THE INFLUENCE OF SITUATION EFFICIENCY OF GOAL SHOOTING ON RESULTS OF HANDBALL MATCHES OF THE FIRST PHASE OF THE WORLD U19 CHAMPIONSHIP 2019

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Abstract
To determine the influence of the situational efficiency of goal shooting on the prediction of the results of the first phase of the competition at the U19 World Handball Championship in 2019 it was analyzed 60 matches, played by national teams that have qualified to this championship. It has been observed 14 variables of situational shooting efficiency with seven positions, from which usually shoots in the attack phase of the handball game. This set of variables was set up so that was analyzed a successful and unsuccessful shot on goal from all positions. The criterion was a binary-defined result of handball. For all analyzed variables were calculated basic descriptive indicators. At this stage of the competition, teams have shot an average of 45.66 times from seven analyzed positions in the game of which was an average 27.53% of successful and 18.14% unsuccessful shots. The percentage of shooting success was 60.09%. The mutual correlation of the predictor variables was calculated with the classical correlation method. The results showed that 7 correlation coefficients are significantly at a more stringent inference level and 4, at a milder inference level. To evaluate the predictive impact of a set of variables which are evaluated situational efficiency within the binary defined result of handball game, the Logistic Regression was used. Its results are shown that the applied set of predictor variables covers between 57.3% and 76.4% of the common variance. The result of the Hosmer & Lemeshow test confirmed the high predictive value of the selected set of variables. The calculated B values and the individual contribution of each of the analyzed predictor variables indicate that the six variables have a statistically significant contribution to the prediction of the results of handball matches of this stage of the World Junior Championships. The highest partial contribution to the prediction of the result of handball matches was shown by the variable for evaluating the successful fast breaks shot. The high individual predictive value was also shown by the variable for evaluating successful shots from the back positions (9m shot - successfully). This phase of the competition was dominated by national teams that play fast handball, with a large number of fast breaks and fast transformations from one phase of handball play to another.

Keywords: handball, situational efficiency, attack, prediction, criterion variable.

INTRODUCTION

The sports games with a large number of players and the relatively small space to play, and continuous simultaneous conflicts in all phases of the game, a real challenge for quality quantification and analysis of collected data.Handball is one of the most complex ball games characterized by a well-defined goal, a wealth of natural forms of movement, variety of movement structures, pronounced situational confrontation of players (contact sport), and the need for creative and organized implementation of technical and tactical elements in situational conditions (Rogulj, 2000).

Today, most researches in handball are based on experimentally based knowledge. It is in human nature to be better, faster, more successful. That is why there is a strong tendency today to be successful in a handball game, so we are witnessing a very fast increase in the qualitative-quantitative of knowledge about handball. With the collection of more predictors and the application of adequate mathematical and statistical algorithms, we are increasingly closer to predicting the success of handball. It is quite common today to use certain methods whose results show the hierarchical influence of certain factors on the result of handball. That is why Milanović (1997) says: "The goals and tasks of training should be operationalized so that the size and structure of anthropological characteristics and motor knowledge are known on which dependssuccess in sport. In his research Vuleta Milanović & Sertić (2004) the first major component in the attack phase, name it as a "factor in the success of the game in the attack phase". With the influence of some parts of the anthropological status of handball players on the explanation of the criteria dealt Horga, 1983; Kuleš, 1983 and Šimenc & Pavlin, 1983. The complexity of the handball game shows that both depend on many factors that are related to each other, and they are manifested in totality.

METHODS

The sample

A statistical data for this research are taken from the official website IHF - and with 60 games of the first round of the competition in four groups of Men's Youth (U19) World Championship North Macedonia, which was held from 6th to 18th August, 2019.

The sample of variables

For this research, a set of 14 manifest variables were selected, which are standard indicators of the

situational efficiency of goal-shooting that are recorded at each match for both teams:

1. 9m shot (ŠDMUS) – SUCCESSFUL,
2. 9m shot (ŠDMNE) – UNSUCCESSFUL,
3. 6m shot (ŠŠMUS) – SUCCESSFUL,
4. 6m shot (ŠŠMNE) – UNSUCCESSFUL,
5. Wing shot (ŠKRUS) – SUCCESSFUL,
6. Wing shot (ŠKRNE) – UNSUCCESSFUL,
7. 7m shot (ŠSMUS) – SUCCESSFUL,
8. 7m shot (ŠSMNE) – UNSUCCESSFUL,
9. Fast break shot (ŠKNUS) – SUCCESSFUL,
10. Fast break shot (ŠKNNE) – UNSUCCESSFUL,
11. Breaktrought shot (ŠPRUS) – SUCCESSFUL,
12. Breaktrought shot (ŠPRNE) – UNSUCCESSFUL,
13. Shot from a long distance (ŠVDUS) – SUCCESSFUL,
14. Shot from a long distance (ŠVDNE) – UNSUCCESSFUL.

The criterion variable is binary defined based on the final results of the matches of wins (1)/defeat (0).

Data methods

The collected data were processed by the statistical package SPSS 15.0 for Windows.

The basic descriptive indicators are calculated for all analyzed variables. Themutual correlation of the predictor variables was calculated using the correlation analysis algorithm. To obtain the information on the regression relation of a set of analyzed predictor variables to a binary defined criterion variable, it was applied a special regression analysis method (logistic regression). In its application, the following parameters were calculated:

- The percentage of cases with no predictor variables in the analysis,
- The values of the hi-squares with the corresponding number of degrees of freedom,
- The Hosmer and Lemesh test values,
- The values of Cox & Snell R Square and Nagelkerke R Square,
- The level of predictive value,
- Individual contribution values of each predictor variable (Wald),
- The significance of the individual influence of predictor variables,
- The values of coefficients B and
- The quotient of probabilities for each independent variable (Exp (B)).

RESULTS AND DISCUSSION

The results of the descriptive statistics are presented in table1. For this purposewas calculated: minimum values (**Min.**), maximum values (**Max.**), arithmetic mean (**Mean**), standard deviation (**Std. Dev**.) and variance (**Variance**).

Table1. The basic descriptive indicators analyzed variables

	N	Min.	Max.	Mean		Std. Dev.	Variance
				Stat.	Std.Er.		
UBRŠUT	120	33.00	64.00	45.6750	.50002	5.47747	30.003
ŠUTUSP	120	13.00	48.00	27.5333	.59995	6.57207	43.192
ŠUTNE	120	7.00	39.00	18.1417	.48727	5.33782	28.492
PROCŠUT	120	7.00	39.00	18.1417	.48727	5.33782	28.492
ŠDMUS	120	2.00	19.00	7.5167	.31511	3.45191	11.916
ŠDMNE	120	1.00	28.00	9.6583	.40263	4.41064	19.454
ŠŠMUS	120	.00	12.00	4.7417	.25007	2.73937	7.504
ŠŠMNE	120	.00	11.00	1.8750	.14081	1.54247	2.379
ŠKRUS	120	.00	14.00	4.5333	.24879	2.72534	7.427
ŠKRNE	120	.00	8.00	2.8583	.17998	1.97163	3.887
ŠSMUS	120	.00	11.00	2.7417	.17211	1.88535	3.555
ŠSMNE	120	.00	5.00	1.0667	.11148	1.22119	1.491
ŠKNUS	120	.00	16.00	3.3167	.30449	3.33553	11.126
ŠKNNE	120	.00	4.00	.8250	.08340	.91360	.835
ŠPRUS	120	.00	11.00	4.2500	.22400	2.45377	6.021
ŠPRNE	120	.00	6.00	1.6333	.13228	1.44904	2.100
ŠVDUS	120	.00	5.00	.4417	.07466	.81782	.669
ŠVDNE	120	.00	2.00	.2333	.04386	.48043	.231

The results of descriptive statistics indicate that the analysis included 120 national teams.

The national teams, participants in this championship at this stage of the competition are, on average, performed 45.66 shots from different positions during this phase of the competition. Successful were on average 27.53% shots and 18.14% shots were unsuccessful. Percentage, the shot efficiency for all national teams in the preliminary round of the competition was 60.09%. Very similar data were obtained by Ćeleš, Vojvodić, and Skender (2014) where they found that the

winning teams had a 61.3% successful shot on goal in the analyzed championship.
The most shots were from outside positions (ŠDMUS 19.00 and ŠUTDMNE 28.00), then from the 6m line (ŠMMUS 12.0 and ŠMMNE 11.0). The most successful shots were from the position of 9m (ŠDMUS 7.52), then from the 6m line (ŠŠMUS 4.74) and shot from the wing positions (ŠKRUS 4.53). Then, followed by breakthrough shots (SPRUS 4.25) and fast break shots (SKNUS 3.32). The values of the correlation analysis of the predictor variable are listed in table 2.

Table 2. Matrix of correlations of predictor variables

	ŠDMUS	ŠDMNE	ŠŠMUS	ŠŠMNE	ŠKRUS	ŠKRNE	ŠSMUS	ŠSMNE	ŠKNUS	ŠKNNE	ŠPRUS	ŠPRNE
ŠDMUS	1											
ŠDMNE	.099	1										
ŠŠMUS	**-.211***	**-.261***	1									
ŠŠMNE	**-.302****	.053	.006	1								
ŠKRUS	-.030	**-.277****	.022	-.170	1							
ŠKRNE	-.109	.005	-.139	-.022	.113	1						
ŠSMUS	-.174	-.170	-.018	-.014	-.163	-.113	1					
ŠSMNE	-.164	-.122	-.178	.174	.009	-.115	.106	1				
ČKNUS	.102	**-.363****	**.213***	-.177	.179	.057	.036	-.92	1			
ŠKNNE	.106	-.071	.136	-.057	.011	.070	-.119	-.57	**.319****	1		
ŠPRUS	**-.218***	**-.293****	-.018	.055	-.089	-.071	.021	.056	-.027	-.100	1	
ŠPRNE	**-.291****	-.104	-.066	.047	.033	-021	-.020	.014	.026	.021	**.255****	1

Legend: ŠDMUS *– 9m shot successful;* ***ŠDMNE –*** *9m shot unsuccessful;* ***ŠŠMUS –*** *6m shot successful;* ***ŠŠMNE –*** *6m shot unsuccessful;* ***ŠKRUS –*** *wing shot successful;* ***ŠKRNE –*** *wing shot unsuccessful;* ***ŠSMUS –*** *7m shot successful;* ***ŠSMNE****-7m shot unsuccessful;* ***ŠKNUS –*** *fast break shot successful;* ***ŠKNNE –*** *fast break shot unsuccessful;* ***ŠPRUS –*** *breaktrough shot successful;* ***ŠPRNE –*** *breaktrough shot unsuccessful.*

The correlation between the predictor variables in this study is shown in table 2. On a stricter criterion of conclusion, 7 coefficients are significant or 10.6%, and on a more lenient criterion of conclusion, 4 coefficients are significant or 6.06%. The most significant coefficients have a negative sign (8 coefficients) while 3 coefficients have a positive sign. The highest negative correlation of -.363 is shown by the variables (ŠDMNE) and (ŠKNUS), and the variables (ŠDVUS) and (ŠŠMNE) by -.302. The highest positive correlation in the value of .319 is shown by the variables (ŠKNUS) and (ŠKNNE). The predictor influence of variables that assessed the situational efficiency (effective and ineffective) of a goal shot on the final binary defined result of a handball match was calculated by a logistic regression method. The results of this method are shown in tables 3, 4, 5 and 6.

Table3. Omnibus Tests of Model Coefficients

		Chi- square	**df**	**Sig.**
Step 1	Step	102.207	14	.000
	Block	102.207	14	.000
	Model	102.207	14	.000

The table shows the values of the chi-square test of 102.207 with 14 degrees of freedom and statistical significance.

Table 4. Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Squere
1	64.115(a)	.573	.764

Table 4 shows the pseudo indicators r^2 as in classical multiple regression. Also, from this table, it can be seen that the applied set of predictor variables explains between 57.3% and 76.4% of the common variance. The results are within the expected range because this analysis covers only one phase of the handball game, that is, only the situational efficiency of goal shooting. Probably, the rest of the unexplained variance should be sought in the successful performance of the technical-tactical elements in the defense.
The confirmation that the model predictor variables situational efficiency has a statistically significant effect on the binary defined result handball is presented in table 5.

Table 5.The value Hosmer and Lemeshow test

Step	Chi-square	df	Sig.
1	2.310	8	.970

As the significant values in this test (Sig. .970) are far above the limit values, it can be confirmed that the model of predictive variables is a very good predictor of a criterion variable. Other researchers (Rogulj, 2000;Srhoj, Rogulj, Padovan & Katić, 2001;Vuleta et al. 2004) have found in their researchers that there is a distinct contribution of predictor variables in the prediction of criterion variables.

The single influence of the variables of situational shot efficiency from the seven analyzed positions, differentiated into winning or losing the handball matches of preliminary competition at the World U 19 Men's Championship held in 2019 in North Macedonia,is presented in table 6.

Table 6. Results of logistic regression analysis on the influence of variables of successful and unsuccessful shot on goal and results of handball match

Variables	B	S.E.	Wald	Sig.	Exp (B)
	Lower	Upper	Upper	Lower	Upper
ŠDMUS	.334	.123	7.342	**.007**	1.397
ŠDMNE	-.204	.106	3.726	.054	.815
ŠŠMUS	.337	.178	4.392	**.036**	1.453
ŠŠMNE	-.481	.337	2.036	.154	.618
ŠKRUS	.457	.186	6.060	**.014**	1.580
ŠKRNE	-.222	.196	1.285	.257	.801
ŠSMUS	.401	.255	2.462	.117	1.493
ŠSMNE	-1.001	.364	7.581	**.006**	.367
ŠKNUS	.664	.193	11.849	**.001**	1.943
ŠKNNE	.445	.350	1.619	.203	1.561
ŠPRUS	.557	.206	7.288	**.007**	1,745
ŠPRNE	.070	.267	.069	.793	1.073
ŠVDUS	.552	.417	1.758	.185	1.737
ŠVDNE	.035	.221	.053	.897	1.054
N = 120; Overal Percentage¹ = 50.8; Overal Percentage² = 86.7					

Legend:ŠDMUS – 9m shot successful; **ŠDMNE** – 9m shot unsuccessful; **ŠŠMUS** – 6m shot successful; **ŠŠMNE** – 6m shot unsuccessful; **ŠKRUS** – wing shot successful; **ŠKRNE** – wing shot unsuccessful; **ŠSMUS** – 7m shot successful; **ŠSMNE**-7m shot unsuccessful; **ŠKNUS** – fast break shot successful; **ŠKNNE** – fast break shot unsuccessful; **ŠPRUS** – breaktrough shot successful; **ŠPRNE**– breaktrough shot unsuccessful; **ŠVDUS** – Shot from a long distance successful; **ŠVDNE** –shot from a long distance unsuccessful.

Table 6. also shows the number of analyzed cases that were handled by this analysis. For this part of the competition, this type of regression analysis was processed by a total of 120 national teams in 60 games. The chosen method of regression analysis in the SPSS package predicts that 50.8% of cases will be correctly classified by research. The obtained value was calculated without including predictor variables (Overal Percentage¹). While the other value (Overal Percentage²) is a significant improvement because the values of the predictor variables were taken into the analysis.

Four variables of the study area have negative B coefficients (ŠDMNE, ŠŠMNE, ŠKNNE, and ŠMMNE), while the largest single contribution as a predictor in the prediction of a binary defined criterion variable is the variables: (ŠKNUS 11,85; ŠDMUS 7,34; ŠPRUS 7,29; ŠSMNE 7.58; ŠKRUS 6.06 and ŠŠMUS 4.39) and their impact was statistically significant on the milder statistical criterion of conclusion (p = 0.05).

As you can see, the biggest single positive prediction of the result of a handball match in this competition has the variable SKNUS (11,85). These results give us the right to say that for success in a handball game, in this championship at this stage of the competition, it is necessary to perform as many successful fast breaks. The national teams that performed fast playing on the field and achieve so-called "light goals", are very close to the final

success of that game. In addition to the resultant advantage, national teams with this style of playing also have a psychological and physiological advantage that, in some games, can be a key factor in winning.

The team that achieves goals from fast breaks, becomes more psychologically stable and with more willing moment to play. In addition to that, a good fast break is performed by an inividual or a small group of players, so that the others can save the energy for hard defense work, which is very important in tournament mode. We must also not forget the fact that a good fast break is a product of a well-implemented defense system. A second individual influence on the criterion variable is The third variable that in this study had a statistically significant influence on the prediction of the results of a handball match of this U 19 Men's World Championship is ŠDMUS (7.34). In the descriptive analysis of the data, we have already noticed that from these positions, shots on goals are most often performed and are achieved an average of 7.5 goals.

Very often, players who shot from the back outside positions are morphologically and physically dominant players in their teams, and very often leaders, so the results of such a high partial impact on the result of handball are expected. Babić (2017) obtained similar data when, among other differences between ranked and non-placed teams, he also found statistically significant differences in the variable (ŠUT9M-US). The ŠPRUS variable (7.29) has also a statistically significant partial influence on the criterion variable. Knowing what is going on and in what kind of shooting position is a player who successfully makes a breakthrough into a goal, this kind of impact is expected. Usually, these types of shooting are performed by technically well-trained players and they can create a technical and tactical advantage for their team, which can be a key advantage in some games. The handball game in its structure has many tactical situations when the planned action is the right action for wing players.

The next variable that has a statistically significant contribution to the prediction of the final result of a handball match is ŠKRUS (6.06). That's why, every team who aspires to a high ranking in a competition should have quality players in the wing positions because as we can see, their shooting success has a significant contribution to the success in handball.

The analyzed ŠŠMUS variable (4.39) in this competition showed a statistically significant partial influence on the result of the matches of this competition. The adequate attention in the training process should be given and this technical element of the handball game.

CONCLUSION

A partial analysis of the impact of the situational efficiency of goal shooting on the result of a handball match of the preliminary part of the shown by the ŠSMNE variable (7.58), which has a negative coefficient. Similar results of the negative impact of this variable were obtained (Srhoj et al. 2001 and Vuleta, 1997). The unsuccessful performance of this way of shooting has a negative effect on the positive result in handball. The mistakes that are made should be minimized, because this is one situation from which the lightest goals can be achieved, and with it optimally approach to the goal of a handball game. To perform a 7m shot, the team must have a player with good shot technique, high self-confidence, good precision and, sometimes, positive sports insolence.

Competition of this U19 World Handball Championship confirmed some previously established knowledge about these relations. The model of predictor variables applied has shown a significant influence on the result of the handball match of this championship. Of the 14 analyzed variables for the predictor set 6 variables also showed statistically significant partial influence in the prediction of the final result of a handball match (ŠKNUS, ŠSMNE, ŠDMUS, ŠPRUS, ŠKRUS, and ŠŠMUS). The set of pediatric variables covers between 57.3 and 76.4% of the common variance, which gives the set of predictor variables a much higher predictive value.

The national teams at this level of competition who have high ambitions in competitions should keep their situational efficiency of goal shooting at over 60%. The biggest single contribution to predicting the final result of a handball game is the variable (ŠKNUS), with which we evaluated the efficiency of fast break-successfully. This situation leads us to think that fast, short and effective actions in the attack phase begin to dominate with their significance. Well, for this reason, we can say that this part of the championship was dominated by teams that play fast handball and that have a fast transformation from one stage to another of handball.

The results of this analysis may serve to better understand the relations within the structure of the handball game in terms of identifying those factors that support or interfere with the resultant success of the handball game. Also, this data can be a clear indicator of modeling the training process, especially in work with young handball players.

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