

Coaches' Education and Practices Regarding Overuse Injury in Youth Swimming

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Abstract

Background: *Overuse injury and joint pain are widespread among competitive swimmers, but no baseline overuse injury-related educational training exists for USA Swimming coaches.*

Methods: *A web-based survey was developed to identify American Swim Coaches' Association (ASCA) training (Levels 1-5), in-water and dryland swim practice content, and coaches' observations of reported joint pain among their swimmers. USA Swimming registered coaches 18 years or older were recruited via email over a 6-week period. Frequency data was calculated using Google Form and Microsoft Excel.*

Results: *Ninety-six coaches completed the survey, of which 44% reported ASCA Level 1 as the highest formal training attained. In-water practice yards and dryland training execution increased with the age and competitive levels of the swimmers. Fifty percent of coaches (n=48) reported that at least one swimmer had complained of lasting joint pain in the past year. Online coaching clinics demonstrated greater utilization (n=38, 40%) than in-person clinics (n=25, 26%). Cited barriers to coaches' continuing education were course time and cost.*

Conclusion: *Pain prevalence and variability in coaching practices suggest that coaches would benefit from specific overuse injury and pain management training within the Level 1 ASCA modules.*

Introduction

An overuse injury is defined as “an injury caused by repeated micro trauma without a single, identifiable event responsible for the injury” (Bahr, 2009). Given their physical immaturity and the rising trend of sports specialization at a young age, youth athletes may be particularly at risk for sports-related overuse injuries (Cassas & Cassettari-Wayhs, 2006). While sports related overuse injuries may develop as a result of improper technique, training errors, and muscle weakness and imbalance (Brenner, 2007; Cassas & Cassettari-Wayhs, 2006; McLeod et al., 2011), many youth athletic coaches have little mandatory training on how to manage and prevent such injuries (O'Donnell, Bowen, & Fossati, 2005). Overuse injuries of the upper extremity are common in young athletes that perform repetitive motions, such as in baseball pitching or swimming (Glenn S Fleisig et al., 2011; Lyman, Fleisig, Andrews, & Osinski, 2002; Parks, 2009; Walker, Gabbe, Wajswelner, Blanch, & Bennell, 2012).

Though overuse injuries can occur within any sport, competitive swimming is unique in the prolonged stresses the activity invokes on the body. At high competitive levels, swimmers may complete 6,000 to 7,000 yards in an individual practice and practice 5-9 times per week (A. Tate et al., 2012; Walker et al., 2012; Wolf, 2009). Depending on an individual youth swimmer's age and their competitive level, practice content and "yardage" (distance swum), varies at the discretion of individual coaches. Given the repeated overhead arm motion of many swimming strokes (Pollard, 2004; Wolf, 2009), it is not surprising that the prevalence of pain in the shoulder joint of competitive swimmers ranges from 40%- 91% (Harrington, Meisel, & Tate, 2014; A. Tate et al., 2012; Walker et al., 2012).

Despite the number of training hours youth swimmers spend with their coaches, many amateur-level coaches have little training in how altered stroke mechanics can affect injuries (O'Donnell et al., 2005). USA Swimming is the official governing body for United States swimming competition and requires baseline educational requirements for all USA Swimming coaches. The required courses include the American Swim Coaches Association's (ASCA) Foundations of Coaching 101 and Foundations of Coaching 201 online modules. Beyond the 201 course, higher ASCA educational levels are not required by USA Swimming unless the coach seeks a "head coach" position. Non-mandatory continuing coach education includes regional in-person coaching clinics, online resources, and interactive webinars available through both USA Swimming and ASCA.

Despite the required education through USA Swimming and ASCA, utilization of this information and its carryover into workout plans is not known. The attitudes and beliefs of athletes and coaches can have substantial influence on the adoption of safety and injury prevention measures (Hibberd & Myers, 2013; Rezanian & Gurney, 2014; White et al., 2013; Zhang & Chelladurai, 2012). Findings from a recent study on shoulder pain and attitudes in elite youth swimmers revealed that up to 85% had shoulder pain and believed that pain was a normal part of swimming (Hibberd & Myers, 2013). While athletes may believe that shoulder pain should not limit swimming participation, pain may be indicative of tissue damage that can alter motor control and in turn increase the risk of further injury development (Mya Lay Sein et al., 2010; Tovin, 2006; Walker et al., 2012). In a recent biomechanical study, most collegiate swimmers demonstrated at least one biomechanical error in their freestyle technique when assessed using under/over water video (Virag, 2012). The high prevalence of biomechanical errors among competitive swimmers combined with swimmers' commonly reported belief that shoulder pain is normal suggests that the injury prevention training of youth swim coaches be explored.

Coaches are often the first adults that youth athletes consult about pain during athletic activity, however, there is limited research on coaches' ability to recognize, prevent, and manage injuries in their athletes. The purpose of this research is to assess the practice patterns and opinions of USA Swimming coaches with regard to prevention of overuse injury among their youth swimmers.

Methods

A cross sectional study was conducted within the Eastern Zone of USA Swimming. Coaches (n=975) from the Eastern Zone were invited to participate in an anonymous on line survey entitled "USA Swimming Youth Swim Coaches' Knowledge and Practices Survey" through an email invitation sent directly from the primary investigator using publically available Local Swimming Committee (LSC) websites. To be eligible for the study, USA Swimming coaches completed online consent affirming that they were at least 18 years of age and were responsible for coaching swimmers 18 years of age or younger. This study was approved by the Arcadia University Institutional Review Board (IRB) on February 27, 2014. All data were received electronically via Google Form until March 31, 2014 and coded in Microsoft Excel.

The survey consisted of 38 questions which were adapted with permission from previously published knowledge and compliance studies for baseball and swimming (Fazarale, Magnussen, Pedroza, & Kaeding, 2012; Angela Tate et al., 2014). All survey answers were voluntary.

The first section of the survey assessed coaches' continuing education utilization as well as swim practice content, including training yardage and in-water and dryland practice patterns. The second section consisted of coaches' perspectives on injury patterns among their swimmers, coaches' opinions on contributors to overuse injury and prevention practices executed during workouts using tick boxes, write-in, Likert scale and multiple choice options, respectively. The proportion of respondents providing each response was tabulated for all 38 survey items.

Discussion

The findings highlighted in this research illustrate the opinions and practice patterns of a group of USA Swimming youth coaches within the Eastern Zone of USA Swimming. To these authors' knowledge, this is the first survey to report qualifications of USA Swimming coaches, barriers to coaching education, and attitudes and perceptions of coaches regarding overuse injuries. This study represents an initial attempt to understand the factors related to coaches' training methods in order to better design future injury prevention education.

Ninety-six coaches completed the survey in whole or in part. The majority of respondents (n=61, 61%) reported over 6 years of USA Swimming coaching experience. Consistent with previous research, the coaches in the sample reported that the shoulder joint was the body area most likely to become injured with swimming (n= 88, 92%). Fifty percent of the coach respondents (n=48) also reported that at least one swimmer had complained to them of lasting joint pain within the last year. Additionally, online coaching education clinics demonstrated greater utilization (n=38, 40%) than in-person clinics (n=25, 26%). Based on the coaches' responses, specific educational areas that we have identified include stroke

choice and stroke technique/biomechanics, swim training volume, and dryland training. We have also identified a preferred method of educational instruction in order to identify appropriate modes for outreach.

Stroke Choice and Injury Prevention Practices

Within the coaching sample, freestyle was the most popular swimming stroke (n=68, 71%) utilized during practice sessions across all swim groups and competition levels. While the biomechanics of each individual swimming stroke vary and stroke balance/moderation is encouraged in all strokes throughout the ASCA educational modules, high volumes of freestyle swimming are thought to overdevelop swimmers’ chest musculature at the expense of the back muscles (Hibberd & Myers, 2013; Pink & Tibone, 2000). Although there are four strokes in competitive swimming (freestyle, butterfly, backstroke, breaststroke), the present study demonstrates a training preference towards the freestyle stroke. The repeated overhead motion needed to complete practice yardage using freestyle can lead to a greater likelihood of shoulder pain if the scapular stabilizers of the back are not sufficiently strengthened (Hibberd & Myers, 2013; Pink & Tibone, 2000).

Freestyle biomechanical errors are prevalent and altered stroke mechanics such as incorrect hand position during hand entry and incorrect hand entry angle may contribute to shoulder pain (Virag, 2012). At this time, in-depth education on detailed stroke biomechanics is covered in the Level 2: Stroke School ASCA module and above. Many of the coaches within this sample, however, only completed the compulsory Level 1a: Foundations of Coaching 101 and Level 1b: Foundations of Coaching 201 (n=42, 48%) necessary for USA Swimming coaching, leaving 52% of our sample without the Level 2 education and above (Table 1).

ASCA Certification Level	Number	%
Level 1a: Foundations of Coaching 101	n=22	23%
Level 1b: Foundations of Coaching 201	n=20	21%
Level 2: The Stroke School	n=16	17%
Level 3: The Physiology School	n=14	15%
Level 4: The Leadership School	n=7	7%
Level 5: The Administration School	n=9	9%
Non-respondents	n=8	8%

Table 1. ASCA Certification Level of Coach Sample (n=96)

Given the low level of ASCA training and high incidence of joint pain complaints, more education regarding stroke choice and technique and its contribution to injury may be beneficial in the baseline ASCA training.

Practice Volume by Age Group and Competitive Level

The volume of training utilized indicates another potential risk factor for overuse injury (Mya Lay Sein et al., 2010; M. L. Sein et al., 2007; A. Tate et al., 2012). Within this study, yardage appeared to increase with age, but also varied considerably by the competitive level (Figure 1). Competitive level was determined by “National Age Group Motivational Time Standards” (B, BB, A, AA, AAA, AAAA times, progressing in speed from B to AAAA) and “National Meet Time Standards” (sectional, national, international competition) of the swimmers coached within each practice group.

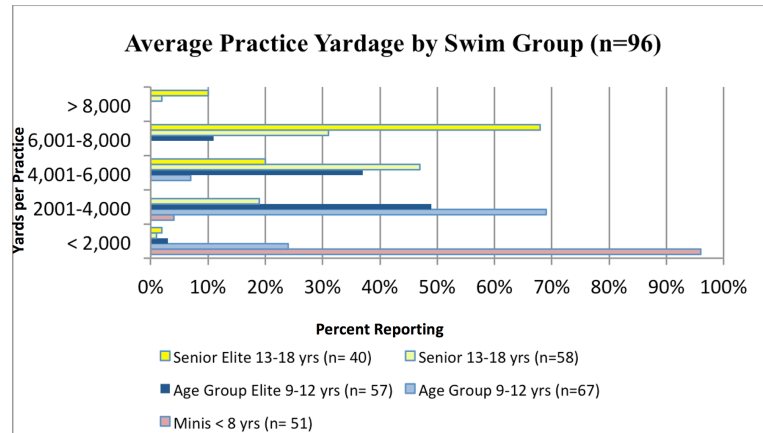


Figure 1. Training Yardage Reported by Swim Group Coached

For example, the majority of Age Group coaches reported 2,001-4,000 yards at peak season (69%) but a few (5%) indicated 4,001-6,000 yards at peak season. For Age Group Elite swimmers, however, yardage varied more widely. Roughly equal numbers of coaches reported 4,000 yards or less per practice at peak season (n=30, 51%) and 4,001 yards or more (n=27, 46%). In addition, 10 Age Group Elite coaches (10%) reported swimmers completed 6,001-8,000 yards per practice at peak season, resembling the training volumes of the older, more developmentally mature Senior and Senior Elite swim groups.

In their study, Tate et al found that female high school competitive swimmers with shoulder pain and swimming related disability had greater swimming exposure than those without pain and disability (A. Tate et al., 2012). In another study of elite Australian swimmers aged 13-25, Sein et al reported that 69% of those swimmers undergoing magnetic resonance imaging (MRI) were found to have supraspinatus tendinopathy related to high quantity of hours trained and yardage swum (M. L. Sein et al., 2007). These studies support the notion that the high training volume is a potential risk factor for the development of overuse injury, particularly in the shoulder. This is information that could be incorporated into basic ASCA training to raise awareness of joint injury risk factors.

Dryland Training by Age Group and Competitive Level

Prevention practices varied widely according to the age and competition level (Table 2). Regardless of the swim group, the most popular preventive measures were warm up, cool down, and technique training and the least popular preventive measures were weight training and scapular stabilization. In addition, the lowest frequency of preventive measures was used in the Minis (youngest) swim group and the highest frequency of preventive measures was used within the Senior Elite groups. For both scapular stabilization and weight training, there was relatively little usage in the younger compared to the senior and senior elite groups.

Table 2: Dryland Practices by Age Group and Competition Level

Group / Level		Warm up	Cool down	Technique training	Weight training	Body weight training	Core Strength	Scapular Stabilization	Stretch
Minis (N=52)	n	52	39	51	1	8	19	9	23
	%	100%	75%	98%	2%	15%	37%	17%	44%
Age Group (N=67)	n	67	60	63	1	28	47	20	44
	%	100%	90%	94%	1%	42%	70%	30%	66%
Age Group Elite (N=59)	n	59	54	57	6	36	51	24	41
	%	100%	92%	97%	11%	61%	86%	41%	70%
Senior (N=57)	n	55	51	57	21	38	53	29	42
	%	96%	89%	100%	37%	67%	93%	51%	74%
Senior Elite (N=36)	n	36	34	35	18	28	36	25	28
	%	100%	94%	97%	50%	78%	100%	69%	78%

Contrary to current research, the trends demonstrated by this coaching sample may reflect the reduced use of resistance training in younger swimmers. According to the American Academy of Pediatrics, children’s balance and postural control skills mature to adult levels by 7 to 8 years of age, and supervised conditioning programs may begin when such milestones are achieved (McCambridge & Stricker, 2008). Given this position, it is surprising that almost half of the senior and senior elite swimmers are not practicing strength training. The USA Swimming Level 1 ASCA training has limited mention of dryland training as a means to potentially reduce overuse injuries, so this may be an additional area to target for coaching education.

Specific Opinions on Swimming-Based Risk Factors

Throughout the survey, the coaches consistently mentioned “good stroke technique” as a means of preventing injury. In addition, all coaches indicated that they worked on stroke technique in their weekly practices. This finding, in combination with the sample’s generally high opinion that poor stroke technique was “a major contributor to pain and injury in swimming” as well as the sample’s consistent practice of other in-water preventive measures (warm up and cool down), suggests that the sample may believe that in-water preventive measures are sufficient to prevent injury.

While research has shown that dryland training, with proper technique and strict supervision, can increase strength in preadolescents and adolescents (McCambridge & Stricker, 2008), the coaches do not appear to be practicing these measures in as high frequency as the swimming-based, in-water ones. Given the relatively low level of ASCA training (Level 1a: Foundations of Coaching 101 and Level 1b: Foundations of Coaching 201, n=42, 48%) and high coach recognition of incidence of joint pain during practice (n=48, 50%), more education regarding both dryland training and stroke technique may be helpful in the baseline ASCA training in order to reduce shoulder injury. Further research could determine the efficacy of additional coaching training.

Preferred Mode of Future Coaching Education

The last factor applicable to executing an overuse injury educational curriculum for USA Swimming coaches is designing a dissemination method that accommodates the lives and learning styles of coaches. Cited barriers to further continuing educational training included “time” and “cost,” but differed by mode of dissemination. Time (spent in training, away from family, traveling to training) was mentioned as a barrier for in-person training among 70% (n=67) of the coach sample, while 53% cited time as a barrier for online training (n=51). Additionally, cost (travel, lodging, course fees) was cited as a barrier for 44% (n=42) of the coach sample for in-person training and 7% (n=7) for online training.

In order to ensure participation and retention of educational information, the mode of dissemination must be one that is accessible to the population and the instructional content must provide pertinent and evidence based information. The relatively high preference for online training (n=38, 40%) suggests that updating the required online module with evidence-based information on overuse injury prevention and risk factors would be a good initial method for ensuring baseline competency. Studies similar to this one could then explore coaches’ perceptions of online overuse injury prevention and management modules as they relate to their implementation of prevention practices.

Conclusion

Individual practices such as technique training are known prevention measures to address overuse injury in many sports, but individual measures represent only one aspect of a comprehensive prevention program (G. S. Fleisig & Andrews, 2012; Glenn S Fleisig et al., 2011; Parks, 2009; Soligard et al., 2008). Swim coaches within this study reported a strong commitment to stroke technique, but given the high prevalence of reported overuse injury symptoms it is clear that more must be done to address this health issue. Our study has identified multiple areas in which additional coaching education may be beneficial for overuse injury prevention and suggestions have also been made for optimal mode of dissemination of this information. Further studies should assess the efficacy of interventions targeted at improving coaching awareness of the effects of their training methods as well as injury prevention measures. The swimming community must approach the issue of overuse injury in a comprehensive manner beginning with a thorough evidence-based education of those responsible for the training of our youth to ensure healthy and competitive athletes for the future.

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