

The Knowledge, Attitudes, and Beliefs of Pediatric Concussion Among USA Swim Coaches

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Abstract

Coaches play a key role in the concussion management team in recognizing and removing student-athletes from play, as they are on the frontline and often closest to the student-athletes. Youth and club sports are unique in that there are few states in the United States that require coaches to receive formal concussion education when compared to high school or collegiate levels. Though concussions occur less frequently in swimming, knowledge and understanding is nonetheless important. This study examines USA Swim Coaches' current knowledge, perceived knowledge, and confidence in knowledge of several topics related to sport-related concussion. USA Swimming coaches were surveyed through email. The survey consisted of 5 sections: knowledge, athletic trainer collaboration, established relationships with healthcare providers, academic adjustments, and demographics. Club swim coaches (n=547) accessed and completed at least one part of the survey. Most importantly we found that club swim coaches who had prior concussion education were more knowledgeable in various sport-related concussion topics which shows that the positive impact of concussion education should extend to youth club sports and require that all youth sport coaches receive concussion education. Additionally, club swim coaches with access to an athletic trainer had higher perceived knowledge and confidence in their knowledge, suggesting that access to an athletic trainer may be valuable in not only providing athletic training services, but also sharing concussion knowledge with coaches and others with whom they interact and communicate regularly. We have made several recommendations in order to assist coaches with proper management of sport-related concussion.

Introduction

It is estimated that between 1.1 to 1.9 million sport-and recreational-related concussions occur annually in the United States (1). In swimming, potential head strikes and concussions most commonly occur during an in water collision with another athlete, a collision with the wall, or during dryland and more commonly during practices than competition (2, 3). More emphasis is being placed on protecting student-athletes from further injury and harm that could occur by continuing to participate in sport while suffering from a concussion. Several best practice guidelines and national healthcare organization position statements include recommendations regarding physical rest, cognitive rest, and some include recommendations for academic

adjustments (4-7). However, these best practice guidelines are often left open for the healthcare providers to interpret since specific recommendations regarding time and type of required rest have not been provided (5-7).

Rather than being handled by a single individual, concussion management should involve a team approach to provide the highest quality of care (5, 7, 8). The concussion management team is responsible for the diagnosis, treatment, progression, and management of concussions, and should consist of individuals that encompass a: family team (e.g., student-athlete, parents, team members, and peers), medical team (e.g., concussion specialist, team physician, primary care physician, emergency room staff), school academic team (e.g., school counselors, school administrators, teachers), and school physical activity team (e.g., athletic trainer, school nurse, physical education teachers,) (5). Each member of the team has a valuable opinion, insight, and role in concussion management; good communication is key to the success of proper and effective concussion management (7, 9).

Coaches have an important role in concussion management, from recognizing signs of a concussion to supporting the student-athlete during recovery. Several state and national sport safety laws (10, 11) require coaches within the secondary school setting to receive formal concussion education, but year-round and travel youth teams may not be required to follow such rules. Therefore, knowledge translation among youth coaches may vary. A majority of youth and collegiate coaches reported that an athlete showing any signs or symptoms of a concussion should not be allowed to return to play and should be evaluated by a physician (12-14). This supports that coaches are able to better recognize and report athletes with sport-related concussion but there is a limit in the healthcare providers youth coaches recommend athletes see prior to return to activity. Symptoms easily recognized across youth coaches were headache, dizziness, confusion, loss of consciousness, and amnesia (13-15). Symptoms that were less likely to be recognized were those in the sleep and emotion symptom clusters (12, 15).

Youth and club sport teams are unique in that few state laws that require coaches to receive formal concussion education (16, 17). USA Swimming is one such unique organization in that it has a large number of participants, with well over 400,000 members and more than 2,800 teams across the United States (18). Though concussions occur less frequently in this population, knowledge and understanding of pediatric concussion is nonetheless important. Currently, there is limited knowledge regarding how USA Swimming club coaches manage concussions when there is no legislation that guides youth club sport teams. Therefore, the purpose of this study was to evaluate the knowledge, attitudes, and beliefs of USA Swim Coaches regarding concussion management of swim athletes following sport-related concussion.

Methods

Design and Participants

This study consisted of a cross-sectional survey research design. The survey entitled, *Club Swim Coaches' Beliefs, Attitudes, and Knowledge of Pediatric Athletes with Concussions* (BAKPAC-SWIM), was sent to 17,990 club swim coaches affiliated with USA Swimming via email. Email addresses were obtained from the USA Swimming administrative office for distribution.

Instrumentation

The BAKPAC-SWIM was modified from a previously validated survey (ie, BAKPAC-COACH) (9). While content, face validity, and comprehensibility were previously established for the BAKPAC-COACH, the BAKPAC-SWIM was revalidated and deemed a valid instrument by a panel of content experts including a concussion researcher, several primary-care sports medicine providers and athletic trainers with experience in swimming. Additionally, the BAKPAC-SWIM was reviewed by several administrative members of USA Swimming to ensure applicability to the population being surveyed.

The BAKPAC-SWIM consisted of several questions related to concussion knowledge, perceived importance, and attitudes and beliefs, which were separated into five sections: knowledge and importance, athletic trainer collaboration, established relationships with healthcare providers, academic adjustments, and demographics. Participants who identified that their club team had access to an athletic trainer were asked an additional subset of questions (i.e., the coach's role in collaboration and communication with an athletic trainer, frequency of communication, and means of communication). All participants were asked which healthcare providers their club team has established relationships with, as well as primary referral for a student-athlete with a concussion. The survey was distributed via Qualtrics (Qualtrics LLC, Provo, UT).

Procedures

The University Institutional Review Board approved this study as exempt research. Data collection occurred over a four-week period between May and June 2016. An initial email was sent at the beginning of the data collection period that included the purpose of the study, how long the survey took to complete, a request to complete the survey, and the survey due date. Two reminder emails were sent during the four-week period until the deadline. The survey took approximately 20 minutes to complete, and consent was implied based on voluntary decision to complete the survey.

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics software (version 22.0; IBM Corporation, Armonk, NY). Descriptive statistics were used to calculate overall perceived importance, knowledge, and confidence in knowledge. Objective knowledge was measured through various question types (e.g., multiple-choice, multiple-answer) related to several sport-relation concussion topics. For several of the objective knowledge questions, there was only one correct answer. Composite perceived knowledge and confidence scores were calculated by totaling all values and then averaging back to the Likert scale (total divided by 4). Mann Whitney *U* tests were used to assess group differences ($P < .05$). The independent variables were concussion education (prior education, no prior education) and swim club access to an athletic trainer (access, no access). The dependent variables were the participants' responses to the survey items.

Results

Of the convenience sample of 17,990 coaches, 547 club swim coaches accessed the survey and completed at least one part of the survey (survey access rate = 3.4%).

385 club swim coaches completed the survey in its entirety (survey completion rate = 70.4%). Participant demographics are shown in Table 1.

Objective Concussion Knowledge

Most participants correctly identified the part of the body injured during a concussion as the brain (422/444; 95.1%), while others identified the skull (22/444; 4.9%). Participants identified the primary symptoms of concussion as headache (379/444; 85.1%), nausea or vomiting (391/444; 87.8%), dizziness (369/444; 82.9%), blurred vision (364/444; 81.8%), balance problems (340/444; 76.4%), and confusion (375/444; 84.2%). Overall, participants were able to identify more general symptoms but fewer were aware of the later manifesting symptoms such as those in the emotional symptom, for instance irritability (179/444; 40.2%), sadness 104/444; 23.4%) or anxiousness (125/444; 28.0%); or sleep cluster such as trouble falling asleep (117/444; 26.29%) or drowsiness (235/444; 52.8%). Participants identified the possible consequences associated with return to play too soon after a concussion as brain damage, more likely to get another concussion and trouble in school.

Perceived Importance, Knowledge and Confidence in Knowledge

Overall, the majority of coaches perceived they were moderately knowledgeable in prevention of concussion, physical signs and symptoms, cognitive signs and symptoms, treatment and management, and return-to-play criteria, but only minimally knowledgeable in academic accommodations and return-to-learn criteria (Figure 1a). Coaches perceived themselves to be moderately to extremely confident in their knowledge of prevention of concussion, physical signs and symptoms, and cognitive signs and symptoms, treatment and management, and return-to-play criteria (Figure 1b). Coaches reported that it was extremely important to know how concussions can be prevented (417/444; 94.0%), steps to follow if an athlete has a concussion (429/442; 97.0%), and how an athlete sustains a concussion (419/444; 94.4%). Additionally, coaches reported it was extremely important for athletes to report symptoms to a medical professional (434/441; 98.4%), for the athlete to not participate in physical activity while experiencing signs and symptoms of a concussion (415/444; 93.5%), and for athletes to limit cognitive activity following a concussion (247/440; 56.1%).

Concussion Education

Nearly 63% (n=242/385) of coaches reported having prior concussion education. Coaches with prior education had significantly higher composite scores for importance (3.87/4.00±.19 vs 3.83/4.00±.19, $P=.032$), perceived knowledge (3.02/4.00±.57 vs 2.5/4.00±.56, $P<.001$), and perceived confidence in their knowledge (3.04/4.00±.58 vs 2.48/4.00±.55). Differences in importance were noted, specifically for removal from activity (3.93/4.00±.38 vs 3.85/4.00±.52, $P=.044$) and limiting cognitive activity (3.50/4.00±.69 vs 3.29/4.00±.87, $P=.038$). Both perceived knowledge and perceived confidence in knowledge was significantly greater among coaches with prior education across all topics of sport-related concussion (Table 2).

Athletic Trainer Access

Twenty-six percent (n=103) of coaches reported access to an AT, while 74% (n=293) did not. Coaches with AT access had significantly higher composite scores for

importance ($3.89 \pm .19$ vs $3.85 \pm .19$, $P=.027$), perceived knowledge ($3.00 \pm .58$ vs $2.82 \pm .60$, $P=.01$), and perceived confidence in their knowledge ($3.01 \pm .60$ vs $2.80 \pm .60$, $P=.005$). Differences in importance were only noted for limiting cognitive activity ($3.56 \pm .71$ vs $3.39 \pm .79$, $P=.038$). Perceived knowledge was greater among coaches with AT access for treatment/management ($3.07 \pm .72$ vs $2.88 \pm .73$, $P=.021$), academic accommodations ($2.63 \pm .91$ vs $2.35 \pm .93$, $P=.009$), return-to-learn ($2.54 \pm .91$ vs $2.27 \pm .93$, $P=.013$), and return-to-play ($3.05 \pm .83$ vs $2.80 \pm .87$, $P=.017$). Perceived confidence in knowledge was significantly greater among coaches with AT access for physical signs/symptoms ($3.37 \pm .61$ vs $3.18 \pm .61$, $P=.009$), cognitive signs/symptoms ($3.15 \pm .64$ vs $2.95 \pm .79$, $P=.031$), academic accommodations ($2.62 \pm .90$ vs $2.30 \pm .89$, $P=.002$), return-to-learn ($2.61 \pm .88$ vs $2.29 \pm .90$, $P=.003$), and return-to-play ($3.09 \pm .79$ vs $2.79 \pm .87$, $P=.004$).

Access to and Collaboration with Healthcare Providers

Just over one-quarter (26.5%, 100/378) of coaches felt that access to medical care for their club was limited. Of the coaches with perceived limited access to medical care, 54.8% (40/91) indicated physicians do not communicate detailed plans of care, 42.5% (31/91) felt it takes a long time to have the athlete scheduled with a physician, and 19.2% (14/91) work in a setting or geographical location where physician access is difficult. Twenty-six percent of coaches (103/396) indicated their club has access to an athletic trainer; 69.3% (70/101) reported they communicate with the athletic trainer, while 14.9% (15/101) communicate with an athletic trainer, but not through their club. 37.1% of coaches reported communicating as needed (26/70), while fewer reported communicating daily (15/70; 21.4%) or 2-3 times per week (15/70; 21.4%). Coaches reported established relationships with athletic trainers (83/412; 20.1%), family physicians (80/412; 19.4%), physical therapists (76/412; 18.4%), orthopedic specialists (57/412; 13.8%), and sports medicine physicians (51/412; 12.4%). However, 43% of coaches (176/412) reported their club does not have any established relationships with healthcare providers and 24.5% (101/412) were unsure whether the club has established relationships. When coaches were asked who they would refer athletes to with a suspected sport-related concussion, answers varied. For the primary referral, coaches reported they would send athletes to their primary care physician (208/383, 54.3%), an athletic trainer (64/383, 16.7%), or leave it to the parents to decide (58/383, 15.1%). The primary and secondary referral matched closely, with an increase in referral to the emergency department or urgent care (33/258, 12.8%). Coaches preferred referral for their third choice included team physicians, concussion specialist, and orthopedic specialists, and other sports medicine physicians (43/183, 23.5%).

Discussion

Club swim coaches were able to identify the most common signs and symptoms of concussion including headache, nausea/vomiting, dizziness, blurred vision, balance problems, and confusion. Similar to the study by Chrisman et al (12) and Valovich McLeod et al (15), coaches were less likely to identify symptoms in the sleep and emotion symptom clusters. Club swim coaches demonstrated higher perceived knowledge and perceived confidence in knowledge in identifying prevention of concussion, physical signs and symptoms, cognitive signs and symptoms, treatment and management and return-to-play criteria. Coaches had both lower perceived knowledge and perceived confidence in knowledge in academic accommodations and return-to-

learn criteria. Coaches reported it was extremely important to have knowledge of how concussions occur, how to prevent concussion, and what to do when they suspect a student-athlete has a concussion. Almost all coaches agreed that participation of physical activity should be limited when the student-athlete is experiencing symptoms of a concussion but just over half agreed that there should be limitations in cognitive activity too. The lack of knowledge and lack of perceived knowledge in this area shows it is critical to provide more information for coaches on return-to-learn and cognitive rest. These responses are similar to the responses from high school teachers, coaches, and administrators (19-21).

Coaches who had prior concussion education were more knowledgeable and more confident in their knowledge in regard to identifying concussion symptoms, treatment/management, academic accommodations, return-to-learn and return-to-play. This supported the same findings of previous studies on coach's knowledge (12-15, 17, 22). Specifically, coaches with prior education were more knowledgeable with removal from activity and limiting cognitive activity. Previous studies (12-14) have shown that coaches held athletes from participation until they were evaluated by a physician when they showed signs and symptoms of concussion. The positive impact of concussion education should extend to youth club sports and require that all youth sport coaches receive concussion education. Areas for improving education include return-to-learn and cognitive rest.

Between 2009-2014, 44 of the 50 states in the United States implemented one or more youth sport traumatic brain injury laws (16), most of which require immediate removal from play for 24 hours if an athlete is suspected to have a concussion, and for the athlete to be evaluated by a healthcare professional before returning to play. Of the 44 states, only 25 required secondary school coaches to receive concussion education (16). For example, in 2009 Washington State passed the Zackery Lystedt Law which requires coaches, parents and youth athletes to receive concussion education, and requires that athletes are removed from play and evaluated by a trained medical professional if a concussion is suspected (17). While some states require concussion education, modalities of education vary between written, video, in-person, PowerPoint, or test. Eighty-five percent of coaches surveyed in Washington State reported the most common modality for education was video, followed by in-person lecture (12).

Access to Athletic Trainers and Healthcare Provider Collaboration

Collaboration with healthcare providers in club swimming is limited. Approximately one quarter reported having access to an AT, and just over half of coaches communicate a detailed plan of care with a physician. Almost half of coaches reported not having any access to healthcare providers. Those with established relationships with athletic trainers were more knowledgeable regarding treatment/management, academic accommodations, return-to-learn and return-to-play. Those with access to a healthcare provider reported having relationships with athletic trainers, family physicians, physical therapists, orthopedic specialists, and sports medicine physicians. Similar to previous studies (12-14), coaches recommended athletes to be evaluated by a physician when suspected of having a concussion. In our study there was a limit in the healthcare providers youth coaches recommend athletes see prior to return to activity. The majority of coaches said they would refer an athlete

to their primary care physician or leave it up to the parent to decide where to take the athlete. Second most common referrals were to an athletic trainer. As coaches are often the point person in directing parents to qualified healthcare professionals. Depending on the state, qualified healthcare professionals that can diagnose and manage a concussion can vary but typically includes athletic trainers, physicians, and physician assistants. Additionally, USA Swimming has a Concussion Information Sheet (23) that can be given to parents which provides information regarding what a concussion is and what should be done to safely return to the pool.

Our results show that the relationship between an athletic trainer and the club swim coach is key in improving knowledge of various topics of sport-related concussion. Previous studies at the high school level have showed that the athletic trainer and coach relationship is key in improving knowledge and beliefs surrounding sport-related concussion. Therefore, athletic trainer collaboration with youth sports teams is important to ensure safety and increased knowledge for youth sport coaches. Coaches and youth sports teams should establish relationships with local athletic trainers and sports medicine physicians, in the event of a sport-related concussion that individual can provide guidance for care and referral of student-athletes.

Limitations and Future Directions

This study had some limitations. The BAKPAC-SWIM was sent to all registered USA Swimming coaches via email, only a small percentage accessed and completed the survey, therefore these findings may not be representative of the population. Additionally, the concussion rate in swimming is much lower than that of other youth sports. Swimming coaches may not be exposed to sport-related concussions as often as other youth sports. Therefore, future studies should expand to other youth sports to include sports with higher concussion rates.

Implications for Practice

Coaches' role in the concussion management team is educating, recognizing, and reporting sport-related concussion. More than half of coaches who received formal concussion education believed it was their role to educate their athletes about sport-related concussions (24). Collegiate athletes reported wanting to receive education from their coach. This role is perceived by athletes as important because it shows that the coaches care about their overall health and well-being. Coaches who are more knowledgeable and support concussion safety are perceived to promote concussion safety (25). Areas of improvement in education include emphasis on cognitive rest and academic accommodations. Athletic trainers serve an important role, beyond their role as a healthcare provider in communicating between members of the concussion management team and providing coaches with the information they need to help student-athletes through the recovery process from sport-related concussion (5, 26, 27).

Conclusion

Coaches are key in recognizing and removing student-athletes from play as they are on the frontline, often closest to the injury and the student-athlete. Education has shown to improve attitude, perceived knowledge, and perceived confidence in knowledge. Furthermore, access to athletic trainers are key in providing coaches with

the tools they need to help a student-athlete through the recovery process. Formal concussion education can help provide coaches important information to recognize, support, and understand the recovery process.

Table 1: Participant Demographics

Demographic Information	n	%
Coach age in years	43± 12.6	
Coaching experience in years	14.6± 11.2	
Gender		
Male participants	207	53.8%
Female participants	178	46.2%
Education		
Participants with Bachelor's degree	202	52.9%
Participants with Master's degree	112	29.3%
Number of swimmers affiliated with swim club		
Coach at a club with less than 100 swimmers	145	37.6%
Coach at a club with 100-199 swimmers	140	36.3%
Location of swim club		
Suburban location	256	67%
Urban location	75	19.5%
Rural location	46	12.7%

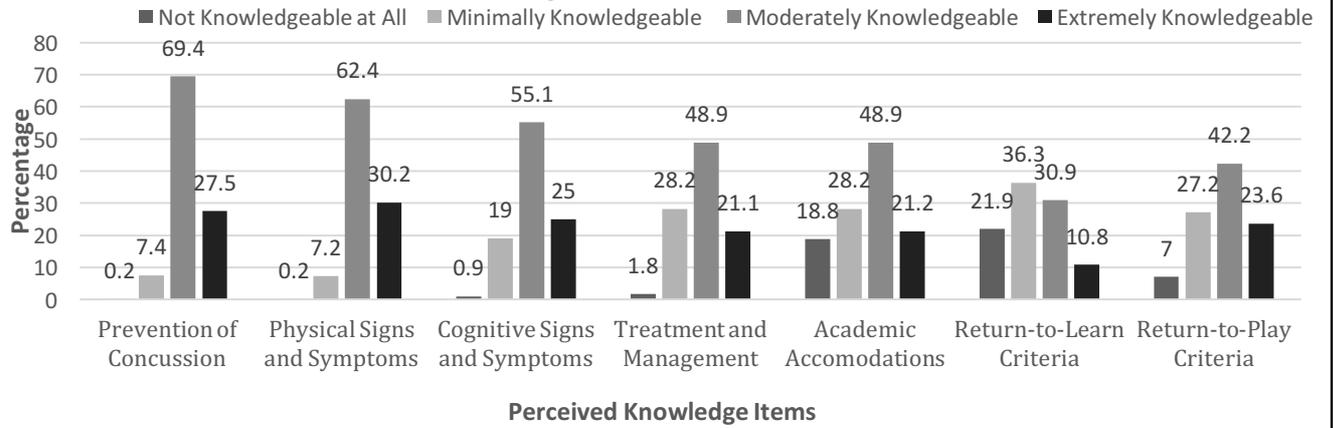
Table 2: Comparison of Perceived Knowledge of Confidence in Knowledge between Club Swim Coaches With and Without Prior Concussion Education

Topics of Sport-Related Concussion	Perceived Knowledge			Perceived Confidence in Knowledge		
	Coaches With Prior Education	Coaches Without Prior Education	P value	Coaches With Prior Education	Coaches Without Prior Education	P value
Prevention of Concussion	3.33±.55	2.98±.55	<i>P</i> <.001	2.98±.55	3.09±.64	<i>P</i> <.001
Physical Signs and Symptoms	3.40±.53	2.98±.58	<i>P</i> <.001	2.98±.58	2.97±.61	<i>P</i> <.001
Cognitive Signs and Symptoms	3.24±.64	2.73±.69	<i>P</i> <.001	2.73±.69	2.61±.74	<i>P</i> <.001
Treatment and Management	3.10±.70	2.57±.72	<i>P</i> <.001	2.57±.72	2.47±.73	<i>P</i> <.001
Academic Accommodations	2.56±.95	2.03±.84	<i>P</i> <.001	2.03±.84	1.99±.81	<i>P</i> <.001
Return-to-Learn Criteria	2.46±.94	1.94±.86	<i>P</i> <.001	1.94±.86	1.94±.80	<i>P</i> <.001
Return-to-Play Criteria	3.07±.82	2.44±.85	<i>P</i> <.001	2.44±.85	2.37±.82	<i>P</i> <.001

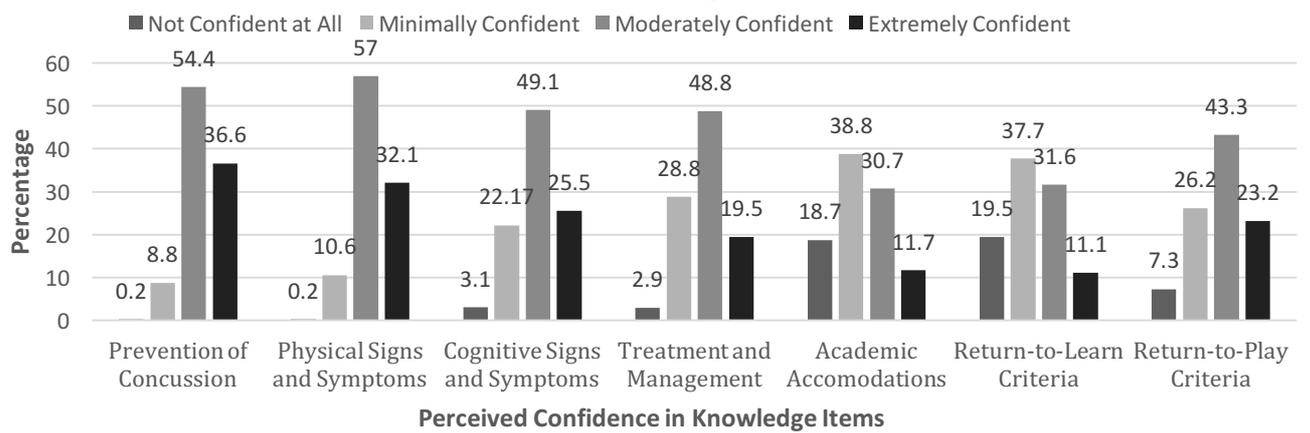
*Total value ranges 0.00- 4.00; Closer to 4.0 indicates higher knowledge and higher perceived knowledge

Figure 1. Club Swim Coaches' Perceived Knowledge and Confidence in Knowledge

a. Club Swim Coaches' Perceived Knowledge



b. Club Swim Coaches' Perceived Confidence in Knowledge



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