

# The impact of match location and crowd attendance during COVID-19 on technical performance in elite Gaelic football

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## Headline

Despite the popularity and perceived importance of technical analysis within Gaelic games, there is a distinct lack of published research in terms of team performance indicators in Gaelic football. Elite Gaelic football literature has reported teams to take  $27 \pm 5$  shots per game, with teams committing  $21 \pm 5$  fouls per game [23]. Further research is required to determine if these findings are normative for Gaelic football, and if variations exist when playing location and crowd is considered.

In line with sports such as Australian football [8], soccer [34], rugby, basketball and handball [35], home advantage has been previously established in Gaelic football [21]. Elite Gaelic football research has observed home advantage in the championship qualifiers to be more prevalent from 2010-2015 than the previous 10 seasons (2001-2010). This investigation also showed that home advantage was evident overall with home teams winning on  $56.1 \pm 4.1$  % of occasions in contrast to away teams winning on  $37.5 \pm 2.5$  % of games [21]. Although the concept of home advantage is well established in team sports, the impact of match location on technical performance indicators in Gaelic football requires further investigation.

Due to the COVID-19 pandemic, supporters have been prevented from attending sporting events and lending their teams live support, including Gaelic football. Elite soccer research identified a relationship between crowd size and home advantage [15], while other elite adult and elite youth soccer literature discovered home advantage was evident even when attendances were minimal [33], or even zero [34]. Recent findings suggest that even if the home crowd matters, there is no straightforward relationship between crowd size and home advantage, with no significance discovered between the two variables [19]. Research investigating home advantage and referee bias in elite soccer discovered a significantly greater magnitude of referee bias to the home team with increased crowd density [16]. Similarly, elite soccer research examining match-play over ten seasons discovered home team bias significantly increased with increasing crowd size [4]. Regarding location and crowd, elite soccer research investigating the effect of crowd support on referee decision-making discovered a positive correlation between home team bias and crowd density [11]. However, the findings of other elite soccer literature examining points per game suggests that home advantage exists for teams playing in their own stadiums, regardless of whether a crowd is present [34]. This suggests that crowd support is not a necessary precondition for the home advantage. With respect to these presumably only temporary conditions, a gap in literature exists regarding the impact of crowd attendance on technical performance in Gaelic football.

**Aim.** The aim of the current study was to examine the technical performance indicators of elite male Gaelic football, comparing location (home and away) and crowd (attendance and no attendance).

## Methods

**Data Collection.** Data were collected across the 2019 and 2020 National Football League (NFL) seasons. Data from the All-Ireland Senior Football Championship was not included as some Championship games can be played in neutral venues. The technical performance indicators were examined for both teams during 18 elite Gaelic football matches (attendance,  $n = 9$ ; no attendance,  $n = 9$ ; 2019 season,  $n = 5$ ; 2020 season,  $n = 13$ ), involving divisions 1, 2, 3 and 4. All empty stadium games were during the 2020 season, and were behind closed doors due to the COVID-19 pandemic. Match videos were obtained from a combination of television broadcasts of live games (RTÉ and TG4) and from the team's own recordings of match-play. All matches were coded using SportsCode software (Hudl SportsCode Elite V11, Sportstec, Nebraska, USA) on a MacBook Air. A customised match analysis template was used to record the data for all games, with all games coded by one experienced performance analyst.

Two games were randomly selected, coded once and then coded a second time 7 days later. Intraclass Correlation Coefficients (ICC) were calculated to examine the agreement between the initial data and the retest data for the individual technical performance variables. ICC estimates and their 95% confident intervals (CI) were calculated using statistical software (Statistical Package for the Social Sciences data analysis software V24.0, SPSS Inc., Chicago, Illinois, USA) based on an absolute-agreement, 2-way mixed-effects model. In the event of  $ICC = 1$ , the determinant of the covariance matrix was zero and statistics based on its inverse matrix such as 95% CI and the level of significance could not be calculated. An excellent level of reliability was observed for each of the variables ( $ICC = 1$ ); fouls conceded ( $ICC = 1$ ); shots taken ( $ICC = 1$ ); shots scored ( $ICC = 1$ ); turnovers won ( $ICC = 1$ ); turnovers lost ( $ICC = 1$ ); own long kickouts won ( $ICC = 1$ ); own long kickouts lost ( $ICC = 1$ ); own short kickouts won ( $ICC = 1$ ) and own short kickouts lost ( $ICC = 1$ ).

**Variables and Definitions.** Fouls awarded and conceded, shots taken and scored, turnovers won and lost, own long kickouts won and lost, and own short kickouts won and lost were recorded for all teams.

**Statistical Analysis.** All data were anonymised before analysis to ensure the confidentiality of the teams involved. All data are presented as mean  $\pm$  standard deviation (SD). A two-way ANOVA was conducted to examine interactions and main effects for attendance (full stadium and empty stadium) or location (home and away) comparing differences in fouls

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Table 1: Technical variables and definitions

Technical variable	Definition
Foul	The referee blows their whistle for what is deemed to be an act of misconduct or a violation to the rules
Shot	An attempt to directly score a goal or point
Turnover	When a team loses possession of the ball resulting from a steal, going out of bounds, committing a violation or committing an offensive foul
Long kickout	When the kickout from the goalkeeper lands outside their 45 metre line
Short kickout	When the kickout from the goalkeeper lands inside their 45 metre line
Kickout won	When the goalkeeper's team maintains possession of the ball following a kickout
Kickout lost	When the opposition team gains possession of the ball following a kickout

awarded, fouls conceded, shots taken, shots scored, turnovers won, turnovers conceded, own long kickouts won, own long kickouts lost, own short kickouts won and own short kickouts lost. The assumptions of normality (Shapiro-Wilk), and homogeneity of variances (Levene's) were verified for all analysis. Where main effects were observed, a Tukey's post hoc analysis was conducted. Any interaction was explored with simple main effects under a Bonferroni adjustment for multiple comparisons (SPSS adjusted p reported). Significance was accepted where  $p \leq 0.05$  (Statistical Package for the Social Sciences data analysis software V23.0, SPSS Inc., Chicago, Illinois, USA).

### Results

There were no significant interaction effects or simple differences observed between location and crowd for fouls awarded and conceded, shots taken and scored, turnovers won and lost, own long kickouts won and lost, and own short kickouts won and lost. However, large variations were observed when comparing location and crowd. All descriptive statistics for the dependent variables can be observed in Table 1.

### Discussion

The aim of the current study was to analyse the technical performance indicators of elite male Gaelic football, compar-

ing location and crowd. The investigation is the first of its kind to examine the impact of crowd attendance on technical performance in Gaelic football. No significant differences were observed when comparing location and crowd, however large variations were evident. Although non-significant statistical differences were found in the current study, the practical impact of the obtained findings may indeed be significant.

In the current investigation, empty stadiums appeared to benefit away teams when fouls awarded and fouls conceded were considered. With no attendance, away teams were awarded 2.1 more fouls per game and conceded 2.9 less fouls per game compared to home teams. Additionally, home teams were awarded 1.8 less fouls per game and conceded 4.0 more fouls per game with no attendance compared to with attendance. This supports the argument of Nevill et al. [26] that the dominant effect of crowd noise is to reduce the number of fouls called against the home team. Elite soccer research investigated the impact of crowd noise during the assessment of recorded tackles on videotape. The study discovered when background noise was present, referees awarded significantly fewer fouls against the home team, compared with those watching in silence [26]. Similar to the current findings, elite soccer literature examining home advantage and referee bias reported a significantly greater magnitude of referee bias to the home team with increased crowd density [16] and size [4]. In contrast to the current findings, elite soccer literature examining full stadium English Premier League games reported

Table 2: Technical performance indicators comparing attendance and location.

Stadium	Location	Fouls awarded	Fouls conceded	Shots taken	Shots scored	Turnovers won	Turnovers conceded	Own long K/O won	Own long K/O lost	Own short K/O won	Own short K/O lost
Attendance (n=18)		16.2 ± 4.3	14.4 ± 4.8	24.9 ± 7.7	14.3 ± 4.0	21.5 ± 4.3	20.9 ± 4.4	6.5 ± 1.8	5.1 ± 3.0	7.9 ± 3.5	0.5 ± 0.7
	No attendance (n=18)	15.9 ± 4.2 (0.3)	15.9 ± 4.2 (0.5)	25.6 ± 4.3 (0.7)	16.0 ± 3.3 (1.7)	16.1 ± 5.0 (5.4)	16.1 ± 5.0 (4.8)	6.2 ± 1.8 (0.3)	5.1 ± 2.9 (0)	8.5 ± 4.9 (0.6)	0.8 ± 0.8 (0.3)
	Home (n=18)	15.8 ± 4.6	15.0 ± 4.4	26.6 ± 6.7	15.8 ± 4.0	19.5 ± 5.3	17.9 ± 5.2	6.0 ± 1.5	5.1 ± 3.1	7.0 ± 4.2	0.4 ± 0.6
	Away (n=18)	16.3 ± 3.8 (0.5)	15.4 ± 4.7 (0.4)	24.8 ± 5.6 (1.8)	14.4 ± 3.4 (1.4)	18.1 ± 5.5 (1.4)	19.1 ± 5.3 (1.2)	6.7 ± 1.9 (0.7)	5.0 ± 2.8 (0.1)	9.4 ± 4.0 (2.4)	0.8 ± 0.9 (0.4)
Attendance (n=9)	Home	16.7 ± 3.7	13.0 ± 5.2	26.4 ± 8.3	15.1 ± 4.7	22.7 ± 4.9	20.0 ± 3.1	5.7 ± 1.5	4.6 ± 3.0	8.0 ± 3.6	0.3 ± 0.5
No attendance (n=9)	Home	14.9 ± 5.4	17.0 ± 2.3	26.8 ± 5.1	16.6 ± 3.4	16.3 ± 3.7	15.9 ± 6.3	6.4 ± 1.6	5.7 ± 3.2	6.0 ± 4.6	0.6 ± 0.7
Attendance (n=9)	Away	15.7 ± 4.9	15.9 ± 4.1	23.3 ± 7.0	13.4 ± 3.3	20.3 ± 3.6	21.9 ± 5.4	7.6 ± 1.6	5.6 ± 3.1	7.9 ± 3.6	0.7 ± 0.9
No attendance (n=9)	Away	17.0 ± 2.3	14.9 ± 5.4	26.3 ± 3.5	15.4 ± 3.4	15.9 ± 6.3	16.3 ± 3.7	6.0 ± 2.0	4.4 ± 2.5	11.0 ± 4.0	1.0 ± 0.9

that away teams committed significantly more fouls per game compared to home teams [5]. Furthermore, a recent investigation of elite soccer during COVID-19 found that both home teams and away teams committed significantly more fouls per game in empty stadiums compared to full stadiums [10]. Although non-significant differences were observed in the current study, the elimination of supporter attendance to the games may have impacted the referees' bias toward home teams.

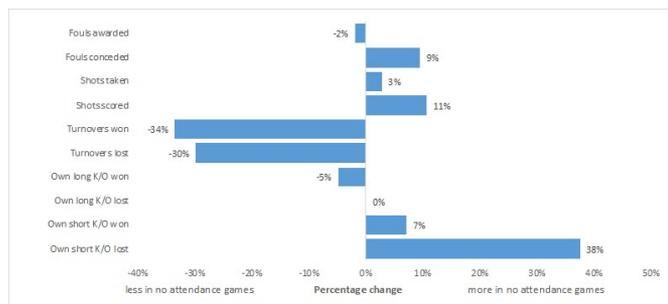


Fig. 1: Technical performance indicator changes with 'no attendance' compared to 'with attendance'

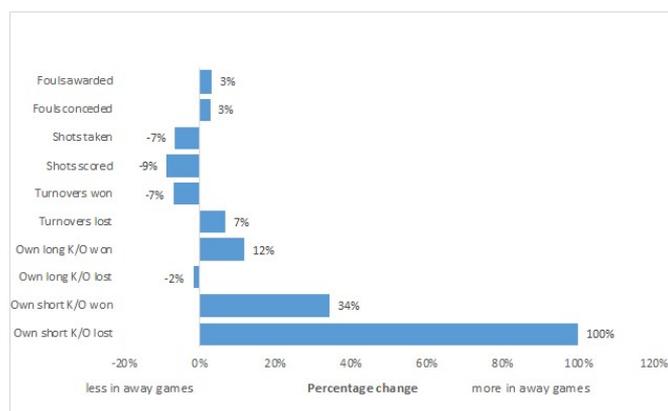


Fig. 2: Technical performance indicator changes in away location compared with home location

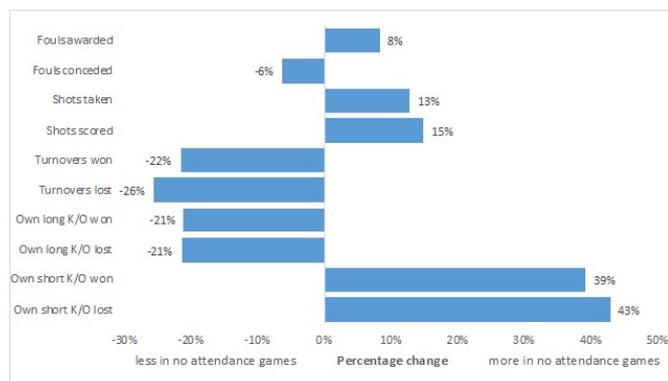


Fig. 3: Technical performance indicator changes for away teams comparing attendance

With no attendance, away teams took 3.0 more shots per game compared to with attendance. Moreover, during games with crowd attendance, away teams took 3.1 less shots per game compared to home teams, with minimal differences observed with no attendance (0.2 less shots per game). Similarly, elite soccer research of nine Greek Superleague seasons

similarly found away teams to take 3.6 less shots per game compared to home teams [3], while analysis of elite Spanish football found home teams to have significantly more total shots than away teams [18]. Although insignificant findings of the current study were evident, the large variations in shots taken across location is unsurprising. The ability to generate shots from attacking positions was previously identified as a key performance indicator of winning performance in Gaelic football [6]. Carroll (2013) compared the top eight ranked inter-county senior football teams (based on quarter-final appearances from 2010-2012) to the rest of the competing counties. Top teams achieved a significantly greater number of shots ( $n = 29.5$ ) when performing against bottom teams compared to when competing against top teams ( $n = 27$ ). When the success of the shots taken was considered, 1.7 more shots were scored per game in empty stadiums, with home teams scoring 1.4 more shots per game compared to away teams. Elite Gaelic football research comparing technical performance variables across different divisions found that division 3 teams performed a significantly greater number of unsuccessful shots compared to their division 1 counterparts [24]. In support of the findings of the current study, elite soccer research found home teams to score significantly more goals per game compared to away teams [18, 32]. Away teams scored 2.0 more shots per game in empty stadiums compared to full stadiums, while home teams scored 1.5 more shots in empty stadiums. Similar to the current findings, elite soccer research conducted during the COVID-19 pandemic discovered away teams scored 0.11 more goals per game in match played behind the doors. However, the authors' discovered home teams scored 0.037 goals less without the support of the crowd [32]. Alternative elite soccer research also discovered home teams to score significantly less goals in empty stadiums during the COVID-19 pandemic [30].

In addition to outscoring the opponent, it is likely that successful Gaelic football teams regain possession through turnovers; generated via tacking, interception and/or unforced errors [14]. Home teams (+6.4) and away teams (+4.4) won more turnovers per game with attendance compared to without attendance. Independent of location, more turnovers (+4.8) were conceded per game with attendance compared to with no attendance. Home teams (+4.1) and away teams (+5.6) conceded more turnovers per game with attendance compared to with no attendance. An elite soccer study analysing match location discovered no significant difference in turnovers won when comparing home and away teams [2]. Regarding Gaelic football, no previous studies have examined the number of turnovers comparing match location and crowd. However, existing literature has found winning teams to win significantly more turnovers than losing teams [6, 14]. Away teams won more (+2.4) short kickouts compared to home teams in all games, with that difference increasing further with no attendance (+3.1) compared to with attendance. Home teams won 2.0 more short kickouts when a crowd was present compared to with no attendance. Research examining kick-out distribution and effectiveness in elite Gaelic football discovered that kick-outs to the wings (57.6%) and 65 m + (53.8%) were the most common distribution strategy. Kick-outs to 21-45 m produced greater success rates of possession retention than longer kickouts, while kick-outs to the wings contributed an 8% greater success rate at creating scoring opportunities when compared to central kick-outs [12]. These findings highlight the increased emphasis and importance of maintaining primary possession in the modern game.

## Main Results

- In empty stadiums, away teams were awarded more fouls and conceded fewer fouls compared to games with attendance. Further, home teams were awarded fewer fouls and conceded more fouls in empty stadiums compared to games with a crowd.
- With no attendance, away teams took more shots per game compared to with attendance. During games with crowd attendance, away teams took less shots per game compared to home teams.
- Away teams scored more shots per game in empty stadiums compared to full stadiums, while home teams scored more shots in empty stadiums.
- Home teams and away teams won more turnovers per game with attendance compared to without attendance. Home teams and away teams conceded more turnovers per game with attendance compared to with no attendance. Independent of location, more turnovers were conceded per game with attendance compared to with no attendance.
- Away teams won more short kickouts compared to home teams in all games, with that difference increasing further with no attendance compared to with attendance. Home teams won more short kickouts when a crowd was present compared to with no attendance.

## Limitations

- This investigation data did not account for team quality. The coded games included division 1, 2, 3 and 4 games. Factors such as playing experience and tactical awareness could potentially influence the technical variables analysed in the current investigation. More robust studies with large samples and accounting for team quality are needed to determine the true impact of empty stadiums on technical performance in Gaelic football.
- During data collection, in some instances when using broadcast coverage of games, replays may be shown when the ball was in play. This may have led to some events being missed in the coding process.
- The variable of pitch and weather conditions were not considered. The games coded were played at different times of the season, in varying weather conditions and thus, may have impacted team tactics and player decision making during match-play.

## Practical applications

- Practitioners may apply this information to organising their defensive and offensive systems in future games with no attendance to generate turnovers and increase productivity.
- This information may also be useful to teams in terms of planning match strategies based on the location of the competition.

## Dataset

Dataset available on SportPerfSci.com

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