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Turnover Dynamics in NCAA Division I Men's Basketball: A Structural Analysis by Game Outcome, Player Position, and Offensive Phase

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Abstract

Effective management of ball possession and minimizing turnovers are widely acknowledged as critical determinants of performance in elite-level basketball. This study aimed to analyze turnovers in NCAA Division I men's basketball games, focusing on their frequency and typology in relation to game outcome, player position, type of offensive play, game half, and timing of occurrence. A total of 951 turnovers were analyzed across 45 official NCAA Division I games, using SportScout v.3.2 for video coding software, and SPSS v.29 for statistical analysis. The most frequent type of turnovers was bad passes (41.4%), followed by ball-handling errors (28.3%) and offensive fouls (13.8%). Winning teams committed fewer turnovers overall (47.2%) compared to losing teams (52.8%), particularly in passing-related errors. Guards accounted for the highest proportion of total turnovers (52.6%), especially during set offense situations (81.8%). Pivots exhibited a higher frequency of offensive fouls. Despite variations in turnover type and frequency across playing positions and offensive contexts, logistic regression analysis indicated that turnover frequency and type did not significantly predict game outcomes at the $p<0.05$ level. These findings suggest that while turnovers serve as a key performance indicator, they do not act in isolation. Instead, they are shaped by a complex interplay of tactical and situational variables within the game environment. Training should emphasize decision-making under high-pressure conditions, enhanced recognition of game patterns, and situational awareness to reduce turnover rates throughout elite-level competitions.

Keywords: *basketball, turnover, result, player position, game half, timing*

Introduction

Basketball is an intermittent team sport involving high-intensity neuromuscular actions, rapid transitions between activities, and intricate technical and tactical demands (Sansone et al., 2020). Statistical analysis of game-related variables has been extensively applied to evaluate both individual and team performance efficiency across different levels of basketball competition (Cabarkapa et al., 2022b). Turnovers are among the most influential factors in determining offensive efficiency in modern basketball, occasionally surpassing traditional metrics such as shooting percentages and rebound counts (Mikes, 1988). The number of turnovers per possession at elite levels has decreased over time (Kubatko et al., 2007), largely due to ongoing improvements in players' fundamental skills and decision-making, as well as enhanced team efficiency. Each turnover represents a lost scoring opportunity and may immediately lead to a transition phase through a steal, which provides the opposing team with a numerical advantage or fast-break possibility (Fotinakis et al., 2002).

The ability to capitalize on opponent turnovers with immediate scoring has been identified as an indicator not only of offensive effectiveness but also of defensive performance. Turnovers are more common in high-tempo games and matches with large performance gaps between teams, high-

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lighting the importance of tactical discipline, organized offensive execution, and team coordination (Komic et al., 2024; Trninic et al., 2002). In men's basketball specifically, scoring after opponent turnovers has become a key factor that separates winning from losing teams, a finding supported by earlier studies (Ibáñez et al., 2003; Ibáñez et al., 2009; Lorenzo et al., 2010). However, despite their recognized importance, turnovers are not always reliable predictors of game outcomes in elite competitions (Bezerra, 2023; Han et al., 2020; Ibáñez et al., 2008; Mikołajec et al., 2021). Csataljay et al. (2009) found that turnovers did not significantly influence the game in close (0–9 points) or balanced (10–22 points) games but played a decisive role in distinguishing winners from losers in unbalanced games (22+ points). Similarly, Ibáñez et al. (2008) concluded that turnovers are not among the key variables that separate successful from unsuccessful teams during a season. As Han et al. (2020) pointed out, whether turnovers occur or not does not consistently link to the final result, highlighting the complex and multifaceted nature of sports performance. All of this emphasizes the need for more detailed analyses of turnovers in basketball, considering positional, temporal, and tactical factors.

In this context, the study by Sampaio et al. (2015), which analyzed EuroBasket 2015 games, showed that the bad pass was the most frequent type of turnover, accounting for between 40% and 44% of total errors. This finding reinforces the view that, although passing is the quickest and most frequently used way of moving the ball during both fast breaks and set plays (Evangelos et al., 2005; Conte et al., 2017), it remains particularly vulnerable when performed under pressure or in high-speed decision-making scenarios. Similar results were observed in the study by Fylaktakidou et al. (2011), which focused on women's basketball. There, the bad pass emerged as the most frequent turnover type (40.2%), followed by poor dribbling (23.9%), traveling violations (23.6%), and offensive fouls (8.6%). Proper dribbling technique has been shown to improve pass quality, especially when passes are made on the move or with one hand, techniques frequently employed by elite athletes and teams (Gryko et al., 2020).

Set plays represent the most frequently used offensive strategy, accounting for over 80% of possessions, and rely heavily on effective ball and player movement. Organized offenses demand high levels of tactical discipline and teamwork in order to create efficient scoring opportunities while minimizing turnovers (Bismpos et al., 2022; Courel-Ibanez et al., 2017; Foteinakis et al., 2024; Lorenzo et al., 2010). In contrast, fast breaks are employed less frequently (approximately 15% of offensive plays), yet tend to yield significantly higher scoring efficiency. Coaches aim to exploit both offensive phases depending on the game situation. The study by Fylaktakidou et al. (2011) found that turnovers were significantly less frequent during fast-break situations compared to set plays, possibly due to the nature of decision-making under pressure and the reduced number of passes involved in the former.

In recent years, differences among guards, forwards, and pivots have mainly been studied through assessments of somatotype, body composition, and physiological responses. One underexplored area in basketball analytics is the connection between player position and their in-game statistical performance (Sampaio et al., 2006). Their study concluded that performance metrics vary significantly by position (guard, forward, pivot) and competition level, with differences being more prominent in leagues such as the NBA, ACB, and LCB. However, these quantitative differences across league levels are gradually diminishing, as Oliver's four factors (Effective Field Goal Percentage, Turnover Rate, Offensive Rebound Rate, and Free Throw Rate) dominate performance metrics (Mandić, R., 2019b). A more recent study by Foteinakis and Pavlidou (2024) identified play-type actions during late-game possessions across player positions that directly impact the possession's outcome, highlighting the key role of guards and the increased efficiency of collaborative actions.

The NCAA league is organized with a structure that emphasizes athlete development through a long-term progression process. This is supported by research from Zestcott et al. (2020), which found that athletes who competed for more years in the NCAA college league and subsequently played at the highest NBA level committed fewer turnovers compared to those with less collegiate experience. Conversely, another study (Sampaio et al., 2010) identified turnovers as the most significant distinguishing factor between starters (players with more playing time) and substitutes, with starters committing significantly fewer turnovers. In this context, turnovers served as an indicator of individual quality rather than team performance. Moreover, Gomez et al. (2009) reported that when starters on a team commit many turnovers (such as poor passes or dribbling errors), the team's chances of losing the game increase. Turnovers may serve as an indicator of disrupted game flow, as they reduce scoring opportunities and limit a team's ability to control possession.

In recent years, researchers, analysts, and coaches have aimed to better understand the complex actions in basketball. To do this, they have used video-based performance analysis tools to systematically study player actions and gain deeper insights into behavior and game performance (Ciampolini et al., 2017). Although several studies have examined turnovers in professional and international competitions, comparatively little attention has been devoted to NCAA Division I men's basketball. In addition, only a limited number of investigations have considered contextual parameters such as player position and offensive phase, thereby leaving a clear gap in the literature concerning how these factors interact to shape turnover dynamics. Therefore, the present study aimed to conduct a comprehensive structural analysis of turnovers in NCAA Division I men's basketball, examining their relationship with game outcome, player position, offensive phase, game half, and timing of occurrence.

Methods

Sample

In the present study, a total of 951 turnovers were recorded from 45 NCAA Division I games conducted during the regular seasons of 2022–2024. The selection of this championship was based on the highly competitive level of the participating teams, while the specific games were selected based on the availability of full-length recordings and complete statistical records. Since this study was observational and conducted without intervention or experimentation, informed consent from participants was not required (American Psychological Association, 1992). Additionally, the public availability of game-related statistics indicated that Institutional Review Board approval was not required (Navalta & Stone, 2020).

Procedure and Variables

The games were recorded using a portable computer running Windows 10 and were subsequently analyzed using the SportScout v.3.2 software (SportScout Group, Thessaloniki, Greece), which enables efficient management and processing of game video footage. Video files were obtained in MP4 format, and an analysis framework comprising the relevant variables was developed following data digitization. Two trained analysts independently coded the turnovers. Inter-rater reliability was assessed using Cohen's kappa coefficient (κ=0.87), indicating a high level of agreement (Altman, 1991). Data entry into Excel spreadsheets was automated. The observation protocol was designed to document the types of turnovers in relation to contextual variables, including game outcome, player position, type of offensive play, game half, and timing of occurrence. By including contextual variables, we aimed to delve deeper into the unique structures and dynamics that affect turnovers in a basketball game. The variable definitions are provided in Table 1.

Table 1. Definition and description of the examined variables.

Variable	Definition and Description
Game Outcome	Outcome of the match: a) Winning team b) Losing team
Turnover Type	Bad pass: a turnover that occurs when a player attempts to pass the ball to a teammate, resulting in a loss of possession. The variable was further explored, including the following subcategories: a) passes that went out of bounds or passes intercepted by opponents (steals) b) passes with poor reception or release Dribbling violations: turnovers made while dribbling the ball, resulting in a possession loss. Included the following subcategories in the observation: a) ball-handling violations: turnovers made while dribbling or managing the ball, such as losing control of the dribble, allowing a defender to steal the ball, or fumbling it out of bounds b) illegal dribbling, a violation that occurs during dribbling, such as carrying the ball or picking up the ball c) traveling, a violation that occurs when a player holding the ball moves one or both feet illegally and double dribble, a turnover that happens when a player either dribbles the ball with both hands simultaneously or stops dribbling and then begins to dribble again Offensive foul: A personal foul committed by a player on offense, resulting in a loss of possession. Included the following subcategories in the observation: a) push-off violation (during dribble) b) offensive rebound, violations during offensive rebound c) dribble hand-off: Offensive foul occurred during the dribble-hand-off action d) pick and roll: Offensive foul occurred during the pick-and-roll action e) off-ball charge: Offensive foul occurred during an off-ball action (screen) f) posting up: Offensive foul during a post-up action Timing violations: included all the timing violations, such as: a) 3-second violation, where an offensive player remains in the area under the basket for more than 3 consecutive seconds while their team has possession of the ball in the frontcourt. b) 5-second inbound or closely guarded violation: Failure to pass the ball within 5 seconds during an inbounds play or when a player is holding the ball and is closely guarded c) 10-second backcourt violation: Taking more than 10 seconds to advance the ball past half-court d) 30-second shot clock violation: Failing to attempt a shot that hits the rim before the shot clock expires Out-of-bounds/backcourt violation: The ball or player holding the ball steps on or beyond the boundary line, and after the offense has brought the ball across the midcourt line, returning the ball to the backcourt without defensive interference results in a turnover
Game Half	a) first b) second
Player Position	a) Guard b) Forward c) Pivot
Type of Offense	a) Fast break: offense occurring in transition before the defense is set b) Set play: structured offense run against a set defense c) Second chance: offense following an offensive rebound

Statistical Analysis

Data processing and statistical analyses were performed using SPSS (Version 29; IBM Corp, Armonk, NY, USA). First, descriptive statistics were computed. Contingency table analysis, employing a chi-square (χ^2) test of independence, was conducted for group comparisons and associations among the categorical variables and their subcategories. Additionally, binary logistic regression was employed to determine whether turnover subcategories in passing and dribbling could predict game outcome. Logistic regression was selected based on its proven effectiveness in sports analytics and its capability to handle binary classification problems (Robertson, 2020). The level of statistical significance was set at $p<0.05$.

Results

A total of 951 turnovers were recorded across 45 games, with an average of 21.13 turnovers per game (SD=5.58). Teams that won committed fewer turnovers, accounting for 47.2% (n=449), compared to the losing teams, which accounted for 52.8% (n=502). The most frequent type of turnover was bad passes, representing 41.4% (n=394), followed by ball-handling violations at 28.3% (n=269) and offensive fouls at 13.8% (n=131). Less frequent were violations such as traveling and double dribble (7.7%, n=73), timing violations (4.9%, n=47), and turnovers related to out-of-bounds/backcourt violations (3.9%, n=37) (Table 2).

Turnover distribution between winning and losing teams is presented in Figure 1. Chi-square test of independence revealed a statistically significant, though small, association between game outcome and turnover type, $\chi^2(5)=11.93$, p=0.036, Cramer's V=0.11. More specifically, winning teams exhibited a lower frequency of dribbling violations (12.1%, n=115), bad passes (19%, n=181), timing violations (2.4%, n=23), and out-of-bounds/back-court violations (1.5%, n=14) compared to losing teams. On the contrary, winners committed statistically significant (p<0.05), more offensive fouls than the losers (8.1%, n=77). The losing teams exhibited a lower frequency of traveling or double dribble violations (3.6%, n=34) and offensive fouls (5.7%, n=54).

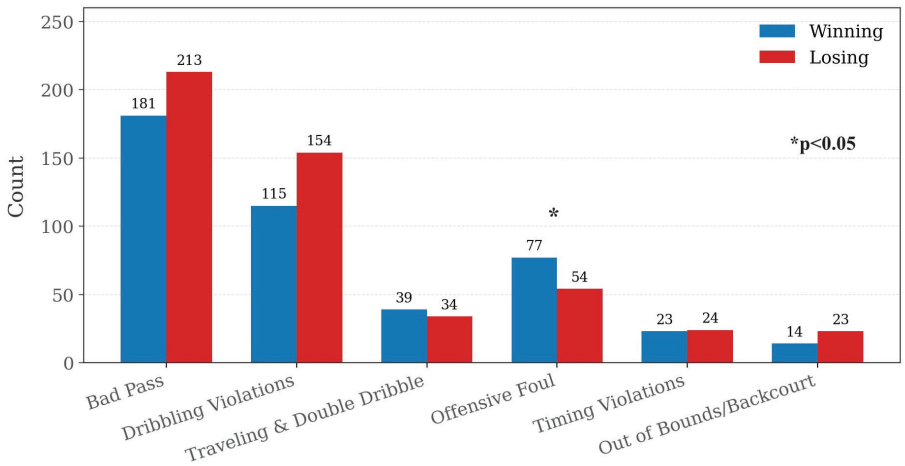

FIGURE 1. Comparison of turnover types between winning and losing teams.

Within the subcategory of passes, there were no significant differences ($\chi^2(2)=2.55$, p=0.280), with 71.6% of turnovers (n=282) involving errant passes that either went out of bounds or were stolen by the opponent, while 28.4% (n=112) were due to poor reception or release of the ball. No statistically significant differences were also observed within the subcategories of dribbling violations ($\chi^2(2)=4.12$, p=0.249). Specifically, 70.6% (n=190) occurred during dribble execution, and 29.4% (n=79) during the pick-up phase. Offensive fouls were classified into six subcategories: during dribbling (32.8%, n=43), contesting offensive rebounds (27.5%, n=36), dribble hand-offs (16.8%, n=22), on-ball screens (12.2%, n=16), off-ball screens (7.6%, n=10), and posting-up situations (3.1%, n=4). Like in passing and dribbling subcategories, no significant differences were found in offensive subcategories and offensive foul violations ($\chi^2(5)=3.51$, p=0.622). All the above are depicted in Figure 2.

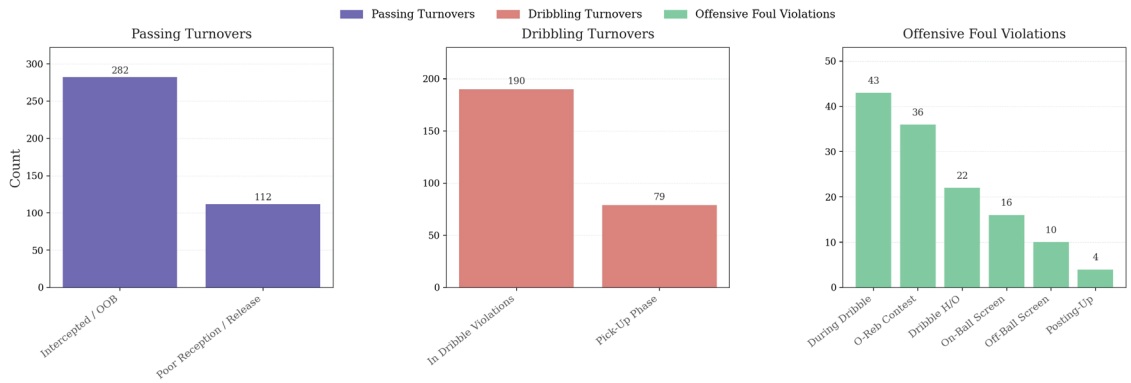

FIGURE 2. Turnover violations across the different subcategories.

Analysis of player position effects on turnover type revealed statistically significant differences ($\chi^2(10)=68.02$, p<0.001, Cramer's V=0.18). Guards exhibited the highest frequency of turnovers (52.6%, n=500), followed by forwards (26.5%, n=252) and pivots (20.9%, n=199). Guards and forwards most frequently committed turnovers through passing (24.2%, n=230 and 10.3%, n=98, respectively) and dribbling violations (15.2%, n=145 and 8%, n=76), followed by offensive fouls (4.2%, n=40 and 3.6%, n=34). In contrast, pivots committed the majority of their turnovers through passing (6.9%, n=66) and offensive fouls (6%, n=57), with the latter being more frequent than among guards and forwards, followed by dribbling violations (5%, n=40), as shown in Table 2.

Table 2. Turnover types by players' position

Turnover Type	Players Positions			
	Guards	Forwards	Pivots	Total
Bad Pass	24.2%**	10.3%	6.9%*	41.4%
Dribbling Violations	15.2%	8%	5%	28.3%
Travelling & Double Dribble	3% *	2.5%	2.1%	7.7%
Offensive Foul	4.2%**	3.6%	6%**	13.8%
Timing Violations	3.5%*	0.8%	0.6%	4.9%
Out of Bounds & Backcourt Violations	2.4%	1.3%	0.2%*	3.9%
Total	52.6%**	26.5%	20.9%	100%

Note: Bottom row (total) percentages are row-wise: Total distribution of turnovers between the positions of the players; Right column (total) percentages are column-wise: total distribution of turnovers. Percentages within cells are column-wise: distribution of turnovers within the position of the player. *p<0.05; **p<0.001.

Guards committed most of their offensive fouls during dribbling actions (10.7%, n=14), while forwards were more prone to such fouls during rebounding contests (9.2%, n=12). Pivots exhibited a high frequency of offensive fouls related to dribbling (16%, n=21), followed by dribble hand-off (D.H.O.) situations (9.9%, n=13), often involving illegal screens (Figure 3). No significant differences were detected between the players' positioning and the offensive foul subcategories ($\chi^2(10)=11.19$, p=0.343).

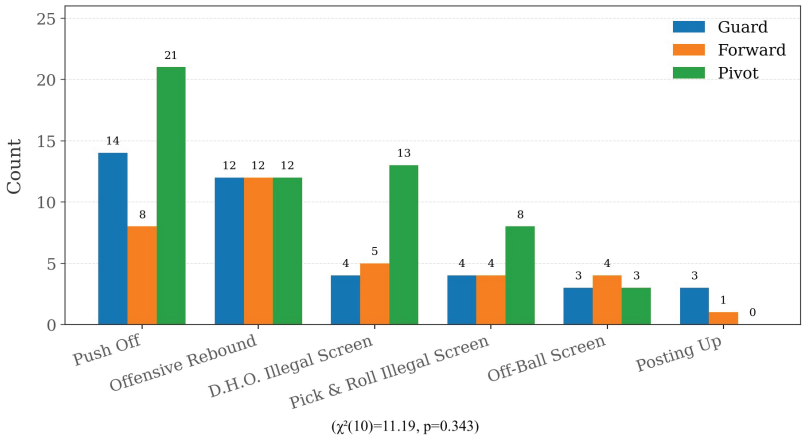

FIGURE 3. Comparison of offensive foul subtypes by player position.

Regarding the association between the players' positioning and the dribbling subcategory turnovers, no significant differences were detected ($\chi^2(6) = 9.45$, p=0.150). Turnovers occurring during dribbling were the most common across all player positions (guards: 10.7%, n=107; forwards: 5.4%, n=51; pivots: 3.9%, n=37), followed by turnovers during the pick-up phase (guards: 4.5%, n=43; forwards: 2.6%, n=25). Pivots, however, most frequently committed violations related to traveling or double dribbling (2.1%, n=20), as shown in Figure 4. Significant differences were also identified between player position and passing subcategories ($\chi^2(4)=12.98$, p=0.011, Cramer's V=0.08), with guards committing the most passing turnovers, followed by forwards, and finally pivots.

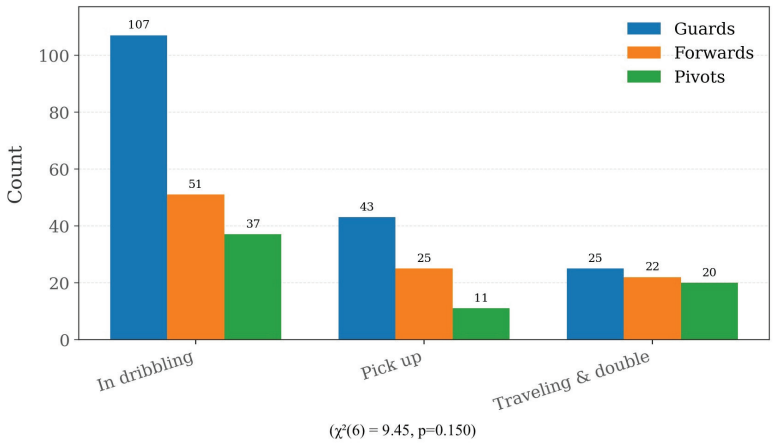

FIGURE 4. Ball-handling turnover types by player position.

Most turnovers were committed during set plays, accounting for 81.8% (n=778), compared to fast breaks at 15.6% (n=148) and second-chance opportunities following offensive rebounds at 2.6% (n=25). Cross-tabulation analysis examining the relationship between type of offense and turnover type was statistically significant ($\chi^2(10)=24.76$, p=0.006, Cramer's V=0.11), with the majority of turnovers occurring during set plays as shown in Table 3. The association between offensive type and passing subcategories was also significant ($\chi^2(4)=11.61$, p=0.021, Cramer's V=0.08). However, no significant differences were observed for dribbling subcategories ($\chi^2(6)=11.61$, p=0.078) or offensive foul subcategories ($\chi^2(10)=13.67$, p=0.189) and type of offense.

Table 3. Turnover distribution by offensive phase and game half.

Category	Percentage	N	Statistical Analysis
Set plays	81.8%	778	$\chi^2(10)=24.76$, p=0.006
Fast Breaks	15.6%	148	
Second Chance	2.6%	25	
First half	53.3%	507	$\chi^2(10)=11.52$, p=0.319
Second half	46.7%	444	

Turnovers occurred more frequently in the first half (53.3%, n=507) compared to the second half (46.7%, n=444), with no significant differences between game half and turnover type ($\chi^2(10)=11.52$, p=0.319) as shown in Table 3. It is noted that 9.6% (n=91) of turnovers occurred within the first five minutes of the game. Likewise, no significant differences were found in the dribbling subcategories ($\chi^2(6)=8.08$, p=0.233), passing subcategories ($\chi^2(4)=1.71$, p=0.790), or offensive foul subcategories ($\chi^2(10)=6.87$, p=0.737) between the first and the second half of the game. Regarding the score difference at the time of the turnover, the majority occurred when the point differential was between 0 and 9 points (65.4%, n=622), with fewer turnovers recorded at 10–19 points (25.5%, n=242) and above 20 points (9.1%, n=87).

Finally, a binary logistic regression was conducted to determine whether turnover subcategories in passing and dribbling could predict game outcome (win=1, loss=0). The overall model was not statistically significant ($\chi^2(5)=8.17$, p=0.147), indicating that none of the variables examined sufficiently predicted the outcome. Pseudo R^2 values (Cox & Snell=0.009, Nagelkerke =0.011) revealed low explanatory power. The overall classification accuracy was 54.9%, with adequate prediction of losses (62.5%) but poor prediction of wins (46.3%). The Hosmer–Lemeshow test ($\chi^2=3.91$, p=0.563) indicated good model fit, yet no independent variables reached statistical significance (all p>0.08). On an individual variable level, no turnover type, nor passing or dribbling violations, showed statistically significant effects (p>0.08 in all cases). Although the regression coefficients indicate trends, such as a negative association between pick-up or reception turnovers and the likelihood of winning, the p-values (0.087–0.099) and odds ratios (0.63–1.11) do not reach statistical significance, preventing definitive conclusions.

Discussion

The finding that winning teams committed fewer turnovers than losing teams corroborates existing literature, which suggests that effective ball possession management is positively associated with the likelihood of victory (Foteinakis & Pavlidou, 2025; Gryko et al., 2020; Sampaio et al., 2010). Teams that are trailing often operate under increased pressure, which can negatively affect their performance and increase turnover propensity. However, this observation contrasts with García et al. (2013), who, in their analysis of regular-season ACB League games, found that although winners recorded slightly fewer turnovers, the variable was not statistically significant in differentiating team outcomes. Similarly, Ibáñez et al. (2009) reported that turnovers were not among the key indicators distinguishing winning from losing teams, unlike variables such as successful two-point field goals, defensive rebounds, and assists, which substantially predicted game outcomes.

A detailed categorization of turnover types revealed that bad passes (41.4%) and dribbling violations (28.3%) were the most frequent categories. This aligns with Gryko et al. (2020), who documented that inaccurate passes account for approximately 40–44% of all turnovers at elite levels. Victorious teams appeared to manage possession more efficiently, particularly by limiting passing turnovers. In contrast, losing teams showed elevated frequencies across nearly all turnover categories, except for offensive fouls and traveling/double-dribble violations, suggesting both quantitative and qualitative differences in execution, especially under pressure conditions.

The present study found that only 9.1% of turnovers occurred in the first five minutes, indicating high player activation and organization. This finding is consistent with Mancha-Triguero et al. (2019), who reported elevated energy levels at the beginning of play. The finding that 53.3% of turnovers occurred in the first half suggests that teams are more prone to errors while adapting to opponents' tactics and defensive pressure, a tendency associated with rushed decisions or inadequate defensive reads (Jin, 2024). Furthermore, 65.4% of turnovers occurred during close-score situations (0–9 point differential), reinforcing the idea that such errors are more prevalent during high-stakes moments, when decision-making is particularly affected by pressure.

Turnover distribution by player position confirmed the central role of guards in organizing offense and playmaking, exposing them to increased defensive pressure, as they accounted for 52.6% of total turnovers. Literature consistently demonstrates that perimeter players, followed by forwards, exhibit higher frequencies of passing and dribbling violations due to the nature of their playmaking duties (Sampaio et al., 2006). Conversely, pivots showed higher rates of offensive fouls, which were not exclusively related to dribbling but mainly associated with post-up situations, dribble hand-offs, and other close-contact actions near the basket. This relates to the physical demands of their role, as constant

contact with defenders, battles for position, and screens on and off the ball often lead to illegal positioning (Sampaio et al., 2006).

Although fast breaks have been statistically identified as significant predictors of success (Conte et al., 2017), the results showed that set plays accounted for 81.8% of all turnovers. This is unsurprising, given that organized offense involves multi-level cooperative plays with more complex passing sequences and coordinated movement, increasing the likelihood of execution turnovers (Christmann et al., 2018). Additionally, statistical analysis confirmed the significant relationship between offensive type and turnover type, supporting the notion that the tactical nature of the phase influences the type of turnovers that occur.

The absence of significant differences between winners and losers in dribbling, passing, and offensive foul violation subcategories suggests that differentiation between winning and losing teams likely lies more in turnover frequency and timing rather than turnover itself. However, significant associations were observed between player position and turnover type, as well as within passing subcategories, emphasizing the need for specialized training approaches tailored to each playing position.

The results of the binary logistic regression analysis suggest that turnover subcategories related to passing and dribbling do not significantly predict game outcomes in NCAA Division I basketball. Although some turnover types, such as pick-up and reception errors, showed a negative trend with respect to winning, these associations did not reach statistical significance. The inability of the model to reliably identify key turnover types that distinguish winners from losers highlights the multifactorial nature of basketball performance. These findings are consistent with previous research (e.g., Han et al., 2020; Ibáñez et al., 2008), which also found that turnovers, when considered in isolation, are limited in their capacity to explain competitive success. Therefore, it is recommended that additional variables, such as the timing of turnovers, defensive formation, and game status, should be incorporated to enhance the explanatory power of future models.

Overall, the present study's findings provide a comprehensive and structural overview of turnovers at a high level of competition, emphasizing the importance of reducing peripheral violations. The findings emphasize the importance of optimizing decision-making under pressure, tactical collaboration, and minimizing high-impact turnovers, especially from players occupying key offensive roles. The increased involvement of guards in turnovers confirms the necessity to develop skills focused on spatial and temporal pressure. Additionally, the prevalence of turnovers in the first half and during structured offensive settings points to the need for improved decision quality during complex offensive sequences. Coaching practices should incorporate position-specific drills, exposure to simulated high-pressure game scenarios, and the integration of real-time performance feedback with increased cognitive and tactical demands to enable players to manage ball possession more effectively under pressure. A limitation of the present study is that the data were drawn exclusively from NCAA Division I games, which restricts the generalizability of the findings to other leagues, competitive levels, or women's basketball. Future research could extend these findings by comparing turnover dynamics across different competitions, incorporating additional game-related variables, and integrating physiological and psychological indicators to provide a deeper understanding of the mechanisms through which errors emerge during the game.

Conclusions

The present study provides a comprehensive and multifactorial depiction of game-related errors in contemporary high-level basketball, revealing key distinctions between winning and losing teams, turnover types, player positions, offensive schemes, and game context. However, the specific nature of the violations themselves (e.g., passing versus dribbling) did not emerge as standalone predictors of game outcomes. Rather, the overall turnover frequency, timing, and most importantly, the competitive context in which turnovers occurred appeared to relate more closely to team effectiveness and match results.

Winning teams committed fewer total turnovers, predominantly limiting violations in passing and dribbling, two fundamental skills linked to ball possession management and offensive execution. Losing teams, conversely, exhibited higher turnover rates across multiple categories, pointing to lower tactical efficiency under pressure and possible breakdowns in offensive coordination. The majority of violations occurred during the first half and in closely contested phases of the game, underscoring the association between psychological pressure and increased likelihood of turnovers.

The distribution of violations across the player's position underscored the pivotal role of guards in game creation and their increased exposure to turnovers, especially in passing and dribbling due to their decision-making responsibilities. Forwards demonstrated a mixed profile, while pivots were more frequently susceptible to offensive fouls, especially in high-contact roles, such as post-up and dribble hand-off situations. Despite its structured framework, organized offense was responsible for the vast majority of turnovers, likely attributable to the inherent complexity and high degree of coordinated actions it demands.

Statistical analysis did not identify individual turnover subtypes (e.g., pick-up errors or pass reception) as independent predictors of game outcomes. This finding supports the need for qualitative analysis of turnovers, incorporating parameters such as timing, defensive configuration, strategic intent, and game status. Turnovers should thus not be interpreted as isolated technical lapses, but rather as the product of complex cognitive and tactical interactions occurring under high-demand conditions.

In conclusion, the findings of this study underscore the importance of targeted context-sensitive coaching strategies and interventions to minimize both tactical and technical errors. Training should emphasize decision-making under high-pressure conditions, enhanced recognition of game patterns, and situational awareness. Moreover, the development of multivariate analytical models that incorporate contextual variables such as the timing of errors, game status, and defensive configurations is essential to improve predictive accuracy and deepen the functional understanding of turnover dynamics. Future research could integrate psychological and physiological indicators such as fatigue and game context analysis to elucidate how and why errors occur. Ultimately, combining quantitative and qualitative methodologies will provide a deeper, more substantive understanding of the role of errors in elite basketball.

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Conflicts of interest
The authors declare no conflict of interest.

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