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Youth and high school sports coaches' experience with and attitudes about concussion and access to athletic trainers by sport type and age of athlete coached☆

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Abstract

Introduction: Concussions are a commonly reported injury in youth and high school sports and much of the responsibility related to concussion identification and response for young athletes is allocated to sports coaches. This paper presents findings on concussion-related education, access to resources, experiences, and attitudes among a large number of youth and high school sports coaches across a variety of sports nationwide.

Methodology: Data were collected among coaches who completed the Centers for Disease Control and Prevention's (CDC) HEADS UP online concussion training pre-test between November 2016 and November 2017. Coaches' concussion-related education, access to resources, experiences, and attitudes were compared by age of athlete coached and level of contact of sport. Medium and large effect sizes were considered of practical significance for interpretation.

Results: During the study period, 187,801 youth sports or high school sports coaches completed the CDC HEADS UP online training and corresponding pre-test. Access to previous concussion training significantly varied among respondents by age of athlete coached. For example, 27.4% of coaches of athletes aged 5 and younger had taken previous training compared to 72.9% of coaches of athletes aged 14–18. About one-quarter (27.4%) of all coaches reported ever having had to pull an athlete out of a game because of a possible concussion and 19.5% reported access to an athletic trainer at all games and practices. These variables differed significantly among coaches by age of athletes coached; coaches of older athletes were more likely to report access to an athletic trainer and having had to pull an athlete out of a game compared to coaches of younger athletes. No statistical differences by level of contact were considered to be of practical significance based on effect size.

Conclusion: Most coaches in this study report having access to education and hold attitudes consistent with best practices about concussion safety; however, overall access to concussion-

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related resources is limited. While differences in access to concussion-related education, experience, resources, and attitudes among coaches of varying levels of contact were small, medium to large variations were identified by age of athlete coached.

Practical applications: Coaches bear an important part of the responsibility to prevent, identify, and manage concussions in young athletes. Tailored educational efforts may assist coaches of young athletes with recognition of concussion signs and symptoms and with feeling comfortable deciding whether an athlete needs to be evaluated for a possible concussion.

Keywords

Concussion; Coach; Education; Sports; Training

1. Introduction

Concussions are a commonly reported injury in youth and high school sports. Each year, as many as 330,000 children age 19 or younger seek care in U.S. emergency departments (ED) for a concussion or other traumatic brain injury (TBI) sustained during sports and recreational activities (Coronado, Haileyesus, Cheng, et al., 2015). From 2001 to 2012, the rate of ED visits for these injuries more than doubled among this age group (Coronado et al., 2015), possibly due to increased awareness. However, these numbers are likely a significant undercount as they do not include concussions and other TBIs that go untreated or those injuries treated in primary care, urgent care, specialty care, or those managed directly on the field or sideline (Arbogast, Curry, Pfeiffer, et al., 2016).

Caused by a bump, blow, or jolt to the head or body, a concussion is associated with chemical changes in the brain and may include stretching and damaging of nerve cells in the brain (Centers for Disease Control and Prevention [CDC], 2017). While most athletes feel better within a couple of weeks, a concussion can lead to short- or long-term changes in how they think, act, learn, and feel (McCrea, Guskiewicz, Randolph, et al., 2013; Zemek, Barrowman, Freedman, et al., 2016). To help reduce the risk of adverse outcomes and prolonged recovery, concussion in sports guidelines recommend that athletes with a suspected concussion are removed from play the day of the injury and that the return to play process begin under the guidance of an appropriate healthcare provider (Giza, Kutcher, Ashwal, et al., 2013; McCrory, Meeuwisse, Dvorak, et al., 2017).

In youth and high school sports, much of the responsibility related to concussion identification and response falls on coaches. Thus, efforts to implement concussion education for coaches have increased dramatically over the past decade. This is exemplified by the coach concussion education requirement included in many of the concussion in sports laws that were passed between 2009 and 2014 in all 50 states and the District of Columbia (Harvey, 2013; Harvey, Koller, & Lowrey, 2015). In addition to state laws, many schools have policies that mandate coaches receive concussion information or complete a pre-season concussion education program (CDC, 2013).

The increasing need for broad access to concussion education for coaches of all sports led the CDC to create an online training on concussion prevention, recognition, and response.

The training was initially launched in 2010 and is part of the CDC *HEADS UP* campaign—an educational campaign that is focused on concussion safety. In 2017, to help ensure the CDC *HEADS UP* training provides youth and high school sports coaches with the information and guidance they need, CDC updated the training to emphasize the importance of improving the culture of concussion safety and to include pre-test and post-test modules. The pre-test module includes questions on coaches' demographic information, access to education and athletic trainers, and questions that gauge coaches' concussion knowledge, attitudes, and behaviors prior to taking the training.

Education of coaches has been positively associated with recognition of concussion signs and symptoms (McLeod, Schwartz, & Bay, 2007) and with feeling comfortable deciding whether an athlete needs to be evaluated for a possible concussion (Chrisman, Schiff, Chung, et al., 2014). However, research examining access to concussion education and programs among coaches generally focuses on contact sports with little to no focus on non-contact sports (Enniss, Basiouny, Brewer, et al., 2018; Waltzman & Sarmiento, 2019). Although concussions are more common in sports in which contact or collisions occur more frequently (such as in football, ice hockey, and soccer) they can happen in any sport (Marar, McIlvain, Fields, & Comstock, 2012). Additionally, despite the varying concussion awareness and educational needs of younger versus older athletes (Bloodgood, Inokuchi, Shawver, et al., 2013) and the applicability of legislation in 42 states to high school, middle school, and children younger than middle school (Baugh & Kroshus, 2014), to our knowledge, no research to date has explored differences in coach education or experience with concussion by age group coached.

To fill this gap, responses to CDC *HEADS UP* pre-test module questions about coaches' experience with concussion, prior concussion training, their access to concussion education and support, and their attitudes toward concussion management were analyzed. Specifically, differences in coaches' responses by the age of the athletes they coach, and whether their sport is contact, limited contact, or non-contact, were examined. It was hypothesized that coaches of older athletes and coaches of contact or collision sports were more likely to have had previous education, have access to resources, and have concussion attitudes consistent with best practices about concussion safety, compared to coaches of younger athletes and of non-contact or limited contact sports. To our knowledge, this is the largest sample of youth and high school sports coaches surveyed on concussion to date.

2. Methodology

Offered at no cost from the CDC, coaches and others involved in youth and school athletics are typically directed to the *HEADS UP* online training through sports programs that require concussion education prior to the start of sports season. Responses to the training's pre-test are recorded in the database using a unique code to protect the privacy of the participants. Data for this paper were obtained from the pre-test results collected in the database between November 2016 and November 2017. It was determined that this secondary analysis of data was exempt from human subjects and paperwork reduction act regulations as data were collected as part of the regular function of the training and were designed for training improvement and evaluation. For this analysis, the sample was limited to youth sports

coaches and high school sports coaches (n=187,801). A future study on the effectiveness of the CDC HEADS UP online training on improving concussion knowledge, attitudes, and behaviors using a comparison of the pre- and post-test data from the online training is in process.

2.1. Measures

Demographics: *Respondent's role* was assessed with the question "I am a (select each option that best describes you)." The response categories were "youth sports coach," "high school sports coach," "sports official," "athletic trainer," "parent," and "other." Respondents were able to choose more than one option. *Sport respondent is involved with* was measured with the question: "What sport(s) are you involved with? (select all that apply)." Please see Table 1 for response options. Each sport was then categorized by level of contact based on the potential for physical contact and intensity (Mirabelli, Devine, Singh, & Mendoza, 2015; Mitchell, Haskell, Snell, & Van Camp, 2005; Moses, 2018; Rice, 2008). The levels include "collision or contact sports" (such as football and soccer), "limited contact sports" (such as baseball and volleyball), and "non-contact sports" (such as track and field and tennis). *Age of athletes respondent works with* was measured with the question "What ages do you work with? (check all that apply)." Response categories were "5 and younger," "6−10," "11−13," "14−18," and "not applicable." *Sex of athletes respondent works with* was assessed with the question "Do you work with boys, girls, or both?"

Education: Prior concussion education was measured with the question "Prior to taking the training today, have you completed a training about concussion prevention and preparedness?" Response options were "Yes" and "No."

Resources: Respondents were asked "How often do you carry information about concussions with you when you are coaching?" and "How often do your athletes have access to an athletic trainer or other health care provider?" Response options for both questions were "At all games and practices," "At some games and practices," "Only at games," "Only at practices," and "Never." The responses "only at games" and "only at practices" were collapsed into a single category.

Experience: Respondents were asked "Have you ever had to pull an athlete out of a game because of a possible concussion?" Response options were "No", "Yes," and "N/A." Respondents were also asked "Has a healthcare provider ever diagnosed an athlete you were coaching with a concussion?" Response options were "No," "Yes," "Unsure," and "N/A."

Attitudes: Respondents were asked six attitude questions that were developed for the CDC *HEADS UP* training pre-test and post-test modules: "I am confident in my ability to recognize concussion symptoms in youth athletes," "There are things I can do to help prevent concussion among my athletes," "My athletes would tell me if they experienced concussion symptoms," "I am confident in my ability to help an athlete with the return to play process," "I talk with my athletes about concussion and encourage them to report concussion symptoms," and "I plan to teach my athletes ways to prevent concussion." Response options for each were "strongly agree," "agree," "neither agree nor disagree,"

"disagree," and "strongly disagree." The five categories were collapsed into three: "strongly agree/agree," "neither agree nor disagree," and "disagree/strongly disagree."

2.2. Analysis

Descriptive statistics for study variables were computed using the entire sample of youth and high school sports coaches. To examine potential differences in study variables by age group, the analytic sample was limited to youth and high school sports coaches who selected a single age group (n=102,673), with those who selected "N/A" excluded (N=1,143). Similarly, to examine potential differences by level of contact, the analytic sample was limited to youth and high school coaches who selected a single sport and excluded those who responded with "other" (n=15,117), which represented a sport that could not be categorized by contact level, to sport coached (n=112,593).

The statistical package SAS version 9.3 was used for the primary analyses (http://www.sas.com). Statistical significance was determined using χ^2 tests at the $p < .05$ level. Due to the large sample size, effect sizes (Cramer's V) were computed for each χ^2 test and effect sizes were interpreted in accordance with their degrees of freedom as described in Ellis (2010) and Zaiontz (2013). When the effect size was medium or large, pairwise comparisons of percentages by age group and level of contact were conducted using the comparison of proportions test in SPSS version 24 with the Bonferroni correction selected in order to identify which specific pairs were different from one another (https://www.ibm.com/analytics/spss-statistics-software). Small effect sizes were considered an artifact of the large sample and were not interpreted in the text as they were not considered to be of practical significance (Ellis, 2010; Zaiontz, 2013).

3. Results

3.1. Background characteristics of respondents (Table 1)

During the study period, a total of 187,801 coaches completed the CDC *HEADS UP* online training and the corresponding pre-test (162,089 youth sports coaches, 13,598 high school sports coaches, and 12,114 who identified as both). Approximately 37.5% of all coaches were involved in soccer, 28.5% in baseball, 22.2% in football, and 17.8% in basketball. Respondents were permitted to select more than one type of sport and 59,300 coaches did so. Approximately 90% of respondents reported coaching at least one contact or collision sport, 48.6% reported coaching at least one limited contact sport, and 5.8% reported coaching at least one non-contact sport. Most respondents (61.1%) coached athletes 6−10 years of age. This was followed by 49.6% coaching athletes 11−13 years of age, 31.6% coaching athletes 14−18 years of age, and 21.3% coaching athletes 5 years of age and younger. Respondents were permitted to report working with more than one age group and nearly half (n=83,809) did so. Almost half of respondents reported coaching both boys and girls (47.2%), 33.1% reported coaching boys only, and 19.6% reported coaching girls only.

3.2. Concussion-related education, access to resources, experiences, and attitudes (Table 2)

Over half of the respondents (59.3%) indicated that they had taken concussion prevention and preparedness training prior to the CDC *HEADS UP* training. Overall, about half of coaches (50.7%) reported carrying concussion information with them at all practices and games. Approximately one-fifth of respondents (19.5%) indicated that their athletes have access to an athletic trainer at all games and practices. About one-quarter (29.6%) of all coaches reported ever having had to pull an athlete out of a game because of a possible concussion. The overall percentage of coaches who reported having an athlete diagnosed with concussion by a medical provider was 20.1%.

Respondents were asked a series of questions related to their attitudes about concussions and their intentions related to conducting concussion education with their athletes. In response to the question “I am confident in my ability to recognize concussion symptoms in youth athletes,” 85.4% of coaches replied “strongly agreed” or “agreed.” About 93.9% of coaches strongly agreed or agreed that “there are things I can do to help prevent concussion among my athletes.” Less than half (47.4%) of coaches agreed or strongly agreed that “my athletes would tell me if they experienced concussion symptoms.” Eight in ten coaches (80.8%) agreed or strongly agreed that “I am confident in my ability to help an athlete with the return to play process.” Similarly, about 79.3% agreed or strongly agreed that they “talk with their athletes about concussion and encourage them to report concussion symptoms.” Finally, 94.4% of all coaches agreed or strongly agreed with the statement “I plan to teach my athletes ways to prevent concussion.”

3.3. Concussion-related education, access to resources, experiences, and attitudes by age group coached (Table 3)

Coaches’ access to education across all age groups was significantly different from one another, with pairwise differences in the expected direction. For example, 27.4% of coaches of athletes age 5 and younger, 50.9% of coaches of athletes ages 6−10, 66.3% of coaches of athletes ages 11−13, and 72.9% of coaches of athletes ages 14−18 reported having taken previous training. The Cramer’s V effect size of 0.26 suggests a medium level of practically significance between the age groups.

Testing of access to resources had mixed results. Although carrying concussion information at all games and practices showed statistically significantly differences by age of athlete coached in bivariate analysis, the effect size was not of practical significance. However, a Cramer’s V of 0.18 suggests that the differences in access to athletic trainers at all games and practices between age groups had medium practical significance. Comparisons of pairs of age groups followed the hypothesized direction, with a greater percentage of those who coached older athletes reporting that they have access to an athletic trainer than those who coached younger athletes. Specifically, 12.7% of coaches of athletes age 5 and younger, 16.3% of coaches of athletes ages 6−10, 19.4% of coaches of athletes ages 11−13, and 31.3% of coaches of athletes ages 14−18 having access to an athletic trainer at all games and practices.

Analysis of the difference in experience with concussion across age groups showed large effect sizes. Pairwise differences between age groups were in the expected direction in terms of reporting having had to pull an athlete out of a game because of suspected concussion and had a large effect size (Cramer's V=0.25). Only 4% of coaches of athletes age 5 and younger reported the experience as compared to 14.9% of coaches of athletes ages 6−10, 35.2% of coaches of athletes ages 11−13, and 47.2% of coaches of athletes ages 14−18 having to do so. Similarly, all pairwise age group differences regarding having an athlete diagnosed with concussion by a medical provider were statistically significant and in the expected direction. A significantly higher percentage of coaches of older athletes reported having a medical provider ever diagnose a player with a concussion, compared to coaches of younger athletes (42.0% of coaches of 14–18 year olds, 21.7% of coaches of 11–13 year olds, 6.8% of coaches of 6–10 year olds, and 2.0% of coaches of athletes 5 years and younger; Cramer's V=0.23).

Differences by age group, while statistically significant, showed a small level of practical significance for all concussion-related attitudes questions except one. A Cramer's V of 0.12 suggests that overall age group differences had a medium level of practical significance for coaches who agreed or strongly agreed that they "talk with their athletes about concussion and encourage them to report concussion symptoms." Pairwise differences indicated that the older the age of athletes coached, the higher level of agreement: 65.7% of those who only coach athletes 5 years of age and younger, 75.7% of those who coach children 6−10 years of age, 85.0% of those who coach children 11−13 years of age, and 88.2% of those who coach children age 14−18 years of age agreed with the statement.

3.4. Concussion-related education, access to resources, experiences, and attitudes by contact level of sport (Table 4)

While differences in access to education between coaches of different levels of contact were statistically significant, they showed small effect sizes and were interpreted as having negligible practical significance (Cramer's V=0.09). In terms of resources, including carrying information about concussions and access to athletic trainers at all games and practices, the Cramer's V effect size values again suggests little practical significance by contact level of sport coached (0.05 and 0.11, respectively). Similarly, experience with concussion did not vary in a meaningful way by the contact level of sport coached (Cramer's V=0.13). Finally, most coaches reported attitudes consistent with best practices for concussion safety. However, while there were statistical variations in attitudes by level of contact of sport coached, none of these differences were of medium or high practical significance.

4. Discussion

Youth and high school sports coaches are often the first to identify and respond to a possible concussion among young athletes. Their unique position to promote concussion safety is exemplified by concussion education requirements for school-based coaches nationwide (CDC, 2013). This study shows that most youth and high school sports coaches have completed or have access to educational opportunities about concussion, but there were

disparities in access across coaches of by age groups of athletes coached, with coaches in older groups having greater access than younger groups. Coaches' access to education did not vary significantly by the level of contact of sport coached. While some contact sports have instituted rule changes and sports-specific interventions to reduce the risk for concussion and other serious brain injuries, the lack of differences in access in education among contact versus noncontact sports may be attributed to the broad implementation of state and sports program concussion in sports policies. While at least one state has introduced primary prevention components into their concussion in sports laws, education components in many state laws are not specific to individual sports, such as sports with the highest incidence of concussion (Harvey et al., 2015). Instead, these policies laws often require coaches of various sports or physical activities to regularly complete concussion training, such as the CDC *HEADS UP* online training.

Concussions are a commonly reported injury among youth and high school athletes (Coronado et al., 2015; Pfister, Pfister, Hagel, Ghali, & Ronksley, 2015; Rosenthal, Foraker, Collins, et al., 2014). One in four coaches reported having had to remove an athlete from a game because of a suspected concussion and about one in six indicated that a healthcare provider has diagnosed one of their athletes with a concussion. The percentage of coaches reporting both of these experiences was significantly higher among those coaching older athletes compared to younger athletes. Athletes experience with concussion is consistent with findings in a recent CDC study on self-reported sports- or recreation-related concussions among high school students (DePadilla, Miller, Jones, et al., 2018). In that study, an estimated 2.5 million high school students reported a sports- or recreation-related concussion in the year before the survey (DePadilla et al., 2018). Similar studies that examine self-reported concussions among middle and elementary school students are warranted. Identifying a possible concussion can be challenging as concussion symptoms may not be noticeable at first or reported by an athlete (Delaney, Al Kashmiri, Drummond, et al., 2008; Rivara, Schiff, Chrisman, et al., 2014). Research by Kroshus et al. indicates that sports programs with greater access to athletic trainers demonstrate higher rates of concussion identification (Kroshus, Babkes Stellino, Chrisman, et al., 2017). However, among school-based sports, a little over one-third (37%) of public high schools have access to a full-time athletic trainer (Broglio, Cantu, Gioia, et al., 2014). Similarly, only about one-third of respondents in this survey indicated that they have access to an athletic trainer or other healthcare provider at some or all games and practices. Expanded access may help provide needed support for coaches on the sideline to assist with athlete safety and response (Kroshus, Rivara, Whitlock, et al., 2017). This is especially critical among contact sports in which the risk for concussion and the likelihood of removing an athlete from play for a possible concussion is increased (Marar et al., 2012).

Most coaches in this study reported that they are confident in their ability to recognize and respond to a concussion and plan to take steps to improve concussion safety for their athletes. This is important as young athletes depend on their coaches for guidance and need to feel comfortable in order to report their concussion symptoms (Chrisman, Quitiquit, & Rivara, 2013; Harmon, Drezner, Gammons, et al., 2013). Previous studies also suggest that increased focus on communication with athletes in educational materials for coaches may help improve reporting behaviors (Kroshus, Babkes Stellino, et al., 2017). Still, despite the

majority of coaches reporting communicating with their athletes about concussion, less than half of coaches in this study agreed or strongly agreed that their athletes would report their concussion symptoms to them. Disparities in perceived likelihood of reporting concussion symptoms by athletes varied by the age of the athletes coached, with coaches of older athletes more likely to state that their athletes would report concussion symptoms. Similarly, coaches of the oldest athletes were more likely to strongly agree that they "talk with their athletes about concussion and encourage them to report concussion symptoms" as compared to coaches of the youngest athletes. The limited number of educational efforts tailored to athletes age 10 and under may be a contributing factor to these differences. An exploratory study by Kroshus, Gillard, Haarbauer-Krupa, Goldman, and Bickham (2016) identified knowledge gaps among young athletes and recommended the development of age-appropriate concussion education programming (Kroshus et al., 2016). Larger studies that assess the educational needs of the youngest athletes and their coaches, and an examination of age-appropriate concussion messages and educational materials is warranted. This study is subject to limitations. First, the pre-test data were collected for program evaluation purposes and are therefore based on a convenience sample of coaches who are involved in youth and high school athletics and chose to take the training; thus the findings are not generalizable to a wider population. Second, given the public and media attention on sports concussion, coaches may have felt the need to answer questions in a way they thought would be acceptable to the training administrators. Social desirability may have biased the level of self-reported agreement with attitudes about concussion captured in the pre-test. Third, the questions in this study capture behavioral intention versus actual behaviors. Follow-up studies that examine the effect of concussion education on concussion incidence and coaches' behaviors on the field is warranted. Third, the data did not capture whether the participants coached at a club, school, or community youth sports program, nor whether the level of athletes coached were elite or beginner. Future studies could explore potential differences in concussion attitudes and behaviors among coaches of recreational versus elite level programs.

5. Conclusion

Most coaches in this study report having access to education and attitudes consistent with best practices about concussion safety; however, over-all access to concussion-related resources is limited. Future studies can assess strategies to tailor educational messages and trainings to reduce disparities in access to concussion prevention and management resources.

6. Practical applications

Coaches bear an important part of the responsibility to prevent, identify, and manage concussions in young athletes. Tailored educational efforts may assist coaches of young athletes with recognition of concussion signs and symptoms and with feeling comfortable deciding whether an athlete needs to be evaluated for a possible concussion.

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Table 1

Background characteristics of respondents of total sample.

Respondent's role	Frequency	Percent
Youth sports coach	162,089	86.3
High school sports coach	13,598	7.2
Both	12,114	6.5
Sport respondent is involved with[a,b]		
Contact or collision sports		
Football	41,634	22.2
Ice hockey	8,977	4.8
Field hockey	1,436	0.8
Soccer	70,300	37.5
Basketball	33,303	17.8
Lacrosse	6,035	3.2
Wrestling	5,047	2.7
Diving	747	0.4
Rugby	773	0.4
Subtotal for contact or collision sports	168,252	89.7
Limited contact sports		
Baseball	53,438	28.5
Softball	22,551	12.0
Gymnastics	5,880	3.1
Volleyball	9,278	5.0
Subtotal for limited contact sports	91,147	48.6
Non-contact sports		
Tennis	2,952	1.6
Track field	7,887	4.2
Subtotal for non-contact sports	10,839	5.8
Unknown level of contact		
Other	23,231	12.4
Age of children respondent works with[a,c]		
5 and younger	39,961	21.3
6−10	114,693	61.1
11−13	93,008	49.6
14−18	59,248	31.6
Sex of children respondent works with		
Boys	62,058	33.1
Girls	36,861	19.6
Both	88,593	47.2

Respondent's role	Frequency	Percent
N/A	281	0.2
Total	187,793	100.0

[a]Respondents were permitted to select more than one response; there were 187,801 unique respondents.

[b]59,300 coaches selected multiple sports.

[c]83,809 coaches selected multiple age groups.

Table 2

Concussion-related education, access to resources, experiences and attitudes.

	Overall	
	Frequency	**Percent**
Education		
Prior to taking the training today, have you completed a training about concussion prevention and preparedness?		
Yes	111,392	59.3
No	76,391	40.7
Total	187,783	100.0
Resources		
How often do you carry information about concussions with you when you are coaching?		
At all games and practices	95,282	50.7
At some games and practices	15,483	8.2
Only at games OR only at practices	5,391	2.9
Never	71,632	38.2
Total	187,788	100.0
How often do your athletes have access to an athletic trainer or other health care provider?		
At all games and practices	36,672	19.5
At some games and practices	34,496	18.4
Only at games OR only at practices	28,291	15.1
Never	61,142	32.6
N/A	27,189	14.5
Total	187,790	100.0
Experience		
Have you ever had to pull an athlete out of a game because of a possible concussion?		
Yes	5,555	29.6
No	118,547	63.1
N/A	13,691	7.3
Total	187,793	100.0
Has a medical provider ever diagnosed an athlete you were coaching with a concussion?		
Yes	37,644	20.1
No	126,990	67.6
Unsure	9,231	4.9
N/A	13,927	7.4
Total	187,792	100.0
Attitudes		
I am confident in my ability to recognize concussion symptoms in youth athletes		
Strongly Agree/Agree	160,292	85.4
Neither Agree Nor Disagree	21,833	11.6

	Overall	
	Frequency	**Percent**
Disagree/Strongly Disagree	5,639	3.0
Total	187,764	100.0
There are things I can do to help prevent concussion among my athletes		
Strongly Agree/Agree	176,214	93.9
Neither Agree Nor Disagree	10,065	5.4
Disagree/Strongly Disagree	1,483	0.8
Total	187,762	100.0
My athletes would tell me if they experienced concussion symptoms		
Strongly Agree/Agree	89,027	47.4
Neither Agree Nor Disagree	66,428	35.4
Disagree/Strongly Disagree	32,304	17.2
Total	187,759	100.0
I am confident in my ability to help an athlete with the return to play process		
Strongly Agree/Agree	151,617	80.8
Neither Agree Nor Disagree	26,562	14.2
Disagree/Strongly Disagree	9,578	5.1
Total	187,757	100.0
I talk with my athletes about concussion and encourage them to report concussion symptoms		
Strongly Agree/Agree	148,851	79.3
Neither Agree Nor Disagree	31,255	16.7
Disagree/Strongly Disagree	7,648	4.1
Total	187,754	100.0
I plan to teach my athletes ways to prevent concussion		
Strongly Agree/Agree	177,212	94.4
Neither Agree Nor Disagree	9,721	5.2
Disagree/Strongly Disagree	819	0.4
Total	187,752	100.0

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Table 3

Concussion-related education, access to resources, experiences and attitudes by age group coached (n = 102,673)[a].

	Mutually exclusive age categories											
	5 years and younger		6–10 years of age		11–13 years of age		14–18 years of age		χ^2	p-value	Cramer's V[b]	DF
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent				
Education												
Prior to taking the training today, have you completed a training about concussion prevention and preparedness?									6950.1	< 0.0001	0.26	3
Yes[c]	2,596	27.4	24,730	50.9	17,182	66.3	13,609	72.9				
No[c]	6,878	72.6	23,885	49.1	8,725	33.7	5,064	27.1				
Total	9,474	100.0	48,615	100.0	25,907	100.0	18,673	100.0				
Resources												
How often do you carry information about concussions with you when you are coaching?									1081.5	< 0.0001	0.06	9
At all games and practices	4,511	47.6	24,202	49.8	14,323	55.3	10,165	54.4				
At some games and practices	456	4.8	3,652	7.5	2,209	8.5	1,780	9.5				
Only at games OR only at practices	177	1.9	1,132	2.3	795	3.1	743	4.0				
Never	4,330	45.7	19,629	40.4	8,580	33.1	5,986	32.1				
Total	9,474	100.0	48,615	100.0	25,907	100.0	18,674	100.0				
How often do your athletes have access to an athletic trainer or other health care provider?									9541.4	< 0.0001	0.18	12
At all games and practices [c]	1,202	12.7	7,910	16.3	5,033	19.4	5,848	31.3				
At some games and practices [c]	651	6.9	6,653	13.7	4,957	19.1	4,282	22.9				
Only at games OR only at practices [d,e,f,g,h]	704	7.4	6,173	12.7	4,683	18.1	3,462	18.5				
Never [c]	3,572	37.7	19,780	40.7	8,576	33.1	3,592	19.2				
N/A	3,345	35.3	8,100	16.7	2,658	10.3	1,490	8.0				
Total	9,474	100.0	48,616	100.0	25,907	100.0	18,674	100.0				
Experience												
Have you ever had to pull an athlete out of a game because of a possible concussion?									12,801.7	< 0.0001	0.25	6

	Mutually exclusive age categories											
	5 years and younger		6–10 years of age		11–13 years of age		14–18 years of age		χ^2	p-value	Cramer's V[b]	DF
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent				
Yes[c]	377	4.0	7,253 14.9		9,124	35.2	8,842	47.4				
No [e,f,g,h,i]	7,154	75.5	37,212 76.5		15,486	59.8	8,817	47.2				
N/A [d,e,f,g,h]	1,943	20.5	4,151 8.5		1298	5.0	1,016	5.4				
Total	9,474	100.0	48,616 100.0		25,908	100.0	18,675	100.0				
Has a medical provider ever diagnosed an athlete you were coaching with a concussion?									16,860.3	< 0.0001	0.23	9
Yes [c]	189	2.0	3,313	6.8	5,619	21.7	7,840	42.0				
No [c]	6,947	73.3	39,255	80.8	17,691	68.3	8,940	47.9				
Unsure [d,e,f,g,h]	202	2.1	1,716	3.5	1,323	5.1	901	4.8				
N/A [d,e,f,g,h]	2,136	22.6	4,332	8.9	1,275	4.9	993	5.3				
Total	9,474	100.0	48,616	100.0	25,908	100.0	18,674	100.0				
Attitudes												
I am confident in my ability to recognize concussion symptoms in youth athletes									792.4	< 0.0001	0.06	6
Strongly Agree/Agree	7,511	79.3	40,844	84.0	22,760	87.9	16,759	89.8				
Neither Agree Nor Disagree	1,516	16.0	6,203	12.8	2,566	9.9	1,548	8.3				
Disagree/Strongly Disagree	447	4.7	1,563	3.2	580	2.2	364	2.0				
Total	9,474	100.0	48,610	100.0	25,906	100.0	18,671	100.0				
There are things I can do to help prevent concussion among my athletes									169.9	< 0.0001	0.03	6
Strongly Agree/Agree	8,915	94.1	45,918	94.5	24,243	93.6	17,188	92.1				
Neither Agree Nor Disagree	506	5.3	2,365	4.9	1,441	5.6	1,229	6.6				
Disagree/Strongly Disagree	53	0.6	327	0.7	222	0.9	254	1.4				
Total	9,474	100.0	48,610	100.0	25,906	100.0	18,671	100.0				
My athletes would tell me if they experienced concussion symptoms									1761.4	< 0.0001	0.09	6
Strongly Agree/Agree	3,299	34.8	21,009	43.2	13,408	51.8	10,500	56.2				
Neither Agree Nor Disagree	3,917	41.4	18,224	37.5	8,394	32.4	5,572	29.8				
Disagree/Strongly Disagree	2,257	23.8	9,377	19.3	4,104	15.8	2,598	13.9				

	Mutually exclusive age categories											
	5 years and younger		6–10 years of age		11–13 years of age		14–18 years of age		χ^2	p-value	Cramer's V[b]	DF
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent				
Total	9,473	100.0	48,610	100.0	25,906	100.0	18,670	100.0				
I am confident in my ability to help an athlete with the return to play process									909.8	< 0.0001	0.07	6
Strongly Agree/Agree	6,914	73.0	37,935	78.0	21,507	83.0	15,951	85.4				
Neither Agree Nor Disagree	1,909	20.2	7,820	16.1	3,232	12.5	1,956	10.5				
Disagree/Strongly Disagree	651	6.9	2,854	5.9	1,167	4.5	763	4.1				
Total	9,474	100.0	48,609	100.0	25,906	100.0	18,670	100.0				
I talk with my athletes about concussion and encourage them to report concussion symptoms									2890.3	< 0.0001	0.12	6
Strongly Agree/Agree [c]	6,225	65.7	36,812	75.7	22,016	85.0	16,464	88.2				
Neither Agree Nor Disagree [c]	2,729	28.8	9,545	19.6	3,134	12.1	1820	9.8				
Disagree/Strongly Disagree [c]	520	5.5	2,251	4.6	756	2.9	385	2.1				
Total	9,474	100.0	48,608	100.0	25,906	100.0	18,669	100.0				
I plan to teach my athletes ways to prevent concussion									247.3	< 0.0001	0.04	6
Strongly Agree/Agree	8,610	90.9	45,885	94.4	24,667	95.2	17,578	94.2				
Neither Agree Nor Disagree	793	8.4	2,513	5.2	1,147	4.4	995	5.3				
Disagree/Strongly Disagree	71	0.8	210	0.4	91	0.4	96	0.5				
Total	9,474	100.0	48,608	100.0	25,905	100.0	18,669	100.0				

[a] This number includes only coaches who selected a single age group and excludes the 1143 coaches who selected N/A for the age group.

[b] Cramer's V helps to determine the effect size of the overall x^2 test. Please see Ellis (2010) and Zaiontz (2013) for interpretation. Given the large sample size, only medium and large effect sizes are considered for pairwise analysis and interpretation.

[c] All differences are significant at the $p < .5$ level.

[d] Difference between 5 and younger and 6–10 is significant at the $p < .5$ level.

[e] Difference between 5 and younger and 11–13 is significant at the $p < .5$ level.

[f] Difference between 5 and younger and 14–18 is significant at the $p < .5$ level.

[g] Difference between 6 and 10 and 11–13 is significant at the $p < .5$ level.

[h] Difference between 6 and 10 and 14–18 is significant at the $p < .5$ level.

[i] Difference between 11 and 13 and 14–18 is significant at the p < .5 level.

Table 4

Concussion-related education, access to resources, experiences and attitudes by contact level of sport (n=112,593)[a].

	Mutually exclusive sport type categories									
	Contact or collision		Limited contact		Noncontact		χ^2	p-value	Cramer's V[b]	DF
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage				
Education										
Prior to taking the training today, have you completed a training about concussion prevention and preparedness?							968.3	<0.0001	0.09	2
Yes	44,759	59.3	17,447	49.6	1,287	64.5				
No	30,683	40.7	17,698	50.4	710	35.6				
Total	75,442	100.0	35,145	100.0	1,997	100.0				
Resources										
How often do you carry information about concussions with you when you are coaching?							465.6	<0.0001	0.05	6
At all games and practices	39,974	53.0	16,871	48.0	985	49.3				
At some games and practices	6,220	8.2	2,480	7.1	189	9.5				
Only at games OR only at practices	2,276	3.0	947	2.7	94	4.7				
Never	26,972	35.8	14,850	42.3	729	36.5				
Total	75,442	100.0	35,148	100.0	1,997	100.0				
How often do your athletes have access to an athletic trainer or other health care provider?							2777.7	<0.0001	0.11	8
At all games and practices	16,115	21.4	4,617	13.1	625	31.3				
At some games and practices	12,991	17.2	5,932	16.9	413	20.7				
Only at games OR only at practices	11,646	15.4	3,362	9.6	294	14.7				
Never	23,608	31.3	14,729	41.9	407	20.4				
N/A	11,083	14.7	6,508	18.5	258	12.9				
Total	75,443	100.0	35,148	100.0	1,997	100.0				
Experience										
Have you ever had to pull an athlete out of a game because of a possible concussion?							4053.7	<0.0001	0.13	4
Yes	24,979	33.1	5,615	16.0	276	13.8				
No	43,843	58.1	26,868	76.4	1,536	76.9				
N/A	6,622	8.8	2,665	7.6	185	9.3				
Total	75,444	100.0	35,148	100.0	1,997	100.0				
Has a medical provider ever diagnosed an athlete you were coaching with a concussion?							2807.0	<0.0001	0.11	6
Yes	16,878	22.4	3,520	10.0	357	17.9				
No	48,214	63.9	27,556	78.4	1,365	68.4				
Unsure	3,387	4.5	1346	3.8	83	4.2				
N/A	6,964	9.2	2,726	7.8	192	9.6				

	Mutually exclusive sport type categories									
	Contact or collision		Limited contact		Noncontact		χ^2	p-value	Cramer's V[b]	DF
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage				
Total	75,443	100.0	35,148	100.0	1,997	100.0				
Attitudes										
I am confident in my ability to recognize concussion symptoms in youth athletes							100.8	<0.0001	0.02	4
Strongly Agree/Agree	65,129	86.3	29,566	84.1	1,672	83.7				
Neither Agree Nor Disagree	8,206	10.9	4,455	12.7	256	12.8				
Disagree/Strongly Disagree	2,100	2.8	1,121	3.2	69	3.5				
Total	75,435	100.0	35,142	100.0	1,997	100.0				
There are things I can do to help prevent concussion among my athletes							25.2	<0.0001	0.01	4
Strongly Agree/Agree	70,243	93.1	32,966	93.8	1,882	94.2				
Neither Agree Nor Disagree	4,472	5.9	1,913	5.4	98	4.9				
Disagree/Strongly Disagree	720	1.0	263	0.8	17	0.9				
Total	75,435	100.0	35,142	100.0	1,997	100.0				
My athletes would tell me if they experienced concussion symptoms							61.0	<0.0001	0.02	4
Strongly Agree/Agree	36,278	48.1	16,306	46.4	1,068	53.5				
Neither Agree Nor Disagree	26,065	34.6	12,728	36.2	621	31.1				
Disagree/Strongly Disagree	13,092	17.4	6,106	17.4	308	15.4				
Total	75,435	100.0	35,140	100.0	1,997	100.0				
I am confident in my ability to help an athlete with the return to play process							29.4	<0.0001	0.01	4
Strongly Agree/Agree	61,110	81.0	28,077	79.9	1,633	81.8				
Neither Agree Nor Disagree	10,406	13.8	5,265	15.0	266	13.3				
Disagree/Strongly Disagree	3918	5.2	1,798	5.1	98	4.9				
Total	75,434	100.0	35,140	100.0	1,997	100.0				
I talk with my athletes about concussion and encourage them to report concussion symptoms							642.2	<0.0001	0.05	4
Strongly Agree/Agree	61,250	81.2	26,208	74.6	1,534	76.8				
Neither Agree Nor Disagree	11,539	15.3	7,218	20.5	367	18.4				
Disagree/Strongly Disagree	2,644	3.5	1,714	4.9	96	4.8				
Total	75,433	100.0	35,140	100.0	1,997	100.0				
I plan to teach my athletes ways to prevent concussion							88.5	<0.0001	0.02	4
Strongly Agree/Agree	71,251	94.5	32,874	93.6	1,810	90.6				
Neither Agree Nor Disagree	3,821	5.1	2,117	6.0	172	8.6				
Disagree/Strongly Disagree	360	0.5	148	0.4	15	0.8				
Total	75,432	100.0	35,139	100.0	1,997	100.0				

[a]This number includes only coaches who selected a single sport and excludes the 15,117 coaches who selected "other" for the sport that they coached, which represents an unknown level of contact.

[b] Cramer's V helps to determine the effect size of the overall x2 test. Please see Ellis (2010) and Zaiontz (2013) for interpretation. Given the large sample size, only medium and large effect sizes are considered for pairwise analysis and interpretation.