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Key factors for predicting winning and losing in men's volleyball world championship

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Abstract

The purpose of the study was to find out what skills or factors of the games played during the 2014 and 2018 FIVB Men's World Championships can predict the winning or losing of the game. The study variables analyzed were the Attack, Block, Serve, Opponent Error, Reception, Dig, Set. The study sample consisted of 188 matches of the 2014 & 2018 FIVB Men's World Championship and the data was taken from the official website of FIVB. The data was analyzed using Binary Logistic Regression (Forward: LR Method) with the result of the game as the dependent variable. The results of the study revealed that the variables found to be significant in predicting the winning and losing of a volleyball match at World championship level are Serve, Block, Attack, and reception while the variables Set, Dig and Opponent Errors were statistically insignificant. Coaches and Players can use our model to identifying the lacunae of their team and according to that they work on the aspects which may increase the probability for winning the championship.

Keywords: Serve, block, dig, reception, attack, opponent error

Introduction

Volleyball is a very popular sport worldwide, with millions of people participating and playing a game at least once a week (Kenny & Grogery, 2006) ^[1]. Volleyball is a sport with complex technical, tactical and athletic demands on the players.

A careful match attendant can specify certain characteristic phases that are repeated during a game (game episodes), that is, service, reception of service, pass, offence, block, and defense. These phases determine the skills that each player should possess so as to cope with success with the demands of the match (Kollath, 1996) ^[2].

A broad scope of research has been conducted in order to understand the dynamics of the game of volleyball (Araújo, Mesquita, & Marcelino, 2009; Bergeles, Barzouka, & Elissavet, 2009; Drikos, Kountouris, Laios, & Laios, 2009; Marcelino, Mesquita, Palao, & Sampaio, 2009; Mesquita & César, 2007; Monteiro, Mesquita, & Marcelino, 2009; Palao, Santos, & Ureña, 2007; Rocha & Barbanti, 2006; Zetou, Tsigilis, Moustakidis, & Komninakidou 2006) ^[3, 4, 5, 6, 7, 8, 9, 10, 11]. Volleyball skills can be divided to attacking and defending skills. The attacking skills are serving, attacking and setting and the defending skills are blocking, defending and receiving. A team can score points in four different ways: by serving, blocking, attacking or from opponent's mistakes. The three skills that support scoring are receiving, setting and defending.

The assessment of performance indicators in high-level volleyball is an important issue for coaches and players to understand the main factors affecting the game. By increasing the knowledge of the game, these indicators emphasize the amount of training necessary for improving the skills that provide a clear advantage through decision-making and error control (Pena, Javier, 2012) ^[12].

Game analysis is widely used in ball games and it provides a lot of useful information for developing effective practices thus enhancing team performance. According to M. Hughes, game analysis can be applied to five different areas: tactical evaluation, technical evaluation, analysis of movement, development of a database and modeling and educational use for both coaches and players (Hughes, M. 1998) ^[13].

The players follow a rotation scheme, where they must rotate one time in clockwise direction after their team wins the serve. Although the rotation scheme imposes some restrictions, this tactical freedom allows teams to adopt a wide variety of match strategies. Therefore, volleyball players need to master the following six basic skills (Haaren, J.V. *et al.* 2016) ^[14].

Serve: The serve is the skill of moving the ball from behind the back-line into the opponent's court. While many different types of serves are used, the most popular type is the jump serve, where the server first tosses the ball high in the air and then jumps to hit it.

Dig: The dig is the defensive skill of preventing the ball from hitting the court when the ball is nearly touching the floor after a serve or attack from the opponent. The dig is a reflex-based skill which often requires a player to dive towards the ball.

Pass: The pass is very similar to the dig. However, in addition to preventing the ball from hitting the court, this defensive skill also involves moving the ball towards a team mate that is well-placed to set up an attack.

Set: The set is the offensive skill of pushing the ball into the air such that a team mate can hit it into the opponent's court. The setter is the player who perform the set, coordinates the offensive play of the team by deciding who will eventually attack the ball.

Spike: The spike is the offensive skill of hitting the ball such that the opponent cannot prevent it from touching their court. The spiker, who is the player performing the spike, first makes a few steps and then jumps to hit the ball.

Block: The block is the skill of stopping or altering an opponent's attack by players standing at the net. An offensive block aims at keeping the ball into the opponent's court, while a defensive block aims at getting the ball under control by slowing it down.

Reception: It is the attempt by a team to properly handle the opponent's serve or any attack.

Opponent Error (OE): It is the acquisition of numbers that are considered to benefit the team because it does not go through the process of the activities of the team itself. It also called 'Free Score'.

The literature has highlighted the importance of the different factors and skills that are considered relevant in volleyball performance. Numerous studies have been conducted to predict the winning and losing of volleyball game at various levels of tournaments (Eom & Schutz, 1992; Hughes & Daniel, 2003; Zetou, Moustakidis, Tsigilis & Komninakidou, 2006, 2007; Palao, Santos & Ureña, 2004; Patsiaouras, Charitonidis, Moustakidis & Korakidas, 2011; Miskin, Fellingham & Florence, 2010; Gómez, Pollard & Luis-Pascual, 2011) [15, 16, 11, 17, 18].

Hence, the purpose of the study was to analyze the variables that are found through review of literature and find out those variables which can help in predicting the winning and losing of a Volleyball game.

Methods

Experimental Approach to the Problem

The purpose of the study was to find out what skills or factors of the games played during the 2014 and 2018 FIVB Men's World Championships can predict the winning or losing of the game.

The study variables analyzed were the Attack, Block, Serve, Opponent Error, Reception, Dig, Set.

Sample

The study sample consisted of 188 matches of the 2014 & 2018 FIVB Men's World Championship held at Poland and Italy & Bulgaria from 30 Aug- 21 Sep 2014 and 9 Sep- 1 Oct 2018.

The games were played by 48 teams no of teams consisting of 576 no of players from different nations. The data was taken from the official website of FIVB <https://www.fivb.com/en/volleyball/competitions>.

The Ethics Committee of the University of Vic according to the revised Declaration of Helsinki approved the protocol of the study.

Procedure

The data for analysis was taken from the official website of FIVB <https://www.fivb.com/en/volleyball/competitions> on date 28 June, 2020.

The following variables were analyzed:

- Result of the game as the dependent variable (1-match won; 0-match lost)
- Skills of the Game as the independent variables (Attack, Block, Service, Reception, Opponent Errors, Dig, Set).

Statistical Analysis

The data was analyzed using Binary Logistic Regression (Forward: LR Method) with the result of the game as the dependent variable.

Previously, a multi-collinearity diagnostic to find inter-correlations between predictive variables was performed. Once the data included in the model were reconsidered by avoiding the use of highly inter-correlated variables, the analysis of the different variables was performed using a logistic regression technique.

Logistic regressions allow for the testing of models to predict the outcomes of a binary dependent variable based on one or more predictor variables using the next formulation, where p is probability, and e is a mathematical constant equal to approximately 2.71828:

$$p = ez/1+eZ \text{ or } p = 1/1+e-Z.$$

Z is the linear combination of:

$$Z = B_0 + B_1X_1 + B_2X_2 + \dots + B_PX_P,$$

Where B is the coefficient estimated by the model, and X is the independent variable y . The significance level for the variables in the equation was established as $p \leq 0.05$.

All the statistical analysis were performed with IBM SPSS (version 20.0.0)

Results

Table 1: Case Processing Summary

Unweighted Cases ^a		N	Percent
Selected Cases	Included in Analysis	363	100.0
	Missing Cases	0	.0
	Total	363	100.0
Unselected Cases		0	.0
Total		363	100.0

a. If weight is in effect, see classification table for the total number of cases.

Table 1 shows the number of cases (N) in each category (e.g., included in the analysis, missing, and total) and their

percentage. A total of 363 cases were included in the study for analysis (N=363).

Table 2: Dependent Variable Encoding

Original Value	Internal Value
Lost	0
Won	1

Table 2 shows the coding of the dependent variable used in the data file, that is, 1 for winning and 0 for losing the match.

Block 0: Beginning Blocks

In the first block (i.e. Block 0), the logistic regression model shall be developed by using the constant without using any of the independent variables. This model may be used to compare the utility of the model developed in block two by using the identified independent variables.

Table 3: Classification Table

Classification Table ^{a,b}					
	Observed	Predicted			
		DV		Percentage Correct	
		Lost	Won		
Step 0	DV	Lost	186	0	100.0
		Won	177	0	.0
	Overall Percentage				51.2

a. Constant is included in the model.
b. The cut value is .500

The Table 3 shows that if nothing is known about the independent variables and one simple guesses that a team will win the match, we would be correct 51.2% of the time.

Table 6: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	423.163 ^a	.197	.263
2	398.117 ^b	.251	.335
3	387.587 ^b	.272	.363
4	375.783 ^b	.296	.394

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.
b. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Table 6 shows the value of -2 log likelihood (-2LL), which is a deviance statistic between the observed and predicted values of the dependent variable. As this deviance statistic is

Table 4: Variable in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)	
Step 0	Constant	-.050	.105	.223	1	.637	.952

Table 4 shows that the Wald statistics is not significant as its significance value is 0.637 which is more than 0.05. Hence, the model with constant is not worth and is equivalent to just guessing about the target variable in the absence of any knowledge about the independent variables.

Table 5: Variables not in the Equation

		Score	df	Sig.	
Step 0	Variables	attack	41.217	1	.000
		block	27.464	1	.000
		service	71.228	1	.000
		oe	.083	1	.774
		dig	23.632	1	.000
		recept	.147	1	.702
	set	1.376	1	.241	
	Overall Statistics	109.916	7	.000	

Table 5 shows whether each independent variable improves the model or not. It is shown in the table that variables - attack, block, service and dig may improve the model as they are significant. Inclusion of these variables would add to the predictive power of the model. If these variables had not been significant and able to contribute to the prediction, then the analysis would obviously be terminated at this stage.

Block 1: Method = Forward: LR

Table 7: Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	14.775	7	.039
2	10.965	8	.204
3	16.410	8	.037
4	13.175	8	.106

In order to find whether the deviance statistic-2 log likelihood is insignificant or not, Hosmer and Lemeshow suggested the chi-square statistic which is shown in Table 7. In order that the model is efficient, this chi-square statistic

should be insignificant. Since the p value associated with chi-square in Table 7 is .106 for the fourth model, which is greater than .05, it is insignificant and it can be interpreted that the model is efficient.

Table 8: Variables in the Equation

	B	S.E.	Wald	Df	Sig.	Exp(B)	
Step 1 ^a	Service	.355	.046	58.746	1	.000	1.427
	Constant	-1.846	.257	51.585	1	.000	.158

Step 2 ^b	Block	.158	.033	23.015	1	.000	1.171
	Service	.359	.048	56.639	1	.000	1.433
	Constant	-3.132	.398	62.063	1	.000	.044
Step 3 ^c	Attack	.039	.012	10.049	1	.002	1.040
	Block	.123	.035	12.311	1	.000	1.131
	Service	.331	.048	47.518	1	.000	1.392
Step 4 ^d	Constant	-4.584	.633	52.405	1	.000	.010
	Attack	.071	.016	19.034	1	.000	1.074
	Block	.114	.036	10.111	1	.001	1.121
	Service	.323	.049	44.052	1	.000	1.382
	Recept	-.074	.022	11.115	1	.001	.928
	Constant	-4.546	.649	49.037	1	.000	.011
a. Variable(s) entered on step 1: service.							
b. Variable(s) entered on step 2: block.							
c. Variable(s) entered on step 3: attack.							
d. Variable(s) entered on step 4: reception.							

Table 8 shows the value of regression coefficients B, Wald statistics, its significance, and odds ratio exp (B) for each variable in all the four models. Significance of the Wald statistics indicates that the variable significantly predicts the success in winning of the match.

Discussion

International level matches in men's volleyball at the highest level are often very even, because the teams are very equal in skills, tactics and physical abilities. The results of this study suggest that the most important skills concerning winning a match or a set in top-level men's volleyball matches were attacking and blocking. The success in attacking after reception was found to be especially important. Serving efficiency and the number of opponent's errors had a significant effect on winning when the results were analyzed from the team matches in World Championships.

The data included in the study is taken from the FIVB official site. The research conducted on Men's World Championship 2014 and 2018 which revealed that the only decisive and statistically significant in the model was Serve, Block, Attack, Reception and the other parameter analysed are Set, Dig, Opponent Errors were statistically insignificant. Attacks, blocks, and serves, due to the possibility of scoring a direct point, are considered Scoring Skills. On the other hand, the defense, setting, and reception procedures are termed Non-Scoring Skills and therefore should, at first glance, contribute less to a win (R. Marcelino, I. Mesquite, J. Sampaio 2010)^[6]. When examining the different skills performance on display in a volleyball match (Attack, Block, Service, Reception, Dig, Set, Opponent Error), it seems reasonable that the team that makes fewest errors should be one that is most likely succeed (Silva, M., Lacerda, D. & Joao, P. V. 2014)^[24].

As we have found, reception errors are a primary factor regarding the degree of significance of winning or losing a match (Rodríguez-Ruiz, D., Quiroga, M. E., Miralles, J. A., Sarmiento, S., de Sáa, Y. & García-Manso, J. M. 2011)^[25]. and high-level teams make fewer negative actions in attacking and have greater efficacy in the counterattack phase (Monteiro, Mesquita & Marcelino, 2009)^[8]. Improvement in the management of high attacks, due to a greater frequency of such attacks in today's games, provides us the keys to understanding similarities in performance, considering the number of attack points, the number of attack errors and the percentage of attacks between teams. Similar or even better attack levels for the losing team,

compared to the winning teams, have been found in high-level European men's volleyball (Rodríguez-Ruiz, D., Quiroga, M. E., Miralles, J. A., Sarmiento, S., de Sáa, Y. & García-Manso, J. M. 2011)^[25]. and high-level teams show improved effectiveness in reception and attack (Yiannis, L. & Panagiotis, K. 2005)^[26]. Handling errors appears to be a more important factor for attacking in high-level volleyball than just attacking effectively.

Quantitative analysis, performance evaluation and statistical processing are becoming an increasingly important process for those involved in several sports and, in particular, in team sports.

Conclusion

The conclusion of our study shows that in Men's Volleyball World Championships teams continue to become more equilibrate and the difference is made by details; competition must be evaluated in terms of performance parameters. By the following of our models some skills which will increase the probability of winning and are associated with success; while poor performance in others leads to failure. By focusing the skills which are significant in the model the players, coaches and teammates focus on those skills that are probable to tilt the balance in favor of their own teams.

The results of our investigation shows the important of attack skills and also improve the service make it more effective as well as two other defensive skills which play a major role for the success of any team are reception and blocking.

References

1. Kenny B, Gregory C. Volleyball: Steps to success. Campaign, IL: Human Kinetics 2006.
2. Kollath E. Bewegungsanalyse in Den Sportspielen Koln, Germany: Sport & Buch Straus. Mavrovouniotis F, Argiriadou IR, Mavrovouniotis Ch, Haritonidis K. Serum enzyme changes following a volleyball game in adolescent players. *Osterreichisches Journal fur Sportmedizi* 1996-2002;4:6-10.
3. Araújo R, Mesquita I, Marcelino R. Relationship between block constraints and set outcome in elite male volleyball. *International Journal of Performance Analysis in Sport* 2009;9(3):306-313.
4. Bergeles N, Barzouka K, Elissavet N. Performance of male and female setters and attackers on Olympic level volleyball teams. *International Journal of Performance Analysis in Sport* 2009;9(1):141-148.

5. Drikos S, Kountouris P, Laios A, Laios Y. Correlates of team performance in volleyball. *International Journal of Performance Analysis in Sport* 2009;9(2):149-156.
6. Marcelino R, Mesquita I, Palao J, Sampaio J. Home advantage in high-level volleyball varies according to set number. *Journal of Sports Science and Medicine* 2009;8:352-356.
7. Mesquita I, César B. Characterisation of the opposite player's attack from the opposition block characteristics. An applied study in the Athens Olympic games in female volleyball teams. *International Journal of Performance Analysis in Sport* 2007;7(2):13-27.
8. Monteiro R, Mesquita I, Marcelino R. Relationship between the set outcome and the dig and attack efficacy in elite male volleyball game. *International Journal of Performance Analysis in Sport* 2009;9(3):294-305.
9. Palao J, Santos J, Ureña A. Effect of the manner of spike execution on spike performance in volleyball. *International Journal of Performance Analysis in Sport* 2007;7(2):126-138.
10. Rocha C, Barbanti V. An analysis of the confrontations in the first sequence of game actions in Brazilian volleyball. *Journal of Human Movement Studies* 2006;50:259-272.
11. Zetou E, Tsigilis N, Moustakidis A, Komninakidou A. Playing characteristics of men's Olympic volleyball teams in complex II. *International Journal of Performance Analysis in Sport* 2006;6(1):172-177.
12. Pena, Javier *et al.* Which skills and factors better predict winning and losing in High-Level Men's Volleyball? *Journal of Strength and Conditioning Research*. December 2012, 77-96
13. Hughes M. Computerized notation analysis in field games. *Ergonomics* 1988;31(11):1585-1592.
14. Haaren JV *et al.* Analyzing Volleyball Match data from the World Championships using machine learning techniques. *Association of Computing Machinery*. August 2014, 2016, 627-634.
15. Eom HJ, Schutz RW. Statistical analyses of volleyball team performance. *Research Quarterly for Exercise and Sport* 1992a;63(1):11-18.
16. Hughes M, Daniel R. Playing patterns of elite and non-elite volleyball. *International Journal of Performance Analysis in Sport* 2003;3(1):50-56.
17. Palao JM, Santos JA, Ureña A. Effect of team level on skill performance in volleyball. *International Journal of Performance Analysis in Sport* 2004;4(2):50-60.
18. Patsiouras A, Charitonidis K, Moustakidis A, Kokaridas D. Technical Skills Leading in Winning or Losing Volleyball Matches During Beijing Olympic Games. *Journal of Physical Education and Sport* 2011;11(2):39-42.
19. Miskin MA, Fellingham GW, Florence LW. Skill importance in women's volleyball. *Journal of Quantitative Analysis in Sports* 2010;(6):5.
20. Gómez MA, Pollard R, Luis-Pascual JC. Comparison of the home advantage in nine different professional team sports in Spain. *Perceptual and Motor Skills* 2011;113(4):150-156.
21. Sabin-Loan Sopa, Alenxendru-Dan Szabo. 2020. Comparison between Statistical Parameters of Attack and Defence in high volleyball performance (CSM Volei Alba Blaj in the CEV Champions League Final Four). *Sciences of Human Kinetics* 2018, 13(62).
22. Apriyanto Tirto, Ilhum Muhammad. The Correlation between the Opponent's Error with the team victory of the Volleyball National Team on Peace Cup Participants. *Advances in Social Science, Education and Humanities Research* 2019, 407.
23. Häyrynen M, Luhtanen P, Hoivala T. Factors affecting winning in men's international level volleyball. 5th Annual Congress of the European College of Sport Sciences, Jyväskylä, Finland, Congress proceedings 2000, 19-22.7, 339.
24. Silva M, Lacerda D, Joao PV. Game-related Volleyball Skills that influence victory. *Journal of Human Kinetics* 2014;41:173-179
25. Rodríguez-Ruiz D, Quiroga ME, Miralles JA, Sarmiento S, De Saa Y, García-Manso JM. Study of the technical and tactical variables determining set win or loss in Top-level European Men's Volleyball. *Journal of Quantitative Analysis in Sports* 2011, 7(1).
26. Yiannis L, Panagiotis K. Evolution in Men's Volleyball skills and tactics as evidenced in Athens Olympic Games. *International Journal of Performance Analysis in Sport* 2004, 2005;5(2):1-8.