches by a second analyst who possessed a similar level of experience and familiarity with the software. Percentage error was calculated between the original test (A), and re-test (B) scores for each performance indicator using equation (1) (Hughes *et al*., 2004). This method allowed for the calculation of absolute error between two values as a percentage of the combined mean.

$$\text{Total \% Error} = 100 * |A\text{-}B| / ((A+B) / 2) \tag{1}$$

For intra-observer reliability, percentage errors ranged from 0.00% (initial breaks, penalties conceded, turnovers conceded and lineout success %) to 4.92% (total passes). The percentage error for inter-observer reliability ranged from 0.00% (initial breaks, penalties conceded, turnovers conceded and lineout success %) to 2.98% (total carries). Errors observed for all variables were within the 5% error limit suggested to be acceptable by Van Rooyen *et al*. (2010).

2.5. Data Analysis

Several of the calculated performance indicators were found to be non-normally distributed and as result, non-parametric tests were favoured. A Wilcoxon signed rank test was used to identify statistical differences between winning and losing teams with statistical significance accepted at the 95% level. To allow comparison between groups, data is presented as descriptive statistics (medians (*mdn*), means and standard deviations (SD)). Effect sizes (ES) were determined using the formula: $r = \text{Z-score/sqrt(N)}$, where N is the number of observations. ES were interpreted in accordance with Cohen (1992) as follows: ≥0.1<0.3 (small ES), ≥0.3<0.5 (medium ES) and ≥0.5 (large ES). All data analysis was completed using Microsoft Excel 2011 (Microsoft Corporation, Washington, USA) and SPSS 20.0.0 (IBM Corporation, New York, USA).

3. Results

Table 1 presents a comparison of performance indicators between winning and losing teams. Variables are displayed as either frequency counts or percentages.

Only two of the analysed performance indicators were statistically different between winning and losing teams. Winning teams conceded a significantly higher percentage (*mdn* =35.50%) of their total penalties than losers in the area of the field between the 50m line and the opposition 22m (*mdn* = 19.50%) ($P = 0.036$, ES = 0.74). A trend was noted towards losing teams (*mdn* = 43.5%) conceding a higher percentage of their total penalties than winning teams (*mdn* =27.0%) in the area between their own 22m and the 50m line. However, these differences were not found to be significant ($P = 0.107$, ES = 0.57). Importantly, the total number of penalties conceded did not differ between winning and losing teams. The only other significant difference was found for total

kicks out of hand, with winning teams (*mdn* = 28.50) kicking the ball more than losing teams (*mdn* = 26.00) (P = 0.040, ES = 0.73).

Large effect sizes for several variables showed a trend towards differences that were not found to be statistically significant (Table 1). Losers conceded more (*mdn* =16.50) turnovers than winners (*mdn* =13.50) (P = 0.107, ES = 0.53), but there didn't appear to be a difference in the area of the pitch in which these occurred. Losers attempted more passes (*mdn* =154.50) than winners (*mdn* =97.00) (P =0.161, ES = 0.50) and also had a higher pass completion percentage than winning teams (Losers *mdn* = 98.00%, winners *mdn* =96.00%, P = 0.112, ES = 0.56). Losing teams (*mdn* =114.00) carried the ball more than winning teams (*mdn* =92.00) (P = 0.123, ES = 0.54), but there were no clear differences in the types of carries between winners and losers. A medium effect size (P= 0.223, ES=0.42) was found to support the notion that losers also completed more rucks than winners (Losers *mdn* = 79.00, winners *mdn* =100.50).

Table 1. Differences in key performance indicators between winning and losing teams during the knockout stages of the 2011 Rugby World Cup.

Variable	Winners (*n=8*)			Losers (*n=8*)			Effect Size	*P* Value
	Median	**Mean**	**SD**	**Median**	**Mean**	**SD**		
Lineout Success (%)	89.00	85.63	11.39	87.00	91.00	12.80	0.22	0.528
Turnovers Conceded	13.50	13.75	3.11	16.50	17.13	4.45	0.57	0.107
Own 22m (%)	3.00	5.25	7.09	8.50	8.25	5.04	0.36	0.310
22m - 50m (%)	34.50	35.38	9.59	30.50	25.88	12.14	0.35	0.326
50m - Opposition 22m (%)	33.00	37.38	18.21	46.00	45.75	10.59	0.36	0.310
Opposition 22m (%)	23.00	21.88	13.62	20.00	20.13	8.92	0.12	0.726
Total Kicks out of hand	28.50	29.63	5.21	26.00	24.40	7.33	0.73	0.040*
Kicks in 22m (%)	30.00	30.88	12.29	35.00	35.75	10.48	0.25	0.483
Kicks in Play (%)	70.00	69.13	12.29	65.00	64.25	10.48	0.25	0.483
Passes	97.00	100.38	39.81	154.50	139.00	45.01	0.50	0.161
Pass Completion (%)	96.00	96.00	2.62	98.00	97.50	0.93	0.56	0.112
Carries	92.00	91.00	26.27	114.00	116.88	32.30	0.54	0.123
Pick and Go (%)	16.00	15.63	7.87	12.50	14.13	6.62	0.20	0.575
One Out Drive (%)	16.50	19.00	7.43	19.00	21.00	9.32	0.17	0.623
Support Carry (%)	4.00	2.59	4.13	6.50	5.25	2.87	0.33	0.351
Kick Return (%)	11.50	13.00	6.97	9.00	10.00	4.14	0.24	0.499
Other Carry (%)	48.50	47.38	7.37	48.00	49.50	8.00	0.10	0.779
Ruck Frequency	79.00	76.00	24.75	100.50	98.00	29.49	0.42	0.233
Own 22m (%)	4.50	7.00	6.46	5.00	6.75	6.32	0.00	1.000
22m - 50m (%)	22.50	27.38	13.76	22.00	25.13	6.24	0.07	0.833
50m - Opposition 22m (%)	47.00	43.63	13.55	45.00	47.00	14.59	0.15	0.674
Opposition 22m (%)	27.00	22.00	11.16	17.50	21.25	13.59	0.05	0.889
Tackle Completion (%)	92.00	91.75	4.37	91.00	90.50	2.45	0.45	0.203
Attempted Tackles	124.50	122.75	32.87	103.00	98.13	39.75	0.35	0.327
Initial Breaks	2.00	2.50	1.77	2.50	2.63	1.06	0.06	0.865
Penalties Conceded	7.00	7.75	2.19	8.50	8.38	2.67	0.20	0.600
Own 22m (%)	12.00	16.00	16.66	15.50	14.63	11.41	0.03	0.933
22m - 50m (%)	27.00	29.38	20.87	43.50	45.44	13.99	0.57	0.107
50m - Opposition 22m (%)	35.50	39.13	18.31	19.50	22.00	10.59	0.74	0.036*
Opposition 22m (%)	13.50	15.50	13.62	10.50	17.19	8.92	0.12	0.735

* = Significant difference at a level of <0.05

4. Discussion

The purpose of this study was to identify performance indicators that discriminate winners and losers in the knockout stages of the 2011 Rugby World Cup. Findings of the study reported that pitch position of penalties conceded and the total number of kicks out of hand were the only performance indicators to significantly discriminate between winning and losing teams.

The total number of penalties conceded by winning and losing teams was similar, which is in line with previous research (Jones, *et al*., 2004a; Vaz *et al*., 2010). However, differences were evident regarding where on the pitch each team conceded these penalties. Winning teams conceded a higher percentage (16% more) of their penalties between 50m and the opposition 22m than losing teams. Importantly though, winning teams conceded fewer penalties between their own 22m and 50m than losing teams (17% less). Conceding penalties in this area increases the likelihood of conceding points through subsequent goal kicks, or from a good attacking position on the field. These findings suggest that pitch location of penalties conceded influenced match outcome with winning teams more able to gain penalties in attacking positions than losing teams. It is suggested that the ability of the winning teams to apply more pressure and force more penalties in attacking positions was indicative of success at the 2011 Rugby World Cup. This finding may also point to better discipline by winning teams when defending in their own half. Although speculative, the fact that winning teams conceded more of their penalties in the opposition half and fewer in their own half, may indicate different defensive strategies used in different areas of the field.

Results of the present study suggested that winning teams kicked the ball out of hand more frequently than losing teams; this supports previous research, which found that a higher number of kicked possessions is a key characteristic of winning teams (Ortega, *et al*., 2009; Vaz *et al*., 2010, 2011). Non significant trends in the data suggested that winning teams made fewer carries and completed fewer rucks than losing teams. These findings are in agreement with Van Rooyen *et al*. (2010) who reported that winning teams had a lower ruck frequency in 100% of the knockout matches at the 2007 World Cup. In addition, winning teams also completed fewer passes than losing teams. The increased number of kicks coupled with fewer carries, rucks and passes suggests that the success of winning teams may be characterised by a more territory-based tactical approach to the match rather than a possession driven approach. This approach can serve to put the opposition under pressure in their own half and can lead to errors in areas of the field that offer the attacking team potential point-scoring opportunities. Therefore, focusing more on gaining territory through kicks above trying to build attacks from defensive positions with multiple phases appeared to be a key strategy for success in the knockout stages of the 2011 World Cup.

Winning teams were found to concede fewer turnovers per game than losing teams, which is supported by findings from previous research (Jones, *et al*., 2004a; Ortega *et al*., 2009). The area in which these turnovers occurred may also be of significance as conceding turnovers in your own half is likely to relate to unsuccessful performance since scoring opportunities most frequently originate from this half of the pitch (Boddington and Lambert, 2004; Van Rooyen and Noakes, 2006; Van Rooyen *et al*.,

2006). However, in the present study no differences between winners and losers were observed for the area in which these turnovers were conceded. Therefore, while turnovers conceded appears to be a performance indictor associated with success in the knockout stages of the 2011 Rugby World Cup, pitch position of these turnovers was not important.

Results from the present study found no differences in lineout success between winning and losing teams. This was surprising given that several previous studies have established success at the lineout to be a key indicator that discriminates winning and losing teams (Jones *et al.,* 2004a; Ortega *et al.,* 2009; Vaz et al., 2010, 2011). Given that this performance indicator has been well established in the professional era, the results from the 2011 World Cup may represent an increased emphasis by teams on the development of a successful attacking lineout which minimises the chances of losing the ball.

Data from the 2011 World Cup suggests a clear development in game play compared to previous competitions. In the knockout stages of the 2011 World Cup, the average number of rucks per game was 174 compared to 121 during the same stages of the competition in 2007 (Van Rooyen *et al.,* 2010). This finding may be due to the introduction of Experimental Law Variations (IRB, 2008), designed to influence how teams play. These laws sought to encourage teams to play a faster game with ball-in-hand and promote counter-attacking rugby. The increase in the number of game actions in the 2011 World Cup compared to 2007 competition, has undoubtedly made the game a better spectacle for viewers, but the changes in the laws do not appear to have rewarded attacking play. The Experimental Law Variations were introduced specifically to reward teams with greater attacking potential and hence the capacity to form more attacking rucks. As a result, Van Rooyen *et al.* (2010) suggested that at the 2011 World Cup, teams who were able to form more rucks would likely be more successful in the knockout stages. However, results from the present study found that a possession-based approach to the game, involving keeping the ball in hand and completing more carries and rucks, was indicative of losing teams. Like in the previous World Cup, it appears that a territory-based approach is still the most effective strategy for game success.

The findings of this study can help to guide modern tactical approaches and coaching interventions for teams competing in knockout tournaments. Results suggest sides should adopt a more territory-based approach through kicking. This approach serves to put the opposition under pressure in their own half and can lead to errors in areas of the field that offer the attacking team potential point-scoring opportunities. A further point to highlight is the lower number of penalties conceded by winning teams between their own 22m and 50m. Therefore, discipline when defending in this area would appear key and something that teams should consider including in their tactical approach. One possible strategy to help reduce the penalty count in this area of the field would be not to commit as many players as normal to the breakdown when defending. Given the high number of penalties conceded by teams at the breakdown, this strategy may be considered when defending in this area of the field.

It is important to note that the findings of this study should be interpreted cautiously. Findings are only based on the knockout stages at the 2011 World Cup, so cannot be

generalised across different competitions. One reason that so few differences were observed between winning and losing teams may have resulted from the presence of both northern and southern hemisphere teams in the competition. Previous research has shown differences in the playing styles between the two (Jones *et al.,* 2004b); a factor which may have made it difficult to establish winning performance indicators based on consistent patterns of play. This study was also the first to identify performance indicators that discriminate winning and losing teams following the introduction of new laws by the IRB. It may serve as a starting point for future research in this area, which should focus on other competition formats at both domestic and international level. Establishing performance indicators related to success across this range will help inform tactical approaches suitable for different competition formats.

5. Conclusion

The aim of this study was to identify the performance indicators that discriminate winning and losing in the knockout stages of the 2011 Rugby World Cup. Results found that winning teams kicked the ball out of hand more than losing teams and conceded fewer penalties in their own half of the field. This suggests that a more territory-based approach through kicking and pressuring opposition is more effective than a possession orientated strategy. Discipline when defending in your own half is also key in trying to minimise the penalty count and reduce the potential scoring opportunities for the attacking team. Although significant differences between winners and losers were only found for two performance indicators, like in the previous World Cup, it appears that a territory-based approach is still the most effective strategy for game success in the knockout stages of the 2011 Rugby World Cup.

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