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Defensive Actions in Crossing: Analysis of Top Spanish, English and German Elite Teams in 2022-2023 Season

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ABSTRACT

The objective of this study is to analyze defensive efficacy and identify effective defensive actions against various types of crosses from different positions in elite football matches. Recordings and analyses were conducted on the top five teams from Germany (Bundesliga), England (Premier League), and Spain (La Liga) during the 2022-2023 season, covering 60 matches. A total of 1,428 crosses were examined to assess defensive responses. The study utilized the Wyscout platform, a personal computer (PC), and a tablet for analysis. Statistical methods included frequency and percentage ratio analysis, along with Crosstabs and the chi-square (x^2) test to examine relationships between categories. Findings indicated that defensive line height significantly impacts defensive success across all crossing zones ($p<0.05$). The origin of the cross also plays a crucial role ($p<0.05$), with failures occurring more frequently when crosses originate from half-spaces rather than lateral areas. The data analysis indicated that the height of the defensive line has a significant impact ($p<0.05$) on defensive effectiveness across all zones of the crosser. The outcome zone is equally important ($p<0.05$), as defenders struggle more when the ball is played centrally between the center-back and weak-side full-back, behind the weak-side full-back, or within the penalty spot-to-goal area in cut-back situations. These results highlight the importance of structured defensive positioning and coordination, particularly in managing crosses from half-spaces and securing critical defensive regions.

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INTRODUCTION

In contemporary football, there exists a continual and dynamic emergence of various research challenges that captivate the attention of analysts. The advancement of tracking data, which has gained prominence in recent years, has significantly heightened interest and enthusiasm in the analysis of tactical performance across different teams. By diligently examining defensive situations in detail, one can not only identify but also gain a deeper comprehension of the intricate characteristics that contribute to performance in actual game scenarios. Understanding these elements is crucial for developing strategies that enhance overall team effectiveness on the field.

A recent comprehensive and in-depth review conducted by Forcher et al. (2022) aimed at thoroughly assessing the various defensive behaviors exhibited by football teams. This extensive analysis considered a total of 23 studies that were meticulously extracted from various electronic databases, including PubMed (n=604), Web of Science (n=593), and SPORTDiscuss (n=872). These studies were specifically chosen as they were the only ones that met the rigorously established scientific quality criteria designed to ensure reliable findings. The key findings of this extensive review indicated that an effective defensive performance in football is characterized by high levels of individual pressing initiated by players, as well as strong synchronization observed among various defensive subunits (inter-team interactions). Additionally, it emphasized the importance of coordination between defensive and attacking subunits (intra-team dynamics). Furthermore, a well-balanced defensive strategy is crucial at both the subunit and overall team levels, all of which contribute significantly to creating a compact, cohesive, and well-coordinated organizational structure on the field.

Abdennour et al. (2021) conducted a thorough examination of the goals that were achieved from crosses during the English Premier League throughout the entire 2020-2021 season. Their comprehensive analysis, which encompassed a total of 269 goals originating from open-play crosses, revealed that players utilized a wide variety of types and styles of crosses. Their main objective was to effectively direct the ball into the crucial area that lies between the six-yard box and the penalty spot, which is recognized as prime scoring territory in football. This focus on the specified area greatly enhances the likelihood of goal opportunities during matches.

A separate and comprehensive investigation sought to discern the tactical behaviors that could potentially serve as predictors of defensive performance efficacy among elite football players, as highlighted by the research carried out by Bruno Santow da Silva et al. in

2022. The sample in this thorough study comprised a total of 533 defensive sequences meticulously gathered from national teams that successfully advanced to the semi-finals of the prestigious 2014 FIFA World Cup. Among its numerous and significant findings, the study notably established that the attacking team's effective utilization of defensive depth resulted in an impressive 71% decrease in the likelihood of the opponent successfully scoring a goal. Such insights into defensive strategies contribute valuable knowledge to the field of football analytics and coaching methodologies.

Forcher et al. (2023) conducted a thorough examination of the intricate relationship between various defensive principles of play and their resultant defensive success by meticulously analyzing a substantial sample of 153 matches from the renowned German Bundesliga. The study's findings revealed that maintaining player compactness in areas that are in close proximity to the ball was of paramount importance for achieving defensive success. In contrast to this crucial insight, the research demonstrated that the overall compact organization of the entire team, while often considered significant, was not found to be a determining factor in the successful recovery of the ball during defensive situations.

A comprehensive series of additional studies investigating defensive team behavior has concluded that one of the most critical success factors significantly impacting match outcomes is indeed defensive actions. In particular, defensive errors play a pivotal role, having the strongest influence on the overall probability of either winning or losing a match. This crucial insight was supported by various analyses conducted by Njororai WWS in 2010, as well as by Lepschy H and colleagues in multiple studies throughout 2020 and 2021, and further reinforced by Run L and others in 2023.

While it is true that some research has been carried out on the defensive phase of the game, the majority of publications tend to concentrate primarily on the offensive tactics employed by various teams. As a result, there exists a significant lack of comprehensive studies specifically pertaining to defensive tactics. This gap is particularly evident in the analysis of the most dangerous phases of the game, especially those critical moments that unfold inside the penalty area, where the outcome can greatly influence the result of a match.

METHODS

The sample comprised the leading five teams from the 2022/2023 season across the following leagues: Premier League (Manchester City, Arsenal FC, Manchester United, Newcastle United, Liverpool FC), La Liga (FC Barcelona, Real Madrid, Atletico de Madrid,

Real Sociedad, Villarreal CF), and Bundesliga (FC Bayern Munich, Borussia Dortmund, RB Leipzig, FC Union Berlin, SC Freiburg). The selection of these teams was predicated on their status as the most formidable competitors in their respective national leagues, thereby guaranteeing that both offensive and defensive actions would exhibit a high level of quality and frequency. It is particularly noteworthy that their defensive performance was anticipated to demonstrate significant effectiveness.

The study encompassed a total of 60 matches, examining 1,428 sequences pertaining to the defensive phase in connection with the tactical behaviour of the defensive line. A defensive sequence was defined as a phase of play during which a team had loss possession of the ball and located within the defensive third of the field, the ball was in either the lateral or half spaces, with the defensive line strategically situated between the ball and the goal to prevent the opponent's scoring attempts.

The selection of sequences was determined by specific inclusion criteria: the sequences took place during full time or extra time match play. The video recordings facilitated the unambiguous identification of all variables being evaluated.

The criteria for exclusion encompassed defensive actions arising from set-piece situations or their resultant developments. Additionally, sequences that followed a penalty kick or its outcome, which included saves by the goalkeeper, were also excluded. Furthermore, sequences that culminated in goal-scoring opportunities that broke the rules of the game were not considered.

This approach guaranteed that the evaluation was exclusively centered on defensive actions executed during gameplay, thereby offering a precise measurement of tactical defensive efficacy among the leading football teams competing at the highest levels of competition.

Procedures

Definitions and Tactical Framework

Data collection was carried out utilizing the Wyscout® platform (Genoa, Italy) by selecting videos that documented all offensive actions of the teams under examination during standard match-play conditions. A filter was implemented to focus exclusively on sequences involving opponent attacks from the flanks, followed by a thorough analysis of the defensive responses exhibited by the teams in each instance. This analysis was conducted as frequently as necessary, either at real-time speed or by employing the pause and forward-rewind

functions for greater clarity. The technical-tactical indices recorded for the purposes of this study, which assesses the effectiveness of the defensive line's tactical behavior in response to the attacking actions of opponents, are as follows:

Definitions and Tactical Framework

1. Defensive Line Height and Width

   The height of the defensive line was defined as the distance between the defensive line and the goal line, determining how close or far it should be positioned.
   The width of the defense was determined by its placement within the defensive cone (Figure 1). According to Marziali & Mora (2011, pp. 66-84), the optimal heights relative to the ball were defined as follows:

   - Zone of the crosser 26-16.5m: Defensive line height 16.5-11m, positioned within the defensive cone (Defensive Line Position A).
   - Zone of the crosser 16.5-11m: Defensive line height 11-5.5m, positioned within the defensive cone (Defensive Line Position B).
   - Zone of the crosser 11-5.5m: Defensive line height 11-5.5m, aligned horizontally with the ball and within the defensive cone (Defensive Line Position C).
   - Zone of the crosser 5.5-0m: Defensive line height 5.5-0m, positioned diagonally opposite to the ball within the defensive cone (Defensive Line Position D).

1. Defensive Cone Definition

   The defensive cone, as defined by Marziali & Mora (2011, p. 65), is the space between the midfield line and the hypothetical lines connecting the goalposts to the points where the half-way l line intersects with the touch lines (Figure 1).

1. Zone of the crosser

   The Zone of the crosser were categorized into the following areas (Figure 2):

   - Crossing from the lateral space (LS): 26-16.5m, 16.5-11m, 11-5.5m, 5.5-0m
   - Crossing from the half spaces (HS): 26-16.5m, 16.5-11m, 11-5.5m, 5.5-0m

1. Zone of the outcome

   The zones where the cross was received were classified into the following areas (Figure 2, Figure 3):

   - Z1: The area around the first post, where the ball passes in front of or over the first defender.
   - Z2: The central goal area extending to the second post, where the ball passes between the second center-back and the weak-side full-back.

- Z3: The area beyond the second post, positioned behind the weak-side full-back.
- Z4: The space between 5.5-11m for cut-back passes.
- Z5: The space between 16.5-11m for cut-back passes.
- Other: Any additional zones not classified above.

1. Delivery type

   Outward: The ball was kicked and moved in a curve away from the goal

   Inward: The ball was kicked and moved in a curve towards the goal

These tactical definitions and zone classifications allow for a structured assessment of defensive positioning, crossing execution, and defensive effectiveness within elite football settings.

Figure 1.
Zone of the crosser and width-hight of the defence line

Figure 2.
Zone of the crosser and zone of the outcome

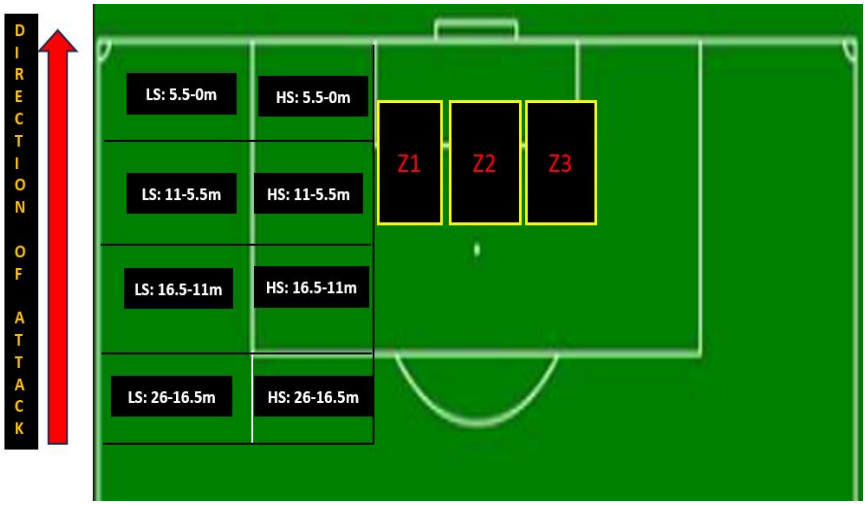
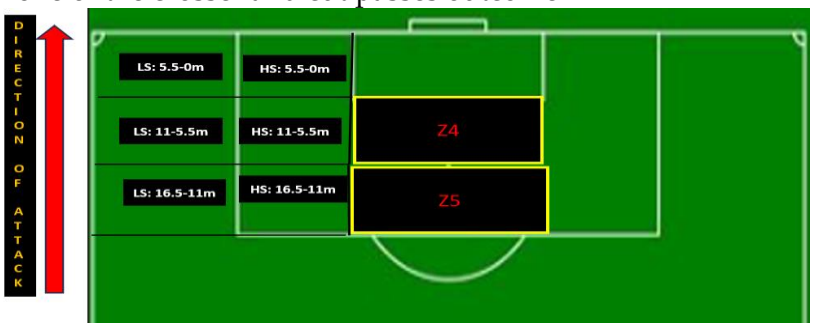


Figure 3.
Zone of the crosser and cut passes outcome



Reliability testing

Intra- and inter-observer reliability tests were examined using Cohen's kappa (κ) correlation coefficient. In order to test the reliability of the observation (intra-observer reliability), he observed 150 randomly selected crosses and analysed on two occasions (separated by a one week interval). Kappa values > 0.90 were reported, showing almost perfect level of agreement (McHugh 2012). Regarding inter-observer reliability, a second independent football analyst analysed the same number of crosses under similar conditions. Kappa values > 0.85 were observed for all performance indicators (Table 1) showing strong level of agreement (McHugh 2012).

Table 1.
The Intra- and Inter-Rater Reliability Analysis (K) for Crossing Variables

Variable	Intra-observer Kappa value	Inter-observer Kappa value
Hight of the defense line	0.91	0.85
Width of the defense line	0.91	0.86
Zone of the crosser	0.95	0.90
Zone of the outcome	0.94	0.89
Cross outcome	0.93	0.87
Inward crosses	1	1
Outward crosses	1	1

Data Analysis

The statistical analysis of the data recorded through digital videos and coded using a PC, the IBM SPSS Statistics 29.0.0 software for Windows was used. The descriptive statistics (frequencies) and the non-parametric chi-square test (x^2) were applied. The level of significance was set at $p<0.05$.

RESULTS

Height of defensive line

From the analysis of data on the correct or incorrect height of the defensive line placement depending on the zone of the crosser, it was found that the defensive line was not correctly positioned in the following areas in order: HS:16.5-11m, HS: 11-5.5m, LS: 16.5-11m, HS: 5.5-0m, LS: 11-5.5m, LS 26-16.5m, LS: 5.5—0m, HS: 26-16.5m (Table2).

Table 2.
Zone of the crosser and percentages of correct and incorrect defensive height

Zone of the crosser	Correct height of the defensive line	Incorrect height of the defensive line
LS: 26-16,5m	67,1%	32,9%
LS:16,5-11m	60,2%	39,8%
LS:11-5,5m	61,4%	38,6%
LS:5,5-0m	73,1%	29,6%
HS:26-16,5m	73%	27%
HS:16,5-11m	51,4%	48,6%
HS:11-5,5m	56,2%	43,8%
HS: 5,5-0m	60,3%	39,7%

Regarding the effectiveness of the defense in dealing with the cross from various zones of the crosser in relation to the correct and incorrect height of the defense line, it was found that there was a statistically significant difference ($p<0.05$) for all positions of crossing (Table 3).

Table 3.
Effectiveness of the defense in relation to the height of the defensive line

Zone of the crosser	x^2, p
LS: 26-16,5m	<,001 $x^2_{(1)} = 18,926$ *p<0.05
LS: 16,5-11m	,002 $x^2_{(1)} =9,603$ *p<0.05
LS: 11-5,5m	,013 $x^2_{(1)} =6,236$ *p<0.05
LS: 5,5-0m	,002 $x^2_{(1)} =9,783$ *p<0.05
HS: 26-16,5m	,009 $x^2_{(1)} =6,908$ *p<0.05
HS: 16,5-11m	,004 $x^2_{(1)} =8,166$ *p<0.05
HS: 11-5,5m	,04 $x^2_{(1)} =4,232$ *p<0.05
HS: 5,5-0m	<,001 $x^2_{(1)} =20,167$ *p<0.05

The frequency analysis of defensive success and failure, based on the correct or incorrect positioning of the defensive line height, revealed that the highest failure rates

occurred when the cross was delivered from the half-spaces: HS: 26-16.5m, HS:16.5-11m, HS: 11-5.5m and HS: 5.5-0m compared to the lateral spaces (Table 4).

Table 4.
Frequencies (%) of success and failure of defensive behaviour at correct -incorrect height of the defensive line

Zone of the crosser	Defensive line height			
	Correct height of the defensive line		Incorrect height of the defensive line	
	Success	Failure	Success	Failure
LS: 26-16,5m	96%	4%	80,4%	19,6%
LS: 16,5-11m	94,2%	5,8%	80%	20%
LS: 11-5,5m	88,5%	11,5%	76,3%	23,7%
LS: 5,5-0m	94,4%	5,6%	78,3%	21,7%
HS: 26-16,5m	83,7%	16,3%	61,8%	38,2%
HS: 16,5-11m	94,7%	5,3%	69,4%	30,6%
HS: 11-5,5m	85,3%	14,7%	69,8%	30,2%
HS: 5,5-0m	94,2%	5,8%	70,9%	29,1%

Zone of the crosser

From the data analysed, it was found that most of the crosses were made predominantly from the lateral spaces compared to the half spaces (Table 5).

Table 5.
Percentages from various zones of the crosser

Zone of the crosser	Frequency (%)
LS: 26-16,5m	20,7%
LS: 16,5-11m	14.1%
LS: 11-5,5m	16,9%
LS: 5,5-0m	12%
HS: 26-16,5m	8,8%
HS: 16,5-11m	5,2%
HS: 11-5,5m	8,5%
HS: 5,5-0m	13,9%

To analyze the impact of crossing zones on defensive effectiveness, the non-parametric χ^2 (chi-square) test was conducted. The results revealed a statistically significant difference across all crossing positions ($\chi^2(7) = 23.468$, $p < 0.05$). Defensive failures were more frequent when crosses originated from HS: 26-16.5m (22.2% failure rate) and HS: 5.5-0m (21.5% failure rate). In contrast,

lower defensive failure rates were observed for crosses taken from LS: 26-16.5m (9.2% failure rate) and LS: 5.5-0m (11.4% failure rate) (Table 6).

Table 6.
Frequencies (%) of defense success – fail in relation to the zone of the crosser

Zone of the crosser	Frequency (%) Success	Frequency (%) Failure
LS: 26-16,5m	90,8%	9,2%
LS:16,5-11m	88,6%	11,4%
LS:11-5,5m	83,8%	16,2%
LS: 5,5-0m	90,1%	9,9%
HS:26-16,5m	77,8%	22,2%
HS: 16,5-11m	82,4%	17,6%
HS: 11-5,5m	84,9%	15,1%
HS: 5,5-0m	78,5%	21,5%

Zone of the outcome

The analysis of the phases showed that mainly in Z1, Z2 and Z3 end up crosses from high zones of the crosser, i.e. away from the goal line (except HS:11-5.5m), in Z4 end up mainly crosses from low positions close to the goal line. In more detail, Z1 is mainly the zone of outcome from zones of the crosser LS: 26-16,m, LS: 16,5-11m, HS 5.5-0m, and LS 5.5-0m, Z2 is mainly the zone of outcome from zones of the crosser HS: 26-16.5m and HS: 16.5-11m, Z3 is mainly the zone of outcome from zones of the crosser HS:26-16.5, LS: 26-16,5m, HS: 16.5-11m and LS: 16.5-11m, Z4 contains mainly crosses from, LS 5.5-0m, HS:11-5.5m HS:5.5-0m and LS:11-5.5m and finally Z5 contains mainly very small percentages of crosses from HS: 16.5-11m, LS 11-5.5m, LS: 5.5-0m, HS:11-5.5m (Table 7).

Table 7.
Zones of the crosser and zones of the outcome in percentages

Zone of the crosser	Z1	Z2	Z3	Z4	Z5	ELSE
LS: 26-16,5m	41,5%	32,7%	25,8%			
LS: 16,5-11m	55,1%	21,2%	23,7%			
LS: 11-5,5m	27,7%	18,4%	15%	23,8%	8,3%	6,8%
LS: 5,5-0m	30,9%	8,9%	9,8%	36,6%	7,3%	6,5%
HS: 26-16,5m	20%	44,5%	35,5%			
HS: 16,5-11m	19,7%	41%	24,6%		14,8%	
HS: 11-5,5m	23,5%	14,1%	15,3%	31,8%	7,1%	8,2%
HS: 5,5-0m	38,3%	29,9%	9,2%	29,1%	5%	8,5%

To find the differences in defensive efficiency in relation to the zone of the outcome, the non-parametric x2 test was used. From the results it was found that there was statistically significant difference for the completion positions LS:11-5.5m, LS: 5.5-0m and HS: 5.5-0m (Table 8).

Table 8.
Defensive effectiveness in relation to the zone of the crosser and the zone of the outcome

Zone of the crosser			x^2, p
LS: 26-16,5m	, 357	BE 2	$x^2_{(2)}$ =2,059 p>0.05
LS:16,5-11m	,357	2	$x^2_{(2)}$ =2061, p>005
LS:11-5,5m	,047	5	$x^2_{(5)}$ =11,218 *p<0.05
LS:5,5-0m	,056	5	$x^2_{(5)}$ =10,792, *p<0.05
HS:26-16,5m	,068	2	$x^2_{(2)}$ =5,388 p>0.05
HS:16,5-11m	,167	3	$x^2_{(3)}$ =5,072 p>0.05
HS:11-5,5m	,468	5	$x^2_{(5)}$ =4,758 p>0.05
HS:5,5-0m	,007	5	$x^2_{(5)}$ =16,033 *p<0.05

*= p<0,05

The success-failure frequencies of the defense in different outcome zones, based on frequency rates, were found to vary depending on the position of the crosser's zone (Table 9).

Table 9.
Success/failure frequencies (%) in the different zones of the outcome

Zone of the crosser	Z1 Success	Z1 Failure	Z2 Success	Z2 Failure	Z 3 Success	Z3 Failure	Z4 Success	Z4 Failure	Z5 Success	Z5 Failure	Else Success	Else Failure
LS: 26-16,5m	91,7%	8,3%	90,6%	9,4%	85,1%	14,9%						
LS: 16,5-11m	88,4%	11,6%	84,8%	15,2%	78,4%	21,6%						
LS: 11-5,5m	87,7%	12,3%	68,4%	31,6%	87,1%	12,9%	77,6%	22,4 %	70,6%	29,4%	100%	0%
LS: 5,5-Om	94,7%	5,3%	90,9%	9,1%	75%	25%	75,6 %	22,4%	100%	0%	100%	0%
HS: 26-16,5m	81,8%	18,2%	81,6%	18,4%	61,5%	38,5%						
HS: 16,5-11m	75%	25%	88%	12%	60%	40%			88,9%	11,1%		
HS:11-5,5m	70%	30%	66,7%	33,3%	61,5%	38,5%	63 %	37%	83,3%	16,7%	100%	0%

HS: 5,5-0m	90,7%	9,3%	71,4%	28,6%	53,8%	46,2%	68,3 %	31,7%	71,4 %	28,6%	100%	0%

Delivery type

The analysis of delivery type frequencies revealed a clear predominance of outward crosses across all positions, accounting for 79.1% of total deliveries, compared to only 20.9% for inward crosses. This trend is consistent across various zones on the pitch.

In particular, the percentage of outward crosses increases as the delivery is made from positions closer to the goal line. For the laterar space (LS), outward crosses were observed at 67.5% in the 26–16.5m zone, rising to 93.6% in the 5.5–0m zone. Similarly, on the half space side (HS), outward crosses ranged from 64.3% in the 26–16.5m zone to 91.5% in the 5.5–0m zone. These findings suggest that as players approach the goal line, they are more likely to deliver outward crosses rather than inward ones.

DISCUSSION

Defensive Line Height

While the height of the defensive line is recognized as a significant element for efficient defensive performance in various team sports, as substantiated by existing academic literature (Longo & Aquino, 2012; Marziali & Mora, 2021; Peter & Arne, 2012; Lucchesi, 2018), it has not been a predominant focus of research to date. A noteworthy exception to this trend is the comprehensive investigation conducted by Hiroshi & Yuta (2015), which illustrated that incorrect depth positioning of the defensive line can lead to more than fifty percent of crosses being delivered behind the defense line thus creating very dangerous situations in the opponent's penalty.

In the current investigation, arose a significant percentage of incorrect defensive line height in all zones of the crosser. Nonetheless, the most pronounced error rates were noted in the half spaces, ranging from 39.7% to 48.6%, in contrast to the lateral spaces, which exhibited error rates between 29.6% and 39.8%. Exceptions were observed in the 26-16.5m zone, where the lateral spaces presented a greater error rate of 32.9% compared to the half spaces, which recorded an error rate of 27% (refer to Table 2).

Upon analyzing the effectiveness of the defensive line (successful versus unsuccessful defense) in relation to the height of the defensive line (correct versus incorrect height), statistically significant differences ($p<0.05$) were identified across all defensive heights concerning the zone of the crosser. Notably, when the defensive line was correctly positioned,

the highest failure rates were noted at HS: 26-16.5m (16.3%), HS: 11-5.5m (14.7%), and LS: 11-5.5m (11.5%). Conversely, in the same zones of the crosser, when the defensive line was incorrect positioned, the failure frequencies nearly doubled, reaching 38.2%, 30.2%, and 23.7%, respectively.

The disparity in failure rates between accurately and inaccurately positioned defensive lines was markedly observed in the following ranges: LS: 26-16.5m, LS: 16.5-11m, LS: 5.5-0m, HS: 16.5-11m, and HS: 5.5-0m. In these instances, the failure rates escalated by a factor ranging from 4 to 6, as detailed in Table 4.

In general, it is observed that higher failure frequencies of the defense, in relation to the positioning height of the defensive line, occur when the ball is in the half-spaces compared to the lateral spaces, regardless of whether the defensive line is positioned at the correct or incorrect height. However, the impact on defensive effectiveness becomes particularly evident when the defensive line is not positioned at the correct height. Therefore, in order to improve defensive effectiveness, according to the present study, special emphasis should be placed during the training process on the correct height positioning of the defensive line in relation to the crossing delivery area.

Zone of the crosser

From the analysis of data conducted in this study, it was found that a greater number of crosses were delivered from the lateral spaces as compared to the half spaces, with the notable exception of the LS: 5.5-0m position (Table 5). These significant findings align with the studies conducted by Pulling et al. (2018) and Mitrotasios et al. (2022), who similarly recorded and reported higher crossing percentages originating from lateral spaces in comparison to those from half spaces.

Regarding defensive effectiveness in relation to the zone of the crosser, statistically significant differences were discovered for all zones of the crosser. The defense recorded the lowest failure frequencies when crosses originated from lateral spaces greater than 16.5 meters compared to crosses that came from less than 16.5 meters (as indicated in Table 6). These important findings are consistent with the research conducted by Vantrakis et al. (2023), who found a notably higher number of successful defensive interventions for crosses originating from distances greater than 16.5 meters compared to those that originated from distances less than 16.5 meters. This emphasizes the importance of cross origin in evaluating defensive strategies and their overall effectiveness during play.

Furthermore, an enhanced level of defensive effectiveness was noted when crosses were delivered from lateral areas in comparison to those originating from half spaces, which exhibited the highest incidence of goal-scoring opportunities. This observation is consistent with the research conducted by Pulling et al. (2018) and Mitrotasios et al. (2022), who reported that crosses from the lateral zone (Z3) within a range of 26-16.5 meters achieved the highest rate of defensive interventions (55.6%) alongside the lowest rate of goal-scoring opportunities (14 %).

In the present study, the defense demonstrated the highest effectiveness when the ball originated from the lateral spaces (LS): 26-16.5m (success rate of 90.8%) as well as from LS: 0-5.5m (success rate of 90.1%). This can be explained by the fact that these zones are farther from the goal, requiring the ball to travel a greater distance and, consequently, take a longer time to reach its destination. This extended duration allows defenders to position themselves appropriately to intercept the ball.

Additionally, Mitrotasios et al. (2022) reported that crosses originating from Zone 5 (HS: 16.5-8m) generated the highest goal-scoring opportunities, with a rate of 27.5%. However, in the present study, the highest failure frequencies for the defense were recorded in HS: 26-16.5m (22.2%) and HS: 5.5-0m (21.5%). Nevertheless, it is important to acknowledge the different methodologies used in the two studies.

Overall, the findings indicate that the defensive line struggles when crosses originate from the half-spaces. Therefore, coaches should take this into serious consideration when training defensive behavior to handle such situations effectively.

Zone of the outcome

According to Pulling et al. (2018), the outcome zone exhibits a strong correlation with both goal-scoring attempts and defensive effectiveness. In the present study, a comprehensive data analysis of the outcome zone has identified several significant trends, as presented in Table 7.

- Z1: Most crosses delivered from LS: 16.5-11m (55.1%), LS: 26-16.5m (41.5%), LS: 11-5.5m (27.7%), and HS: 5.5-0m (38.3%).
- Z2: Most crosses delivered from HS: 26-16.5m (44.5%) and HS: 16.5-11m (41%).
- Z3: Most crosses delivered from HS: 26-16.5m (35.5%), HS: 16.5-11m (24.6%) and LS: 16.5-11m (23.7%). Crosses received in the Z3 area posed the greatest defensive difficulties, presenting the highest failure frequencies across nearly all zones of the

crosser. As a result, it is essential to focus on and carefully cover this specific zone when defending against crosses from any position on the field (Table 9).

- For cut-back passes, the primary reception zone was Z4, with most coming from LS: 5.5-0m (36.6%) and HS: 11-5.5m (31.8%).
- In Z5 ended up with crosses coming from half spaces, HS:16.5-11m (14.8%), HS:11-5.5m (7.1%), HS: 5.5-0m (5%) and from lateral spaces, LS:11-5.5m (8.3%), LS:5.5-0m (7.3%), however, of these spaces the option of ending up with a cross in Z5 showed the lowest frequencies.

Regarding the effectiveness of the defense in relation to the outcome zone the following emerged:

A statistically significant difference was found in the effectiveness of the defense concerning the outcome zone when the cross originated from the lateral space (LS: 11-5.5m). Specifically, when crosses or cut-back passes were delivered from these areas, the defensive line faced significant challenges and was largely unsuccessful, particularly when the outcome zone was Z2 (31.6%), Z4 (22.4%), and Z5 (29.4%).

These conclusions are in line with other past research, although these studies followed a different methodology. In particular, Yamada/Hayashi (2015) demonstrated that as the ball approaches the touch line the gaps between the defensive line players increase which is likely to be the cause of defensive line failures (31. 6%) when the zone outcome is the Z2 i.e. the space between the second central defender and the opposite side's wingback, while Kyranoudis et al (2024) showed that the final offensive actions were more effective when they took place from the space between the penalty spot and the goal area. Also, in this research another weak point of the defensive line in crosses coming from LS:11-5.5m namely the Z5 area with 29.4% failure rate was also highlighted in this research. The practice of the defensive line on crosses coming from the mentioned zones is deemed necessary.

A statistically significant difference was observed in defensive effectiveness based on the outcome zone when the cross was delivered from the lateral space (LS: 5.5-0m). Specifically, crosses and cutback passes from these areas pose significant challenges for the defensive line, leading to higher failure rates, particularly when the outcome zone is Z3 (25% failure rate) and Z4 (22.4% failure rate).

This issue arises because, when a cross is delivered from the lateral spaces, the weak-side full-back (on the opposite side) typically shifts towards the ball to close the gap between himself and the central defender. As a result, crosses played into the space behind him can

create defensive vulnerabilities, as demonstrated in this study, which recorded a 25% failure rate in such scenarios. Furthermore, cutback passes from these areas into Z4 also reduce defensive effectiveness, leading to a 22.4% failure rate, aligning with the findings of Kyranoudis et al. (2024). It is imperative to practice the defensive line in similar situations.

A statistically significant difference was found in the effectiveness of the defense compared to the zone of the outcome when the zone of the crosser was half space HS: 5.5-0 m. Because the ball travels a short distance from this space, it is difficult for defenders to predict the direction of the ball and prepare properly while controlling their opponents. Both cut backs passes from the goal line and crosses around the goal line cause major problems for the defensive line since goalkeeper is forced to move towards the 1st post for a potential shot and it is therefore difficult for him to intervene in crosses in the space behind the second post (Yamada/Hayashi 2025, Kyranoudis et al (2024). In the present study, the defense was unsuccessful especially when the zone of the outcome is Z3 (46.20%%), Z4 (37.10%), Z2 (28.60%), and Z5 (28.60%). The necessity of practicing the defensive line in dealing with such dangerous situations is obvious.

CONCLUSION

The primary objective of this comprehensive study was to thoroughly analyze defensive behavior exhibited within the penalty area in direct response to crosses originating from various zones of the crosser. This analysis focused on the defensive strategies of the top five teams in the prestigious Premier League, La Liga, and Bundesliga throughout the competitive 2022-23 season. The findings derived from this study indicate:

1. The height of the defensive line has a considerable impact on the efficacy of defensive strategies across all zones of the crosser. It is essential to prioritize the enhancement of defensive line positioning in relation to the ball within tactical training sessions.
2. The zone of the crosser is greatly influences the effectiveness of the defense. A higher incidence of defensive lapses was observed when crosses originated from half spaces in comparison to lateral spaces, underscoring the necessity for defensive training to adequately address these scenarios.
3. The zone of the outcome plays a crucial role in determining the effectiveness of defensive strategies. Defenders encountered greater challenges when the cross end up centrally between the center-back and the weak-side full-back, behind the weak-

side full-back, as well as in the central region situated between the penalty spot and the six-yard box during instances of cut-back passes.

4. The zone of the outcome behind the weak-side full-back consistently exhibited the highest rates of defensive failures across nearly all zones of the crosser. It is imperative to closely monitor this region when implementing defensive strategies against crosses originating from various zones of the crosser.
5. Since teams playing in lower ranks often place greater emphasis on defensive principles, future research should also examine their defensive actions in similar contexts. Comparative analysis between top-ranking and lower-ranking teams may provide a more holistic understanding of defensive behavior in response to crosses.

Acknowledgments

This study is inspired by the Master's thesis of the lead author, which explored the tactical aspects of defensive strategies, particularly focusing on defensive responses to different types of crosses. While the original thesis laid the foundation for understanding the impact of crosses on defensive actions, this study extends and refines the methodology by analyzing the tactical approaches of elite-level teams in Germany's Bundesliga, England's Premier League, and Spain's La Liga during the 2022-2023 season. I would like to express my gratitude to my academic advisors, colleagues, and the institutions that assisted in the data collection process for their invaluable contributions to the completion of this study.

Authors' Contribution

Minas-Panagiotis Ispirlidis conceptualized and designed the study. Ioannis Ispirlidis contributed to data collection and analysis. Giorgos Pafis assisted in statistical processing and interpretation of results. Angelos E. Kyranoudis provided expertise in tactical and methodological aspects of the research. Mert Isbilir contributed to manuscript writing and revisions. All authors participated in the review process, approved the final version of the manuscript, and agreed to be accountable for all aspects of the work.

Declaration of Conflict Interest

The authors declare no conflicts of interest.

Ethics Statement

This study does not require ethical committee approval. The research is based solely on existing literature and tactical analyses of football matches, and does not involve any interventions or experimental procedures with human or animal subjects. Therefore, obtaining

approval from an ethical committee was not necessary. All data were collected from open and accessible sources, and no ethical violations are involved in the study.

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