

# Pediatric Health Care Provider Awareness, Perceptions, and Utility of Sport Specialization Recommendations

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**Context:** Sport specialization, or focused participation in a single sport, is associated with an increased rate of overuse injury and burnout. Medical associations and sport organizations have published recommendations for sport specialization aimed at reducing its negative consequences. Health care providers (HCPs) are often identified as individuals who can educate athletes and parents about these important recommendations.

**Objective:** To compare knowledge, perceptions, awareness, confidence in knowledge, and use of sport specialization recommendations among HCPs who work with pediatric athletes.

**Design:** Cross-sectional study.

**Setting:** An online web-based survey was developed to assess HCPs' knowledge, perceptions, awareness, confidence in knowledge, and clinical use of sport specialization recommendations.

**Patients or Other Participants:** Participants were recruited from the research survey services of 4 professional organizations.

**Main Outcome Measure(s):** Dependent variables were responses for awareness, perceptions, confidence in knowledge, use, and barriers sections of the survey. Data were analyzed with descriptive statistics; comparisons among HCPs were made through  $\chi^2$  and Kruskal-Wallis tests.

**Results:** The survey was completed by 770 HCPs (completion rate = 95.1%). Respondents lacked awareness specific to recommendations surrounding the maximum number of sport participation months per year (39.5%), maximum hours per week (40.7%), and maximum number of teams on which youth athletes should participate concurrently (43.9%). Physicians were the most aware of medical organization recommendations generally (48%–68.8%) and confident in their knowledge (41.5%–75.1%). All HCPs were less aware and confident in their knowledge of sport organization recommendations, with no differences among HCPs. Physicians did not perceive many barriers to the use of the recommendations, whereas athletic trainers felt that patient (39.9%) and parent (45.3%) behaviors were the greatest barriers to usage.

**Conclusions:** Awareness, perceptions, and use of sport specialization recommendations varied by discipline, but most respondents believed they were associated with a decreased risk of injury. Future researchers should focus on improved education and implementation of recommendations across all roles.

**Key Words:** adolescents, sports sampling, overuse injury, knowledge translation, youth

## Key Points

- We found differences in the awareness, perceptions, confidence in knowledge, and use of sport specialization recommendations among medical disciplines, with physicians having the highest awareness and confidence.
- Respondents believed that sport specialization recommendations aided in decreasing the risk of injury.
- Participants tended to be most knowledgeable about their own medical organization's recommendations and were less knowledgeable about recommendations from other medical organizations as well as those published by sports organizations, highlighting a need for additional education.

Sport specialization has dramatically increased in youth sports in recent years. *Sport specialization* has been defined as focused participation in 1 sport to the exclusion of participation in other sports or extracurricular activities.<sup>1</sup> Historically, athletes have been considered *specialized* if they participate in a single sport for more than 8 months of the year, if they have ended

participation in other sports to focus on 1 sport, and if the focus on 1 sport limits participation in other activities.<sup>1</sup> Although focused training may be necessary to achieve high levels of performance in sports at some stages, early specialization (before adolescence) is controversial and considered both harmful and potentially unnecessary in youth sports.<sup>1</sup>

Early sport specialization is fraught with numerous medical and performance concerns, and its consequences are well documented in the literature. Several systematic reviews have identified that highly specialized athletes had higher rates of overuse injuries.<sup>2-4</sup> In addition to increased injuries, the authors<sup>5</sup> of a 2020 systematic review and meta-analysis of more than 1400 athletes concluded that sport specialists were at a higher risk of burnout than those who did not specialize. Despite a growing prevalence of early sport specialization in youth, a 2019 systematic review<sup>6</sup> established that elite athletes were more likely to specialize later in their teens than nonelite or semielite athletes, indicating that early specialization did not help athletes achieve higher levels of sport success.

In response to the hazards of early sport specialization, multiple recommendations exist.<sup>7-11</sup> These overarching guidelines typically suggest delaying specialization until mid to late adolescence and limiting excessive training volume in a single sport and include strategies to mitigate burnout and fatigue while promoting diversification and a holistic approach to activity.<sup>1,9-12</sup> Several recommendations were developed by medical organizations and are promoted by health care provider (HCP) members of those organizations, yet numerous sports organizations or governing bodies, including the International Olympic Committee (IOC),<sup>12</sup> Major League Baseball (MLB),<sup>13,14</sup> the National Basketball Association (NBA),<sup>7</sup> and USA Hockey,<sup>15</sup> have also provided recommendations to limit sport specialization through athlete development models and prevention of overuse injuries. *Athlete development models* are integrated frameworks that follow a progression from a foundation of fun and fitness to skill acquisition and talent development, with age-appropriate expectations and concepts as the athlete progresses through each stage of development.<sup>12,15</sup>

Although the effectiveness of these sport specialization and athlete development recommendations is contingent upon the support of HCPs, no previous researchers have evaluated HCPs' awareness, perceptions, confidence in knowledge, and use of safe sport recommendations. The purpose of our study was to assess the knowledge, perceptions, awareness, confidence in knowledge, and use of sport specialization and safe sport recommendations among HCPs who work with youth athletes. The findings will provide a foundation for next steps, including the improved application of sport specialization recommendations to create a safer and more productive sport environment for young athletes.

## METHODS

### Participants

Health care providers who regularly worked with pediatric patients were recruited from the research survey services of 4 professional organizations: the American Medical Society for Sports Medicine (AMSSM), the National Association of Pediatric Nurse Practitioners (NAPNAP), the National Athletic Trainers' Association (NATA), and the Pediatric Research in Sports Medicine Society (PRiSM). Three of the organizations are profession specific (AMSSM, NAPNAP, and NATA), whereas the PRiSM is a multidisciplinary organization whose members include physicians (PHYSs), physical therapists, athletic trainers (ATs), nurse practitioners (NPs), and physician assistants. The inclusion criteria were having worked as a

licensed HCP treating youth athletes (18 years old or younger) in the previous 12 months and being fluent in English. The study was approved by the Education Social/Behavioral Science Institutional Review Board at the University of Wisconsin-Madison.

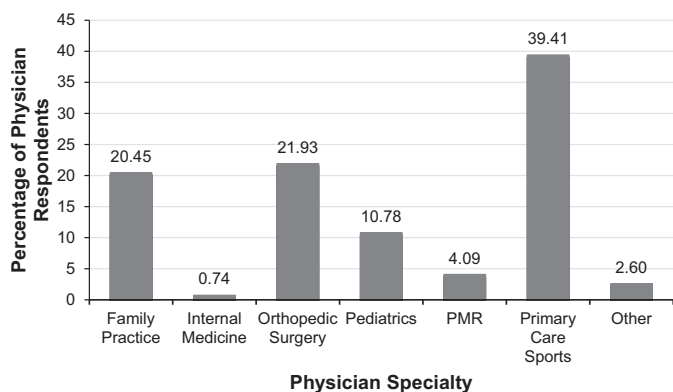
### Instrumentation

We developed a cross-sectional online survey to assess pediatric HCP awareness, perceptions, confidence in knowledge, and clinical use of sport specialization recommendations. The survey addressed (1) personal demographics; (2) professional demographics; (3) knowledge and perceptions of sports specialization; (4) awareness, confidence in knowledge, and use of recommendations; and (5) HCP program training and professional development background specific to sport specialization. The survey was created using questions from a previously validated survey designed to assess awareness of various sport specialization recommendations among youth sport parents<sup>16</sup> and coaches.<sup>17</sup> Questions consisted of dichotomous (*yes* or *no*) response items for the perceptions and awareness of recommendations and Likert-scale response items for confidence, use, and barriers. These recommendations included not participating in a single sport for more than 8 months in a year, not participating in organized sports for more hours per week than the child's age, and not participating on multiple teams of the same sport at the same time. Questions were added to the original survey instrument to evaluate the awareness of various professional medical association recommendations (American Academy of Pediatrics [AAP],<sup>10</sup> AMSSM,<sup>11</sup> American Orthopaedic Society for Sports Medicine [AOSSM],<sup>8</sup> NATA<sup>9</sup>) and sports governing body recommendations (IOC,<sup>12</sup> NBA,<sup>7</sup> MLB,<sup>14</sup> and USA Hockey<sup>15</sup>). Face and content validity were determined through expert feedback from members of the PRiSM Sports Specialization Research Interest Group, a multidisciplinary group of HCPs with expertise in research methodology and sport specialization content. For this study, only the personal and professional demographic sections, knowledge and perceptions, and additional survey items specific to awareness, confidence, use, and barriers of recommendations were analyzed.

### Procedures

We used the internal research survey services of the 3 professional organizations and 1 multidisciplinary organization focused on pediatric sports medicine research, previously identified, that distributed emails to their membership. The email contained consent language and an explanation of the survey and its purpose, along with a link to the online survey platform (Qualtrics). Clicking on the link signaled consent to participate in this study.

Survey links were sent between October 2019 and June 2020. Surveys were sent to the NATA list in fall 2019 and the PRiSM list in January 2020. A delay in recruiting from the AMSSM and NAPNAP email lists occurred until July 2020 due to the start of the COVID-19 pandemic and discussions among the research team to pause sending emails to the PHYS and NP groups. The survey was open for 4 weeks for each distribution



**Figure 1. Physician specialty areas. Abbreviation: PMR, physical medicine and rehabilitation.**

service, with an email reminder sent once 2 weeks after the initial distribution.

### Statistical Analysis

The independent variable was HCP group, which was self-identified through a survey question. Dependent variables were responses to the awareness, perceptions, confidence, use, and barriers sections of the survey. Data were analyzed with descriptive statistics, and comparisons between health care professions were made via  $\chi^2$  and Kruskal-Wallis tests with significance set at  $P < .05$  a priori. Post hoc analyses were completed through pairwise Mann-Whitney  $U$  tests with Bonferroni adjustments made for multiple comparisons. All analyses were conducted in SPSS (version 28; IBM Corp).

## RESULTS

### Access and Completion Rates

Initial emails were sent to 15 313 HCPs (AMSSM = 4118, NAPNAP = 5872, NATA = 5000, PRiSM = 323). The survey was accessed by 810 respondents (access rate = 5.2%) and completed by 770 HCPs (completion rate = 95.1%).

### Participants

The respondents consisted of 770 pediatric HCPs: 378 ATs, 123 NPs, and 269 PHYSs. On average, the HCPs had  $11.97 \pm 9.44$  years providing care to youth athletes (ATs =  $10.96 \pm 9.4$  years, NPs =  $14.8 \pm 10.22$  years, PHYSs =  $11.91 \pm 8.99$  years) and had completed their training in the year  $2007 \pm 10$  years (ATs =  $2007 \pm 9.5$  years, NPs =  $2002 \pm 11.97$  years, PHYSs =  $2008 \pm 9.1$  years). The PHYS specialty distribution is presented in Figure 1. The NP respondents were primarily working in pediatrics (89.4%; 110 of 123), with fewer working in family medicine (4.1%; 5 of 123) or other specialty areas (6.5%; 8 of 123). Table 1 provides practice settings by profession.

### Awareness

Respondents noted differences in awareness specific to common suggestions contained within the formal recommendations. Specifically, a greater percentage of PHYSs

**Table 1. Respondent Employment Settings by Profession**

Setting	% (No.)		
	Athletic Trainers	Nurse Practitioners	Physicians
Emergency department	0.8 (3)	4.1 (5)	0.7 (2)
Primary care	1.1 (4)	70.7 (87)	19 (51)
School based	81.5 (308)	7.3 (9)	1.9 (5)
Specialty clinic	16.4 (62)	14.6 (18)	77.7 (209)
Urgent care	0.3 (1)	3.3 (4)	0.7 (2)

(78.8%) were aware of recommendations for the maximum number of months in a year that athletes should participate, compared with 56.1% of ATs and 17.9% of NPs ( $P < .001$ ). With respect to the maximum number of hours in a week that youth should participate, more ATs (55.8%) and PHYSs (54.8%) were aware compared with NPs (19.5%,  $P < .001$ ). Similarly, ATs (53.3%) and PHYSs (69.4%) were more aware of the recommendations about the number of teams on which a youth athlete should participate at 1 time compared with NPs (24.4%,  $P < .001$ ). Responses regarding the maximum number of months that it is appropriate for a youth athlete to participate in a single organized competitive sport varied among disciplines, with PHYSs noting a higher number of months ( $8.22 \pm 1.68$ ; range = 3–12) compared with ATs ( $6.66 \pm 2.25$ ; range = 2–11) or NPs ( $6.85 \pm 2.51$ ; range = 2–12).

The responses for each profession regarding general awareness of recommendations published by various professional or sports organizations are provided in Table 2. Differences ( $P < .001$ ) regarding awareness were seen among professions for all recommendations except for those from USA Hockey ( $P = .232$ ). Post hoc analyses identified that PHYSs were more likely to be aware of recommendations from the AAP, AMSSM, AOSSM, IOC, MLB, and NBA. Athletic trainers had greater awareness of the NATA recommendations compared with NPs and PHYSs. Generally, all respondents had greater awareness of recommendations from the 4 medical organizations (AAP, AMSSM, AOSSM, NATA) and less awareness of the recommendations from the 4 sports organizations (IOC, MLB, NBA, USA Hockey).

### Perceptions

In regard to perceptions about sport participation and sport specialization, respondents differed on several items (Table 3). Close to one-quarter of ATs and PHYSs reported being extremely concerned about the risk of injury in youth sports, compared with only 9% of NPs (Figure 2). Only 8.2% of ATs felt it was appropriate for a youth to participate on multiple teams of the same sport at the same time, compared with 21.9% of NPs and 19.3% of PHYSs ( $P < .001$ ). In contrast, a higher percentage of PHYSs (75.5%,  $P < .001$ ) felt it was appropriate for a youth to participate on multiple teams of different sports at the same time, compared with only 65.6% of NPs and 43.6% of ATs. The age at which respondents perceived it best for a youth athlete to begin specializing in a single sport was also different among provider groups: ATs =  $16.12 \pm 1.62$  years (range = 8–18 years), NPs =  $13.56 \pm 2.15$  years (range = 6–18 years), and PHYSs =  $15.06 \pm 1.65$  years (range = 8–18 years). Athletic trainers ( $18.0\% \pm 18.7\%$ ) and NPs ( $15.5\% \pm$

**Table 2. Health Care Providers' Awareness of Each Organization's Sport Specialization Recommendations**

Organization	%		P Value	Post Hoc Results
	Yes	No		
American Academy of Pediatrics				
ATs	35.4	63.0	<.001	PHYSs, NPs > ATs
NPs	63.4	35.8		
PHYSs	68.8	29.0		
American Medical Society for Sports Medicine				
ATs	38.4	59.5	<.001	PHYSs > ATs, NPs; ATs > NPs
NPs	14.6	81.3		
PHYSs	79.2	19.3		
American Orthopaedic Society for Sports Medicine				
ATs	39.4	57.9	<.001	PHYSs, ATs > NPs
NPs	13.8	82.1		
PHYSs	48.0	49.1		
National Athletic Trainers' Association				
ATs	84.1	15.6	<.001	ATs > NPs, PHYSs; PHYSs > NPs
NPs	12.2	83.7		
PHYSs	34.9	61.0		
International Olympic Committee				
ATs	9.5	86.8	<.001	PHYSs > ATs, NPs
NPs	92.7	16.7		
PHYSs	24.2	70.3		
Major League Baseball				
ATs	25.1	71.0	<.001	PHYSs > ATs, NPs; ATs > NPs
NPs	10.6	86.2		
PHYSs	37.9	58.7		
National Basketball Association				
ATs	7.9	88.4	<.001	PHYSs > NPs
NPs	3.3	92.7		
PHYSs	13.8	79.9		
USA Hockey				
ATs	13.0	83.3	.232	
NPs	7.3	86.6		
PHYSs	14.5	79.9		

Abbreviations: AT, athletic trainer; NP, nurse practitioner; PHYS, physician.

13.5%) perceived that a higher percentage of youth athletes received college athletic scholarships compared with PHYSs (8.4% ± 9.7%,  $P < .001$ ).

### Confidence in Knowledge

Respondents' confidence in their knowledge of organizational recommendations is shown in Table 4. Differences among professions were noted for confidence in knowledge of the 4 medical organization recommendations ( $P < .05$ ),

whereas no differences among professions existed for the 4 sports organization recommendations. Specifically, one-fourth to one-half of all respondents were *not confident at all* in their knowledge regarding the 4 sports organization recommendations. Physicians had greater confidence in their knowledge than at least 1 other profession regarding the AAP, AMSSM, and AOSSM recommendations. Athletic trainers had greater confidence in their knowledge regarding the NATA recommendations compared with NPs and PHYSs. Nurse practitioners were the least confident in their knowledge of the recommendations;

**Table 3. Health Care Providers' Perceptions of Sport Specialization Items**

Item	Perception, %				
	Not at All	A Little	Somewhat	Quite a Bit	A Great Deal
How much does specializing in a single sport increase the chances of a youth athlete getting an injury from overuse?					
ATs	0.26	1.06	6.35	49.21	43.12
NPs	0.81	0.81	17.89	48.21	31.71
PHYSs	0.0	1.04	11.04	47.21	39.22
How much does playing a wide variety of sports improve a youth athlete's overall athletic ability?					
ATs	0.26	1.06	3.97	32.80	61.90
NPs	0.0	2.46	22.13	50.82	24.59
PHYSs	0.37	0.74	7.06	34.57	57.25
How much of a problem is early sport specialization in youth sports?					
ATs	0.53	1.06	10.05	45.77	42.59
NPs	0.81	2.44	21.95	47.15	27.64
PHYSs	0.37	1.86	10.04	47.21	40.52

Abbreviations: AT, athletic trainer; NP, nurse practitioner; PHYS, physician.



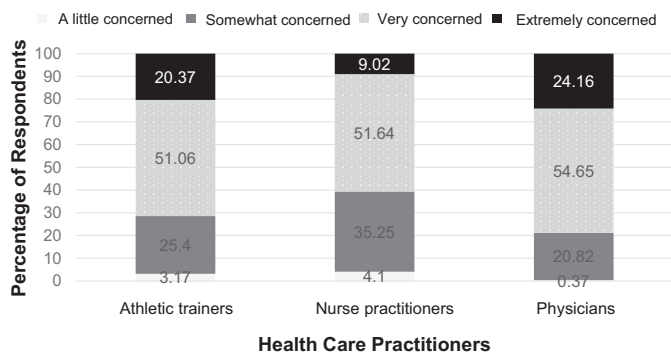


Figure 2. Concerns regarding injury in sport.

at least half stated they were *not confident at all* or *minimally confident* in their knowledge of each recommendation.

### Use of Recommendations

The degree to which each recommendation was used by respondents across the different professions to counsel patients regarding overuse injuries is shown in Table 5. Differences among professions ( $P < .05$ ) were present for use of the AAP, AMSSM, and NATA recommendations, with ATs using the NATA recommendations more than all other professions but using the AAP and AMSSM

recommendations less than NPs and PHYSs, respectively. No differences in use of the sports organization recommendations were found among professions.

### Barriers

Respondents' perceptions of barriers that limit the use of recommendations in clinical practice are listed in Table 6. Differences were reported among professions for all barriers except *do not believe recommendations will reduce risk*. Post hoc analyses indicated that ATs and NPs tended to perceive that all other barriers would have a greater effect in limiting their use of the recommendations compared with PHYSs.

### DISCUSSION

Our primary findings suggest that HCPs generally agreed that early sport specialization places youth athletes at a high risk for injury and is a significant problem; awareness of medical recommendations regarding these topics was low. Also, HCPs demonstrated greater awareness, confidence in knowledge, and use of recommendations from medical organizations and less awareness of recommendations from sports organizations. Specifically, HCPs tended to have better awareness of the recommendations from their own medical organization, with nearly 80% of PHYSs aware of the AMSSM recommendations and 84% of ATs

Table 4. Health Care Providers' Confidence in Their Knowledge Regarding Sport Specialization Recommendations, %

Organization	Level of Confidence, %					P Value	Post Hoc Results
	Not at All	Minimal	Moderate	Extreme	Not Aware		
American Academy of Pediatrics							
ATs	28.6	21.4	20.1	6.3	23.0	<.001	PHYSs > ATs, NPs
NPs	19.5	23.6	37.4	9.8	8.9		
PHYSs	9.7	14.9	42.0	21.2	11.2		
American Medical Society for Sports Medicine							
ATs	27.8	20.4	22.2	8.5	20.1	<.001	PHYSs > ATs, NPs
NPs	47.2	9.8	11.4	0.8	26.8		
PHYSs	9.7	8.9	42.0	33.1	5.2		
American Orthopaedic Society for Sports Medicine							
ATs	28.6	18.5	21.7	10.1	19.8	.43	PHYSs > NPs
NPs	50.4	6.5	8.9	0.8	30.1		
PHYSs	21.9	17.5	29.0	11.5	18.6		
National Athletic Trainers' Association							
ATs	5.6	10.6	37.0	41.0	5.0	<.001	ATs > NPs, PHYSs
NPs	52.8	5.7	5.7	3.3	29.3		
PHYSs	28.3	16.7	21.6	7.1	24.2		
International Olympic Committee							
ATs	39.7	17.2	8.5	2.1	31.2	.372	
NPs	53.7	7.3	0.0	0.0	35.8		
PHYSs	34.6	17.1	14.5	3.7	27.9		
Major League Baseball							
ATs	34.9	19.6	13.0	5.0	26.5	.061	
NPs	54.5	5.7	4.9	0.8	31.7		
PHYSs	29.4	20.4	18.2	8.2	22.3		
National Basketball Association							
ATs	43.7	15.6	5.0	1.6	32.5	.632	
NPs	52.8	5.7	0.0	0.8	35.0		
PHYSs	40.5	16.4	8.6	1.9	29.7		
USA Hockey							
ATs	41.0	16.1	7.7	2.6	30.7	.616	
NPs	49.6	7.3	3.3	0.8	33.3		
PHYSs	41.6	14.1	7.8	2.2	32.0		

Abbreviations: AT, athletic trainer; NP, nurse practitioner; PHYS, physician.

**Table 5. Health Care Providers' Use of Each Organization's Sport Specialization Recommendations**

Organization	Use, %						P Value	Post Hoc Results
	Never	Sometimes	About Half the Time	Most of the Time	Always	Not Aware		
American Academy of Pediatrics								
ATs	37.0	23.0	2.4	8.2	3.2	25.4	.002	NPs > ATs
NPs	18.7	22.8	8.1	17.1	17.1	15.4		
PHYSs	18.6	24.9	8.9	21.6	11.9	12.3		
American Medical Society for Sports Medicine								
ATs	33.1	24.9	3.2	9.5	4.0	24.3	.004	PHYSs > ATs
NPs	40.7	6.5	3.3	4.9	3.3	39.0		
PHYSs	13.8	18.6	10.8	28.3	19.3	7.8		
American Orthopaedic Society for Sports Medicine								
ATs	32.2	24.3	4.5	9.3	5.0	23.3	.202	
NPs	46.3	3.3	1.6	4.1	2.4	39.8		
PHYSs	29.0	21.9	5.6	14.1	3.3	23.0		
National Athletic Trainers' Association								
ATs	8.5	22.2	9.8	26.7	25.9	5.8	.008	ATs > PHYSs
NPs	48.0	3.3	0.8	4.1	1.6	39.8		
PHYSs	37.2	14.5	5.2	8.2	1.1	30.1		
International Olympic Committee								
ATs	47.1	10.8	1.6	2.1	1.9	34.9	.185	
NPs	47.2	1.6	1.6	0.0	0.0	46.3		
PHYSs	42.0	13.8	3.7	4.5	0.0	32.7		
Major League Baseball								
ATs	42.9	14.3	2.6	4.0	4.2	30.4	.174	
NPs	47.2	3.3	0.8	1.6	0.0	43.1		
PHYSs	32.7	15.6	4.5	11.9	5.6	26.8		
National Basketball Association								
ATs	49.7	10.1	0.3	0.8	1.6	36.2	.294	
NPs	47.2	2.4	0.0	0.0	0.0	46.3		
PHYSs	45.0	8.6	2.2	2.2	1.5	36.4		
USA Hockey								
ATs	48.9	10.8	1.1	0.5	1.9	34.9	.405	
NPs	44.7	3.3	0.8	2.4	0.0	43.9		
PHYSs	44.6	9.7	2.6	1.1	1.5	36.8		

Abbreviations: AT, athletic trainer; NP, nurse practitioner; PHYS, physician.

aware of the NATA recommendations regarding sport specialization.

**Awareness**

In regard to awareness of general recommendations, higher percentages of PHYS and AT participants commented that they were aware of key recommendations regarding participation volume and duration. This may not be surprising, given the efforts that the NATA and AMSSM have made in recent years with respect to educational campaigns related to sport specialization and overuse injury. In addition to public-focused infographics and social media campaigns,<sup>18</sup> conferences<sup>19</sup> and special journal issues<sup>20,21</sup> on this topic have been directed at researchers and clinicians. Interestingly, with respect to the suggested number of months of participation in a single sport, both ATs and NPs were more conservative in their responses, noting 6.66 and 6.85 months, respectively, whereas most organizations recommended no more than 8 months of the year.

Related to published recommendation documents, HCPs had greater awareness of recommendations from their own or like organizations, with PHYSs most aware of the AMSSM, ATs most aware of the NATA, and NPs most aware of the AAP recommendations. Although this may not be surprising, as HCPs are likely more in tune with the literature from their respective organizations or receive special

communications from their own organizations when important statements are published, it does highlight the need for improved communication among organizations and inter-professional collaboration. As we are the first to evaluate awareness of these statements, further study is needed to refine our understanding of this awareness and to determine the best methods for improving it. Interestingly, fewer than 50% of all HCPs were aware of the MLB recommendations, fewer than 25% were aware of the IOC recommendations, and fewer than 17% were aware of the NBA and USA Hockey recommendations. This could be due to those organizations promoting their recommendations to athletes and parents or the HCPs surveyed not caring for a high percentage of patients engaged in those particular sports. Another explanation for low levels of awareness is limited publication in medical journals, with these recommendations often being published in 1 journal with little to no promotion of the recommendations to a wider variety of health professions that may be involved in the care of young athletes. Developing robust dissemination plans to share important recommendations with numerous medical organizations should be a consideration of those organizations developing recommendations and guidelines. However, it is interesting to note the lower level of awareness of the MLB recommendations, as a greater number of baseball publications linked pitch volume to injury among youth<sup>22-24</sup> and pitch count limits were some of the first recommendations

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**Table 6. Health Care Providers' Perceptions of Barriers to Using Each Organization's Sport Specialization Recommendations**

Barrier	Perception, %					P Value	Post Hoc Results
	Not at All	A Little	Somewhat	Quite a Bit	A Great Deal		
<b>Awareness</b>							
ATs	35.2	18	22.2	12.7	11.4	<.001	NPs > ATs, PHYS; ATs > PHYSs
NPs	19.5	19.5	22.8	15.4	21.1		
PHYSs	55.8	16	16.7	5.6	4.8		
<b>Unsure which</b>							
ATs	33.3	23.8	27.8	9.3	4.5	<.001	NPs > PHYSs, ATs; ATs > PHYSs
NPs	13	22.8	30.9	14.6	16.3		
PHYSs	47.2	26.4	17.1	5.9	1.9		
<b>Parent behavior</b>							
ATs	11.4	15.1	27.8	29.4	15.9	<.001	ATs > NPs, PHYSs; NPs > PHYSs
NPs	21.1	25.2	22	23.6	6.5		
PHYSs	28.3	29.4	27.5	10.8	2.2		
<b>Patient behavior</b>							
ATs	9.8	18.8	31	23.5	16.4	<.001	ATs > NPs, PHYSs; NPs > PHYSs
NPs	17.1	24.4	24.4	26.8	5.7		
PHYSs	28.6	28.3	26.8	11.9	2.2		
<b>No risk reduction</b>							
ATs	73.3	14.8	8.5	2.4	0.3	.391	
NPs	69.9	18.7	4.9	2.4	1.6		
PHYSs	75.1	18.6	3.3	0.7	0.4		
<b>Unsure if it would facilitate change in parent or patient</b>							
ATs	16.1	31.2	29.9	16.4	5.8	<.001	ATs, NPs > PHYSs
NPs	14.6	35	25.2	17.9	4.9		
PHYSs	29.4	33.5	24.5	8.2	2.6		

Abbreviations: AT, athletic trainer; NP, nurse practitioner; PHYS, physician.

put into practice among youth sports leagues. Regardless, this finding is similar to the results of a recent investigation<sup>25</sup> of youth baseball caregivers in which 83% of respondents were unaware of existing safe pitch guidelines and just over half noted they did not monitor their child's pitch count. Similarly, Bell et al<sup>16</sup> observed that more than 80% of parents of youth athletes were not aware of safe sports recommendations related to the volume of participation. Thus, although awareness of the MLB recommendations in HCPs was better than in parents, improvement in HCP education about all sport specialization recommendations is essential.

**Perceptions**

Across all 3 professions, perceptions of sport specialization's potential negative consequences were higher than has been reported in parents,<sup>16,26</sup> athletes,<sup>26</sup> and coaches.<sup>17</sup> Specifically, nearly one-quarter of ATs and PHYSs were extremely concerned about the risk of injury in youth sports, whereas fewer than 7% of parents,<sup>16,26</sup> 3.7% of athletes,<sup>26</sup> and 11.1% of coaches were extremely concerned.<sup>17</sup> With respect to participating on multiple teams of the same sport concurrently, fewer than 10% of ATs felt it was appropriate, whereas around 20% of NPs and PHYSs felt it was appropriate, similar to percentages reported for parents<sup>16</sup> and coaches.<sup>17</sup> In contrast, a more consistent response was evident regarding participating in 2 different sports concurrently, with approximately 60% of parents<sup>16</sup> and coaches<sup>17</sup> indicating that such behavior would be appropriate and an even greater percentage of ATs and PHYSs concurring. Although greater concerns and more conservative perceptions among HCPs should not be surprising given the role of medical providers in youth sports safety, this does highlight areas for future educational efforts regarding sport specialization recommendations.

**Confidence in Knowledge**

In regard to confidence in their knowledge of the recommendations, PHYSs tended to be the most confident regarding the AAP, AMSSM, and AOSSM recommendations, with ATs being most confident in their knowledge of the NATA recommendations. The NPs were the least confident across all medical recommendations; this perhaps is related to most working in a primary care setting, where they may not be counseling as many young athletes regarding over-use injuries and causes, such as sport specialization. Additionally, NPs did not have a specialty-specific sports medicine organization with specialization recommendations, and this may have contributed to their lower confidence level. Interestingly, one-third to one-half of all respondents were not confident in their knowledge of the sports organization recommendations, suggesting an area for improved professional development across all HCPs.

**Use of Recommendations**

A high percentage of all HCPs did not use the recommendations in their practice. Those who did tended to use the recommendations from their own organizations. For example, nearly 50% of ATs noted that they used the NATA recommendations *most of the time* or *always* and nearly 50% of PHYSs conveyed that they used the AMSSM recommendations *most of the time* or *always*. In contrast, recommendations from the sports organizations were never used by 25% to 50% of respondents. When comparing these results with HCPs' use of other recommendations, we found that use of the sports medicine organization recommendations did appear to be better than the use of recommended concussion tools, as measured in the DocStyles survey<sup>27</sup> of family PHYSs, internists,

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pediatricians, and NPs. In that study,<sup>27</sup> almost half reported that they *seldom* or *never* used screening or assessment tools recommended for pediatric traumatic brain injury (24.6% and 22.0%, respectively). The authors described an ongoing need to improve the awareness, dissemination, and implementation of concussion assessment tools to better empower HCPs to use the recommended tools routinely in practice.<sup>27</sup>

## Barriers

When investigating the use of any health care recommendation, it is important to understand the barriers to use. In our research, all HCPs disagreed with the statement that “Sport specialization recommendations do not reduce the risk of injury,” highlighting the value of these recommendations among all HCP groups as a means of risk reduction. The other acknowledged barriers differed among HCP groups, with NPs citing awareness as a key barrier and ATs attributing parent and patient behavior (ie, lack of compliance) as the primary barrier. Thus, for NPs, the first step to overcoming the barrier to use of the recommendations is education. Curiously, PHYSs did not recognize many of the response options as barriers, perhaps because of their confidence that patients and parents may listen to the suggestions provided. However, although PHYSs did not indicate significant barriers in using the sport specialization recommendations, only their use of the AMSSM recommendations was higher than that of other HCPs. Identifying barriers specific to individual professions or settings may guide further efforts to improve the access and confidence of all HCPs and, in turn, improve the use of the established recommendations. Furthermore, when an organization publishes new or updated guidelines, concerted efforts should be targeted toward dissemination strategies that include other professional organizations in order to better inform HCPs across disciplines. The promotion of recommendations across professions may serve as a catalyst for increased knowledge among all HCPs and enhance inter-professional collaboration and practice for the benefit of patients.

## Limitations

Our work was not without limitations. Selection bias in the respondents may have been a factor, as we sent the survey through professional organizations and only members of those organizations were eligible to respond. Moreover, the access rate was low, perhaps contributing to a response bias toward HCPs interested in this topic. Repeating this study to evaluate results among a general pediatrician group would help to further elucidate the awareness, confidence in knowledge, and use of sport specialization recommendations, including those from medical and governing body organizations not included in our survey. We also relied on participants’ reports of their awareness of the recommendations without requiring them to correctly describe the elements of each recommendation.

## CONCLUSIONS

Health care provider awareness and use of sport specialization recommendations varied by discipline, but most believed they were associated with a decreased risk of

injury. Health care providers play an important role in counseling patients and parents regarding safe sport recommendations. Improving their knowledge and use of recommendations is important to mitigating potential injury in this population. Future researchers should focus on implementation of the recommendations across all medical disciplines.

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