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Career Patterns in National Youth Basketball Teams

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Abstract: *This study examines the trends and factors influencing the performance and career trajectories of players within the National men's senior basketball team from Croatia. The research analyzes data from 189 Croatian youth national team players born between 1992 and 2003, who competed in major international tournaments between 2008 and 2022. Key factors such as the player's year of birth, the number of appearances for youth national teams (U16 to U20), and the senior A-team are explored. The findings reveal important insights into the structure of Croatian basketball talent development, the role of continuity and consistency, and the impact of international competition experience. Data on the duration of the players' representative careers shows that the majority of careers lasted one year (40.2%), followed by two or three-year careers (54%), with four or five-year careers being the least common (less than 5%). Statistical tests reveal moderate to significant relationships between career duration, career type and appearances for the senior national team. Binary logistic regression results indicate a positive correlation between participation in youth categories (U18, U19, and U20) and senior team appearances, with the strongest association seen for U19 World Championship participants.This study also highlights the significance of long-term career trajectories in shaping successful transitions to senior teams.*
Keywords: *basketball, performance, selection, talent development*

Introduction

The identification and development of sports talent is a critical component of national sporting organizations' strategies. These organizations are dedicated to identifying and nurturing elite athletes to achieve international sporting success. Kalen et al. (2021) emphasize the commitment of sports organizations to invest in specialized programs for talent identification and development. However, this process is complex and dynamic, involving continuous selection, reselection, and deselection of athletes. To illustrate this complexity, the German Football Association (DFB) and the German Football League (DFL) have developed an advanced talent identification and development concept (Schroepf et al., 2018). This holistic approach includes systematic implementation of development programs for young athletes, the formation of academies for professional clubs, and the identification and promotion of elite talents through youth teams.

In the context of building successful teams, Dogan et al. (2015) identified key factors such as offensive efficiency, team coordination, and possession of the ball as critical elements of team success. These insights are invaluable for coaches and scouting teams in decision-making processes and optimizing player performance. Beyond technical and tactical factors, biological maturation also plays a key role. Arede et al. (2021) found that players who are biologically more advanced have a greater likelihood of being selected for representation. This further underscores the importance of accurately assessing various aspects of players in the selection process. In their analysis of NBA professionals, Moxley et al. (2015) identified several key early career indicators, such as player height, age, college basketball experience, and performance at the NBA Draft Combine, as significant predictors of future performance.

On the other hand, the phenomenon of relative age effects (RAE), which points to an overrepresentation of players born in the first quarter of the year, plays an important role in team sports selection (Arrieta et al., 2016; de Subijana et al., 2018). This phenomenon highlights developmental differences in physical, cognitive, and motivational aspects among athletes, leading to inequality in the selection process. This often results in a disadvantage for players born later in the year. These findings highlight the need for further research and innovations in talent identification and development strategies.

Methods

The aim of this research is to identify the career patterns of top young Croatian basketball players across different time periods by tracking their appearances in youth national teams. The study involved a significant number of young Croatian national basketball players during a 14-year period from 2008 to 2022. Players born between year 1992. and 2003. were selected for this study, as they had the opportunity to go through U16 to U20 teams and had already reached senior status by the time of the study. A total of 189 players were included in this research. Success at the senior level in this study was defined as an appearance for the Croatian senior national team. All appearances of young players who participated in at least one official match in their respective age categories between the 2007./2008. and 2021./2022. seasons were included in the data analysis. For each player, the following data was collected: name, year of birth, number of appearances in youth national teams (from U16 to U20), professional status, and appearances for the senior national team. Table 1 highlights the European (U16, U18, U20) and World Championships (U17, U19) in which the Croatian youth national team participated during each season, with relevant years marked in grey.

Table 1. *Cohorts included in this study*

	Youth categories										
Season	**1992.**	**1993.**	**1994.**	**1995.**	**1996.**	**1997.**	**1998.**	**1999.**	**2000.**	**2001.**	**2002.**
2007./2008.	**U16**										
2008./2009.	U17	**U16**									
2009./2010.	**U18**	U17	**U16**								
2010./2011.	**U19**	**U18**	U17	**U16**							
2011./2012.	**U20**	U19	**U18**	**U17**	**U16**						
2012./2013.		**U20**	**U19**	**U18**	U17	**U16**					
2013./2014.			**U20**	U19	**U18**	U17	**U16**				
2014./2015.				**U20**	**U19**	**U18**	U17	**U16**			
2015./2016.					**U20**	U19	**U18**	U17	U16		
2016./2017.						**U20**	U19	**U18**	U17	**U16**	
2017./2018.							**U20**	U19	**U18**	**U17**	**U16**
2018./2019.								U20	U19	**U18**	U17
2019./2020.									**U20**	U19	**U18**
2020./2021.										**U20**	U19
2021/2022.											U20

** Championships in which the Croatian youth national team participated are marked in grey*

A vector of length five was generated to describe the player's status between U16 and U20. Appearances were coded as 1, and non-appearances as 0. The first digit in the binary representation indicates an appearance in U16, the second for U17, the third for U18, the fourth for U19, and the fifth for U20. Out of the 25 possible career patterns, 24 were found in the sample of players included in the study. The remaining eight career patterns were excluded as they were not found in the sample. Furthermore, the 24 career patterns were classified into six types of careers for further statistical analysis by grouping similar career patterns. These similarities were characterized by the number of appearances as well as the timing of selection. The study identified the following categories: "one appearance," which refers to national careers in youth national teams consisting of a nomination in just one year; "short career," consisting of two or three nominations; and "long career," which consists of four or five nominations. Appearances at European, World, or both championships were classified as a sixth career type and also served as a classification criterion.

The data used in this study was sourced from FIBA.com and scoutbasketball.com. Statistical analysis was performed using IBM SPSS software. Descriptive statistics were applied to obtain basic characteristics of the sample. The Kruskal-Wallis test was used to determine differences between positions and the number of appearances for the senior team. The chi-square test was used to determine the probability of a relationship between different classifications of players and their appearances for the senior national team, with Cramér's V used as a measure of effect

size for the chi-square test (indicating the strength of association between two categorical variables). Binary logistic regression was used to examine possible connections between players' appearances in specific categories and their appearances for the senior national team. Binary logistic regression was used to predict the outcome of a binary variable based on one or more predictor variables. In this case, the outcome was an appearance for the senior national team (yes/no), and the predictor variables were the appearances in various categories.

Results

The total number of players who have represented the Croatian youth basketball national team in competitions, as well as their number of appearances for the senior national team, is presented in Table 2. The cumulative values for each national category indicate that the most frequently occurring number of appearances corresponds to the number of games a player can participate in during a single tournament (appearing in every match). Specifically, for the U16 category, this number is nine (35 different players), for U17 it is seven (10 players), for U18 it is nine (27 players), for U19 it is seven (7 players), and for U20 it is seven (22 players).

Table 2. *Descriptive statistics of the total number of appearances of the Croatian basketball national team*

	N U16	N U17	N U18	N U19	N U20	N SA
N	189	189	189	189	189	189
Mean	4.90	0.85	4.13	1.23	4.49	1.69
Median	5.00	0.00	1.00	0.00	4.00	0.00
SD	4.67	2.27	4.85	3.17	5.00	5.79
Skew	0.58	2.42	0.94	3.01	0.81	6.06
Kurt	-0.31	4.15	0.17	10.04	-0.27	47.85
Min	0	0	0	0	0	0
Max	18	8	18	18	19	57

N – *total number of participants in the study,* Mean – *arithmetic mean,* Median – *central value,* Min – *minimum value,* Max – *maximum value,* SD – *standard deviation,* Skew – *skewness,* Kurt – *kurtosis,* N U16 – *number of appearances at the U16 European Championship,* N U17 – *number of appearances at the U17 World Championship,* N U18 – *number of appearances at the U18 European Championship,* N U19 – *number of appearances at the U19 World Championship,* N U20 – *number of appearances at the U20 European Championship,* N SA – *number of senior appearances.*

Data on the duration of the players' representative careers, which shows that the majority of careers lasted one year (40.2%), followed by two or three-year careers (54%), with four or five-year careers being the least common (less than 5%) (Table 3).

Table 3. *Duration of the national team career*

Career duration	Frequency	Percentage	Cumulative frequency
1 year	76	40.2	40.2
2 years	55	29.1	69.3
3 years	47	24.9	94.2
4 years	9	4.8	98.9
5 years	2	1.1	100.0
Total	189	100.0	

Statistical tests (Cramér's V and chi-square tests) that reveal moderate to significant relationships between career duration, career type and appearances for the senior national team are presented in Tables 4-5.

Table 4. *Duration of national team career * BNS Crosstabulation*

			BNS		Total
			No appearance	Appearance	
Duration of national team career	1 year	Count	72	4	76
		Expected Count	62.3	13.7	76.0
	2 years	Count	49	6	55
		Expected Count	45.1	9.9	55.0
	3 years	Count	29	18	47
		Expected Count	38.5	8.5	47.0
	4 years	Count	5	4	9
		Expected Count	7.4	1.6	9.0
	5 years	Count	0	2	2
		Expected Count	1.6	0.4	2.0
Total		Count	155	34	189
		Expected Count	155.0	34.0	189.0

Table 5. *One appearance, short career, long career * BNS Crosstabulation*

		BNS		Total
		No appearance	Appearance	
One Appearance	Count	72	4	76
	Expected Count	62.3	13.7	76.0
Short career	Count	78	24	102
	Expected Count	83.7	18.3	102.0
Long career	Count	5	6	11
	Expected Count	9.0	2.0	11.0
Total	Count	155	34	189
	Expected Count	155.0	34.0	189.0

Binary logistic regression results indicate a positive correlation between participation in youth categories (U18, U19, and U20) and senior team appearances, with the strongest association seen for U19 World Championship participants (Table 6).

Table 6. *Results of binary logistic regression*

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1	BN16	0.44	0.48	0.836	1	0.36	1.550	0.606	3.963
	BN17	0.98	0.59	2.880	1	0.09	2.709	0.857	8.564
	BN18	1.100	0.48	5.334	1	0.02	3.005	1.181	7.646
	BN19	1.920	0.47	16.405	1	0.00	6.820	2.693	17.269
	BN20	1.069	0.47	5.210	1	0.02	2.913	1.163	7.294
	Konstant	-3.750	0.64	34.260	1	0.00	0.024		

**Variables included in step 1: BN16, BN17, BN18, BN19, BN20.*

Discussion

This study provides a thorough analysis of the factors influencing the career trajectory of players in Croatian youth basketball teams and their eventual transition to the senior national team. The results emphasize the importance of consistent participation in youth tournaments, with a particular focus on experiences gained at major international events like the U19 World Cup, which significantly increases the likelihood of players progressing to the senior level.

In the context of the total number of appearances for all categories of the Croatian national basketball team, the obtained results indicate that the average number of appearances per player varies across different age groups and tournaments. Given the lowest average values for the U17 and U19 World Championships (M = 0.85, M = 1.23), it can be inferred that participation in these tournaments represents a challenge in terms of placement and player availability. On the other hand, the highest number of appearances was recorded for the senior national team (Max =

57), suggesting a longer career at this level. This result contrasts with the maximum number of appearances in tournaments for Croatian youth teams (U16, U18, U19, and U20), which is significantly lower, suggesting that players typically appear at most twice in each of these tournaments. Particularly interesting is the difference in the maximum number of appearances in the U17 World Championship, which is smaller than in other tournaments. This is likely due to the fact that this tournament is held every two years, and there are certain qualification criteria for participation, which must be met at the U16 European Championship. A study by Arede et al. (2021) evaluated the impact of maturity timing on the functional abilities and situational efficiency indicators of U16 basketball players. Results from the situational efficiency of games during the U16 national championship and U16 European Championship were correlated with further selection into the U18 team (Arede et al., 2021).

The cumulative values for each national category reflect a trend where the most common appearance number is equal to the maximum number a player can achieve in a single tournament. This could point to a high level of competition and a tendency for players to maximize their participation in international tournaments. The results of this study confirmed only the first hypothesis, which states that there is no statistically significant difference in the number of appearances for the senior national team among players of different positions ($p > 0.05$). The results show that a player's position on the court – whether they are point guards, shooting guards, forwards, small forwards, power forwards, or centers – does not influence the number of appearances for the senior national team. These findings, derived from the Kruskal-Wallis test, indicate that there are no statistically significant differences in the participation of players in the senior team based on their positions.

Analysis of the careers of players promoted to the Croatian youth national teams shows different forms of career durations, which may include – one appearance, short careers, and long careers. A significant number of players, as much as 40.2% of the total sample, had representative careers lasting only one year. This could suggest a high turnover of players within the youth teams, which may have been influenced by factors such as player development, injuries, or changes in tactical decisions and strategies. Schroepf and Lames (2018) also identified high player turnover within youth teams, with careers lasting one or two years accounting for 60.5% of the total sample. Similarly, in this study, a significant number of players (40.2%) had representative careers lasting only one year, and the majority (54%) had careers lasting two to three years (Schroepf et al., 2018). In contrast, the majority of players, over half of the total sample (54%), had careers lasting two to three years. This data reflects a certain stability within the youth teams, indicating that players managed to maintain continuity in their international appearances and development at the youth level. However, on the other hand, careers lasting four to five years are extremely rare, making up less than 5% of each category. This suggests that maintaining a long-term presence in the youth teams is challenging, perhaps due to competition for spots, physical demands, or player transitions to senior teams.

Direct comparison with the analysis focusing on the number of nominations shows similar trends. Most players ($N = 102$) had short careers with two to three nominations, while a significant number ($N = 76$) recorded only one appearance for the national team. In contrast, a relatively small number of players ($N = 11$) had longer careers with four or five nominations. These data point to similar factors that may influence the duration of careers and the number of nominations, such as competition, player performance, tactical decisions, and injuries. These two sets of analysis, while focusing on different aspects of players' careers, provide complementary insights into the dynamics within the Croatian youth basketball national team. The analysis shows a significant moderate probability of a correlation between the type of player's career and their appearances for the senior Croatian national team ($\chi^2 = 20.43$, $p < 0.01$). Players who made only one appearance in the youth teams recorded fewer appearances for the senior team than expected (4/13.4), while players with short and long careers in the youth teams made more appearances for the senior team than anticipated (24/18.3 and 6/2.0, respectively). Schroepf and Lames (2018) also found that early and short representative stints generally do not lead to a professional career, whereas later and longer careers in youth teams are more likely to result in a successful senior career. There is also a significant moderate probability of a correlation between the type of participation in major international tournaments – European Championship, World Championship, or both – and appearances for the senior Croatian national team ($\chi^2 = 27.53$, $p < 0.01$). Players who participated only in the European Championships or only in the World Championships did not achieve the expected number of appearances for the senior national team (13/21.0 and 1/4.7, respectively). On the other hand, players who participated in both major competitions made significantly more appearances for the senior team than expected (20/8.3). These results could suggest the importance of experience in different types of international competitions for

a successful transition to the senior level. Experience gained by participating in both major competitions may provide players with the necessary skills, experience, and confidence to succeed at the senior level.

Binary logistic regression analysis shows a positive correlation between all youth national team categories and appearances for the senior A national team. Statistically significant differences ($p < 0.05$) were observed in appearances for the U18, U19, and U20 categories. Particularly significant was the link between appearances at the U19 World Championship and appearances for the senior A national team (Exp = 6.8, $p = 0.00$). This result suggests that players who participated in the U19 World Championship were much more likely to appear for the senior A national team. These findings emphasize the importance of experience gained at the U19 World Championship, which could be a key factor in promoting players to higher levels, in line with research by Doğan et al. (2016), who also highlighted the importance of experience and performance in specific statistical categories for team success.

Conclusion

This study provided a detailed insight into the factors that are involved in talent developmental of Croatian basketball players in youth categories and their transition to the senior national team. The results consistently highlight the importance of continuous participation in international competitions, particularly the U19 World Cup, which emerged as one of the most significant predictors of later appearances for the senior national team. Differences in the average and maximum number of appearances across youth categories reflect structural challenges faced by young players, such as the biennial tournament cycle and demanding qualification criteria.

The analysis of career duration within the youth national teams revealed a high proportion of short-term involvement, which aligns with previous research indicating substantial player turnover. While most players had careers spanning two to three years, long-term continuity in youth teams was relatively rare. Nevertheless, players with longer and more stable participation in international competitions demonstrated a higher probability of progressing to the senior level. A similar pattern was observed in the analysis of nomination counts, where shorter careers were less likely to result in senior-level appearances.

Statistical analyses confirmed a moderate association between the type of career in youth national teams, participation in major international tournaments, and senior national team appearances. Particularly important was participation in both the European and World Championships, which proved to be a strong indicator of successful transition to the senior team. Furthermore, logistic regression identified the U18, U19, and U20 categories as the most influential developmental stages, with experience gained at the U19 World Cup standing out as the strongest individual predictor.

Ultimately, the findings of this study emphasize the importance of systematic and long-term planning in the development of young basketball players. A combination of consistent participation, exposure to different types of international competition, and involvement in key tournaments proved essential for successful advancement to the senior level. These results may serve as valuable guidelines for coaching staff and sports organizations in optimizing talent development and creating more effective selection strategies.

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