

Effect of offensive rebound on the game outcome during the 2019 Basketball World Cup

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Abstract:

The offensive rebound (OR) is particularly important because it offers a second opportunity to score against a misplaced defense, and it is a performance indicator that distinguishes the winning teams in playoff games. This research was conducted to investigate the effectiveness of offensive plays following an offensive rebound, both from winners and losers. The secondary aim was to compare and analyze factors that could have an impact on the effectiveness of offensive plays following an OR. The sample size consisted of 28 basketball games from the World Basketball Cup, which was held in China (2019). For statistical analysis of the variables, we used frequency analysis, crosstabulation analysis with χ^2 (Chi-square) test (significance level set at $p < 0.05$), adjusted standardized residual and CHAID decision trees. The results indicated that each team was awarded ~10.3 ORs per game, and more than 7 out of 10 ORs were recovered in the paint. Furthermore, teams that ultimately lost the game executed more offensive plays during the first 5 s after their OR than teams that won the game ($p = 0.035$). At the same time, teams that lost the game had more unsuccessful offensive plays after the OR with no statistically significant difference. Regarding the effectiveness of the offense following an OR, individual actions were found to be more effective than organized plays ($p = 0.01$). In addition, plays that were executed during the first 5 s after the OR were more efficient in contrast with plays that lasted more seconds ($p = 0.003$). These findings indicate the importance of the OR in the game and can be used by basketball coaches who want to optimize their coaching plan.

KeyWords: Sport, Effectiveness, Performance Analysis, Offense, Coaching

Introduction

Over the course of the last years, the researches about basketball have increased, the game is constantly evolving and new concerns are on the rise that need to be investigated (Sampaio, Drinkwater, & Leite, 2010; Ribas, Navarro, Tavares, & Gómez, 2011). The information obtained through the analysis of the games in different situations allows the identification of the development trends and the understanding of the game. Moreover, it contributes to the optimization of the training planning (Hughes & Franks, 2004; Lorenzo, Gómez, Ortega, Ibáñez, & Sampaio, 2010; Ribas et al., 2011). Finally, the performance analysis in basketball tries to illuminate the factors that have an impact during the game and determine which of them are the key points (Christoforidis, Papadimitrou, Taxildaris, Aggelousis, & Gourgoulis, 2000; Tsitskaris, Theoharopoulos, Galanis, & Nikopoulou, 2002; Wang, Liu, & Moffit, 2009; Vaquera García-Tormo, Gómez Ruano, & Morante, 2016; Koutsouridis, Karamousalidis, Galazoulas, 2018) and besides, the role of capable analysts, who aim to provide coaches and athletes with specific guidelines for better decision-making in any situation, is considered necessary (Nunes, Iglesias, Daza, Irurtia, Caparrós et al., 2016; Stamiris, Karamousalidis & Stavropoulos, 2020).

It is important that a basketball team create offensive opportunities and improve its effectiveness by making attempts for score with a high percentage of shots made, in order to maximize its score in a game. One of the most effective ways to increase the number of the attempts is to get the rebounds (Hojo, Fuji, & Kawahara, 2019). Plenty of researchers claim that rebound dominance is an important factor of the game that characterizes the best basketball teams (Gómez, Lorenzo, Sampaio, Ibáñez, & Ortega, 2008; Csátlajay et al., 2009; Sampaio et al., 2010; Puente, Coso, Salinero, & Abián-Vicén, 2015; Suárez-Cadenas & Courel-Ibáñez, 2017; Zhang, Lorenzo, Gómez, Liu, Gonçalves et al., 2017).

When the defensive team takes the possession of the ball (defensive rebound), it reduces the attempts for score of the opposing team and it has an opportunity for a good fast break. On the contrary, when the offensive team takes the control of the ball (offensive rebound), it leads to a good opportunity for a second shot, since the rebounding area is usually close to the basket. This fact leads to the general idea that "the team that

controls the rebounds also controls the game" (Bryant, 1967; Allsen, 1967; Huberty, 1970; Moormeier, 1971; Komure, Aoyagi, Sakuragi, & Tagata, 2014).

In general, the ratio of defensive to ORs on a team is approximately 70% to 30%. There are two reasons for this. First of all, only 2-3 players usually participate in the OR, because the rest of the players should return to the defense in order to prevent their opponents' fast break. In addition, the defensive players are usually closer to the basket than the offensive ones and they can block out (Tsitskaris et al., 2016). However, other researchers found out a smaller percentage for the ORs. They found that only after 8-10% of the total missed shots is the rebound taken by an offensive player. As a result, teams have an average of 10-15 second scoring opportunities (Gómez et al., 2008; Csátaljay et al., 2009; Suárez-Cadenas & Courel-Ibáñez, 2017).

In respect to the zone of the court where the OR is obtained, the researchers agree that nine out of ten rebounds are taken in the zones close to the basket, and mainly facing on it (Tsamourtzis & Athanasiou, 2004; Suárez-Cadenas & Courel-Ibáñez, 2017). Furthermore, in a study conducted to evaluate the number of players who participate in rebounds, the results showed that when defensive players are more than the offensive ones, then they take more rebounds with statistically significant difference. But the same is true in the opposite side for the offensive players. However, when the number of participating players in the rebound is equal, the defense does not get more rebounds from the offense (Ribas et al., 2011b).

The main factors predicting who obtains a rebound are: the player's position, the distance between the player and basket and the difference in distance between the nearest opponent players. The shorter the player's distance from the basket compared with the nearest opponent, the higher the probability of obtaining a rebound (Hojo et al., 2019). Regarding the second opportunities of the teams, it was found that the efficiency of the shots increased by 67% when they were made after an OR. In addition, winners were more efficient than the losers after their ORs. Finally, the winners made significantly more shots from the outside zones than the losers, while there were no differences from the zones close to the basket (Suárez-Cadenas & Courel-Ibáñez, 2017).

If a team increases the number of rebounds and its successful shots after them, its score will be raised to high levels, regardless of the final score of the game. Even unsuccessful shots after an OR have a positive effect on the differences in scores between winners and losers. This fact can be explained by the augmentation of the shots themselves for the winning team. In other words, the more shots are made by a team, the more the effective attempts are increased after recovering ORs (Komure et al., 2014). Therefore, the OR is particularly important because it offers a second opportunity to score against a misplaced defense (Oliver, 2004; Kubatko, Oliver, Pelton, & Rosenbaum, 2007; Suárez-Cadenas & Courel-Ibáñez, 2017) and it is a performance indicator that distinguishes the winning teams in playoff games (Sampaio & Janeira, 2003; Ribas et al., 2011).

The aim of the present study is to investigate the effectiveness of the offensive plays following an OR, both from the winners and the losers. The secondary aim is to compare and analyze factors that could have an impact on the effectiveness of the offensive plays following an OR.

Material & methods

Sample

The sample size consisted of 28 basketball games from the World Basketball Cup which was held in China (2019). The games selected were all the games from the second round, the quarter-finals, the classification 5-8, the semi-finals and the finals. The above games were chosen in order for the research to be conducted at the highest level of basketball teams. The teams that qualified for the second round and whose games were the sample of the survey were: Argentina, Australia, Brazil, Czech Republic, Dominican Republic, France, Greece, Italy, Lithuania, Poland, Puerto Rico, Serbia, Spain USA and Venezuela.

Recording instruments

The instruments used for the research were: a laptop with OS Windows 10 Pro, the SportScout STA video-analysis program, and the software pack SPSS v.25.

Procedure and variables

First of all, in order to analyze the games with the SportScout STA program, it is necessary for the observer to create a new scout model, depending on the variables that will be investigated.

The variables studied, both for the winners and the losers, were the following:

1. The seconds to perform the offense before the OR (0-8", 9-16", 17-24").
2. The number of participating players in the OR (1, 2 or 3 players).
3. The position of the player who gets the OR. The positions of the players were obtained from the rosters of the teams that are available on the official website of FIBA (Guard, Forward, Center).
4. The rebounding zone (Figure 1). The court was divided into 14 zones according to Ribas et al. (2011).
5. The offensive action (team action or individual action).
6. The seconds to perform the offense after the OR (0-5", 6-10", 11-14").
7. The points made (0, 1, 2, 3 or 4 points).

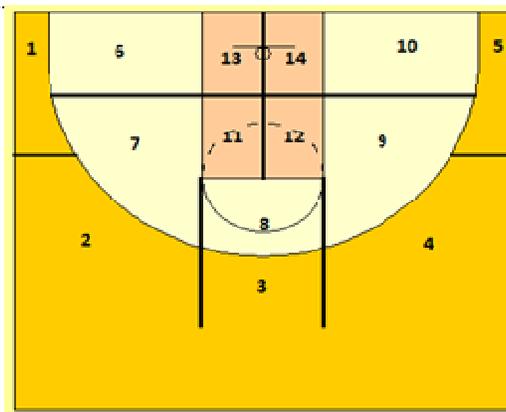


Figure 1: Zones of the court

8. The effectiveness of the offense (Effective, if they score 1-4 points, and Ineffective, if they did not score).
9. The difference in the final score. Close (≤ 9 points), balanced (10-19 points), unbalanced game (≥ 20 points) according to Conte & Lukonaitiene (2018).
10. Quarter (1st, 2nd, 3rd, 4th and overtime).

The ORs which were obtained against a zone defense were excluded in this survey. The reason is that the situation in which the defensive players are in a zone is completely different from the man-to-man defense. Moreover, team ORs and offenses in which a foul was made, that did not lead to free throws, were not included. The reason that the specific situations were ruled out was to determine how the offenses react after the OR against a usually misplaced defense.

Statistical analysis

The software pack SPSS 25 for windows was used for the processing of the data and the statistical analysis. To determine possible differences in the variables examined, in relation to the offenses' effectiveness and the outcome of the games, Crosstabulation analysis was used with chi-square distribution and the level of significance set at $p < 0.05$. Given the fact that χ^2 check measures possible differences between the observed and the expected counts, Adjusted Standardized Residual (critical value=1.96 and $p=0.05$) was used to determine which cross-section is responsible for the independence of the variables. Finally, CHAID decision trees were also created.

Results

Out of the 28 games analyzed, a total of 576 ORs were recorded. From this total, 459 were used for statistical analysis because, as mentioned above, some of the ORs were excluded from this survey. Frequency analysis was performed for all variables. The results are shown in Tables 1, 2 and 3.

Table 1: Frequency Analysis of variables (Part 1)

Offense's sec before OR			Players Involved			Player's Position			Offense's sec after OR		
Var.	n	%	Var.	n	%	Var.	n	%	Var.	n	%
0-8"	77	16.8	1 player	94	20.5	Guard	95	20.7	0-5"	352	76.7
9-16"	211	46.0	2 players	236	51.4	Forward	191	41.6	6-10"	52	11.3
17-24"	171	37.3	3 players	129	28.1	Center	173	37.7	11-14"	55	12.0
Total	459	100	Total	459	100	Total	459	100	Total	459	100

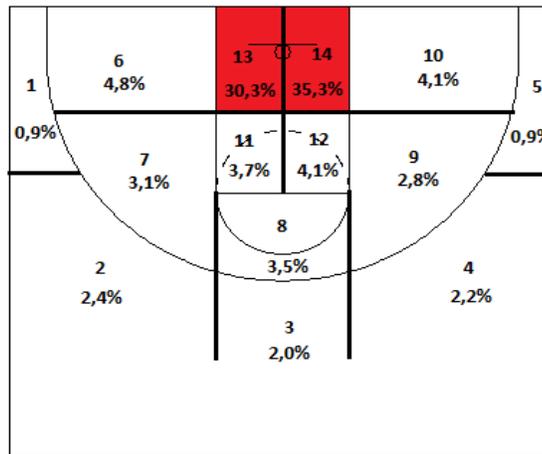
Table 2: Frequency Analysis of variables (Part 2)

Points after OR			Offense's Effectiveness after OR			Game's Result			Offense's Action after OR		
Var.	n	%	Var.	n	%	Var.	n	%	Var.	n	%
0 p.	238	51.9	Efficient	221	48.1	Winners	220	47.9	Individual Action	254	52.1
1 p.	19	4.1	Inefficient	238	51.9	Losers	239	52.1			
2 p.	160	34.9							Team Action	205	44.7
3 p.	42	9.2									
Total	459	100	Total	459	100	Total	459	100	Total	459	100

Table 3: Frequency Analysis of variables (Part 3)

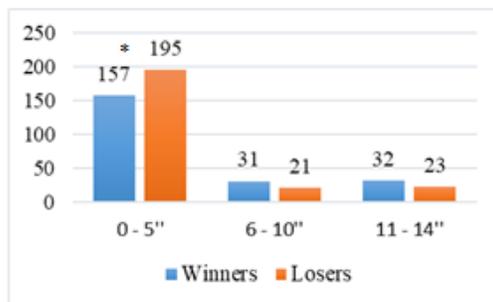
Difference in Score			Quarter		
Var.	n	%	Var.	n	%
Close	184	40.1	1 st	112	24.4
Balanced	204	44.4	2 nd	105	22.9
Unbalanced	71	15.5	3 rd	106	23.1
			4 th	131	28.5
			Overtime	5	1.1
Total	459	100	Total	459	100

Regarding the zones of the court where the ORs were obtained, the highest percentage was found in the two inside zones of the paint, under the basket. More specifically, zone 14 (n=162, 35.3%) and zone 13 (n=139, 30.3%) are the ones closest to the basket and those in which the most ORs were obtained (Figure 2). Therefore, 65.6% of ORs are taken in the low post area and 73.4% in the paint (3 seconds area).



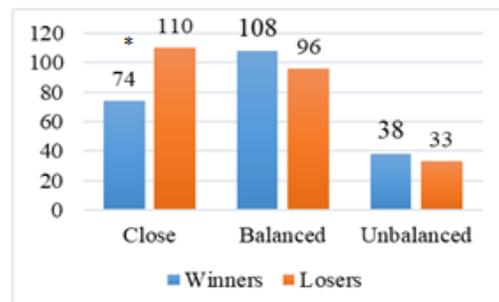
In order to compare the variables between winners and losers, Crosstabulation analysis was used with the χ^2 distribution (chi-square), which informs us about the result of the independence test. The variables in which statistically significant differences were observed between winners and losers were: 1) the seconds to perform the offense after the OR (Figure 3), 2) the difference in the final score (Figure 4) and 3) the quarter, when the ORs were obtained (Figure 5). In the seconds to perform the offense before the offense (p=0.618, $\chi^2=0.962$, Cramer's V=0.046), the number of participating players (p=0.387, $\chi^2=1.898$, Cramer's V=0.064), the position of the rebounder (p=0.388, $\chi^2=1.894$, Cramer's V=0.064), the zone of the court (p=0.724, $\chi^2=9.633$, Cramer's V=0.145), the type of offensive action (p=0.205, $\chi^2=1.606$, Cramer's V=0.059) and the points scored after the OR (p=0.868, $\chi^2=0.724$, Cramer's V=0.040) no statistically significant differences were observed between winners and losers. With regard to the effectiveness of the offenses after the OR, there was a difference between winners and losers, but not statistically significant (Figure 6).

Figure 3: The Seconds to Perform the Offense After the OR in Relation to the Game's Result



$p=0.035$, $\chi^2=6.723$, Cramer's V=0.121

Figure 4: The Difference in the Final Score in Relation to the Game's Result



$p=0.026$, $\chi^2=7.328$, Cramer's V=0.126

Figure 5: The Quarter of the Game in Relation to the Game's Result

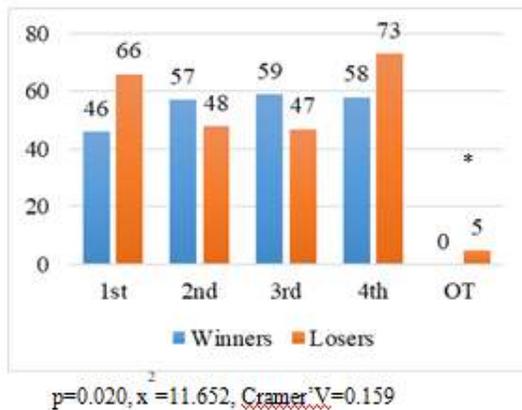
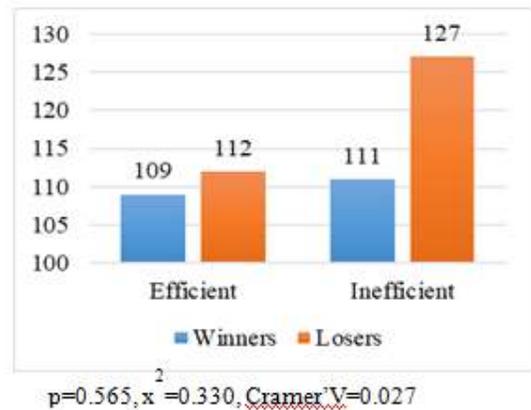


Figure 6: The Effectiveness of the Offenses After the OR in Relation to the Game's result



In order to compare the variables with the effectiveness of the offense after the OR, Crosstabulation analysis with the χ^2 distribution (chi-square) was also used. The variables that affected with a statistically significant difference the effectiveness of the offense following an OR were: 1) the type of the offensive action (Figure 7) and 2) the seconds to perform the offense after the OR (Figure 8).

On the other side, the seconds to perform the offense before the OR ($p=0.142$, $\chi^2=3.907$, Cramer's $V=0.092$), the number of participating players ($p=0.373$, $\chi^2=1.974$, Cramer's $V=0.666$), the position of the rebounder ($p=0.301$, $\chi^2=2.400$, Cramer's $V=0.072$), the zone of the court ($p=0.469$, $\chi^2=12.727$, Cramer's $V=0.167$), the difference in the final score ($p=0.278$, $\chi^2=2,559$, Cramer's $V=0.075$) and the quarter, when the ORs were obtained, ($p=0.652$, $\chi^2=2,460$, Cramer's $V=0.073$) are variables that did not affect the effectiveness of the offenses significantly after an OR.

Figure 7: The Type of the Offensive Action in Relation to the Offense's Effectiveness after the OR

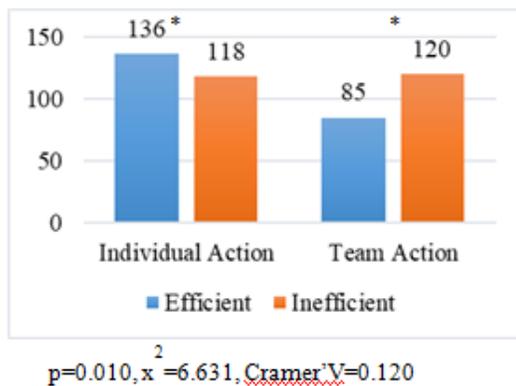
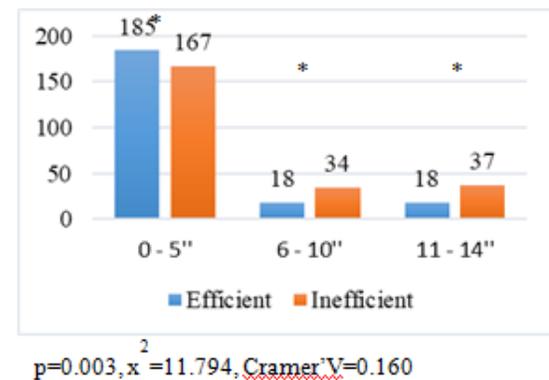


Figure 8: The Seconds to Perform the Offense after the OR in Relation to the Offense's Effectiveness.



Finally, two CHAID Decision Trees were created. Figure 9 indicates that the effectiveness of the offenses reached 75.4% ($p\text{-value}=0.012$, $\chi^2=8.323$) in close games, when they came from offenses that were executed in 9-16" and the shot after the OR was made during the first 5".

Figure 10 shows that in close games the losers got 71.3% of the ORs during the first quarters, the last ones and the overtime while on the contrary, during the second and third quarters the winners got 56.6% of the ORs ($p\text{-value}=0.002$, $\chi^2=14.417$).

Figure 9: Growing Method: CHAID Tree Describing Frequency Result of Effectiveness (%) According to the Seconds to Perform the Offense After the OR, the Seconds to Perform the Offense Before the OR and the Difference in the Final Score

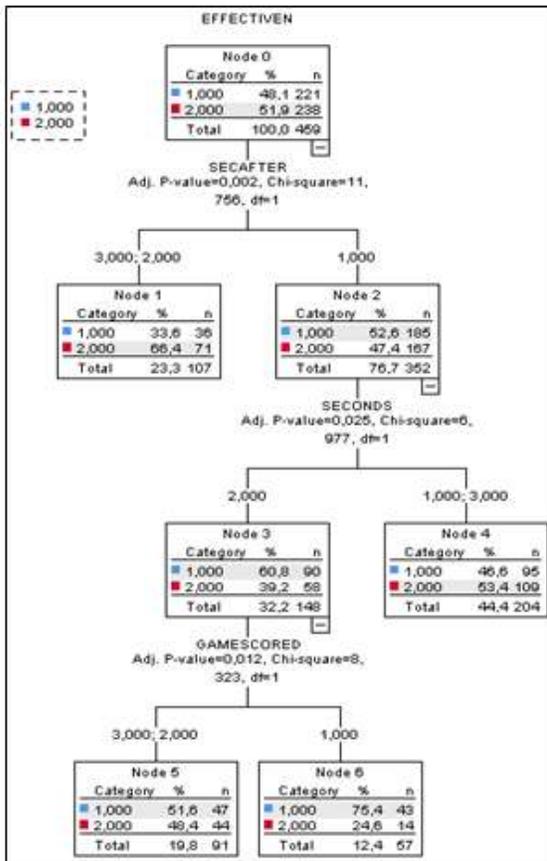
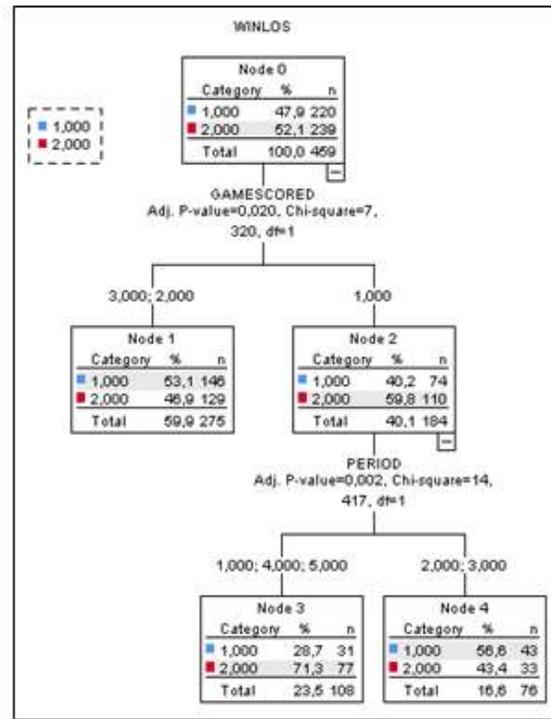


Figure 10: Growing Method: CHAID Tree Describing Frequency Result of the Game (%) According to the Difference in the Final Score and the Quarter in Which the ORs were Obtained



Discussion

The aim of this study was to investigate the effectiveness of the offensive actions following an OR between winners and losers with specific data and results. Results that would provide further information about the offensive actions of the teams after the recovery of the OR.

The importance of the rebounds (both defensive and offensive ones) in the outcome of a basketball game is great. This is explained by the fact that the more rebounds a team gets, the more its possessions are increased, and therefore its shooting attempts as well. While at the same time, it reduces the ball possessions of the opposing team (Lorenzo et al., 2010). For this reason, during the last decade, there has been a significant increase in researchers' interest in studying the subject of rebound.

In the present study, each team obtained an average of 10.3 ORs per game. This result agrees with the research of Gómez et al. (2008); Csátaljay et al. (2009); and Suárez-Cadenas & Courel-Ibáñez (2017), who concluded that each team gets 10 - 15 ORs per game.

In terms of the seconds to perform the offense before the OR, the results showed that most rebounds were obtained when the offense was performed during 9-16" (46.0%) and afterwards when the offense was performed during the last 8" (37.3%). On the other hand, the seconds to perform the offense before the OR affect neither the outcome of the game, given the fact that there were no statistically significant differences between winners and losers, nor the effectiveness of the second chance shot.

According to Tsitskaris et al. (2016), only 2-3 offensive players are involved in the OR because the rest of the players should return to the defense in order to prevent their opponents' fast break. The present study agrees with this result, since 2 or 3 players participated in 79.5% of the ORs (2 players in 51.4% and 3 players in 28.1%). However, there was no statistically significant difference between winners and losers in terms of the number of players involved. There was no statistically significant difference in the effectiveness of the second chance shot too.

Regarding the position of the player who obtains the OR, the results of the present research showed that the greatest percentage of the ORs is taken by Forward (41.6%). However, given that the starting lineup usually consists of two Guards, two Forwards and one Center, if it was counted each position separately, then the Center would have the highest percentage (37.7%). On the other side, Guards have the lowest percentage (20.7%) because they are usually the first players who return to the defense, since during the execution of the shot they are usually in the outside zones. Moreover, the physical characteristics of the players are an important factor (height, strength, etc.), which play an important role in the dominance of rebounds (Suárez-Cadenas & Courel-Ibáñez, 2017). Finally, no statistically significant differences were found neither between the winners and the losers nor in the effectiveness of the second chance shot also, depending on the player who took the rebound.

Another important variable is the zone of the court where the ORs were recovered. The 65.6% of ORs ended up under the basket. Moreover, 73.4% of ORs were taken inside the paint, 18.3% in the 2-point zone and 8.4% in the 3-point zone. These results agree partially with those of Tsamourtzis & Athanasiou (2004), Ribas et al. (2011a) and Suárez-Cadenas & Courel-Ibáñez (2017), although they found out that the proportion of rebounds which are obtained inside the paint is 9 out of 10. In addition, the zone of the court where the ORs were obtained did not affect the offenses' effectiveness. In other words, there was no zone in which the OR was taken and the effectiveness of the offense after that had a statistically significant difference.

Regarding the offensive actions that were selected by the teams after the OR, the separation in the present study was made in two cases. The first one is the individual action of the player who takes the OR (usually a Shot, a Movement near the basket, a Follow and others) and the second case is the team action which includes all actions in which at least 2 players collaborated. The results showed that 55.3% of the offenses after the OR were executed with individual action, while the remaining 44.7% with a team action. The superiority of individual actions is due to the fact that most ORs are obtained near the basket and in addition, when the ORs are taken, the defensive players are usually in a bad position. However, the offensive action did not affect the outcome of the game, as there were no differences between winners and losers. In contrast, the way the offense is carried out after the OR plays an important role in its effectiveness, as the effective individual actions were statistically more significant than the ineffective ones. And team actions were with a statistically significant difference less effective. The reason for this result is that the offensive player who takes the rebound is usually in a better position than his defender.

Regarding the seconds that passed after the OR, until the second chance shot is made, the results showed that 76.7% of the offenses after the OR were made during the first 5 seconds. The reason for the difference with the other two second's spaces (6-10" and 11-14") is that the teams usually perform the second offenses quickly, either because the defensive players are in bad positions or because the ball is already in a zone close to the basket. Moreover, the losers had, with a statistically significant difference, more offenses during the first 5" than the winners. The above result was found because when a team is fallen behind in score, its players often try to make a quick shot. On the contrary, when a team leads the score, its players do not prefer to make a shot quickly after the ORs. They prefer to take the ball outside the paint both for spending the remaining time and for organizing the offensive play better. In addition, the seconds to perform the offense, after the OR, played an important role in its effectiveness, as during the first 5" the effective offenses were with statistically significant difference more than the ineffective ones. While in the next two second's spaces (6-10" and 11-14") the ineffective offenses were with statistically significant difference more than the effective ones. This result was probably found out because most teams do not include in their training plan particular drills for the execution of the offenses after an OR. From the above results, the conclusion is that after an OR, if a team executes the shot while the defenders are in bad positions, it is more likely to score than if it delays.

Regarding the points scored by the teams after the OR and the effectiveness of the offense, the results showed that in more than half of the cases (51.9%) the teams failed to make a shot. Therefore, in total, the attacks after the OR were effective only at 48.1%. This percentage is close to 67% that is found in the research of Suárez-Cadenas and Courel-Ibáñez (2017), given the fact that they investigated only the offenses that a shot was performed. On the contrary, 48.1% of the present research includes all offenses.

There was also a difference in the effectiveness of the offenses after the ORs between winners and losers, but it was not statistically significant. This result agrees with that of Suárez-Cadenas and Courel-Ibáñez (2017), who managed to find out a statistically significant difference in the effectiveness of offenses, between winners and losers, with a larger sample. Similar results were found by Conte and Lukonaitiene (2018), who concluded that the winning teams had significantly more Second Chance Points than the losers in balanced and unbalanced games.

Regarding the number of ORs that each team gets, the results showed that losers got 52.1% and winners 47.9%. So, according to what has been mentioned before, it is important for a team not only to get the ORs, but also to find the right way to use them. Moreover, the outcome of the game can be affected by many factors. In this case, the field goal percentage of a team plays an important role. In other words, if a team has a high field goal percentage, it is not necessary to obtain a lot of ORs to win the game. Trninić et al. (2002) came to this conclusion, emphasizing that the three variables that distinguished the winners from the losers were the defensive rebounds, the field goal percentage and the percentage of free throws.

Finally, using CHAID Decision Trees, we ended up to some additional conclusions. The first one is that the offense's effectiveness post OR reached to high levels (75.4%), when it was preceded by an offense which was executed in 9-16", followed by a shot in the first 5" and took place in a close game. This conclusion demonstrates that in close games, where there are a lot of set plays, if the OR is obtained and the players shoots during the first 5", where the defensive players usually are in bad positions, there is a high probability of scoring. In a close game, every possession and every point can play a determinant role, which confirms the importance of ORs.

The second finding with the use of CHAID Decision Tree is that in close games the losers got 59.8% of ORs and the winners only 40.2%. More specifically, in close games, during the first period, the last one and the extra time, the losers got 71.3% of the ORs. From this result, we conclude that the field goal percentage and the ability to exploit the second possessions play a more important role than the number of ORs which a team obtains.

Conclusions

After a closer inspection of the above results, it is apparent that ORs can play an important role to the game's outcome. However, their effect also depends on further factors. Among these factors is the field goal percentage and the way that the teams play post ORs.

From the processing and analysis of the data, we conclude that:

- Each team averages 10.3 ORs per game.
- Two or three players usually participate in the OR. This is a significant number for coaches, because if only one player is involved, the chances of getting an OR will be reduced, and if more than three players participate, the function of the defensive transition will be poor, allowing the opposing team the fastbreak.
- The OR is usually obtained by a forward or center.
- More than 7 out of 10 ORs end up inside the paint, but this result doesn't affect the second chance offense's effectiveness.
- Individual actions are more than the team actions after ORs. Moreover, individual actions are more efficient than team actions.
- Almost 8 out of 10 offenses after OR are executed during the first 5". During this time period offenses are mostly efficient, nevertheless afterwards they are usually. Moreover, losers usually make a shot during the first 5".
- The offense's effectiveness after an OR is great (48.1%). Winners had more effective offenses than the losers, but not with a statistically significant difference.
- Losers get on average a little more ORs than the winners.
- In close games, losers had more ORs, while in balanced and unbalanced games, winners had more ORs.
- During the fourth quarter more ORs are obtained than the other ones.

Other variables that would be useful to be measured in a future survey are a) the exact individual action - movement of the offensive player who gets the OR (follow, hook shot, lay-up and others), b) the type of team action (pass to an outside player and shot, pick and roll and others), c) the offensive rebounding techniques (V - Cut, Swim, Rear - Turn and others), and d) the ORs which are obtained against the zone.

The above variables could give us a more complete image about the teams' actions post OR. However, the findings of this study are useful for basketball coaches at all levels. Additionally, the situations that occur before, during and after the OR are mentioned in the present study. All results that mentioned before can contribute to a better training plan, in order for the players to improve the offensive rebounding techniques and exploit second chance possessions better.

Conflicts of interest

No potential conflict of interest was reported by the authors.

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