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STONE, Joseph <http://orcid.org/0000-0002-9861-4443>, KUBAYI, Alliance, SMITH, Adam and NORTH, Jamie

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Joseph. A. Stone[1], Alliance Kubayi[2], Adam Smith[3], & Jamie S. North[4]

[1]Sport and Physical Activity Research Centre, Sheffield Hallam University, Sheffield, United Kingdom.

[2]Department of Sport, Rehabilitation and Dental Sciences, Tshwane University of Technology, Pretoria, South Africa.

[3]Nottingham Forest Football Club, Nottingham, United Kingdom.

[4]St Mary's University, Twickenham, London, United Kingdom.

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Abstract

Limited research has investigated the impact of throw-in strategy on match performance. Hence, this study examined throw-in strategy used by teams across five European competitions and how that strategy affected first contact success, possession retention, and attacking outcomes. Throw-ins from 1,826 matches across five European Leagues (Premier League; Bundesliga; Serie A; La Liga; Ligue) during the 2022/2023 season were analysed. StatsBomb data resulted in 71,220 phases of play originating from a throw-in. Variables such as competition, throw-in distance and direction were assessed on their impact on first contact success, possession metrics and shot creation. On average, 39 throw-ins were taken per match. 42,287 throws originated from the middle zones of the pitch, with throwing the ball backwards (99.5%) or laterally (96.9%) increasing first contact success compared to throwing the ball forwards (71.3%) ($p< 0.05$). Quicker throw-in restarts resulted in increased first contact success rate (0-5 seconds, 94.4%, compared to 78.31% >15 seconds). Retaining possession from the throw-ins was highest when going backwards (92.13%) compared to laterally (71.20%) and forwards (49.75%). Results showed an increased chance of shot creation for throw-ins directed backwards or laterally compared to those directed forwards. Findings are discussed in relation to applied performance and coaching implications.

1.0 Introduction

Performance analysis research in association football continually evolves to investigate contemporary tactical and technical developments across European football competitions; recent examples include how offensive team variables affect goal scoring in Spain (Prieto-González et al. 2024), and the effect of rule changes on technical performance outcomes in the UFEA Champions League (Kubayi, & Stone, 2024). However, one area which has continued to attract researchers' attention over many years is the use and effectiveness of set-plays (Sarmento et al., 2022). During a football match, when the ball goes out of the playing area or play is stopped due to fouls, the game is restarted through set plays (e.g., penalty kicks, free kicks, corner kicks, and throw-ins). Considerable research attention has been focused on corner kicks (e.g., Goodman et al., 2024; Strafford et al., 2019), free kicks (e.g., Casal et al. 2014) and penalty kicks (e.g., Bijlstra et al. 2020; Prieto-Lage et al. 2024). However, until recently throw-ins have been an under researched set-play in football (see Stone et al. 2021; Casal et al., 2023; Epasinghege & Swartz, 2024).

A throw-in is awarded to the opposing team of the player who last touched the ball when the whole of the ball passes over the touchline, on the ground or in the air (Law 15, International Football Association Board, 2024). Early research on throw-ins examined how players could maximise the length of the throw via biomechanical analysis to enable goal scoring opportunities from attacking final third throw-ins like corner kicks with a pre-planned routine (Kline & Samonisky, 1981; Stanculescu et al. 2014; Linthorne & Thomas, 2016). However, these types of throw-ins represent only a small proportion of the total throw-ins taken per match (Wallace & Norton, 2014), with throw-ins typically used to restart and build possession in the middle areas of the pitch.

The potential tactical value of the throw-in is highlighted by their frequency, with research reporting an average of 43 per match in the English Premier League (Stone et al.,

2021) and 40 per match in the Spanish La Liga (Casal et al. 2023). This is compared to typically 10 corners (Starfford et al. 2019; Casal et al., 2015) or 35 free kicks being awarded per match (Link et al., 2016). As throw-ins occur so frequently during a match, they are an important set-piece area that warrant further investigations.

Research examining throw-in tactics on performance outcomes within the English Premier League, demonstrated that 83% of throw-ins resulted in a successful first contact, 54% resulted in possession being retained and 8.8% of throw-ins led to a shot at goal from the possession achieved after a successful first contact (Stone et al., 2021). Furthermore, throw-ins which were directed backwards or laterally resulted in increased first contact success, retaining of possession, and shot creation. In contrast, the least effective throw-ins were those directed forwards and over a longer distance, which resulted in both reduced first contact success and possession retention. Augste and Prestel (2021) examined a relatively small sample of 265 throw-ins in the German Bundesliga, highlighting that throwing the ball forward was the most common strategy, while applying high defensive pressure on the opponent was an important tactic to recover possession from throw-ins. Following these two studies, Casal et al. (2023) examined 2,658 throw-ins in the Spanish La Liga during the 2021-2022 season, which demonstrated how a series of tactical indicators such as duration (how quickly the throw is taken after it goes out of play), defensive press, throw distance, throw direction and pitch location affected throw-in outcomes. Casal et al. (2023) also highlighted how situational factors such as team quality, match status and match time influenced the throw-in outcome. More recently, Epasinghege and Swartz (2024) investigated throw-ins via a causal analysis in the Chinese Super League, suggesting that throwing the ball backwards was beneficial by creating an extra two shots per 100 throw-ins, alongside throwing the ball long (four more shots per 100 throw-ins).

The findings from these previous studies (e.g., Stone et al., 2021; Augste & Prestel, 2021; Casal et al., 2023; Epasinghege & Swartz, 2024) provide a starting point to support the importance of coaches focusing on how throw-in strategy may affect possession and chance creations within professional football. However, with limited published data to date, and often small sample sizes of throws examined, the findings should be interpreted with caution. Furthermore, although the Premier League, La Liga and Bundesliga leagues have been examined, direct comparison between the results is challenging given some of the varying definitions applied to performance indicators. Therefore, comparison within and between some of the top tier European football leagues will enable a greater understanding of the importance of throw-in strategy on team performance and if the strategy employed varies by league. Hence, the aim of this study was to expand current throw-in research by examining the effect of throw-ins on team performance across the five top tier men's professional football leagues in Europe (Premier League, England; Bundesliga, Germany; Serie A; Italy, La Liga, Spain; Ligue 1, France). To achieve this, we first examined the throw-in strategy used by teams across those five competitions. Second, we examined how the strategy that was used affected first contact success, possession retention, and attacking outcomes from the throw-in.

2.0 Method

2.1. Sample

A total of 98 football teams were included in the sample from the top tier domestic leagues in five European countries (Premier League, England; Bundesliga, Germany; Serie A; Italy, La Liga, Spain; Ligue 1, France). For each team, raw event-by-event data was extracted from the 1,826 games played during the 2022/2023 football seasons from the Statsbomb database (https://statsbomb.com). This resulted in 72,363 phases of play starting from a throw-in. After excluding throws-ins from injury clearances (i.e., possession freely given back to the

opposition following the ball being kicked out of play due to an injury), a total of 71,220 throw-ins were included in the sample (see Table 1).

The Local University ethics committee granted approval for the study (ID: ER65542150) which included explicit permission to use the data for this project being granted by Statsbomb before the study commenced.

Table 1. Sample of Throw-Ins from the five European leagues

Competition	Teams Per Competition	Matches Per Team	Total Throws Per Team (Mean ± SD)	Throw In Per Team Match (Mean ± SD)
Premier League (England)	20	38	711.75 ± 63.08	18.73 ± 1.66
Ligue 1 (France)	20	38	693.35 ± 60.18	18.25 ± 1.58
Bundesliga (Germany)	18	34	715.22 ± 58.76	21.04 ± 1.73
Serie A (Italy)	20	38	761.40 ± 71.73	20.04 ± 1.89
La Liga (Spain)	20	38	753.00 ± 69.37	19.82 ± 1.82

2.2 Measures and Procedures

All data processing and analyses were performed using a custom written R-Script within R-Studio software (v2023.06, Posit Software). Raw data from each league and match was imported into R-Studio via Statsbomb using an application programming interface (www.statsbomb.com). The full-match data set which included event-by-event actions (see specification here: Data Specification) was then filtered to create a sub-set of data which contained each throw-in phase of play. The phase of play was defined from the start of the throw-in action to the point the team which threw the ball lost possession. Raw data included the team, opposition team, throw in location (x, y), outcome of the throw, throw-in outcome location (x, y), angle of throw-in, length of throw-in, time in the match, actions during the possession from the throw-in, and the outcome of possession from the throw-in (see Statsbomb event definitions here: Data Specification). Using the raw data, team performance indicators were calculated for each of the 98 teams. Based on Stone et al.'s (2021) definitions, throw-in length (short, medium, long) and direction (backwards, lateral, forwards) were computed for

each throw (see Figure 1 for definition). Four equal size pitch locations were also created (see Figure 1). The match state (winning, drawing, losing) and time the ball was out of play were also included. The effect of these independent variables was examined via calculating four dependent variables, first contact success, possession retention success, mean time in possession, and shot creation (See Table 2 and Figure 1 for categories and definitions).

Table 2. Operational definitions for throw-in lengths, directions and outcome variables (based on Statsbomb, Stone et al., 2021, McKinley, 2018).

Category	Operational Definition
First Contact	**Successful**: A player from the same team which throws the ball into play makes first contact with the ball post throw-in without an opposition player making contact. **Unsuccessful:** A player from the opposition team which throws the ball into play makes first contact with the ball post throw-in. **Success percentage:** Calculated by dividing the number of successful first contacts in a category (i.e. short) by the total number of actions (Successful + Unsuccessful) performed in that category and multiplying by 100
Time in Possession	The time (seconds) from the throw-in action to the end of possession. A possession was defined as a passage of play during which one team is largely in control of the ball. This may involve that team temporarily being dispossessed, but a new possession will only start if the opposing team is then able to demonstrate that they are fully in control of the ball (www.Stasbomb.co.uk).
Possession Retention	**Successful:** The ball is retained in possession (as defined above) for 7 seconds from the point in which the ball is thrown. **Unsuccessful:** The ball possession is lost (as defined above) with in 7 seconds from the point in which the ball is thrown. **Success percentage:** Calculated using only the throw-ins which achieved a successful first contact (n = 13376). Calculated by dividing the number of successful possessions retained in a category (i.e. short) by the total number of actions (excluding those this did not achieve a successful first contact) performed in that category and multiplying by 100
Throw-in resulting in a shot	**Shot Creation:** A shot was recorded when a player attempted a shot at goal which resulted from the throw-in possession. **Success percentage:** Calculated based on all throw-ins taken with throw-ins in each category resulting in a shot divided by total number of throws in that category, multiplied by 100.
Throw in Length	**Short:** The ball was thrown a distance between 0-10 yards (0-9.1meters). **Medium:** The ball was thrown a distance between 10-20 yards (9.1-18.2m). **Long:** The ball was thrown a distance of 20 yards or longer (18.2m).
Throw in Direction	**Forward:** The ball is thrown between 0-60 degrees in reference to the sideline towards the offensive goal. **Lateral:** The ball is thrown between 60-120 degrees in reference to the sideline. **Backward:** The ball is thrown between 120-180 degrees in reference to the sideline towards the defensive goal.
Match-State	**Winning:** The team taking the throw-in has scored more goals than the opponent.

	Drawing: The team taking the throw-in has scored the equal amount of goals as the opponent. **Losing:** The team taking the throw-in has scored less goals than the opponent.
Time Out of Play	**0-5 Seconds:** The throw-in was executed within 5 seconds of the ball going out of touch. **5-10 Seconds:** The throw-in was executed between 5 and 10 seconds of the ball going out of touch. **10-15 Seconds:** The throw-in was executed between 10 and 15 seconds of the ball going out of touch. **>15 Seconds:** The throw-in was executed more then 15 seconds after the ball had gone out of touch

*** Insert Figure 1 Here***

2.3 Reliability

To test the reliability of the statsbomb data set, five randomly selected matches (1 from each competition) were independently coded by the lead author using a NacSport (NacSport Elite, Las Palmas de Gran Canaria, Spain) custom-notational analysis system examining throw-in location, length, direction and outcome (i.e., first contact succuss and possession retention). Cohen's kappa coefficient (k = (po – pc)/(1- pc)) was calculated, based on analysis of 164 throw-ins, with a mean kappa value of $k = 0.97$, demonstrating excellent reliability (see Table 3) (Fleiss, 1981).

Table 3. Inter-Rater Reliability Analysis

Variable	Kappa Value
Pitch Location	0.98
Throw Direction	0.98
Throw Length	0.92
Throw Completion	1
Possession Retention	0.97

2.4 Data Analysis

Descriptive and inferential analyses were all undertaken in R-Studio (v2023.06, Posit Software). Firstly, throw-ins per match were calculated for each team (Total throw-ins / Matches played). The total amount of Throw-ins taken, in each pitch location, per match

were also calculated. Most of the data was normally distributed, examined via Kolmogorvo-Smirnov tests (p >.05) and Q-Q plots, therefore parametric analysis was employed. A One-way Analysis of Variance (ANOVA) was used to examine if the competition affected the number of throw-ins per match. A repeated measures ANOVA was used to examined if pitch location affected the number of throw-ins per match.

Following Stone et al.'s (2021) method, to enable comparison of results, and the lower number of throw-ins taken in the defensive zone, and the expectation of throw-ins in the attacking zone to have more of an emphasis on direct set pieces and not possession retention, these two zones were excluded from further analysis. Furthermore, we combined the two remaining zones' data as previous research demonstrated this not to affect throw-in outcomes (Stone et al., 2021).

To assess throw-in strategy, a Four-Way Mixed Design ANOVA examined if Competition x match-state x throw-direction x throw-length affected the percentage of throw-ins taken. To assess throw-in first contact success, a Four-Way Mixed Design ANOVA examined if Competition x time-out-of-play x throw-direction x throw-length affected the percentage of first contact success. Furthermore, separate three-Way Mixed Design ANOVAs examined if Competition x throw-direction x throw-length affected possession retention, mean time in possession and shot creation percentage. If there was a significant difference ($p < 0.05$), pairwise post-hoc analysis was employed with a Bonferroni correction. Partial eta squared was used for effect size calculations (ηp^2 = < 0.01, negligible; < 0.06, small, < 0.14, medium; > 0.14, large; Richardson, 2011).

3.0 Results

3.1. Throw-Ins per Competition and Location

There was a significant difference with large effect size in the number of throw-ins per match between competitions (F (4, 93) = 7.663, $p < 0.001$, $\eta p^2 = 0.248$). Post-hoc analysis

demonstrated teams in the Bundesliga had more throw-ins per match than teams in the Premier League ($p < 0.001$) and Ligue 1 ($p < 0.001$). Furthermore, Italian teams had more throw-ins per match compared to French teams ($p < 0.05$), who had the lowest number of throw-ins per match across the five leagues.

Table 4. Total Throw-ins and throws per match (mean and standard deviation) across the five football competitions.

Competition	Total Throw-Ins	Throw-Ins Per Match
Bundesliga	12,886	42.0 ± 9.1
Serie A	15,214	40.0 ± 9.5
La Liga	15,049	39.6 ± 9.1
Premier League	14,227	37.4 ± 8.9
Ligue 1	13,864	36.5 ± 9.1

There was a significant difference in the number of throw-ins taken based on pitch location (F (2.26, 219.3) = 588.286. $p < 0.001$, $\eta p^2 = 0.858$). Post-hoc testing showed there were significant differences in the number of throw-ins between all pitch location ($p < 0.001$) with the attacking middle zone (5.99 ± 0.75 throws) having the most throw-ins, followed by defensive middle zone (5.61 ± 0.65 throws) and attacking zone (5.23 ± 0.95 throws). The least common was in the defensive zone (2.70 ± 0.41 throws).

3.2. Throw-in Strategy- Middle Zones of the Pitch

A total of 42,287 throw-ins were taken in the middle zones of the pitch. There was a significant three-way interaction between the competition, throw-direction and throw-length for the percentage of throw-ins taken (F(10.42, 604.18) = 3.31 $p < 0.001$, $\eta p^2 = 0.05$) however, with a negligible effect size. There was also a significant three-way interaction on match state by throw-direction by throw-length interaction with large effect size (F (5.21, 604.18) = 19.819, $p < 0.001$, $\eta p^2 = 0.14$).

There was a significant two-way interaction between competition and throw-direction (*F* (5.64, 326.92) = 4.906, $p < 0.001$, $\eta p^2 = 0.08$). Spanish (41.7% ± 12.01) and German (40.56% ± 12.01) teams had the highest use of forward throws. French teams had the most balanced use of all three directions. Italian and English teams had a balance of forward (40.04%, 38.32%) and backwards (39.01%, 37.39%) throws, but lowest use of lateral throws (20.94%, 24.29%).

There was a significant competition and throw-length interaction ($F(5.71, 330.97) = 4.52$, $p < 0.001$, $\eta p^2 = 0.07$). French and Spanish teams favoured medium (46.5% ± 4.9% & 44.9% ± 3.8%) over long throws (38.1% ± 7.2%, 41.3% ± 6.03%). Italian (45.7% ± 8.1%) and German (45.05% ± 10.8%) teams had the highest ratio of long throws. Short throws were the least used (range between 11.4% and 15.4% across competitions).

There was a significant two-way interaction between match state and throw-direction with large effect size ($F(2.82, 326.92) = 42.420$, $p < 0.001$, $\eta p^2 = 0.27$. Teams when winning favoured forward (54.7% ± 16.2%) throw-ins, whereas teams in a losing position threw the ball backwards more often (44.0% ± 10.02%). When teams were drawing, a balance of backward and forward throw-ins was seen (35.7% ± 38.7%). Match state did not seem to affect the use of lateral throw-ins (23-27% range across the three match states). There was a significant interaction between match state and throw-length but with a negligible effect size ($F(2.85, 330.97) = 4.51$, $p < 0.01$, $\eta p^2 = 0.04$). The use of short throws was similar across match state (13.8% drawing, losing, 13.5%, winning 13.1%). Long throws were used more when winning (45.5%) than drawing (42.9%) and losing (40.6%).

There was a significant two-way significant between throw-direction and throw-length with large effect size ($F(2.60, 604.18) = 227.225$, $p < 0.001$, $\eta p^2 = 0.49$). Backward (17.7% ± 5.7%) and forward (19.3% ± 9.16%), throws were thrown long more often comparison to lateral throws (5.57% ± 2.52%). Short throws were used the least for forward (3.79% ± 1.76%) and

backwards (3.08% ± 1.28%) directions. Lateral throws were taken at a medium length most often (13.63% ± 3.95%).

There was a significant effect of throw-direction on throw percentage (F(1.41, 326.92) = 62.353, $p < 0.001$, $\eta p^2 = 0.21$). Post-hoc analysis demonstrated that forward (39.2% ± 11.4%) and backwards (34.9% ± 8.9%) directions were used more than lateral direction (25.9% ± 6.44%) ($p < 0.001$). There was also a significant effect of throw-length on throw percentage per match with large effect size (F (1.43. 330.97) = 991.481, $p < 0.001$, $\eta p^2 = 0.81$). The use of long (42.6% ± 8.4%) and medium (43.8% ± 5.7%) length throws was more common than short (13.6% ± 4.1%, both $p < 0.001$).

3.3. Throw-In Outcome

87.3% of throw-ins resulted in a successful first contact and 63.3% of throw-ins resulted in possession retention (see Table 5 for more details).

Table. 5. Throw-in first contact and possession retention outcome between the five competitions.

	First Contact			Possession Retention	
	Frequency	First Contact	Percentage	Frequency	Percentage
Premier League [England]	8346	7172	86.1 ± 5.27	5264	63.4 ± 9.0
Ligue 1 [France]	8309	7355	88.7 ± 4.35	5358	64.9 ± 8.3
Bundesliga [Germany]	7731	6722	87.0 ± 5.80	4762	61.7 ± 8.6
Serie A [Italy]	8965	7814	87.2 ± 6.26	5798	64.8 ± 8.8
La Liga [Spain]	8936	7848	87.9 ± 4.82	5588	62.9 ± 9.9

3.4. First Contact Success

A significant two-way interaction was present for first contact success between throw-length and throw-direction with large effect size (F(2.36, 66.04) = 70.344, $p < 0.001$, $\eta p^2 = 0.715$) (see Figure 2);

*** Insert Figure 2 Here***

There was also a significant two-way interaction for first contact success between throw-direction and time-out-of-play ($F(3.11, 87.10) = 6.021$, $p < 0.001$, $\eta p^2 = 0.177$) (see Figure 3).

*** Insert Figure 3 Here***

There was also a main effect of direction on first contact success ($F(1.28, 35.73) = 264.077$, $p < 0.001$ $\eta p^2 = 0.904$). Post-hoc testing showed that throwing the ball backward (99.5 ± 0.7%) or laterally (96.9 ± 1.8%) was more likely to result in a successful first contact compared to throwing the ball forward (71.3% ± 7.7%). There was a main effect of throw-length (F (2.00, 56.00) = 121.574, $\eta p^2 = 0.813$). Medium (92.0 ± 3.5%) and short (98.0 ± 1.8) throws achieved greater first contact success than long (79.8 ± 8.4%) throws ($p < 0.05$). There was a main effect of Time-Out-of-Play on first contact success ($F(3.00, 84.00) = 19.627$, $p < 0.001$, $\eta p^2 = 0.412$). Although there was no significant difference between 0-5 (94.4%) and 5-10 (95.0%) seconds, as time out of play further increased success rate significantly decreased 10-15 (87.75%) and over 15 seconds (78.31%) ($p < 0.001$).

3.5. Possession Retention

There was no competition by throw-direction by throw-length interaction for possession retention ($F(12.98, 301.73) = 0.838$, $p > 0.05$, $\eta p^2 = 0.035$). However, there was a significant two-way interaction between throw-length by throw-direction interaction with large effect size ($F(3.24, 301.73) = 120.510$, $p < 0.001$, $\eta p^2 = 0.564$) and a competition by throw-length interaction (F (6.37, 148.02) = 2.750, $p < 0.05$, $\eta p^2 = 0.106$) on possession retention. There was a main effect of throw-direction ($F(2.00, 186.00) = 1012.501$, $p < 0.001$, $\eta p^2 = 0.916$). Post-hoc analysis showed throwing the ball backward (92.13% ± 3.61%) had the highest chance of retaining possession in comparison to throwing the ball forward (49.75% ± 6.6%) or laterally (71.20% ± 7.27%). Furthermore, throwing laterally had a significant higher chance of possession retention than backwards ($p < 0.001$). There was a main effect of throw-

length ($F(1.59, 148.20) = 41.839$, $p < 0.001$, $\eta p^2 = 0.310$). Throwing the ball long (74.63% ± 22.61%) had greater possession retention success compared to medium (69.61% ± 18.44%) and short (68.48% ± 14.50%) throw-ins.

3.6. Average time in Possession

There was a throw-direction by throw-length interaction ($F(3.10, 288.04) = 29.986$, $p < 0.001$, $\eta p^2 = 0.244$). Throws which went backwards or laterally, had increased average time in possession as the distance of the throw increased. Whereas, the average time in possession for forward throws-ins decreased as the length of the throw increased (see Figure 2). There was also a main effect of throw-direction on mean time in possession ($F(2, 186) = 441.725$, $p < 0.001$, $\eta p^2 = 0.826$). Throwing backward (28.02 ± 4.06 secs) had the longest mean possession, followed by lateral (21.46 ± 4.32 secs) and forward (13.94 ± 2.98secs) throws. There was also a main effect of throw-length ($F(1.52, 141.75) = 3.412$, $p < 0.05$, $\eta p^2 = 0.035$). There was a significant difference with long (22.99 ± 4.71 secs) throw-ins resulting in increased average time in possession compared to medium (21.24 ± 4.52 secs) length throws, and also long throws having increase time compared to short throw-ins (20.57 ± 5.21 secs) ($p < 0.05$).

3.7. Shot Creation

From throw-ins which resulted in a successful first contact, 9.89% led to a shot at goal. There was a significant two-way interaction between throw-direction and throw-length with a medium effect size ($F(3.28, 305.00) = 6.766$, $p < 0.05$, $\eta p^2 = 0.068$). Lateral throws had greater success as the length of throw increased, from short (8.05% ± 6.01%) to medium (10.42% ± 4.69%) and long (13.52% ± 9.03%). The length of throw did not affect the outcome for backward throws; short (10.36% ± 9.06%) long (10.06% ± 3.99%), medium (10.77% ± 4.90%). The highest success rates for forward throws were when combining it with a long throw length (9.07% ± 5.10%), compared to short (8.85% ± 8.78%) and medium length (7.89% ± 4.67%).

There was a main effect of throw-direction on shot creation ($F(2, 186.00) = 8.874$, $p < 0.05$, $\eta p^2 = 0.087$). Post-hoc analysis indicated there was an increased chance of shot creation

for backwards (10.46% ± 3.21%) and lateral (10.30% ± 3.68%) throws than forward throws (8.39% ± 3.36%). There was a main effect of throw-length on shot creation ($F(1.71, 159.02) = 5.376$, $p < 0.05$, $\eta p^2 = 0.055$). Post-hoc testing showed that long throws had a greater chance of shot creation (10.33 ± 3.29%) compared to short throws (8.85% ± 4.34%) ($p < 0.05$), but no differences compared to Medium length throws

4.0 Discussion

The aim of this study was first to examine the throw-in strategy used by teams from the five top tier European leagues. Second, it was to examine how the throw-in strategy used affected the outcome of the throw and resulting possession. The findings demonstrate that throw-in direction, throw-in length and the length of time the ball is out of before the throw-in is taken all affect throw-in success and resulting possession outcome.

An average of 39 throws-in were taken per match across all competition, which is consistent with previous research data from the English Premier League (43 throw-ins; Stone et al. 2018), German Bundesliga (40 throw-ins, Siegle & Lames, 2012, 44.8 throw-ins; Augste & Prestel, 2021) and Spanish La Liga (40.45 throw-ins; Casal et al., 2023), making them the most frequent of all set pieces within men's professional football. There were, however, differences between competitions with the German Bundesliga having the most throw-ins per match, compared to the English and French leagues. The French Ligue 1 had the lowest number of throw-ins per match. These findings may indicate that teams in the Bundesliga either lose control of the ball more often leading to the ball going out of play, or defending players utilise a strategy of kicking the ball out of play more often to reduce immediate pressure and allow the team to reset their defensive structure. It was also demonstrated that most throw-ins were taken in the middle zones of the pitch, with the least common in the defensive zone (Wallace & Norton, 2014). This highlights the importance that throw-ins have on restarting, and then

building a team's possession in open play and hence, we further explored these specific pitch locations in more detail.

When examining throw-in strategy in the middle zones of the pitch, the most common throw-in was forward, then backwards, and the least common was lateral. Backward and forward throw-ins were most often thrown long, then medium, and least often over short distances. In contrast, lateral throws were most often thrown over a medium length followed by short and long lengths. These results align with the few studies to date in men's professional football across competition who have reported similar findings (Stone et al., 2021; Casal et al., 2023, Augste & Prestel, 2021). When examining specific competition, Spanish and German teams had the highest use of forward throws. In comparison, Italian and English teams had a balance of forward and backwards throws, but the lowest use of lateral throws. French teams had the most balance use of all three directions. Short throw-ins were the least used across all competitions, whereas French and Spanish teams favoured medium over long throws compared to Italian and German teams who favoured long throws. Together these findings highlight how, across the top tier leagues, teams favour forward throws, and medium and long lengths. In applied training settings, coaches may be emphasising creating distance between the receiver and the thrower to enable greater space to receive the ball. Also, when throwing backwards, longer throws increase the distance the opposition need to press and thus may create further space to explore when moving forwards up the pitch. Importantly, coaches and performance analysts should consider the competition and playing styles across competitions which might influence the throw-in strategy adopted.

When considering match state, when teams were drawing, there was a balanced use of forward and backwards throws. However, when teams were winning, they adopted to throw the ball forward more often, whereas teams that were losing threw the ball backwards more often. It could suggest, when teams are losing, they may look to keep possession of the ball

and build up towards their attack (Lago-Peñas et al., 2010). Whereas teams that are winning, may favour the coaching principle of throwing the ball forwards and long away from the goal to reduce the likelihood of an attack against them, but are less concerned with building further potential goal-scoring opportunities. Furthermore, this idea is supported by teams using long throws most often when winning than drawing or losing.

Overall, 87.3% throw-ins resulted in a successful first contact, with 63.3% then leading to possession retention and 9.89% resulting in a shot at goal. The competition had no effect on the first contact outcome success rate and aligned with previous research that has suggested that regardless of competition or season, first contact success rates remain consistent (Stone et al., 2018; Casal et al., 2023, Augste & Prestel, 2021). In line with previous research, throwing the ball backward and laterally was more likely to result in a successful first contact compared to throwing the ball forward (Stone et al., 2021). Furthermore, short and medium length throws resulted in increased first contact success than throwing the ball long. Stone et al. (2021) previously reported that when throwing the ball forwards, the opposition are set up in a more compact shape, thereby outnumbering the attacking team with defensive players. This results in a 'fight ball' being thrown down the line into an unfavourable situation, therefore resulting in a loss of first contact. This idea was further supported in the German leagues which demonstrated that putting high defensive pressure on the opponent was an important tactic to recover possession from throw-ins (Augste & Prestel, 2021).

Additional data on the speed of throw after the ball leaves the pitch could further support this idea of the importance of defensive pressure. If the throw-in was taken within 10 seconds of the ball going out of play, there was an increased first contact success compared to when the ball was out of play for longer time periods. Casal et al. (2023) found similar results in the La Liga that fast throw-ins (< 5 seconds) increased the odds of continuing possession compared to losing possession. This supports the idea, that if the attacking team take the throw-

in quicker after the ball has gone out of play, the defensive team have less time to get into an organised defensive shape to compete for the ball. McKinley (2018) suggests that the optimal time to take a throw-in to retain possession is about five seconds after the ball goes out of play. Casal et al. (2023) who examined throw in time with two categories (below or above 5 seconds) found that throws within 5 seconds were more effective. The results reported in this study in which there were a greater number of time categories suggest the timing is also dependent on the direction of throw. The timing of the throw was most affected when the ball was thrown forwards, compared to backwards or lateral. When throwing the ball forwards it seems a time-window of within 10 seconds of the ball going out of play results in increased likelihood of first contact succuss. The results here, add further support to the coaching principle that throwing the ball forwards and long and away from the goal may be a less effective tactic to gain a successful first contact to then control the ball and resulting possession, especially if the throw in taken beyond 10 seconds of the ball going out of play.

Throws which went backwards had a greater chance at retaining possession for 7 seconds or longer and resulted in increased average time in possession. There was also a main effect of throw-direction on percentage of shot creation with demonstrated an increased chance of shot creation for backwards and lateral throws in comparison to forward throws, while also demonstrating throwing the ball long had a greater chance of shot creation compared to short throws. Prieto-González et al. (2024) demonstrated the positive impact of positional attacks on goals scored in La Liga which demonstrated teams employing a structured positional play can result in more scoring opportunities. Hence teams with greater offensive success effectively execute plays from stable position. This could highlight why backwards and lateral throws which are less direct in nature but allow teams to build up play in a structured manner could lead to increased chance creations. These findings align with those from the Chinese Super League that throwing the ball backwards was beneficial by creating an extra two shots per 100

throw-ins, alongside throwing the ball long (four more shots per 100 throw-ins) (Epasinghege & Swartz, 2024).

The findings in this study provide an additional level of understanding of throw-ins in elite football. However, further research could explore if the findings remain consistent for professional teams in lower tier leagues across Europe and if a team's rank within a league affects throw-in strategy. Furthermore, with the growing rise of elite level women's football, there is also scope to see if the findings in the men's game translate to professional women leagues. Finally, the data here has focused upon the middle zones of the football pitch, therefore future research could focus upon the attacking and defensive quarters of the pitch to investigate more direct throw-in which may be used like those of corner kicks to create goal-scoring opportunities.

5.0. Conclusion

In conclusion, this research examined the largest sample of throw-ins across five top tier leagues in European football to date. Throwing the ball forward in the middle zones of the pitch is a common but less effective strategy. The data suggests, in general, throwing the ball quicker from the restart results in greater chance of a successful first contact. Furthermore, throwing the ball backwards gives teams a higher chance of retaining possession from the throw and increases the likelihood of scoring a goal from that possession. The results demonstrate across European football leagues that throw-ins are an important set-piece for researchers and applied performance analysis to consider in football.

6.0. References

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Figure 1. Pitch locations and definitions of variables

588 **Figure 2.** First contact, possession retention and mean time in possession based on throw-in
589 length and direction in the middle zones of the pitch.
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613 **Figure 3.** The influence of restart time and throw direction on first contact succuss percentage.

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