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1     **Determinants of successful possession in Elite Gaelic Football**

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## 12 **Determinants of successful possession in Elite Gaelic Football**

13 Game demands of Elite Men’s Gaelic Football (GF) are understudied and far from  
14 clear. This first study to investigate the performance outcomes for winners and  
15 losers in a complete Senior Inter-county championship (SFC) will analyse which  
16 characteristics of possession were more likely to lead to score.

17 Possessions (n = 6,174) from all games in the 2016 SFC (n = 64) were analysed  
18 using Dartfish ConnectPlus 7.0. Wilcoxon signed rank test identified statistical  
19 differences (p<0.05) between 20 performance indicators for winning versus losing  
20 teams, while a binary logistic regression was used to model shot outcome in terms  
21 of process indicators; method of gaining possession, area possession is gained,  
22 number of passes and duration of each possession, on the outcome of the  
23 possession.

24 Findings reveal winning teams had significantly more possessions, higher  
25 productivity and lower turnover rates than losers. Logistic regression highlighted  
26 that opposition kickouts, possession duration and area where possession  
27 commenced were associated with possession outcome.

28  
29 Keywords: Gaelic Football, possession, productivity,

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30           **1. Introduction**

31    Gaelic Football (GF) is one of the most popular invasion sports in Ireland in which the  
32    aim is to retain possession and outscore the opponent (Reilly & Collins, 2008).  
33    Discovering which factors help predict or are associated with success has become the  
34    holy grail of performance analysis (PA) work (Carling et al., 2014), resulting in research  
35    into the correlation between performance indicators (PIs) and success in numerous sports,  
36    for example; Rugby (Jones et al., 2004; James et al., 2005), Basketball (Gómez et al.,  
37    2008), Soccer (Hughes & Churchill, 2005; Hughes & Franks, 2005; Lago-Peñas et al.,  
38    2011), Handball (Ohnjec et al., 2008; Oliveira et al., 2012), Water Polo (Lupo et al., 2012;  
39    Medić et al., 2014) and Australian Rules football (Robertson, Back, & Bartlett, 2016).

40            In recent years, there has been increasing use of data within performance sport,  
41    and applied performance analysts are broadly accepted as practitioners who provide  
42    objective information to coaches and support staff. A survey of Irish coaches showed  
43    Gaelic games coaches to be the biggest users of PA and analysts, in spite of their amateur  
44    status (Martin et al., 2018). To date all of the research into GF performance metrics  
45    available to these coaches is based on measuring largely isolated performance variables  
46    using limited samples based on selections of championship and national football league  
47    (NFL) games in various years.

48            McGuigan et al., (2018) recently conducted a similar study for sub-elite, or club  
49    level GF, analysing forty-eight Ulster Club championship games. Across all grades of  
50    Ulster Club GF, they found that winning teams had higher productivity, achieving a score  
51    for every three possessions, than losing teams who take almost five possessions to  
52    generate a score. Mangan et al., (2017) included the kickout as a possession in their

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53 investigation of the relationship between technical performance indicators and running  
54 performance in fifty-two NFL and SFC matches, though they did not measure  
55 productivity. Gamble et al., (2019) also included kickouts which were lost immediately  
56 thus their productivity calculations are considerably lower than McGuigan et al's., (2018)  
57 findings. Despite using a different definition of possession to McGuigan et al., (2018),  
58 Gamble et al., (2019) also found productivity to be significantly higher for winning teams.  
59 The definition of possession is critical as the possession count will form the basis of two  
60 metrics to be investigated, productivity and turnover rate.

61 Attempts to explore and identify performance indicators in GF have largely  
62 focused on kickouts, shots/scores, attacks/attack efficiency, turnovers and fouls. Allister  
63 et al., (2018) investigated the game-related statistics that discriminate winning and losing  
64 teams within elite intercounty GF. Their multivariate discriminant analysis found that  
65 three PIs (fouls committed, goals and total attacks) significantly discriminated winning  
66 and losing teams. More specifically, when the sample was classified according to the final  
67 score margin, in close games (less than 6 point deficit), five PIs (total attacks, shot  
68 efficiency, goals, fouls committed and black cards) and eight PI in unbalanced games  
69 (fouls committed, goals and total attacks, attack efficiency, shot efficiency, opposition  
70 kick-out win %, and yellow, black and red cards) significantly differentiated winners from  
71 losers. However, their sample of twenty-eight games was taken across three seasons and  
72 it is unclear which games were selected, at which stage of the SFC, involving which teams  
73 thus it is difficult to know if it is reflective of a typical SFC per se.

74 Gamble et al., (2019) have published the broadest study to date in GF, examining  
75 the relationships between eighty-three technical and tactical variables in a twenty-six  
76 game sample of league and SFC games in 2014-15. Their univariate analysis of full-

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77 games revealed that winners achieved a significantly higher total score, number of scores,  
78 shots, points, points from play and goals, resulting in superior shot efficiency, average  
79 attack per score, and scores per 10 possessions (Gamble et al., 2019).

80 At club level GF, McGuigan et al., (2018) highlight the importance of shot count  
81 and shot efficiency as key performance indicators for winning and losing teams. Mangan  
82 and Collins (2016) determined the ratio of shots taken versus those conceded in a sample  
83 of fifteen elite games (2014/15) and also found a significant difference between winners  
84 and losers. Additionally, they noted the significant impact shot location makes on the  
85 likelihood of scoring in GF. Thus, the research to date suggests that a successful  
86 possession in GF is one that leads to a shot, ideally in a favourable location which results  
87 in a score.

88 In GF possession originates from a throw in, a kickout or turnover, though it is  
89 not known in what proportions. The number of possessions lost, or turnovers, has long  
90 been identified as a factor in GF performance (Martin, 2004) but not initially as a  
91 significant distinguisher of performance (Carroll, 2013). However, McGuigan et al.,  
92 (2018) calculated the turnover rate relative to the total number of possessions, and found  
93 it to be significantly lower for winning teams at all sub-elite grades on a sample of sixteen  
94 games per grade. The findings of Gamble et al., (2019) who considered turnovers won,  
95 agree with this trend reporting a significant difference in turnover count for winners and  
96 losers at elite level.

97 This study will provide the first comprehensive investigation of possession in a full  
98 SFC season and bridge the gap to previous literature relating to PIs. The investigation  
99 aims to analyse possession at two levels of abstraction. Firstly, performance will be  
100 analysed at possession level to associate the success of possessions with tactical factors.

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101 Secondly, possession variables will be analysed at match level to compare characteristics  
102 of possessions and how they ultimately influence match success. This research provides  
103 an exciting opportunity to create a more holistic understanding of the nature of  
104 possessions in GF and the influence of the various factors which contribute to shot  
105 creation.

106 **2. Methods**

107 Data were collected by analysing all thirty-three teams for the complete 2016 All-Ireland  
108 Senior Football Championship (64 games). Of the sixty-four games, fifty-nine resulted in  
109 success for one team and five resulted in a draw. Drawn games were included in the  
110 overall analysis but excluded from the analysis of winners and losers. Match recordings  
111 were sourced from Radio Telefís Éireann (RTE) (n = 52 games), Ulster GAA Council, (n  
112 = 10 games) and team performance analysts (n = 2 games). Match video was coded using  
113 Dartfish 7 ConnectPlus (Dartfish Limited, Switzerland). The data were collected,  
114 checked, then exported to Microsoft Excel, where a specifically designed report was  
115 created to filter and categorise all essential information.

116  
117 PIs for this study were developed in three stages; a review of GF performance  
118 analysis literature was conducted, minor adaptations were made to existing definitions  
119 (Bradley & O’Donoghue, 2011; Carroll, 2013) and new PIs were formulated to align with  
120 the study. New variables were given draft operational definitions which were tested and  
121 refined using sample footage. Identified indicators, derived performance indicators and  
122 operational definitions (Table 1) were presented to, and subsequently validated by an  
123 expert coaching panel with a combined experience of 100 years in GF. This approach  
124 permits consistent data collection by knowledgeable observers based on accepted  
125 meanings of terms such as “securing possession” without using counterproductive

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126 operational detail. Their consensus on the possession definition was to code kickouts as  
127 a ‘starter play’ and begin possessions when the ball was secured after a kickout  
128 (McGuigan et al., 2018, Clear et al., 2017).

129

130 \*\*\*\* TABLE 1 NEAR HERE \*\*\*\*

131 \*\*\*\* TABLE 2 NEAR HERE \*\*\*\*

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133 Inter and intra-operator reliability tests were conducted and variance calculated using  
134 Intraclass Correlation Coefficient (ICC). The first author and an additional operator, an  
135 accredited ISPAS and Level 4 GAA analyst both analysed a single match independently  
136 (Table 2) reporting ICC values of 1.000 with a 95% confidence interval from 0.998 to  
137 1.000,  $p < 0.001$  for event and outcome variables. When divided into 10 second bands,  
138 duration of possession also demonstrated a high degree of reliability with average  
139 measure ICC 0.979 (95% confidence interval from 0.959 to 0.989,  $p < 0.001$ ). The intra-  
140 operator test was conducted by analysis of one match on two occasions, four weeks apart,  
141 with an ICC value of 0.99 (95% confidence interval from 0.990 to 1.000,  $p < 0.001$ ). Using  
142 SPSS (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0.  
143 Armonk, NY: IBM Corp.), descriptive statistics for all performance indicators were  
144 compiled for total possessions and winning versus losing possessions. Seven of the 20  
145 dependent variables being compared between winning and losing teams were normally  
146 distributed according to the Kolmogorov-Smirnov test ( $p > 0.05$ ). Therefore, statistical  
147 differences in performance indicators between winning and losing teams were identified  
148 using paired samples t tests ( $p < 0.05$ ) for these seven variables and Wilcoxon signed rank  
149 tests for the remaining variables ( $p < 0.05$ ). The outcome of individual possessions (shot  
150 or not) was modelled using binary logistic regression with a combination of numerical

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151 and categorical variables being included. Cohen’s d was used to estimate effect sizes  
152 where variables were normally distributed otherwise Cliff’s delta was used. A total of  
153 6,174 possessions were analysed including 3,574 that resulted in a shot while the  
154 remaining 2,600 did not. The possessions were randomly divided into a sample of 4,116  
155 possessions (two thirds of the data set) used to create the predictive model with the  
156 remaining 2,058 being used to test the model. The predictor variables included were half,  
157 duration of the possession, number of passes, area of the pitch where the possession  
158 started and method of possession.

159

**3. Results**

161 The minimum and maximum values presented with descriptive statistics of all possession  
162 outcomes for the 2016 SFC (Table 3) highlight the variance in performance. The least  
163 productive team were Wexford against Kildare while Louth registered a productivity of  
164 6.5 scores per 10 possessions against Carlow.

165

166 \*\*\*\*\*TABLE 3 NEAR HERE \*\*\*\*\*

167 \*\*\*\*\*TABLE 4 NEAR HERE \*\*\*\*\*

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169 A detailed breakdown of all possessions, their characteristics and outcomes (Table  
170 4) reveals that possession is predominantly secured via kickouts or turnovers in nearly  
171 equal proportions (49.4% and 48.5% respectively). The most effective possession to win  
172 from a scoring perspective is a short opposition kickout or a turnover in attack but these  
173 are also the most infrequent occurrences. Significant differences in performance between  
174 winners and losers were evident for 12 of the variables investigated (Table 5).

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176 \*\*\*\*\*TABLE 5 NEAR HERE \*\*\*\*\*

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178           Losing teams have nearly 20% more kickouts than winning teams and are more  
179 likely to kick the ball long; 56.5% versus 51.3% of winners kickouts. Winners are  
180 securing scores from over a quarter (26.8%) of their total kickouts and conceding scores  
181 from just 8%. By contrast, losers are only scoring with 18.4% of the kickouts taken and  
182 are conceding scores from 13.4% - particularly punished on short kickouts lost. The  
183 analysis also highlights the contrast between the retention rates for long and short  
184 kickouts, with the short kickout providing a much safer option for teams at 93/94%  
185 retention.

186

187 \*\*\*\*\*TABLE 6 NEAR HERE \*\*\*\*\*

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189           The breakdown of turnover related possessions (Table 5/6) reveal winning teams  
190 win more turnovers (52% versus 48%) and convert a third of these possessions to scores,  
191 compared to losing teams' conversion rate of 27%.

192

193 \*\*\*\*\*TABLE 7 NEAR HERE \*\*\*\*\*

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195           Table 8 shows the coefficients of the binary logistic regression model for  
196 possession outcome. The most significant predictors of possession outcome were the  
197 duration of the possession and starting area. Possessions were more likely to lead to a  
198 shot for longer possessions than shorter possessions as shown by the positive regression  
199 coefficient for this term. Possessions were more likely to result in a shot if they originated  
200 in the attacking term as indicated by the negative regression coefficients for the other two

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201 areas. The only other significant predictor of a possession leading to a shot was the  
202 method of possession being an opposition kick out. Table 9 shows the results of the cross-  
203 validation of the model which had a 62.1% accuracy for predicting possession outcome.

204

205 \*\*\*\* TABLE 8 NEAR HERE \*\*\*\*

#### 206 **4. Discussion**

207 This is the first study to compile average performance data for a full GF championship  
208 (64 games) and profile the 6,174 possessions played, creating a picture of how and where  
209 possession was gained, its duration, the number of passes involved, and which factors  
210 were important in leading to a shot. In the 2016 SFC, the average team had 48  
211 possessions; lost nearly half of these as turnovers (48%) and converted a third to scores  
212 (31%), averaging 1.14 or 17 points. Winning teams had more possessions (49), lost fewer  
213 turnovers (45%) and were more efficient, scoring 1.17 (20 points) with 41.4% of  
214 possession. This simple summary has not previously been reported and provides basic  
215 benchmark data for coaches and applied performance analysts.

216

217 Our findings reveal for the first time the origin of possessions, made up of  
218 kickouts and turnovers in almost equal measure (49.4% and 48.5% respectively) with  
219 throw-ins accounting for the remainder. In light of the GAA's 2019 failed trial of a limit  
220 to the number of passes which can be executed in a row, the analysis of pass count data  
221 is particularly important. The majority of possessions (58%) consist of four passes or  
222 fewer and these produced scores 30% of the time. The analyses showed that prolonged  
223 passing sequences of five or more generated many more shots per possession than  
224 sequences of four or fewer (64% possession to shot conversion versus 53%), however the  
225 increase in score return was marginal (33.2% for 5-9 pass possession) and actually

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226 decreased for sequences beyond ten passes (29.1%). The logistic regression highlights  
227 that possession duration, area of the pitch where possessions commence and possessions  
228 starting with kickouts influence outcome. Almost three-quarters (74.1%) of possessions  
229 in 2016 were under 30 s with the 21-30 s range the optimum for converting possession  
230 to scores given its incidence. These findings are similar to those of Bradley and  
231 O'Donoghue's (2013) investigation into counterattacking. As discussed by Gamble et  
232 al., (2019) it is likely that longer passing sequences allow defenders funnel back and  
233 protect the scoring zone making it more difficult convert possessions.

234

235           Despite Bradley and O'Donoghue's (2013) investigation of counterattacking play,  
236 it was not previously established what proportion of total possession came from turnovers  
237 or where they occurred. Of the almost three thousand turnovers recorded in the present  
238 study, nearly 70% occurred in defence, with winners converting 30% of these to scores  
239 while the losers' conversion rate was 23%. These data potentially highlight the superior  
240 skill and structure of stronger teams in transitioning from defence to attack, in exploiting  
241 disorganised opposition defensive structures, supporting previous findings (Gamble et al.,  
242 2019), but also in retaining and recycling longer phases of possession with patience and  
243 precision in order to create a score. Additionally, the findings highlight the superior  
244 technical capacity of winners both in retaining possession and executing defensive actions  
245 necessary to win turnovers from the opposition. Winners conceded significantly less  
246 turnovers (24 to 22) than losers, similar to Gamble et al., (2019) and had a significantly  
247 lower turnover rate relative to total possession than losers (45% versus 51.8%). This  
248 finding concurs with McGuigan et al., (2018) and supports their assertion that turnover  
249 rate is possibly a key performance indicator for the sport (Hughes and Bartlett, 2002).

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251           The average shot count recorded (28) agrees with previous findings (Martin,  
252 2004; Carroll, 2013; Mangan et al., 2017 and Allister et al., 2018), suggesting that this  
253 variable has remained relatively stable since the early 2000s. However, the actual score  
254 in matches shows an upward trend, from an average of 1-10 in the 2003 championship  
255 (Martin, 2004), to 1-12 in the 2011/12 seasons (Carroll, 2013), to 1-14 in this study of the  
256 2016 season. ‘What it takes to win’ in GF seems to have increased from posting a score  
257 of 1-10 in 2003 to 1-17 in 2016. As the shot count remains relatively stable, this trend  
258 demonstrates that teams have become more accurate when shooting. Our study found  
259 average shot efficiency in 2016 to be 53%, with champions Dublin recording 57% mean  
260 shot success from an average shot count of 32. Shot efficiency was found to be significant  
261 higher for winners which agrees with other elite GF championship studies (Gamble et al.,  
262 2019; Allister et al., 2018; Carroll, 2013) and club level GF (McGuigan et al., 2018). The  
263 figures over time also support the theory of a trend towards improved accuracy with  
264 averages climbing from 44% (Martin, 2004) to 48% (Carroll, 2013) to the current  
265 reported value of 53%, which concurs with Allister et al.’s (2018) 53.5% finding. This  
266 fifteen-year time span has coincided with tactical shift in the game where teams are  
267 playing more in defensive zones than traditional ‘man to man’ marking (Bradley &  
268 O’Donoghue, 2011). As teams are afforded less space and freedom to attempt shots, they  
269 are increasingly being coached to be more clinical with the shots they attempt, potentially  
270 explaining the increase in scoring efficiency over time.

271

272           The present study establishes a benchmark ‘hands on ball’ possession count of 48  
273 with little variation between winners and losers. McGuigan et al., (2018), identified a  
274 similar pattern in Senior Club GF with both winning and losing teams recording  
275 possession counts of 41 in the sixty-minute game. Our data support their suggestion and

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276 that of Gamble et al., (2019) that it is not the quantity of possession gained which is the  
277 critical factor in success, but the capacity to convert possession into scores; productivity.  
278 Our data support previous findings that productivity was a significant distinguisher  
279 between winners and losers, supporting their assertion that it is a key performance  
280 indicator in GF (McGuigan et al., 2018; Gamble et al., 2019). The number of points per  
281 ten possessions scored at elite level were comparable to the senior club data with elite  
282 winners scoring 4.14 / 10 possessions and losers scoring 3 / 10 possessions, versus senior  
283 club winners converting 4 /10 possessions and losers 2.5 / 10 possessions (McGuigan et  
284 al., 2018). This slightly upward trend is to be expected; as the skill level increases at elite  
285 level, players are less likely to lose possession and more skilful in shooting accurately.

286

287         In our analysis of the 3,050 kickouts taken in 2016, teams opted for a short kickout  
288 47% of the time, an increase in the 30% incidence reported by Mangan et al., (2017) from  
289 older data. Given a retention rate of 93.4% for short kickouts as opposed to 53.5% for  
290 long ones, it is easy to see why teams take this option, however winners are much more  
291 efficient at converting this possession to scores (30.8% versus losers' 21.4%). Neither  
292 winners nor losers concede many of these kickouts, (1-2 per game) but when they do, the  
293 superior attacking prowess of the winning teams is evident converting 63% of these  
294 possessions versus just 28% for losers. The binary logistic regression analysis reveals that  
295 teams are significantly more likely to score off the opposition kickout than their own,  
296 providing food for thought for coaches in terms of the strategies they employ for this set  
297 piece. The overall kickout success of 72% is lower than Alister et al.'s, (2018) finding of  
298 78% which potentially reflects the difference in sampling as the present study includes  
299 all games played. As with soccer (MacKenzie & Cushion, 2013), no representative  
300 sample size for a GF season has been established.

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The breadth of games sampled is a potential limitation of the present study as it incorporates and does not discriminate between knock-out and matches where teams had another opportunity to play. Recommendations for future study would be to break down the games over several seasons according to contextual factors such as venue, phase of competition; by margin of victory and investigate if score-line status affects the options taken in possession by teams (Carling et al., 2014). Further analysis of the inter-relationships between variables rather than isolated reporting of performance indicators would greatly enhance the general understanding of game demands.

## 5. Conclusion

As a unique snapshot in time, the findings of this study can be used to assess how GF has evolved over time and provides a valuable benchmark to assess the impact of the current raft of rule changes on the nature of the game, for example if the introduction of a ‘mark’ for a kickout catch has encouraged more long kickouts.

The isolation and profiling of possessions in GF is novel information for coaches and applied performance analysts, revealing which characteristics of possession are most likely to yield scores. The linking of performance variables to outcomes in the logistic regression is an important step forward in understanding the game demands and may be of value to coaches in assessing if their practice environment replicates game conditions. In providing further evidence for the significance of productivity and turnover rate to winning performances, this study contributes to our understanding and measurement of ‘What it takes to Win’ of GF and establishes benchmark ‘winners’ data to which coaches can compare performance.

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# 1 **Determinants of successful possession in Elite Gaelic Football**

2 Game demands of Elite Men's Gaelic Football (GF) are understudied and far from  
3 clear. This first study to investigate the performance outcomes for winners and  
4 losers in a complete Senior Inter-county championship (SFC) will analyse which  
5 characteristics of possession were more likely to lead to score.

6 Possessions (n = 6,174) from all games in the 2016 SFC (n = 64) were analysed  
7 using Dartfish ConnectPlus 7.0. Wilcoxon signed rank test identified statistical  
8 differences ( $p < 0.05$ ) between 20 performance indicators for winning versus losing  
9 teams, while a binary logistic regression was used to model shot outcome in terms  
10 of process indicators; method of gaining possession, area possession is gained,  
11 number of passes and duration of each possession, on the outcome of the  
12 possession.

13 Findings reveal winning teams had significantly more possessions, higher  
14 productivity and lower turnover rates than losers. Logistic regression highlighted  
15 that opposition kickouts, possession duration and area where possession  
16 commenced were associated with possession outcome.

17

18 Keywords: Gaelic Football, possession, productivity,

19        **1. Introduction**

20        Gaelic Football (GF) is one of the most popular invasion sports in Ireland in which the  
21        aim is to retain possession and outscore the opponent (Reilly & Collins, 2008).  
22        Discovering which factors help predict or are associated with success has become the  
23        holy grail of performance analysis (PA) work (Carling et al., 2014), resulting in research  
24        into the correlation between performance indicators (PIs) and success in numerous sports,  
25        for example; Rugby (Jones et al., 2004; James et al., 2005), Basketball (Gómez et al.,  
26        2008), Soccer (Hughes & Churchill, 2005; Hughes & Franks, 2005; Lago-Peñas et al.,  
27        2011), Handball (Ohnjec et al., 2008; Oliveira et al., 2012), Water Polo (Lupo et al., 2012;  
28        Medić et al., 2014) and Australian Rules football (Robertson, Back, & Bartlett, 2016).

29                In recent years, there has been increasing use of data within performance sport,  
30        and applied performance analysts are broadly accepted as practitioners who provide  
31        objective information to coaches and support staff. A survey of Irish coaches showed  
32        Gaelic games coaches to be the biggest users of PA and analysts, in spite of their amateur  
33        status (Martin et al., 2018). To date all of the research into GF performance metrics  
34        available to these coaches is based on measuring largely isolated performance variables  
35        using limited samples based on selections of championship and national football league  
36        (NFL) games in various years.

37                McGuigan et al., (2018) recently conducted a similar study for sub-elite, or club  
38        level GF, analysing forty-eight Ulster Club championship games. Across all grades of  
39        Ulster Club GF, they found that winning teams had higher productivity, achieving a score  
40        for every three possessions, than losing teams who take almost five possessions to  
41        generate a score. Mangan et al., (2017) included the kickout as a possession in their

42 investigation of the relationship between technical performance indicators and running  
43 performance in fifty-two NFL and SFC matches, though they did not measure  
44 productivity. Gamble et al., (2019) also included kickouts which were lost immediately  
45 thus their productivity calculations are considerably lower than McGuigan et al's., (2018)  
46 findings. Despite using a different definition of possession to McGuigan et al., (2018),  
47 Gamble et al., (2019) also found productivity to be significantly higher for winning teams.  
48 The definition of possession is critical as the possession count will form the basis of two  
49 metrics to be investigated, productivity and turnover rate.

50         Attempts to explore and identify performance indicators in GF have largely  
51 focused on kickouts, shots/scores, attacks/attack efficiency, turnovers and fouls. Allister  
52 et al., (2018) investigated the game-related statistics that discriminate winning and losing  
53 teams within elite intercounty GF. Their multivariate discriminant analysis found that  
54 three PIs (fouls committed, goals and total attacks) significantly discriminated winning  
55 and losing teams. More specifically, when the sample was classified according to the final  
56 score margin, in close games (less than 6 point deficit), five PIs (total attacks, shot  
57 efficiency, goals, fouls committed and black cards) and eight PI in unbalanced games  
58 (fouls committed, goals and total attacks, attack efficiency, shot efficiency, opposition  
59 kick-out win %, and yellow, black and red cards) significantly differentiated winners from  
60 losers. However, their sample of twenty-eight games was taken across three seasons and  
61 it is unclear which games were selected, at which stage of the SFC, involving which teams  
62 thus it is difficult to know if it is reflective of a typical SFC per se.

63         Gamble et al., (2019) have published the broadest study to date in GF, examining  
64 the relationships between eighty-three technical and tactical variables in a twenty-six  
65 game sample of league and SFC games in 2014-15. Their univariate analysis of full-

66 games revealed that winners achieved a significantly higher total score, number of scores,  
67 shots, points, points from play and goals, resulting in superior shot efficiency, average  
68 attack per score, and scores per 10 possessions (Gamble et al., 2019).

69 At club level GF, McGuigan et al., (2018) highlight the importance of shot count  
70 and shot efficiency as key performance indicators for winning and losing teams. Mangan  
71 and Collins (2016) determined the ratio of shots taken versus those conceded in a sample  
72 of fifteen elite games (2014/15) and also found a significant difference between winners  
73 and losers. Additionally, they noted the significant impact shot location makes on the  
74 likelihood of scoring in GF. Thus, the research to date suggests that a successful  
75 possession in GF is one that leads to a shot, ideally in a favourable location which results  
76 in a score.

77 In GF possession originates from a throw in, a kickout or turnover, though it is  
78 not known in what proportions. The number of possessions lost, or turnovers, has long  
79 been identified as a factor in GF performance (Martin, 2004) but not initially as a  
80 significant distinguisher of performance (Carroll, 2013). However, McGuigan et al.,  
81 (2018) calculated the turnover rate relative to the total number of possessions, and found  
82 it to be significantly lower for winning teams at all sub-elite grades on a sample of sixteen  
83 games per grade. The findings of Gamble et al., (2019) who considered turnovers won,  
84 agree with this trend reporting a significant difference in turnover count for winners and  
85 losers at elite level.

86 This study will provide the first comprehensive investigation of possession in a full  
87 SFC season and bridge the gap to previous literature relating to PIs. The investigation  
88 aims to analyse possession at two levels of abstraction. Firstly, performance will be  
89 analysed at possession level to associate the success of possessions with tactical factors.

90 Secondly, possession variables will be analysed at match level to compare characteristics  
91 of possessions and how they ultimately influence match success. This research provides  
92 an exciting opportunity to create a more holistic understanding of the nature of  
93 possessions in GF and the influence of the various factors which contribute to shot  
94 creation.

## 95 **2. Methods**

96 Data were collected by analysing all thirty-three teams for the complete 2016 All-Ireland  
97 Senior Football Championship (64 games). Of the sixty-four games, fifty-nine resulted in  
98 success for one team and five resulted in a draw. Drawn games were included in the  
99 overall analysis but excluded from the analysis of winners and losers. Match recordings  
100 were sourced from Radio Telefís Éireann (RTE) (n = 52 games), Ulster GAA Council, (n  
101 = 10 games) and team performance analysts (n = 2 games). Match video was coded using  
102 Dartfish 7 ConnectPlus (Dartfish Limited, Switzerland). The data were collected,  
103 checked, then exported to Microsoft Excel, where a specifically designed report was  
104 created to filter and categorise all essential information.

105

106 PIs for this study were developed in three stages; a review of GF performance  
107 analysis literature was conducted, minor adaptations were made to existing definitions  
108 (Bradley & O'Donoghue, 2011; Carroll, 2013) and new PIs were formulated to align with  
109 the study. New variables were given draft operational definitions which were tested and  
110 refined using sample footage. Identified indicators, derived performance indicators and  
111 operational definitions (Table 1) were presented to, and subsequently validated by an  
112 expert coaching panel with a combined experience of 100 years in GF. This approach  
113 permits consistent data collection by knowledgeable observers based on accepted  
114 meanings of terms such as “securing possession” without using counterproductive

115 operational detail. Their consensus on the possession definition was to code kickouts as  
116 a ‘starter play’ and begin possessions when the ball was secured after a kickout  
117 (McGuigan et al., 2018, Clear et al., 2017).

118

119 \*\*\*\* TABLE 1 NEAR HERE \*\*\*\*

120 \*\*\*\* TABLE 2 NEAR HERE \*\*\*\*

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122 Inter and intra-operator reliability tests were conducted and variance calculated using  
123 Intraclass Correlation Coefficient (ICC). The first author and an additional operator, an  
124 accredited ISPAS and Level 4 GAA analyst both analysed a single match independently  
125 (Table 2) reporting ICC values of 1.000 with a 95% confidence interval from 0.998 to  
126 1.000,  $p < 0.001$  for event and outcome variables. When divided into 10 second bands,  
127 duration of possession also demonstrated a high degree of reliability with average  
128 measure ICC 0.979 (95% confidence interval from 0.959 to 0.989,  $p < 0.001$ ). The intra-  
129 operator test was conducted by analysis of one match on two occasions, four weeks apart,  
130 with an ICC value of 0.99 (95% confidence interval from 0.990 to 1.000,  $p < 0.001$ ). Using  
131 SPSS (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0.  
132 Armonk, NY: IBM Corp.), descriptive statistics for all performance indicators were  
133 compiled for total possessions and winning versus losing possessions. Seven of the 20  
134 dependent variables being compared between winning and losing teams were normally  
135 distributed according to the Kolmogorov-Smirnov test ( $p > 0.05$ ). Therefore, statistical  
136 differences in performance indicators between winning and losing teams were identified  
137 using paired samples t tests ( $p < 0.05$ ) for these seven variables and Wilcoxon signed rank  
138 tests for the remaining variables ( $p < 0.05$ ). The outcome of individual possessions (shot  
139 or not) was modelled using binary logistic regression with a combination of numerical

140 and categorical variables being included. Cohen's d was used to estimate effect sizes  
141 where variables were normally distributed otherwise Cliff's delta was used. A total of  
142 6,174 possessions were analysed including 3,574 that resulted in a shot while the  
143 remaining 2,600 did not. The possessions were randomly divided into a sample of 4,116  
144 possessions (two thirds of the data set) used to create the predictive model with the  
145 remaining 2,058 being used to test the model. The predictor variables included were half,  
146 duration of the possession, number of passes, area of the pitch where the possession  
147 started and method of possession.

148

### 149 **3. Results**

150 The minimum and maximum values presented with descriptive statistics of all possession  
151 outcomes for the 2016 SFC (Table 3) highlight the variance in performance. The least  
152 productive team were Wexford against Kildare while Louth registered a productivity of  
153 6.5 scores per 10 possessions against Carlow.

154

155 \*\*\*\*\*TABLE 3 NEAR HERE \*\*\*\*\*

156 \*\*\*\*\*TABLE 4 NEAR HERE \*\*\*\*\*

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158 A detailed breakdown of all possessions, their characteristics and outcomes (Table  
159 4) reveals that possession is predominantly secured via kickouts or turnovers in nearly  
160 equal proportions (49.4% and 48.5% respectively). The most effective possession to win  
161 from a scoring perspective is a short opposition kickout or a turnover in attack but these  
162 are also the most infrequent occurrences. Significant differences in performance between  
163 winners and losers were evident for 12 of the variables investigated (Table 5).

164

165 \*\*\*\*TABLE 5 NEAR HERE \*\*\*\*

166

167           Losing teams have nearly 20% more kickouts than winning teams and are more  
168 likely to kick the ball long; 56.5% versus 51.3% of winners kickouts. Winners are  
169 securing scores from over a quarter (26.8%) of their total kickouts and conceding scores  
170 from just 8%. By contrast, losers are only scoring with 18.4% of the kickouts taken and  
171 are conceding scores from 13.4% - particularly punished on short kickouts lost. The  
172 analysis also highlights the contrast between the retention rates for long and short  
173 kickouts, with the short kickout providing a much safer option for teams at 93/94%  
174 retention.

175

176 \*\*\*\*TABLE 6 NEAR HERE \*\*\*\*

177

178           The breakdown of turnover related possessions (Table 5/6) reveal winning teams  
179 win more turnovers (52% versus 48%) and convert a third of these possessions to scores,  
180 compared to losing teams' conversion rate of 27%.

181

182 \*\*\*\*TABLE 7 NEAR HERE \*\*\*\*

183

184           Table 8 shows the coefficients of the binary logistic regression model for  
185 possession outcome. The most significant predictors of possession outcome were the  
186 duration of the possession and starting area. Possessions were more likely to lead to a  
187 shot for longer possessions than shorter possessions as shown by the positive regression  
188 coefficient for this term. Possessions were more likely to result in a shot if they originated  
189 in the attacking term as indicated by the negative regression coefficients for the other two

190 areas. The only other significant predictor of a possession leading to a shot was the  
191 method of possession being an opposition kick out. Table 9 shows the results of the cross-  
192 validation of the model which had a 62.1% accuracy for predicting possession outcome.

193

194 \*\*\*\* TABLE 8 NEAR HERE \*\*\*\*

#### 195 **4. Discussion**

196 This is the first study to compile average performance data for a full GF championship  
197 (64 games) and profile the 6,174 possessions played, creating a picture of how and where  
198 possession was gained, its duration, the number of passes involved, and which factors  
199 were important in leading to a shot. In the 2016 SFC, the average team had 48  
200 possessions; lost nearly half of these as turnovers (48%) and converted a third to scores  
201 (31%), averaging 1.14 or 17 points. Winning teams had more possessions (49), lost fewer  
202 turnovers (45%) and were more efficient, scoring 1.17 (20 points) with 41.4% of  
203 possession. This simple summary has not previously been reported and provides basic  
204 benchmark data for coaches and applied performance analysts.

205

206 Our findings reveal for the first time the origin of possessions, made up of  
207 kickouts and turnovers in almost equal measure (49.4% and 48.5% respectively) with  
208 throw-ins accounting for the remainder. In light of the GAA's 2019 failed trial of a limit  
209 to the number of passes which can be executed in a row, the analysis of pass count data  
210 is particularly important. The majority of possessions (58%) consist of four passes or  
211 fewer and these produced scores 30% of the time. The analyses showed that prolonged  
212 passing sequences of five or more generated many more shots per possession than  
213 sequences of four or fewer (64% possession to shot conversion versus 53%), however the  
214 increase in score return was marginal (33.2% for 5-9 pass possession) and actually

215 decreased for sequences beyond ten passes (29.1%). The logistic regression highlights  
216 that possession duration, area of the pitch where possessions commence and possessions  
217 starting with kickouts influence outcome. Almost three-quarters (74.1%) of possessions  
218 in 2016 were under 30 s with the 21-30 s range the optimum for converting possession  
219 to scores given its incidence. These findings are similar to those of Bradley and  
220 O'Donoghue's (2013) investigation into counterattacking. As discussed by Gamble et  
221 al., (2019) it is likely that longer passing sequences allow defenders funnel back and  
222 protect the scoring zone making it more difficult convert possessions.

223

224         Despite Bradley and O'Donoghue's (2013) investigation of counterattacking play,  
225 it was not previously established what proportion of total possession came from turnovers  
226 or where they occurred. Of the almost three thousand turnovers recorded in the present  
227 study, nearly 70% occurred in defence, with winners converting 30% of these to scores  
228 while the losers' conversion rate was 23%. These data potentially highlight the superior  
229 skill and structure of stronger teams in transitioning from defence to attack, in exploiting  
230 disorganised opposition defensive structures, supporting previous findings (Gamble et al.,  
231 2019), but also in retaining and recycling longer phases of possession with patience and  
232 precision in order to create a score. Additionally, the findings highlight the superior  
233 technical capacity of winners both in retaining possession and executing defensive actions  
234 necessary to win turnovers from the opposition. Winners conceded significantly less  
235 turnovers (24 to 22) than losers, similar to Gamble et al., (2019) and had a significantly  
236 lower turnover rate relative to total possession than losers (45% versus 51.8%). This  
237 finding concurs with McGuigan et al., (2018) and supports their assertion that turnover  
238 rate is possibly a key performance indicator for the sport (Hughes and Bartlett, 2002).

239

240           The average shot count recorded (28) agrees with previous findings (Martin,  
241 2004; Carroll, 2013; Mangan et al., 2017 and Allister et al., 2018), suggesting that this  
242 variable has remained relatively stable since the early 2000s. However, the actual score  
243 in matches shows an upward trend, from an average of 1-10 in the 2003 championship  
244 (Martin, 2004), to 1-12 in the 2011/12 seasons (Carroll, 2013), to 1-14 in this study of the  
245 2016 season. ‘What it takes to win’ in GF seems to have increased from posting a score  
246 of 1-10 in 2003 to 1-17 in 2016. As the shot count remains relatively stable, this trend  
247 demonstrates that teams have become more accurate when shooting. Our study found  
248 average shot efficiency in 2016 to be 53%, with champions Dublin recording 57% mean  
249 shot success from an average shot count of 32. Shot efficiency was found to be significant  
250 higher for winners which agrees with other elite GF championship studies (Gamble et al.,  
251 2019; Allister et al., 2018; Carroll, 2013) and club level GF (McGuigan et al., 2018). The  
252 figures over time also support the theory of a trend towards improved accuracy with  
253 averages climbing from 44% (Martin, 2004) to 48% (Carroll, 2013) to the current  
254 reported value of 53%, which concurs with Allister et al.’s (2018) 53.5% finding. This  
255 fifteen-year time span has coincided with tactical shift in the game where teams are  
256 playing more in defensive zones than traditional ‘man to man’ marking (Bradley &  
257 O’Donoghue, 2011). As teams are afforded less space and freedom to attempt shots, they  
258 are increasingly being coached to be more clinical with the shots they attempt, potentially  
259 explaining the increase in scoring efficiency over time.

260

261           The present study establishes a benchmark ‘hands on ball’ possession count of 48  
262 with little variation between winners and losers. McGuigan et al., (2018), identified a  
263 similar pattern in Senior Club GF with both winning and losing teams recording  
264 possession counts of 41 in the sixty-minute game. Our data support their suggestion and

265 that of Gamble et al., (2019) that it is not the quantity of possession gained which is the  
266 critical factor in success, but the capacity to convert possession into scores; productivity.  
267 Our data support previous findings that productivity was a significant distinguisher  
268 between winners and losers, supporting their assertion that it is a key performance  
269 indicator in GF (McGuigan et al., 2018; Gamble et al., 2019). The number of points per  
270 ten possessions scored at elite level were comparable to the senior club data with elite  
271 winners scoring 4.14 / 10 possessions and losers scoring 3 / 10 possessions, versus senior  
272 club winners converting 4 /10 possessions and losers 2.5 / 10 possessions (McGuigan et  
273 al., 2018). This slightly upward trend is to be expected; as the skill level increases at elite  
274 level, players are less likely to lose possession and more skilful in shooting accurately.

275

276 In our analysis of the 3,050 kickouts taken in 2016, teams opted for a short kickout  
277 47% of the time, an increase in the 30% incidence reported by Mangan et al., (2017) from  
278 older data. Given a retention rate of 93.4% for short kickouts as opposed to 53.5% for  
279 long ones, it is easy to see why teams take this option, however winners are much more  
280 efficient at converting this possession to scores (30.8% versus losers' 21.4%). Neither  
281 winners nor losers concede many of these kickouts, (1-2 per game) but when they do, the  
282 superior attacking prowess of the winning teams is evident converting 63% of these  
283 possessions versus just 28% for losers. The binary logistic regression analysis reveals that  
284 teams are significantly more likely to score off the opposition kickout than their own,  
285 providing food for thought for coaches in terms of the strategies they employ for this set  
286 piece. The overall kickout success of 72% is lower than Alister et al.'s, (2018) finding of  
287 78% which potentially reflects the difference in sampling as the present study includes  
288 all games played. As with soccer (MacKenzie & Cushion, 2013), no representative  
289 sample size for a GF season has been established.

290

291           The breadth of games sampled is a potential limitation of the present study as it  
292 incorporates and does not discriminate between knock-out and matches where teams had  
293 another opportunity to play. Recommendations for future study would be to break down  
294 the games over several seasons according to contextual factors such as venue, phase of  
295 competition; by margin of victory and investigate if score-line status affects the options  
296 taken in possession by teams (Carling et al., 2014). Further analysis of the inter-  
297 relationships between variables rather than isolated reporting of performance indicators  
298 would greatly enhance the general understanding of game demands.

## 299           **5. Conclusion**

300           As a unique snapshot in time, the findings of this study can be used to assess how  
301 GF has evolved over time and provides a valuable benchmark to assess the impact of the  
302 current raft of rule changes on the nature of the game, for example if the introduction of  
303 a ‘mark’ for a kickout catch has encouraged more long kickouts.

304

305           The isolation and profiling of possessions in GF is novel information for coaches  
306 and applied performance analysts, revealing which characteristics of possession are most  
307 likely to yield scores. The linking of performance variables to outcomes in the logistic  
308 regression is an important step forward in understanding the game demands and may be  
309 of value to coaches in assessing if their practice environment replicates game conditions.  
310 In providing further evidence for the significance of productivity and turnover rate to  
311 winning performances, this study contributes to our understanding and measurement of  
312 ‘What it takes to Win’ of GF and establishes benchmark ‘winners’ data to which coaches  
313 can compare performance.

314

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## 1 McGuckin et al., 2019 Tables and Figures

2 **Table 1.** Operational definitions of variables used

Action / Outcome	Definition
Team	The team that has possession of the ball
Possession	Each time a team is in control (held in hand or foot) of the ball. One possession will persist until the team loses control of the ball. Does not include GK holding kickout.
Possession Source	The method that was used to gain possession
Own Kickout	When possession is secured from a teams' own kickout.
Opposition Kickout	When possession is secured from the opposition kickout.
Turnover	When possession is secured from any variation of turnover from the opposition.
Throw in (Restart)	When possession is secured following a throw up between the two teams at the start of the first and second half.
Kickout	Any time the goalkeeper kicks the ball from the ground as a result of the ball travelling over the end line having been last touched by a player on the opposing team.
Turnover	When a player in possession surrenders possession to the opposition through physical contact, an unsuccessful shot or pass, or through committing a foul.
Possession Area	The location on the pitch where possession was gained by a team
Defensive Third (Defence)	Between a team's end line and the nearest 45m line.
Middle Third (Midfield)	Between the two 45m lines.
Attacking Third (Attack)	Between the opponents' end line and the nearest 45m line.
Attack	An 'attack' occurs when a team plays the ball over the 45m line into their attacking third of the field if a shot was attempted from outside the 45m line.
Possession Outcome	The ability of the team in possession to create a shot
No Shot	When the attacking team do not attempt a shot and subsequently lose possession to the opposition.
Shot	An action that sends the ball directly towards the opposing teams' goal in an attempt to score a point or goal.
Shot outcome	What happens as a result of the shot
Goal	The ball going below the crossbar and between the posts.
Point (P)	When the ball is kicked or fisted over the crossbar and between the two posts.
Point (F)	When the ball is kicked over the crossbar and between the two posts directly, as a result of the referee awarding the attacking team a free kick.
Point (45)	When the ball is kicked over the crossbar and between the two posts from the ground on the opposition teams 45m line. A '45' is awarded when the defending team play the ball other their own end line.
Productivity	Number of points scored per 10 possessions. A measure of the effectiveness of possession. $(\text{Total Score}/\text{Possessions}) \times 10$
Wide	A shot that travels wide of either side of the goal posts.
Short	When the ball falls short of the opposing goal when attempting to score a point or goal
Saved	The goalkeeper/defender stopping the ball from going between the two posts when a goal chance is achievable.
Post	The ball striking the post or crossbar and returning to play.
Blocked	When any player from the opposition team (other than the GK) block the shot from reaching the target or going between the two posts.
Shot Area	The zone of the pitch where the shot occurred.
Turnover Rate (%)	Number of turnovers expressed as a percentage of the total number of team possessions
Number of passes	The total number of passes that occur in a team's phase of possession. The count of passes starts when the team gains possession and continues until the team take a shot or lose possession.

3

4

5 **Table 2.** final inter-analyst reliability test for percentage error in variables where  
6 agreement was less than 100%. ICC values of 1.000 with a 95% confidence interval from  
7 0.998 to 1.000,  $p < 0.001$  for event and outcome variables.

	v1	v2	%Error
Team A Possessions	50	49	0.02
Team A Attack	39	40	0.03
Team A Shots	25	24	0.04
Team A Shot	25	24	0.04
Team A Wide	8	7	0.13
Team A Kickout Own	23	22	0.04
Team A Midfield	12	13	0.08
Team A Attack	37	35	0.06
Team B Possessions	52	53	0.02
Team B Kickout Own	20	1	1.81
Team B Turnover	27	26	0.04
Team B Midfield	8	10	0.22
Team B Attack	37	36	0.03

8

9 **Table 3.** Mean and standard deviation for performance indicators in all (n=64) games in  
10 the 2016 All Ireland Football Championship.

	Mean	Std. Error	Minimum	Maximum
Total possession count	48.2 ± 5.7	.50	33.0	68.0
Possession in Defence (%)	55.5 ± 10.6	.01	29.5	81.1
Possession in Midfield (%)	40.3 ± 10.9	.01	15.4	65.2
Possession in Attack (%)	4.2 ± 3.2	.00	0.0	19.6
Attacks	41.2 ± 5.6	.49	29.0	58.0
Attack creation (%)	85.5 ± 6.0	.53	67.0	98.0
Shot count	27.9 ± 5.2	.46	15.0	48.0
Territorial effectiveness (%)	67.5 ± 8.9	.79	48.0	91.0
Scores	15.0 ± 4.2	.38	7.0	26.0
Points	17.2 ± 5.5	.48	8.0	33.0
Scoring efficiency (%)	53.4 ± 10.3	.91	29.0	83.0
Productivity	3.6 ± 1.0	.09	1.7	6.5
Own Kickout Won	17.2 ± 4.0	.35	8.0	29.0
Opp Kickout Won	6.6 ± 3.9	.34	0.0	16
Turnovers	23.4 ± 4.9	.44	12.0	34.0
Turnover Rate (%)	48.5 ± 8.5	0.8	26.0	66.7

11

12 **Table 4.** Breakdown of count and percentage of all possessions and possessions leading to shots and scores ( $n = 64$  Games, Total Possessions =  
 13 6,174)

	Total Possessions		Possessions leading to shots			Possessions leading to scores		
	Count	% of total possessions	Count	% of total possessions	% possessions leading to a shot	Count	% of total possessions	% possessions leading to a score
<i>Origin of possession</i>								
<b>Throw In</b>	<b>130</b>	<b>2.1</b>	<b>75</b>	<b>1.2</b>	<b>57.7</b>	<b>35</b>	<b>0.6</b>	<b>26.9</b>
<b>Own Kickout</b>	<b>2198</b>	<b>35.6</b>	<b>1227</b>	<b>19.9</b>	<b>55.8</b>	<b>674</b>	<b>10.9</b>	<b>30.7</b>
<i>Short</i>	1325	21.5	958	15.5	72.3	367	5.9	27.7
<i>Long</i>	873	14.1	566	9.2	64.8	307	5.0	35.2
<b>Opposition Kickout</b>	<b>852</b>	<b>13.8</b>	<b>583</b>	<b>9.4</b>	<b>68.4</b>	<b>327</b>	<b>5.3</b>	<b>38.4</b>
<i>Short</i>	94	1.5	68	1.1	72.3	43	0.7	45.7
<i>Long</i>	758	12.3	515	8.3	67.9	284	4.6	37.5
<b>Turnover</b>	<b>2994</b>	<b>48.5</b>	<b>1689</b>	<b>27.4</b>	<b>56.4</b>	<b>882</b>	<b>14.3</b>	<b>29.5</b>
<i>Defence</i>	2087	33.8	1090	17.7	52.2	547	8.9	26.2
<i>Midfield</i>	738	12.0	469	7.6	63.6	253	4.1	34.3
<i>Attack</i>	169	2.7	130	2.1	76.9	82	1.3	48.5
<i>Pass Count</i>								
0 - 4	3579	58.0	1902	30.8	53.1	1079	17.5	30.1
5-9	2042	33.1	1312	21.3	64.3	678	11.0	33.2
≥10	553	9.0	360	5.8	65.1	161	2.6	29.1
<i>Time in possession (s)</i>								
1-10	1201	19.4	512	8.3	42.6	319	5.2	26.6
11-20	1927	31.2	1077	17.5	55.9	609	9.9	31.6
21-30	1453	23.5	954	15.5	65.7	502	8.1	34.5
31-40	750	12.1	483	7.8	64.4	253	4.1	33.7
41-50	387	6.3	247	4.0	63.8	103	1.7	26.6
51-60	191	3.1	128	2.0	67.0	67	1.1	35.1
≥61	265	4.3	173	2.8	65.3	65	1.1	24.5

15 **Table 5.** Mean and standard deviation for performance indicators of winning (n = 59) versus losing  
 16 teams (n = 59)

	Winning Teams	Losing Teams	P value	Effect size
Total possession count	49.1 ± 5.2	46.5 ± 5.2	0.002 <sup>^</sup>	Delta = 0.27
Possession (%)	51.3 ± 2.8	48.7 ± 2.8	0.001*	d = 0.08
Attacks	42.2 ± 5.4	39.5 ± 5.2	0.006*	d = 0.10
Attack creation (%)	85.9 ± 6.1	84.9 ± 6.2	0.332 <sup>^</sup>	Delta = 0.11
Shot count	30.2 ± 5.0	25.5 ± 3.8	<0.001	Delta = 0.96
Territorial effectiveness (%)	71.2 ± 8.6	64.7 ± 7.8	<0.001*	d = 0.14
Scores	17.3 ± 3.9	12.7 ± 3.0	<0.001 <sup>^</sup>	Delta = 0.66
Points	20.3 ± 5.0	14.2 ± 3.9	<0.001 <sup>^</sup>	Delta = 0.66
Scoring efficiency (%)	57.6 ± 9.9	49.6 ± 9.4	<0.001*	d = 0.22
Productivity	4.1 ± 1.0	3.1 ± 0.9	<0.001*	d = 0.44
Own Kickout Won	16.0 ± 3.7	18.2 ± 4.1	0.001 <sup>^</sup>	Delta = -0.31
Opp Kickout Won	8.0 ± 4.0	5.4 ± 3.3	0.001 <sup>^</sup>	Delta = 0.40
Turnovers	24.0 ± 5.0	22.1 ± 4.7	0.003*	d = 0.12
Turnover Rate (%)	45.0 ± 8.3	51.3 ± 7.8	<0.001*	d = -0.17
Poss starting in DEF%	54.4 ± 10.5	56.1 ± 10.7	0.349 <sup>^</sup>	Delta = 0.07
Poss starting in MID%	41.9 ± 10.5	39.5 ± 10.9	0.125 <sup>^</sup>	Delta = 0.23
Poss starting in ATT%	3.7 ± 2.9	4.4 ± 3.4	0.421 <sup>^</sup>	Delta = -0.09
%Success of poss (DEF)	57.0 ± 12.2	49.5 ± 10.6	<0.001 <sup>^</sup>	Delta = 0.36
%Success of poss (MID)	66.2 ± 12.5	60.4 ± 13.3	0.023 <sup>^</sup>	Delta = 0.26
%Success of poss (ATT)	77.1 ± 31.7	79.0 ± 33.4	0.949 <sup>^</sup>	Delta = -0.15

17 \* Paired samples t test was used, <sup>^</sup> Wilcoxon signed ranks test was used

18 **Table 6.** Breakdown of possessions from kickout by area and outcome for winners and losers ( $N = 59$   
 19 Games)

<b>OWN KICKOUT</b>				
	<b>Winners</b>		<b>Losers</b>	
	<b>Short</b>	<b>Long</b>	<b>Short</b>	<b>Long</b>
No. Possessions	570	372	637	434
No. Shots Created	336	238	309	248
No. Scores	189 (33%)	149 (40%)	145 (22%)	137 (31%)
<b>OPP KICKOUT</b>				
	<b>Winners</b>		<b>Losers</b>	
	<b>Short</b>	<b>Long</b>	<b>Short</b>	<b>Long</b>
No. Possessions	40	433	43	275
No. Shots Created	32	308	31	176
No. Scores	25 (63%)	180 (42%)	12 (28%)	88 (32%)

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 21 **Table 7.** Breakdown of possession from turnovers by area and outcome for winners and losers ( $N= 59$ )

<b>WINNERS</b>				
	<b>Defence</b>	<b>Midfield</b>	<b>Attack</b>	<b>Total</b>
	No. Possessions	997	349	69
No. Shots Created	552	218	55	825
No. Scores	302 (30%)	127 (38%)	35 (51%)	464 (33%)
<b>LOSERS</b>				
	<b>Defence</b>	<b>Midfield</b>	<b>Attack</b>	
No. Possessions	902	324	79	1305
No. Shots Created	447	205	62	714
No. Scores	207 (23%)	101 (31%)	38 (48%)	346 (27%)

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**Table 8.** Coefficients of the binary logistic regression model

<b>Variable</b>	<b>B</b>	<b>S.E.</b>	<b>Wald</b>	<b>df</b>	<b>Sig.</b>	<b>Exp(B)</b>
Half	-0.0348	0.065	0.286	1	0.593	1.035
Duration (s)	0.0221	0.004	38.507	1	0.000	0.978
Passes	0.0228	0.017	1.881	1	0.170	0.977
Starting area defence	-1.5012	0.193	60.420	1	0.000	4.487
Starting area midfield	-0.8996	0.191	22.281	1	0.000	2.459
Method = throw in	-0.1908	0.232	0.677	1	0.411	1.210
Method = own kick out	-0.0458	0.072	0.401	1	0.527	1.047
Method = opp kick out	0.2396	0.116	4.251	1	0.039	0.787
Constant	0.9259	0.187	24.565	1	0.000	0.396