JOURNAL OF PHYSICAL ACTIVITY NUTRITION AND REHABILITATION

Journal of Physical Activity, Nutrition and Rehabilitation, 2018
www.panr.com.cy
info.panr@unic.ac.cy

Pass level and the outcome of attack for age categories in male Volleyball

Drikos, S.*

National & Kapodistiran University of Athens, School of Physical Education & Sport Sciences, 41 Ethnikis Antistasis Avenue, Athens, 17237, Greece

Abstract

In Volleyball, complex 1 consists of pass-set-attack skills in this specified order. This sequence is a stable pattern to win a point. Furthermore, it is important for teams' success. Taking into account that this pattern is a first-order Markov chain, the creation of a probability transition matrix is feasible. Assuming multinomial likelihood with a Dirichlet prior on the transition probabilities a Markovian transition matrix can be constructed, and the calculation of conditional success probabilities is, thus, achievable. Data from the performance analysis of the winning team from recent world championships in three age categories (U19, U21, Men) of male Volleyball is used. Evaluation of the pass through a six-level ordinal scale is possible after the validation of the entire scale. The findings lead to redefining target pass area and to shrinking the evaluation scale at least for the teams under study. Moreover, pass accuracy is necessary because it must give at least two options for attack, but not sufficient condition for the success of attack in all age categories for male Volleyball. In U19 age category, there is a lack of stabilization in the complex 1 sequence after pass against jump spin serve.

Keywords: Volleyball; pass; age categories; evaluation scale; Bayesian analysis; conditional probabilities.

1 Introduction

Volleyball consists of 3 stable patterns to win a point: pass-setting-attack after pass-outcome serve-outcome and block-dig- setting- attack after dig or counterattack-outcome (Florence, Fellingham, Vehrs, & Mortensen, 2008). For each pattern three are the possible outcomes: win a point, continuation of the action and a point for the opponent. In rally point system the pattern pass-setting-attack after the pass is the necessary condition to claim the victory because in terms of probability winning a point when receiving is easier than winning a point when serving (Calhoun, Dargahi-Noubary, & Shi, 2002; Ferrante & Fonseca, 2014).

Winning teams were significantly better in attack after pass than losing teams (Hayrinen, Hoivala, & Blomqvist, 2004) and attack after pass emerged as a decisive factor for team's success (Patsiaouras, Charitonidis, Moustakidis, & Kokaridas, 2009). It is crucial for a team to organise a tactically well-structured and highly synchronised offensive game after receiving opponents serve. It is the hierarchical order of skills in Volleyball (Nishijima, Ohswava, & Matsuura, 1987) that makes the performance in one skill depend on the performance in the previous one. The precise pass is a powerful aggressive tool for high-level teams and is a good predictor for winning (Zetou, Moustakidis, Tsigilis, & Komninakidou, 2007). For many coaches receiving well is a guarantee for a winning attack. The connection between quality of pass and achievement in attack is undoubted

*Corresponding author: e-mail: sdrikos@gmail.com

for men age category in many types of research (Barzouka, Nikolaidou, Malousaris, & Bergeles, 2006; Eom & Schutz, 1992; Papadimitriou, Pashali, Sermaki, Mellas, & Papas, 2004). A partial rejection of this belief is suggested by Lobietti, Michele, & Merni (2006) who proposed that passing accuracy does not appear so fundamental, but it is important avoiding passing errors.

Most of the studies have focused on top level competitions and only a few of them deal with the development age categories. For U19 age category attack after the pass is a good discriminator for a team's performance, while the pass is not (Durkovic, Marelic, & Resetar, 2009). According to Costa G. C., et al. (2011) pass is not determinant of the attack effectiveness in the age category of U19 due to the fact that because of lack of players' maturity the game is not well intergraded.

An important issue when recording pass is the instrument to be used for its evaluation. Initially, the evaluation scale for pass which was used by researchers was consisted of three levels (excellent performance, continuity of the rally, error) (Marcelino & Mesquita, 2006; Marcelino, Mesquita, & Sampaio, 2009; Marcelino R., Mesquita, Palao, & Sampaio, 2009; Nishijima et al., 1987). This scale is used by F.I.V.B. and is called V.I.S. (Volleyball Information System) (F.I.V.B., 2017). There are also analyses (Barzouka et al., 2006; Durkovic et al., 2009; Hayrinen et al., 2004; Florence et al., 2008; Marelic, Resetar, & Jankovic, 2004) which have used as an instrument of pass evaluation a 5-point numerical rating scale, with 0 representing an error and 4 representing a perfect execution. This scale was introduced and validated by Eom & Schutz (1992). Moreover, a 6-level ordinal scale was used to rate passes without a discriminate recording for passes against jump spin and jump float serve (Miskin, Fellingham, & Florence, 2010).

The vast majority of previous analyses were carried out using accumulated data of volleyball skills in order to determine the most important of them with the use of statistical techniques as Chi-square test (Lirola & Gonzalez, 2009; Monteiro, Mesquita, & Marcelino, 2009), multivariate techniques as discriminate analysis (Drikos & Vagenas, 2011) or logistic regression (Pena, Rodriguez - Guerra, Busca, & Serra, 2012) or even with multidimensional scaling analysis (Zirhlioglu, 2013). The assumption that pass-setting-attack after pass pattern is a first-order Markov chain allows the recording of these sequences in a transition probabilities matrix where data of the matrix represent the probability to move from one state to another and, finally, to an outcome. With the use of the Bayesian analysis, the past team's performance or the coaches' opinions about passing effects in the attack can be taken into consideration as a prior distribution in order to create with actual data the posterior distribution and, consequently, the conditional success probability.

Thus, the aim of this study is to validate a 6-level ordinal scale for evaluation of pass and to determine the influence of each level of a pass to the success of attack in 3 different age categories (U19, U21, Men) for male high-level Volleyball.

2 Method

All recorded data refer to the performance in pass and attack after the pass of the winning team of the world championship for national teams in three age categories for male volleyball. All data record the performance on selected matches of the World national team champions (Poland in Men, 2014; Russia in U21 and in U19 for 2013). Thus, the initial sample (N=) was 815 for Men, 525 for U21 and 407 for U19 passes respectively. For the evaluation of pass, a 6-level ordinal scale was used with the 1st level being a passing error and the 6th level to be a pass performed in an optimal way. In Table 1 the performance

ratings and a brief description of each passing level are presented. Attack was evaluated with three possible outcomes: point for the team under observation, rally continuation and point for the opponent.

Table 1. Performance ratings for pass (vs Jump Spin & Jump Float Serve).

Level code (Level Symbol)	Level brief description
6(#)	The ball was passed accurately with a suitable height, speed and parabolic trajectory in the target area (3m-4m from the right sideline and about 30-50 cm from the net or over 30-50 cm over the net if setter has the ability to jump setting). The setter could have all the options (location & type) for a set from the sidelines and the central lane without any adjustments in his approach to the ball.
5(+)	The ball was passed either away (1m. behind or 2m. in front the target area), or travelled higher, or lower (setter's shoulder level). The setter could have all the options for attack (location & type) from the sidelines and the central lane with adjustments in his approach to the ball.
4(!)	The ball was passed with either 3m. away from the net or near the sidelines or to the top of the net. The setter could have two options for attack only from the sidelines.
3(-)	The ball was passed with very poor parabolic trajectory or near the sidelines, end line or outside of the court. The setter could have just one mandatory option for attack or the setter could not approach the ball and another player sets the ball mandatory.
2(/)	The ball was passed directly to the serving team court. No option for attack for the receiving team.
1(=)	The ball hit the floor directly or after touched by a receiver. The rally was ended after 1st or 2nd contact.

The evaluation of a scale's content validity is a critical step in reinforcing the validity of an instrument. To evaluate each item level, 4 expert coaches were asked to rate the relevance of each item on a 4-point scale (1= not relevant, 2= somewhat relevant, 3= quite relevant, 4= highly relevant) (Davis, 1992) after the presentation of the detailed description of each level. Then, the Scale-Content Validity Index (S-CVI/Ave) is computed as an average across items. Acceptable value for S-CVI/Ave is 0.90 (Polit, Takano Beck, & Owen, 2007). Also, Scale Content Validity Index with Universal Agreement between experts (S-CVI/UA) is computed with an acceptable value of 0.80 (Polit et al., 2007).

Based on the fact that decision accuracy is a type of criterion reference validity proper for sport performance analysis (O' Donoghue, 2010, p. 152), a tape of a five-set World League match 2015 which contained 189 passes was presented to 4 experts in performance recording of volleyball skills with a brief description of the 6 levels scale for pass. The experts were asked to assess the performance and evaluate passes using Data Project software (Data Project, 2000). The aim of this additional procedure was to obtain feedback about whether analysts have a commonly agreeable evaluation of pass performance based on the 6-level scale. Each possible pair of observers were checked with the computation of Adjusted Cohen's κ with an acceptable value of 0.80 (Altman,

1991).

The observer was a volleyball coach, expert in evaluation and recording of volleyball performance data and excellent user of the software. The interobserver reliability of the data collection and recording was checked by a test-retest procedure, with a one-week interval, from a random sample of 100 actions of stable pattern pass-set attack after pass-outcome for each one of the teams under observation. As the acceptable value of Adjusted Cohen's κ is set 0.80 (Altman, 1991).

Every time the opponent serves the ball on the side of the observed team a sequence of events takes place that follows a specific scheme: pass–set–attack after pass–outcome. An assumption that this scheme is a first-order Markov chain is stated. This sequence was recorded in a transition probability matrix where data of the matrix represent the probability to move from one state to another and finally to reach an outcome.

A Bayesian model to estimate the transition probabilities, and through them, the success probabilities were made. In this way three (one for each team) transition probabilities matrices were created. The multinomial likelihood for each row (i.e. level of the pass) was assumed. Given that the interest was in what the data suggest on the relationship between the different states of the sequence, a non-informative prior distribution is assumed. A conjugate Dirichlet prior distribution was used where each row of the prior parameters were all assumed to be equal to one (except those that were constrained to be zero). All conditional probabilities scores were calculated using a simple Monte Carlo scheme of 10,000 iterations to acquire a random sample from the posterior distribution. For a detailed description of the model see Drikos & Ntzoufras (2015).

3 Results

Table 2 shows the S-CVI/Ave as the average of the I-CVI (Item-Content Validity Index) for all the items on the scale. Also, in Table 2 the S-CVI/UA is presented as a proportion of items given a rating of 3 or 4 by all the raters involved. Both indexes have acceptable values. So, the pass rating scale with 6 levels has excellent content validity as it is composed of items that have an S-CVI/Ave above 0.90 and an S-CVI/UA above 0.80.

Table 2. Validity indexes for pass evaluation scale.

Validity Indexes	Evaluation scale for Pass
Scale Content Validity Index (S-CVI)	0.96
Scale Content Validity Index with Universal Agreement between experts (S-CVI/UA)	0.83

Table 3 shows the Adjusted Cohen's κ of each possible pair of experts-raters. All values are above 0.80. According to Altman's (1991) interpretation scheme, experienced raters have a very good commonly agreeable opinion when evaluating pass performance based on a 6-level ordinal rating scale. Considering that the raters were given a brief description of the criteria for each level of pass, it can be concluded that the criteria were sufficiently defined with an acceptable degree of practical applicability.

Table 3. Agreement between raters for the validity of observation criteria.

	K1-K2	K1-K3	K1-K4	K2-K3	K2-K4	K3-K4
Adjusted Cohen's κ	0.9006	0.8465	0.8310	0.8800	0.8523	0.8452

The interobserver reliability in evaluation and recording of data was well established because of acceptable Adjusted Cohen's κ values calculated after the test-retest procedure. The values were 0.91 and 0.90 for a pass against jump spin and jump float serve respectively.

The posterior means of unconditional probabilities for each no terminal level of the evaluation scale for jump spin and jump float serve are presented in Table 4. Level 1 of pass scale is a terminal level and its probability to move to another state or to reach a positive outcome is zero. For level 2 of the pass, there is a noticeable finding. After overpass against jump spin serve the receiving team keeps a sufficiently higher probability (0.45) to win a point than to keep the ball in its court and have a mandatory attack (level 3). As expected, the pass in level 4, 5, and 6 of the scales have higher conditional probabilities. An important increase of probability to win a point is obvious when the pass is evaluated as level 4 (two options from sidelines) contrary to evaluation as level 3 (one mandatory option for the setter). This increase is 0.21, 0.16, 0.28 against jump spin serve and 0.19, 0.19, 0.16 against jump float serve for Men, U21, and U19 respectively. For U19 against jump serve the probability to win a point with pass level 4 is higher than with more precise passes (levels 5&6). Comparing success probabilities between levels 5 & 6 it is clear that more precise pass (level 6) does not mean higher success probabilities. Taking into consideration the standard deviation of each posterior mean, it is clear that success probabilities of a pass in levels 5 & 6 are almost equal for each age category. Also in Table 4, the tail posterior probability level of differences across age categories for each level of pass evaluation scale is presented. It is remarkable that U19 team has a significantly higher probability of taking a point after a pass level 4 against both types of serve (offensive options only from sidelines) than U21 and Men team. Also, the U19 team has a higher probability to gain a point after an overpass against jump spin serve than both U21 and Men. Meanwhile, the U19 team has a higher probability of winning a point compared to U21 when the pass from a float serve is accurate on the net (level 6).

Table 4. Posterior means (±sd) of conditional probabilities and summary of posterior differences across age categories for each no terminal level of pass evaluation scale.

Skills *(S_i)*	**Skills (sub)**	**Men**	**U21**	**U19**	**Posterior differences***
Pass in Jump Spin	2(/)	0.274 (±0.058)	0.266 (±0.053)	0.454 (±0.124)	*Men, U21<U19*
	3(-)	0.308 (±0.038)	0.337 (±0.055)	0.307 (±0.090)	
	4(!)	0.548 (±0.022)	0.515 (±0.033)	0.631 (±0.045)	*Men<U19, U21<<U19*
	5(+)	0.593 (±0.022)	0.548 (±0.029)	0.605 (±0.045)	
	6(#)	0.589 (±0.0212)	0.545 (±0.032)	0.565 (±0.048)	
Pass in Jump Float	2(/)	0.256 (±0.046)	0.188 (±0.069)	0.281 (±0.049)	
	3(-)	0.325 (±0.039)	0.304 (±0.052)	0.412 (±0.079)	
	4(!)	0.539 (±0.024)	0.513 (±0.031)	0.603 (±0.035)	*Men<U19, U21<<U19*
	5(+)	0.581 (±0.022)	0.563 (±0.027)	0.616 (±0.031)	
	6(#)	0.569 (±0.022)	0.558 (±0.026)	0.629 (±0.030)	*Men<U19, U21<<U19*

** Inequalities indicate important differences between age categories: Age category A has lower success rates than age category B with posterior probability less than 0.01 ("A<<<B"), between 0.01 and 0.05 ("A<<B"), between 0.05 and 0.10("A<B").*

A detailed preview of success unconditional probabilities is provided in Figures 1&2.

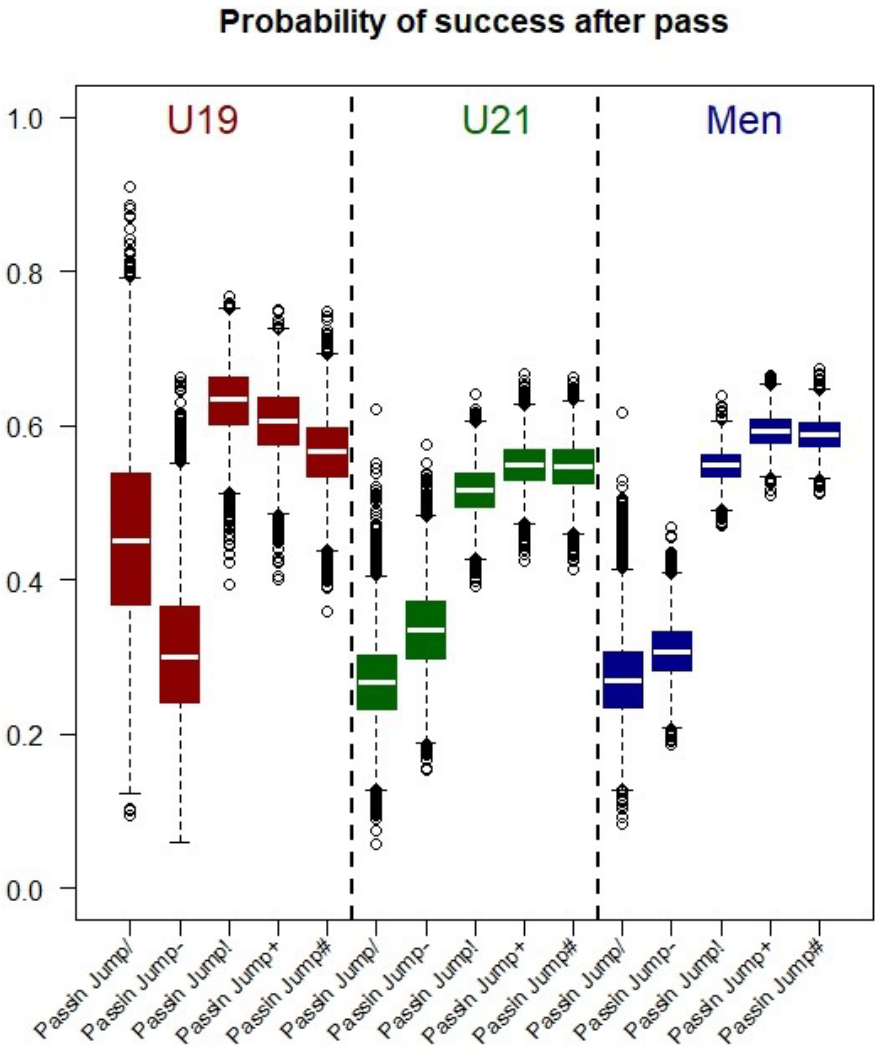

Figure 1. Box-plot (with outliers) of success conditional probability of each no terminal level of evaluation scale for a pass in Jump spin serve.

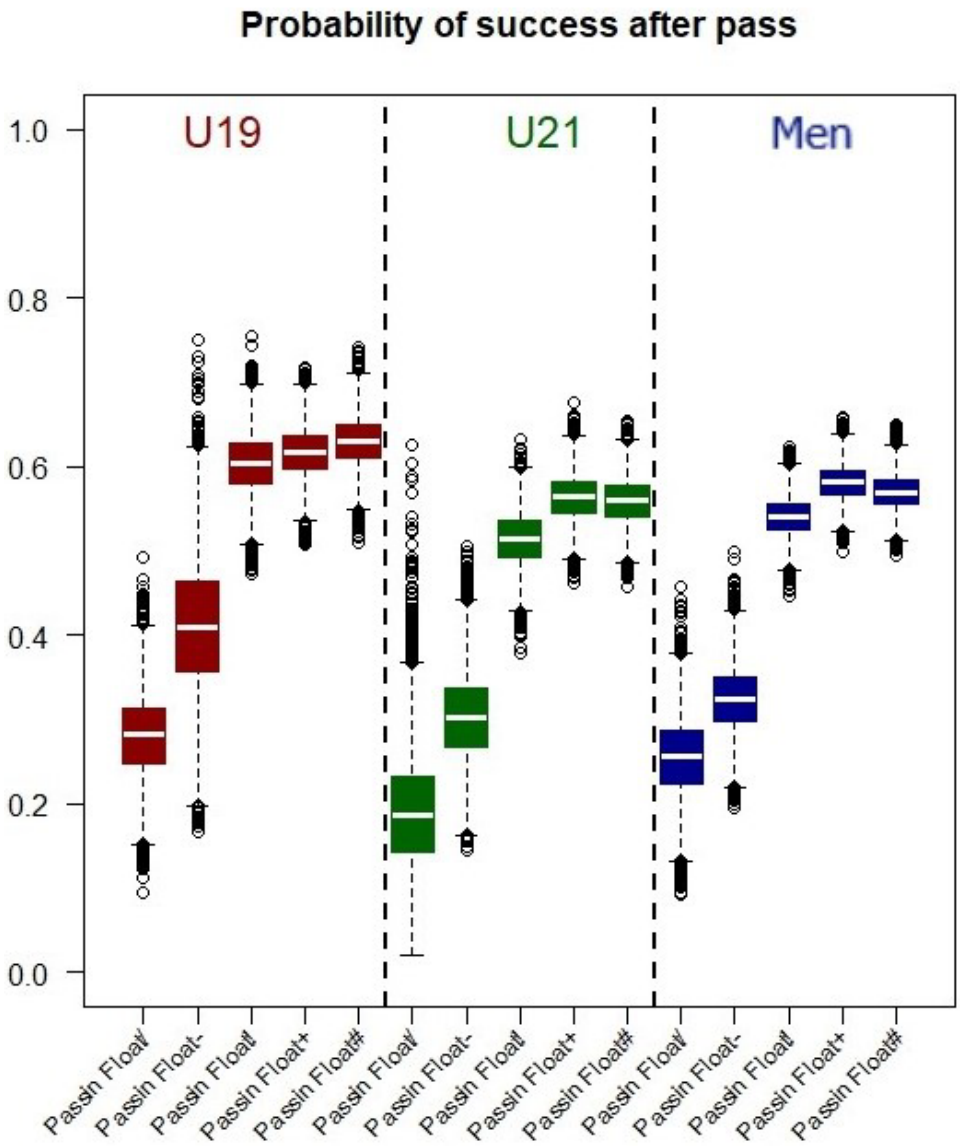

Figure 2. Box-plot (with outliers) of success conditional probability of each no terminal level of evaluation scale for a pass in Jump float serve.

4 Discussion

The target for the receiver is an area close to the net or sometimes over it (3m-4m from the right sideline and about 30-50 cm from the net or over 30-50 cm over the net if the setter has the ability for jump setting). The pass that is directed to the court of the serving team (2nd level, that is to say, overpass) and the pass with the one-option setting (3rd level of the evaluation scale) have the same characteristics at all ages, with an exception of U19 only for a pass against jump spin serve. The penalty for the overpass is higher compared to this for a 3rd level pass. Also, the pass level 6 on the net or too close to the net does not present higher probability compared to 5th level. Silva, Lacerda, & Joao (2014) have mentioned the possible difficulty of the setter to handle a ball on the net.

These findings follow the conclusions of Miskin et al. (2010) that, at least for the teams under consideration, the target area of a pass on the net must be more conservative.

In all age categories, the probability of winning a point in the stable pattern pass-set-attack after the pass is above 0.5 when the pass is evaluated on levels 4, 5, 6 of the evaluation scale. Thus, the first priority for a team should be to keep the ball in its court giving the setter the opportunity to choose at least between two attackers from the sidelines (outside hitter and opposite). The coaches' belief that a good pass is a guarantee for an effective attack can be more specified by pointing out that a pass which secures at least two attacking options increase the probability of a successful attack for all age categories in male Volleyball. This is in partial agreement with many studies about the relationship between pass and attack (Barzouka et al., 2006; Eom & Schutz, 1992b; Marelic, Resetar, & Jankovic, 2004; Papadimitriou et al., 2004). The lack of discrimination between the 5th and 6th level of evaluation scale according to success probabilities ensures the finding of Lobietti et al. (2006) that passing with high accuracy is not a necessary condition for a successful attack. Also, this means that, at least for the teams under examination, the passing rating system has to be changed. A possible junction of 5th and 6th level should be examined.

The large discrepancy of success probability from 1st, 2nd and 3rd in relation to 4th, 5th, 6th level of the pass evaluation scale is a clear message that the probability of success is not increasable as the evaluation grade gets higher. This phenomenon is observed in all age categories. There is no a fixed interval between levels of the scale, thus the assumption of treating ordinal data as numerical data and the use of descriptive statistics, such as mean and standard deviation, for the evaluation of teams' or players' performance may be groundless. The same has been concluded by Florence et al. (2008) after examination of a college women's volleyball team.

It is difficult to explain the finding that the U19 team has higher probabilities after an overpass against jump spin serve instead of keeping the ball in its court with only one option for attack. It is clear that this analysis is applicable only to these teams, their level and their opponents and generalisations may be not applicable to other teams. In the model, only the next two touches of the team under observation were recorded, so it is highly likely that a point after an overpass is due to opponents' error. But even with this assumption, it is important to mention that the jump spin serve has higher speed than jump float serve (Pena, Busca, Galceran, & Bauza, 2013). For this reason, the reaction time for receivers is reduced in <0.5s (Katsikadelli, 1996). Consequently, the reaction time is also limited to the serving team too, especially if they are not well prepared to play an opponents' overpass as a free ball.

Team U19 after pass level 4 against jump spin serve is more effective than Men & U21 teams. Also, it is noteworthy that there is not increased the probability to win a point when passing performance rises above level 4, contrary to Men and U21 teams. Performance of U19 team in pass-set-attack after pass pattern confirms the findings of Costa G. C., et al. (2011) that subsequent actions do not have high functional dependence in relation to the precedent ones in the age category of U19 due to the fact that because of lack of players' maturity the game is not well integrated.

To sum up, the present study is validating the six-level scale for evaluation of pass, it is developing a Bayesian model including prior distribution and is applying this model to performance data of world champion teams in three age categories. The conclusion reached is that for all ages the quality of pass is important to ensure at least two offensive options for the setter. Furthermore, the discrepancy of success probabilities among the levels of the scale makes it clear that for this ordinal scale it is unrealistic to use descriptive statistics, like a mean and standard deviation. Finally, the target area of the pass must be

more conservative, and the evaluation scale must be shrunk, at least for teams under observation.

References

Altman, D. G. (1991). *Practical Statistics for Medical Research.* London: Chapman & Hall.

Barzouka, K., Nikolaidou, M. E., Malousaris, G., & Bergeles, N. (2006). Performance Excellence of male setters and attackers in Complex 1 and 2 on Volleyball teams in the 2004 Olympic games. *International Journal of Volleyball Research, 9*(1), 19-23.

Calhoun, W., Dargahi-Noubary, G. R., & Shi, Y. (2002). Volleyball Scoring Systems. *Mathematics and Computer Education, 36*(1), 70-79.

Costa, G. C., Caetano, R. J., Ferreira, N. N., Alfonso, J., & Costa, P. (2011). Determinants of attacking tactics in youth male elite Volleyball. *International Journal of Performance Analysis in Sport, 11*(1), 96-104.

Data Project. (2000). Data Volley. *2.1.9.* Salerno, Italy.

Davis, L. L. (1992). Instrument review: Getting the most from a panel of experts. *Applied Nursing Research* (5), pp. 194-197.

Drikos, S., & Ntzoufras, I. (2015). Skills importance across ages for Men's Volleyball. In A. Kay, A. Owen, B. Halkon, & M. King (Ed.), *Proceedings of the 5th International Conference on Mathematics in Sport*, 32-40.

Drikos, S., & Vagenas, G. (2011). Multivariate assessment of selected performance indicators in relation to the type and result of a typical set in Men's Elite Volleyball. *International Journal of Performance Analysis in Sport* 11, 85-95.

Durkovic, T., Marelic, N., & Resetar, T. (2009). Rotation analysis of team's performances at 2003 Youth European Volleyball Championship. *Kinesiology* 41, 60-66.

Eom, H. J., & Schutz, N. R. (1992). Statistical analysis of Volleyball team performance. *Research Quarterly for Exercises and Sport, 63*(1), 11-18.

Eom, H. J., & Schutz, N. R. (1992). Transition play in team performance of Volleyball: a log-linear analysis. *Research Quarterly for Exercise and Sport, 63*(3), 261-269.

F.I.V.B. (2017, 5 28). Retrieved from http://www.fivb.org/en/volleyball/VIS.asp.

Ferrante, M., & Fonseca, G. (2014, June). On the winning probabilities and mean duration of Volleyball. *Journal of Quantitative Analysis in Sports, 10*(2), pp. 91-98.

Florence, L., Fellingham, G., Vehrs, P., & Mortensen, N. (2008). Skill Evaluation in Women's Volleyball. *Journal of Quantitative Analysis in Sports, 4*(2).

Hayrinen, M., Hoivala, T., & Blomqvist, M. (2004). Differences between winning and losing teams in men's European top-level volleyball. In P. O'Donoghue, & M. Hughes (Ed.), *Performance Analysis of Sport* (pp. 194-199). Cardiff: Center for Performance Analysis, School of Sport, Physical Education and Recreation, University of Wales.

Katsikadelli, A. (1996). A comparative study of the attack serve in high-level volleyball tournaments. *Journal of Human Movement Studies* 30, 223-232.

Lirola, D. C., & Gonzalez, C. H. (2009). Research and analysis of the reception in the current high-performance Men's Volleyball. *International Journal of Sport Science, 5*(16), 34-51.

Lobietti, R., Michele, R., & Merni, F. (2006). Relationships between performance parameters and final ranking in professional Volleyball. In H. Dancs, M. Hughes, & J. Ekler (Ed.), *World Congress of Performance Analysis in Sports 7.* Szombathely: Berzenyi College.

Marcelino, R., & Mesquita, I. (2006). Characterizing the efficacy of skills in high-performance competitive Volleyball. In H. Danks, M. Hughes, & J. H. Ekler (Ed.), *World Congress of performance analysis of sports* (pp. 491-196). Szombathely: Berzsenyi College.

Marcelino, R., Mesquita, I., & Sampaio, J. (2010). Efficacy of the volleyball game actions related to the quality of opposition. *The Open Sports Sciences Journal, 3*, 34-35.

Marcelino, R., Mesquita, I., Palao, J. M., & Sampaio, J. (2009). Home advantage in high-level volleyball varies according to set number. *Journal of Sports Science and Medicine* 8, 352-356.

Marelic, N., Resetar, T., & Jankovic, V. (2004). Discriminant Analysis of the sets won and the sets lost by one team in A1 volleyball league - a case study. *Kinesiology* (36), pp. 77-82.

Miskin, M., Fellingham, G., & Florence, L. (2010). Skill Importance in Women's Volleyball. *Journal of Quantitative Analysis in Sports, 6*(2).

Monteiro, R., Mesquita, I., & Marcelino, R. (2009). Relationship between the set outcome and the dig and attack efficacy in elite male Volleyball game. *International Journal of Performance Analysis in Sport, 9*(3), 294-305.

Nishijima, T., Ohswava, S., & Matsuura, Y. (1987). The relationship between the game performance and group skill in Volleyball. *International Journal of Physical Education, 4*(24), 20-26.

O' Donoghue, P. (2010). *Research methods for sports performance analysis.* New York: Routledge.

Papadimitriou, K., Pashali, E., Sermaki, I., Mellas, S., & Papas, M. (2004). The effect of the opponents' serve on the offensive actions of Greek setters in volleyball games. *International Journal of Performance Analysis in Sport, 4*(1), 23-33.

Patsiaouras, A., Charitonidis, K., Moustakidis, A., & Kokaridas, D. (2009). Comparison of technical skills effectiveness of Men's National Volleyball teams. *International Journal of Performance Analysis in Sport* (9), 1-7.

Pena, J., Busca, B., Galceran, D.-M., & Bauza, J. (2013). The effect of aerodynamic drag in the service speed of high-level men's volleyball. *Proceedings of the 18th Congress European College of Sport Sciences.* Barcelona, Spain.

Pena, J., Rodriguez - Guerra, J., Busca, B., & Serra, N. (2012, December). Which skills and factors better predict winning and losing in high-level men's volleyball? *The Journal of Strength and Conditioning Research, 27*(9), 2487-2493.

Polit, D. F., Takano Beck, C., & Owen, S. (2007). Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Research in Nursing & Health* (30), 459-467.

Silva, M., Lacerda, D., & Joao, P. V. (2014, August). Match analysis of discrimination skills according to the setter defence zone position in high-level Volleyball. *International Journal of Performance Analysis in Sport, 14*(2), 463-472.

Zetou, E., Moustakidis, A., Tsigilis, N., & Komninakidou, A. (2007). Does effectiveness of skill Complex 1 predict win in Men's Olympic Volleyball Games? *Journal of Quantitative Analysis in Sports, 3*(4).

Zirhlioglu, G. (2013). Evaluation of Volleyball Statistics with Multidimensional Scaling Analysis. *International Journal of Sports Science and Engineering, 7*(1), 21-25.