

[Athletic Training]

A Survey Examining the Correlations Between Japanese Little League Baseball Coaches' Knowledge of and Compliance With Pitch Count Recommendations and Player Elbow Pain

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Background: With the incidence of Little League elbow increasing, pitch limit recommendations for preventing throwing injuries have been developed in both the United States and Japan. However, levels of knowledge of and compliance with these recommendations among coaches of young baseball teams in Japan remain unknown. The relationship between these levels and elbow pain among players has not been adequately studied.

Hypothesis: Knowledge of and compliance with these recommendations is similar in the United States and Japan. Greater knowledge and higher levels of compliance have a significant correlation with reduced elbow pain in Little League baseball players.

Study Design: Cross-sectional study.

Methods: Coaches of youth baseball teams in Kyoto, Japan, completed a questionnaire assessing knowledge of and compliance with recommendations. Team variables and coach-related factors concerning elbow pain among young baseball players were surveyed, and the questionnaire investigated demographic data and elbow pain history in the previous 12 months.

Results: In total, 123 baseball coaches and 654 baseball players aged 6 to 12 years participated in this study; data were analyzed for 113 coaches and 339 players. Among coaches, 39.8% had accurate knowledge of the recommendations (similar to the US data) and 28.3% complied with them (lower than the US data). There was no correlation between elbow pain and knowledge of and compliance with the recommendations, but coaches' opinions on the number of games were indicated as a significant risk factor for elbow pain; the more coaches considered the number of games played, the fewer the number of players who experienced elbow pain.

Conclusion: The level of knowledge of recommendations in Japan was similar to that in the United States, but compliance levels were far lower. There was no correlation between elbow pain and knowledge and compliance.

Clinical Relevance: The Little League elbow problem should be addressed at global and national levels.

Keywords: Little League; coaches; pitch count recommendation; elbow pain

Many people enjoy playing baseball both professionally and recreationally. There are millions of school-aged Little League baseball players worldwide, and Japan is one of the countries where baseball is most popular. As many as 15,000 youth baseball teams in Japan train on a daily

basis.⁷ However, the incidence of Little League elbow, the most severe throwing injury among children, is increasing.² This injury can sometimes result in children no longer being able to play baseball; therefore, prevention is crucial for Little League baseball players.^{4,5,9}

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Table 1. Comparison between pitch limit recommendations for 12-year-old baseball players in the United States and Japan (excerpts from each recommendation)^{8,12}

	USA Baseball Medical and Safety Advisory Committee Guidelines	Japanese Society of Clinical Sports Medicine Recommendations
Year recommended	2006	1995
Pitch counts		
Per day	75	50
Per week	100	200
Per season	1000	—
Per year	3000	—
Practice		
Days per week	—	3
Hours per day	—	2
Pitch type	Avoid breaking pitches	(Prohibited)
Multiple league	Discouraged	—
Year-round baseball	Discouraged	—

Recent studies on the risk factors for throwing injuries among young baseball players in the United States and Japan have recommended that pitch counts be limited to protect players from throwing injuries (Table 1).^{3,10,11} In 2006, the USA Baseball Medical and Safety Advisory Committee guidelines provided science-based limits to reduce the risk of injury among 11- and 12-year-old athletes; this limit was 75 pitches per game and 100 pitches per week.^{9,12} In 1995, the Japanese Society of Clinical Sports Medicine announced limits of 50 pitches per day and 200 pitches per week to prevent throwing injuries in 12-year-old baseball players.⁸ However, these limits are meaningless without strict compliance. Recommendations stipulating that coaches limit a player's pitch count are impractical—players must commit to honing their skills, and pitchers must perform the same motion over and over again, flawlessly, to win games.

In the United States, the ratios of youth baseball coaches' knowledge of and strict compliance with pitch count recommendations were surveyed by an anonymous Internet-based questionnaire in 2012. This study showed that 43% of coaches had sufficient knowledge of pitch count limits, and 73% of coaches reported that they followed the recommendations, although their knowledge of the recommendation was poor.¹ However, the authors of that study stated that their research was limited because it was difficult to generalize the results for coaches in other geographic zones. Therefore, it is meaningful to study knowledge of and compliance with the pitch count recommendations in Japan. Additionally, the relationship between these ratios and elbow pain has not been investigated in sufficient detail thus far.

The current study aimed to determine knowledge of and compliance with Japanese pitch count recommendations among coaches of youth baseball teams in Japan and to compare these with the previous study conducted in the United States. In addition, the relationship between these ratios and elbow pain in youth baseball players was investigated. It was hypothesized that these ratios in Japan would be similar to those reported in the United States, and that greater knowledge and compliance with the pitch count recommendations would have a significant correlation with elbow pain in Little League baseball players.

METHODS

This was a cross-sectional study of coaches and players of youth baseball teams in Japan. Two original questionnaires were created, 1 targeting coaches and 1 targeting Little League baseball players (see appendix, available at <http://sph.sagepub.com/content/suppl>); these questionnaires were distributed to teams that participated in the annual tournament in Kyoto City in August 2011. A total of 111 teams received the questionnaires. To increase response reliability, the players' parents were instructed to work with the players to help them in filling out the player questionnaires. After the parents had verified the responses, the coaches and the players/parents mailed their completed questionnaires back. This study was approved by the Institutional Review Board of Kyoto University (approval No. E1217). The purpose and methods of this study were explained to the coaches and players' parents in detail in a verbal statement and written informed consent obtained from the coaches and players' parents.

Table 2. Comparison of groups with and without knowledge of the pitch limit recommendations

	Knowledge, n = 45	No Knowledge, n = 68	P
Age of coaches, y	50.0 ± 12.4	46.1 ± 8.6	0.07
No. of years spent coaching baseball	9.9 ± 11.2	7.8 ± 7.4	0.27

The questionnaire for coaches contained items on coach-related factors and team variables. These included data on the coaches' age, number of years that they had coached baseball, and number of years that they had played baseball. Also included in the questionnaire for coaches were items addressing the number of games per year played by the team; their opinion on whether the number of games was few, a moderate amount, or many; total training days per week; presence or absence of an off-season; and if they had correct knowledge of and complied with the pitch count recommendations. The number of games per year was recorded as ≤ 50 or > 50 . Off-season was defined as the period or season during which the players did not throw any pitches at all. Knowledge of the recommendation was ascertained with a question asking the coaches if they knew about the Japanese pitch count limit that prohibits 12-year-old players from throwing more than 50 pitches per day. For ascertaining the compliance, they were asked if they routinely complied with the limit.

The players were questioned about their age, height, weight, number of years spent playing baseball, and incidence of elbow pain within the past 12 months. Only episodes of pain in the elbow joint during actual throwing were considered for analysis.

The ratio of coaches who had correct knowledge of the pitch count recommendations and who complied with these recommendations was calculated. Subsequently, the relationship between these ratios and coach age and years spent coaching baseball was analyzed statistically using the unpaired *t* test. Following this, the interrelatedness of these factors using multivariate logistic regression models was demonstrated. Episodes of elbow pain in the past 12 months were assigned as the dependent variable. The independent variables comprised (1) the coach-related factors for the 58 head coaches of the 58 teams in this study (these 58 coaches were taken to represent the total of 123 coaches who participated in the study) and (2) the team variables for the teams that these 58 coaches were responsible for. Players who had experienced elbow pain before August 2010 were excluded. The results for the *t* test and the multivariate logistic regression models were considered significant if the *P* value was less than 0.05.

RESULTS

A total of 111 teams received the questionnaire, and 58 teams (123 baseball coaches aged 32-77 years, 48.0 ± 10.5 years and 654 players aged 6-12 years, all male, 11.3 ± 0.8 years) returned the questionnaire (collection rate, 52.3%). Data were statistically analyzed for those coaches and players who had filled out the

questionnaire completely, without any omissions. Thus, the data of 113 coaches (47.7 ± 10.4 years) and 339 players (11.4 ± 0.8 years) was analyzed.

In total, 45 of 113 coaches had correct knowledge of the pitch count recommendations (39.8%). Older coaches tended to have better knowledge of the limit, but this difference was not significant ($P = 0.07$) (Table 2). Among the 113 coaches, only 32 coaches reported that they routinely complied with the limit (28.3%). The unpaired *t* test result showed that older coaches were significantly more likely to comply ($P = 0.04$) (Table 3). No significant relationship was found between years spent coaching baseball and knowing about or compliance with the recommendations, but those coaches who had been coaching longer tended to have higher rates of correct knowledge and compliance with the limit.

Among 339 players, 54 had experienced episodes of elbow pain in the past 12 months (15.9%, 11.4 ± 0.7 years). Based on multivariate analysis, 2 factors were significantly correlated: player height and coaches' opinions on the number of games per year (Table 4). The odds ratios (95% confidence interval) were 1.08 (1.01-1.15, $P = 0.02$) for height and 0.29 (0.11-0.75, $P = 0.01$) for coaches' opinions on the number of games per year. In short, the taller the player, the greater the incidence of elbow pain; further, when coaches believed that there were many games in a season, fewer players were predisposed to elbow pain. However, a correlation between elbow pain and knowledge of and compliance with pitch count recommendations could not be established using the multivariable analysis.

DISCUSSION

This study demonstrated that the ratio of knowledge of recommendations was similar to levels in the United States but that compliance in Japan was lower. While there was no correlation between these coach-related factors and player elbow pain, coaches' opinions on the number of games played in a season was a significant factor. Thus, coaches may need to recognize that "overuse" includes the amount of training as well as pitch counts.

In this study, 39.8% of coaches surveyed had correct knowledge of the Japanese pitch count recommendations. This is similar to the 43% reported in the United States in 2012.¹ In the US study, knowledge of the limit was poor despite significant efforts to educate coaches regarding youth baseball pitching injuries.¹ This suggests the same problem

Table 3. Comparison of groups complying with and not complying with the pitch limit recommendations

	Complying, n = 32	Noncomplying, n = 81	P
Age of coaches, y	51.6 ± 13.4	46.1 ± 8.6	0.04*
No. of years spent coaching baseball	10.2 ± 11.2	8.0 ± 7.5	0.34

*P < 0.05.

Table 4. Coach- and team-related variables related to elbow pain among players^a

	With Pain, n = 54	Without Pain, n = 285	Odds Ratio (95% CI)	P
Age of players, y	11.4 ± 0.7	11.2 ± 1.0	1.09 (0.65-1.84)	0.74
Height, cm	144.2 ± 7.4	140.7 ± 7.3	1.08 (1.01-1.15)	0.02*
Weight, kg	35.3 ± 6.3	33.7 ± 6.1	0.98 (0.91-1.06)	0.62
Years played baseball	2.8 ± 1.3	2.7 ± 1.5	0.91 (0.71-1.17)	0.44
Age of coaches, y	51.7 ± 10.2	51.3 ± 10.2	1.02 (0.95-1.09)	0.64
No. of years spent coaching baseball	13.1 ± 10.3	11.9 ± 10.1	0.99 (0.92-1.06)	0.77
No. of years that coaches played baseball	11.8 ± 6.8	12.6 ± 8.1	1.01 (0.96-1.05)	0.83
No. of games per year				
≤ 50	19 (35.2)	102 (35.8)	1 [Reference]	
50 <	35 (64.8)	183 (64.2)	1.29 (0.58-2.88)	0.54
Opinion on the number of games				
Moderate	34 (63.0)	147 (51.6)	1 [Reference]	
Many	10 (18.5)	98 (34.4)	0.29 (0.11-0.75)	0.01**
Few	10 (18.5)	40 (14.0)	1.21 (0.47-3.11)	0.70
Training days per week	2.5 ± 0.8	2.5 ± 0.9	0.93 (0.61-1.42)	0.74
Presence of off-season	31 (57.4)	179 (62.8)	0.66 (0.34-1.28)	0.22
No. of coaches with knowledge of the recommendations	11 (20.4)	67 (23.5)	1.84 (0.51-6.66)	0.35
No. of coaches complying with the recommendations	6 (11.1)	44 (15.4)	0.31 (0.06-1.56)	0.16

CI, confidence interval.

^aMean ± standard deviation or n (%).

*P < 0.05. **P < 0.01.

is occurring in youth baseball in Japan. In Japan, there have been many education programs aimed at preventing throwing injuries. Annual medical checks have been held for secondary prevention in each prefecture, and handbooks on injuries have

been distributed.^{6,13} It is important to examine the knowledge issue at a global level. However, the results show that only 28.3% of the Japanese coaches surveyed complied with the pitch count recommendations, which is obviously lower than

the value of 73% that was seen in the United States. Thus, it appears that differences between baseball systems and customs at levels from the recreational to the professional have resulted in these differing compliance levels. For example, it is common for starting pitchers to be replaced after approximately 100 pitches in Major League Baseball, but this is not the case in Japan's professional baseball league.

The present study found no correlation between elbow pain and knowledge of and compliance with the pitch count recommendations; however, a coach's opinion on the number of games per year was the most significant risk factor for player elbow pain. If coaches regarded the number of games to be many, players were less predisposed to elbow pain. This may reflect a subconscious decision on the part of the coaches; if they feel that the players have played many games, they may subconsciously reduce the amount of training. Coaches should recognize that "overuse" includes the amount of training as well as pitch counts.

There are several limitations in this study. First, there may be poor reliability in the questionnaire, as was the case with the previously mentioned US-based study.¹ There may also be recall bias in players' memories of episodes of elbow pain. Also, the authors were unable to investigate the severity and location of the elbow pain. Another limitation is the difference in recommended pitch count limits between the United States and Japan. Consequently, the knowledge and compliance ratio cannot be compared directly.

CONCLUSION

In this study, levels of knowledge of pitch count recommendations were similar in Japan and the US. However, compliance with this limit was far lower in Japan.

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REFERENCES

1. Fazarale JJ, Magnussen RA, Pedroza AD, et al. Knowledge of and compliance with pitch count recommendations: a survey of youth baseball coaches. *Sports Health*. 2012;4(3):202-204.
2. Fleisig GS, Andrews JR. Prevention of elbow injuries in youth baseball pitchers. *Sports Health*. 2012;4(5):419-424.
3. Fleisig GS, Andrews JR, Cutter GR, et al. Risk of serious injury for young baseball pitchers: a 10-year prospective study. *Am J Sports Med*. 2011;39(2):253-257.
4. Fleisig GS, Weber A, Hassell N, et al. Prevention of elbow injuries in youth baseball pitchers. *Curr Sports Med Rep*. 2009;8(5):250-254.
5. Harada M, Takahara M, Mura N, et al. Risk factors for elbow injuries among young baseball players. *J Shoulder Elbow Surg*. 2010;19(4):502-507.
6. Harada M, Takahara M, Sasaki J, et al. Using sonography for the early detection of elbow injuries among young baseball players. *AJR Am J Roentgenol*. 2006;187(6):1436-1441.
7. Japan Softball Baseball Association. <http://jsbb.or.jp/outline/teams>. Accessed October 17, 2012.
8. Japanese Society of Clinical Sports Medicine. http://www.rinspo.jp/proposal_03-1.pdf. Accessed October 17, 2012.
9. Kerut EK, Kerut DG, Fleisig GS, et al. Prevention of arm injury in youth baseball pitchers. *J La State Med Soc*. 2008;160(2):95-98.
10. Lyman S, Fleisig GS, Waterbor JW, et al. Longitudinal study of elbow and shoulder pain in youth baseball pitchers. *Med Sci Sports Exerc*. 2001;33(11):1803-1810.
11. Olsen SJ 2nd, Fleisig GS, Dun S, et al. Risk factors for shoulder and elbow injuries in adolescent baseball pitchers. *Am J Sports Med*. 2006;34(6):905-912.
12. USA Baseball. http://web.usabaseball.com/news/article.jsp?ymd=20080618&content_id=33889&vkey=news_usab&gid=. Accessed October 17, 2012.
13. Yamamoto N, Itoi E, Minagawa H, et al. Why is the humeral retroversion of throwing athletes greater in dominant shoulders than in nondominant shoulders? *J Shoulder Elbow Surg*. 2006;15(5):571-575.