A systematic review of coach and parent knowledge of concussion

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Abstract
Coach and parent knowledge of concussion is essential for the prevention, appropriate diagnosis, management, and return-to-play of youth athletes. This systematic review examined concussion knowledge of coaches and parents of youth athletes including general knowledge, sign and symptom recognition, management, and return-to-play protocols. Six databases were searched for studies that evaluated baseline knowledge levels of coaches and parents of youth athletes regarding concussion. A total of 17 articles (out of 1500 articles) met selection criteria. Coaches and parents could identify common signs and symptoms of concussion (e.g. headaches, dizziness, etc.) but were less aware of emotional symptoms (e.g. sadness or mood swings). Coaches were unaware that youth athletes may require more time to recover from a concussion compared to adults. Parents lacked knowledge regarding proper concussion management and return-to-play guidelines. Physicians were the main source of information for parents, while coaches and athletic trainers were the least utilized. There were clear gaps in both coach and parent knowledge of concussion. Future education programs should provide pediatric-specific information for concussion management, recovery, and return-to-play. Additional efforts are needed to increase communication and knowledge transfer between coaches, medical staff, and parents.

Keywords
Injury prevention/safety, sports, pediatric health, health policy, health education

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Introduction
Annually, 300,000 youth athletes sustain a concussion.1 As many as 50% of concussions are unreported; thus, the actual incidence could be as high as 3.8 million.2 If sports medicine staff are not present at the time of injury, the onus falls on the coaches and parents to determine the correct course of action if a concussion is suspected. It is critical that coaches and parents are knowledgeable about the signs/symptoms of concussion and state/league regulations regarding concussion to treat suspected injuries accordingly.

Most coaches are familiar with a general definition of a concussion and the common signs and symptoms (e.g. headache, dizziness, blurred vision, loss of consciousness, etc.).3 However, coaches show increases in knowledge and changes in attitudes from concussion education programs designed to increase their general knowledge of concussion, recognition of signs and symptoms, as well as procedures for diagnosis, management, and return-to-play.4–7 Yet, according to a report on 1 July 2017, only 34 states required concussion-specific training for coaches,8 and there are no such mandates for parents.

Although 47 states require the distribution of concussion information to parents prior to their child’s participation in interscholastic sport (e.g. information sheet/pamphlet), the law does not specify who distributes this information sheet (e.g. coaches, medical staff, athletic trainers). Physicians were the main source of information for parents, while coaches and athletic trainers were the least utilized. There were clear gaps in both coach and parent knowledge of concussion. Future education programs should provide pediatric-specific information for concussion management, recovery, and return-to-play. Additional efforts are needed to increase communication and knowledge transfer between coaches, medical staff, and parents.
etc.) and its content is not standardized. Only 41 of these 47 states require the signatures of parents of youth student-athletes verifying that the information was received and only three of these states require that updates are made to the information sheet, so it is possible that parents may not have current information regarding concussions. Therefore, once their child has sustained a concussion, a parent may lack the requisite knowledge to recognize worsening symptoms, follow concussion management protocols, and adhere to safe return-to-play guidelines. Indeed, recent studies suggest that parents know less about concussion than coaches.

The purpose of this systematic review was to evaluate knowledge of coaches and parents of youth athletes regarding general definitions of concussion, signs and symptoms of concussion, recommended concussion management, and proper return-to-play protocols. The goal of this review was to identify knowledge gaps in coaches and parents of youth athletes in order to make specific recommendations for improving concussion education programs for both populations.

Methods

Data sources

Consistent with the PRISMA guidelines, six databases were queried: EBSCOHost (including SPORTDiscus, Academic Search Premiere, CINAHL and PsycINFO), PubMed, and Google Scholar. The following search terms were used: (inform* OR educat* OR aware* OR know*) AND (parent* OR coach*) AND (concussion OR mtbi OR mild traumatic brain injury) AND sport AND (prevent* OR reduc*).

Inclusion and exclusion criteria

Articles were excluded based on the following criteria: not a peer-reviewed study, not related to concussion knowledge or education of parents or coaches, did not assess coach or parent concussion knowledge, examined the impact of a concussion education intervention rather than baseline knowledge of coaches or parents, not youth athletes (i.e. <18 y/o), and insufficient methods details. No limitations were placed on the year of publication.

Data extraction

Figure 1 depicts the PRISMA flow diagram outlining the different stages of the identification and eligibility review. The initial search conducted on 1 May 2018, returned 1500 articles. After removing duplicates, 1198 articles were screened by title and abstract. A total of 107 articles were submitted for full-text review. Following the full-text review, a total of 90 articles were excluded yielding a total of 17 articles that met inclusion. Reference sections of included articles were searched for other articles meeting inclusion criteria; however, no articles were added during this search. The title and abstract and full-text reviews were conducted by RSF and ML. Any disagreements regarding inclusion and exclusion were settled via consultation with a third author.

Risk of bias

All of the 17 studies included were observational (no interventions); therefore, they could not be evaluated according to any of the current risk of bias assessment tools (i.e. GRADE, AGREE-II, ROBINS-I, etc.). However, the majority of studies had large samples (N > 100), with a total of 10,036 parents and coaches evaluated across all studies.

Results

Study specifics are reported in Table 1. All 17 studies were published between 2010 and 2018. A total of 1030 coaches and 3775 parents were surveyed across 16 studies. Additionally, Cusimano et al. surveyed 5231 participants, but they did not differentiate between coaches or parents. No standardized questionnaires were used. The specific areas of knowledge, questions asked of coaches/parents, and content areas differed across studies and population. Variability in the outcomes regarding coach and parent knowledge may be due to differences in the specific questions asked.

The percentage of coaches able to correctly identify signs and symptoms of concussion are presented in Figure 2. These signs and symptoms are categorized into cognitive, physical, emotional, or sleep symptoms. Cognitive signs and symptoms included difficulty concentrating, feeling slowed down or foggy, confusion, memory issues. Physical symptoms included headache, dizziness, nausea, loss of consciousness, blurred vision, sensitivity to light or sound, drowsiness or fatigue, tinnitus. Emotional signs and symptoms included nervousness, anxiety, sadness or depression, irritability, and agitation. Sleep symptoms included sleeping more than usual, and sleep disturbances/trouble sleeping.

Figure 3 presents the percentage of coaches and parents reporting knowledge in different areas of concussion management or return-to-play protocol including increased risks of second concussion or cumulative effect of multiple concussions, increased recovery time compared to adults, suspected concussion (i.e. a player suspected of a concussion cannot return-to-play), clearance for return-to-play (i.e. players must be cleared by...
loss of consciousness (i.e. loss of consciousness is a sign of concussion but is not necessary for a concussion diagnosis).

Supplementary Table 2 provides a detailed summary of the percentage of coaches or parents that reported knowledge regarding sign and symptom recognition, concussion management, and return-to-play protocols. It should also be noted that Broglio et al., Cusimano et al., Hecimovich et al., Hunt et al., and Weerdenburg et al. used non-U.S.-based samples and the countries in which their samples are based (Italy, Australia, and Canada) may have different policies and practices regarding concussion education.

Coach knowledge

Recognition of signs and symptoms. Several studies investigated coaches’ ability to identify various signs and symptoms of concussion. Coaches showed a high ability to recognize cognitive and physical signs and symptoms. Of coaches surveyed, 82.6–96.2% correctly stated that loss of consciousness is not necessary for a concussion diagnosis. Although 80–100% of coaches in these studies are able to identify cognitive and physical symptoms (e.g. dizziness, confusion, etc.), they were less aware of emotional or sleep symptoms (e.g. sadness, trouble sleeping, etc.).

Concussion management and return-to-play protocols. Studies reported that 86.6–100% of coaches were aware that a player should be taken off the field and held out of play when presenting with concussion symptoms. Furthermore, 85–92.5% were aware that once a concussion is diagnosed, a player cannot return-to-play without the approval of a medical professional. Currently, all states require clearance from a medical professional for a youth athlete to return-to-play after a concussion; however, some
Table 1. Study characteristics and key findings regarding coach and parent concussion knowledge (N = 17).

| References               | Age group of athletes (youth or high school), age range | Number of participants, participant details | Outcome measures                                                                 | Key findings                                                                                                                                 |
|--------------------------|---------------------------------------------------------|---------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Bloodgood et al.³        | Both, 5–18                                              | 300, parents of youth athletes              | Awareness and knowledge of concussion; attitudes about concussion; information-seeking behaviour | Parents with high concussion awareness were also likely to consider the injury a critical issue; mothers were more likely to consider concussion a critical issue than fathers |
| Broglio et al.¹²         | High school                                             | 27, Italian club level soccer coaches       | General concussion knowledge; sign and symptom recognition; concussion management/recovery | Coaches more likely to correctly identify detractor symptoms than correct symptoms                                                           |
| Cusimano et al.⁹         | N/A                                                     | 5231, parents and coaches of athletes and athletes | Sign and symptom recognition; management; return to sport; factors affecting knowledge levels | Coaches are more knowledgeable than parents; those with traumatic brain injury (TBI) history are more knowledgeable regarding concussion than those who have not suffered a TBI |
| Esquivel et al.¹³        | High school                                             | 119, head high school coaches               | Familiarity with state concussion guidelines laws; sign and symptom identification; concussion management | Nearly all coaches are familiar with state concussion guidelines, signs and symptoms provided were generally the ones which are most commonly reported; nearly all reported following proper concussion management guidelines |
| Hecimovich et al.¹⁴      | Both, 8–19                                              | 1441, parents of youth and high school athletes | Recognition of signs and symptoms; concussion management; return-to-play criteria | Parents who had received concussion training prior to the study had better recognition of signs and symptoms and knowledge of concussion management and return-to-play criteria |
| Hossler and Phang⁴       | High school                                             | 544, high school coaches                    | General knowledge; signs and symptom recognition; concussion misconceptions         | Although the majority of coaches were not aware of age-related differences in concussion risk and recovery, they were able to correctly identify the majority of symptoms and misconceptions |
| Hunt et al.¹⁰            | Both, N/A                                               | 68, youth ice-hockey coaches; 248, parents of youth ice-hockey players | General knowledge; sign and symptom recognition; management; return-to-play          | Coaches are more knowledgeable than parents; coaches and athletes with a history of concussion are more knowledgeable than coaches or athletes who have not experienced a concussion; doctor/nurse are the |

(continued)
| References             | Age group of athletes (youth or high school), age range | Number of participants, participant details | Outcome measures                                                                 | Key findings                                                                                                                                 |
|------------------------|---------------------------------------------------------|---------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Kay et al.15            | Youth, 11–14                                            | 234, parents of youth athletes               | Sign and symptom recognition; possible consequences of concussion; parental attitudes regarding sport-related concussions | Most common knowledge source for parents. Physical signs/symptoms of concussion were the most commonly recognized; parents are generally aware of the consequences of one or multiple concussions. |
| Konin and Horsley16     | Youth, 7–10                                             | 45, parents of youth ice-hockey players      | Sign and symptom recognition; concussion management; awareness of concussion policy and computerized diagnostic tools | Parents are less aware of emotional symptoms; parents know recovery time differs between individual; parents are not aware of computerized diagnostic tools. |
| Lin et al.17            | Both                                                    | 214, parents of youth athletes               | Concussion knowledge; attitudes about concussion                                  | Parents with higher education and income had higher concussion knowledge and concussion attitude scores. |
| Mannings et al.18       | Both, 5–15                                              | 310, parents attending youth football games  | General concussion knowledge; sign and symptom recognition; source of concussion information | Majority of parents answered at least 5 of 7 concussion knowledge statements correctly; majority of parents correctly identified at least 8 of 12 signs/symptoms correctly; majority of parents received concussion information from a physician or other health care provider. |
| Nanos et al.7           | High school, 13–19                                       | 15, coaches of high school athletes; 132, parents of high school athletes | Sign and symptom recognition; management; potential consequences of concussion; knowledge resources; influence of sport type (contact vs. non-contact) | Those with history of concussion were more likely to be involved in contact sport and have higher knowledge levels; those associated with contact sports perceived themselves to be more knowledgeable, but knowledge scores were not higher. |
| O’Donoghue et al.5      | High school                                             | 126, high school coaches                     | Concussion sign and symptom recognition; concussion management; concussion prevention | Largest knowledge gap is in concussion management; attending a concussion workshop was related to higher knowledge scores. |
| Shenouda et al.19       | Both or N/A                                             | 246, parents of youth soccer players; 78, coaches of youth soccer players | Knowledge of concussion signs and symptoms; return-to-play                          | Majority of both coaches and parents have a strong knowledge of signs and symptoms of concussion and return-to-play protocols. |
| Shroyer and Stewart20    | High school                                             | 53, high school coaches in rural environments | Knowledge of concussion signs and symptoms; concussion management                  | Coaches demonstrated strong knowledge regarding signs and symptoms and return-to-play guidelines; however, the majority. |
states have only adopted policies regarding medical clearance as recently as 2015. Therefore, coaches in states with more recent requirements for medical clearance may be less knowledgeable of this rule change. Over 85% of high school coaches knew that having a single concussion increases an athlete’s likelihood of sustaining a second concussion and cumulative effects of concussions.4,7,20

While coaches appeared to have general knowledge regarding concussions, they do not know how concussions affect pediatric athletes differently than adult athletes. Only 13.7–16% were aware that youth athletes take longer to recover from a concussion than older athletes.4,20 Concussion management (i.e. response after the athlete is removed from play, rate of recovery, criteria to return-to-play) was the most substantial knowledge gap for coaches.5

Factors that influence coach knowledge and attitudes regarding concussion. According to the National Athletic Trainers’ Association Position Statement on the Management of Concussion, it is the athletic trainer’s role to educate coaches, players, and parents of sport-related concussion regarding cause, identification, management, restrictions, and return-to-play protocols.23 Two studies assessed whether access to an athletic trainer (AT) increased coach knowledge of concussion. Knowledge of concussion was not different between coaches that had access to an AT and those that did not, and knowledge did not differ between coaches that had discussed concussions with an AT and those that did not.4,5

Parent knowledge

Although the majority of concussion education research focused on coach knowledge, a few studies investigated concussion knowledge in parents of youth athletes.14,18,22 These studies assessed parents’ general knowledge, signs and symptoms, management of concussion, return-to-play protocols. Some studies also examined factors that influenced parent knowledge of concussion.3,5,14,22

General knowledge of concussion and recognition of signs and symptoms. Mannings et al.18 found that 73.6% of parents correctly answered at least five out of seven general knowledge questions (i.e. whether a concussion affects the brain, whether a concussion can only occur from a direct blow to the head), but only 46.8% scored at least a six out of seven. Hunt et al.10 found similar results; 62.5% were aware that loss of consciousness and/or a direct blow to the head are not necessary for a concussion to be sustained. However, only
22.6% correctly identified how long symptoms of a concussion could last.\(^\text{10}\)

Beyond the basic definition of a concussion, parents were also able to recognize cognitive and physical signs and symptoms but were somewhat less knowledgeable about emotional and sleep signs and symptoms. Over 90% of parents were able to identify that memory problems, disorientation, and confusion are signs or symptoms of a concussion.\(^\text{14–16,18}\) In studies using a free-recall of symptom identification, the most common symptoms reported were dizziness (60%), headache (47%), and confusion (43%).\(^\text{21}\) Difficulty sleeping was a commonly identified sign or symptom (70.5–73%),\(^\text{14,16}\) although in one study only 28.2% of parents identified this as a sign or symptom.\(^\text{18}\) Only 44.2%\(^\text{18}\) and 47%\(^\text{16}\) identified emotional dysregulation as signs or symptoms of a concussion. Parents also commonly incorrectly reported distractor symptoms as actual signs and symptoms of a concussion. For example, over 90% reported believing that numbness or weakness in the arms or legs were concussion signs or symptoms,\(^\text{18}\) while another study found that 21.6–68.1% identified distractor symptoms including chest pain and having a black eye as concussion signs or symptoms.\(^\text{15}\)

**Concussion management and return-to-play protocols.** Two studies examined parents’ knowledge of appropriate concussion management and return-to-play protocols. More than 90% of parents reported that a child suspected of a concussion should not be allowed to return-to-play.\(^\text{14,22}\) When presented with two scenarios, 94.5% reported that an athlete should not return-to-play when exhibiting mild dizziness and a headache after a hit to the head, while 69% reported that an athlete exhibiting a mild headache without dizziness after a hit to the head should not return-to-play.\(^\text{14}\) Only 41% recognized proper concussion management and progressive return-to-play.\(^\text{14}\) Lastly, 71.4% were aware that their child’s participation in sport might be affected for weeks up to months after sustaining a concussion and 66.7% were aware that their child’s academics might be affected as well.\(^\text{22}\)

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*Figure 2.* The percentage of coaches or parents that reported knowledge in three categories of sign and symptom recognition. *\(^a\)This study was conducted outside of the U.S. *\(^b\)Did not differentiate between parents and coaches.*
Factors that influence parent knowledge. Demographics were an important determinant of parental knowledge of concussion. One study examined the relationship between parent demographics and concussion knowledge in parents and youth athletes. A U-shaped relationship between parent awareness of concussion and age was observed; an increasing percentage of parents reporting some concussion awareness was observed up to age 50 years, followed by a decrease in the percentage of parental awareness for parents older than 50 years. The age of the child also influenced parental awareness. Parents whose oldest child was 10- to 13-years-old were more likely to be aware of concussions (i.e. 99% of parents heard of concussion), compared with parents whose oldest child’s age was 5–9 years (72%) or 14–18 years (85%). While 84% believed concussions are a “critical issue,” this differed between mothers (68%) and fathers (34%). In addition to parent and child age, a recent study reported significant differences among ethnic groups, education level, and marital status with respect to knowledge level and attitude regarding concussions. Caucasians, parents with at least a bachelor’s degree, and parents who were divorced were more informed and exhibited more concern regarding concussion.

Hecimovich et al. found that parents who had received first aid and/or specialized concussion training were better able to correctly identify signs and symptoms compared to those with no training. Parents with concussion-specific training scored better on surveys of knowledge of concussion management and return-to-play compared to those with first aid training or no training.

Another critical factor that influenced parental knowledge of concussion was the source of information. As reliability and credibility of information vary based on the source, it is essential to know where parents gain information about concussion. Parents reported obtaining information from physicians (58%) or other health care professionals (45.6%). The media (57%) and Internet (43.1%) were the second and third most common sources parents used to obtain information regarding concussion. Similarly, Bloodgood et al. found a positive relationship between concussion awareness and Internet usage. Ninety-three percent of parents reporting daily Internet use had heard of concussions, while only 40% who accessed the Internet 1–2 days per week had heard of concussions. Of those having reported hearing about a concussion, 63% who accessed the Internet several times a day reported that they “strongly agree” that concussions are a serious issue.

Only 24.5% of parents reported that coaches and ATs provided information about concussion. Parents reported a lack of desire to talk to coaches or seek out further information related to a concussion. Interestingly, after receiving concussion education, the majority of coaches believed that educating their athletes’ parents about concussions was part of their role.

Discussion

This systematic review identified relative strengths and weakness in coach and parent knowledge of concussion signs and symptoms, management, and the return-to-play process. The primary knowledge gap for coaches was recognizing the difference in recovery time for a youth athlete compared to an adult athlete. No studies asked parents about youth specific recovery times. The largest knowledge gap for the parents was the fact that medical clearance was necessary for their child to return-to-play after a concussion.

There were notable inconsistencies regarding factors that influenced parent knowledge. While it is part of the role of both a coach and an AT to...
educate parents regarding concussions, parents reported that coaches and ATs were the least utilized source for concussion education.\textsuperscript{22}

**Coach knowledge**

Coaches' recognition of signs and symptoms appeared to be the strongest area of concussion knowledge, while less knowledge of management protocols or return-to-play guidelines was reported.\textsuperscript{5,9,19,20} Interestingly, coaches in the Broglio et al.\textsuperscript{12} study reported much lower sign and symptom recognition than coaches in other studies. This is likely due to a combination of factors including the year and location of the study and the fact that this study only examined soccer. Although the current focus of coach educational materials is the recognition of signs and symptoms,\textsuperscript{26} knowledge gaps regarding youth-specific management and return-to-play suggest that future programs place a greater emphasis on these aspects.\textsuperscript{4,19,20} While medical professionals are commonly responsible for concussion management, they may not be easily accessed by all athletes (i.e. athletes from low-income families or those that live in rural areas). Therefore, coach knowledge of concussion management may prevent premature return-to-play and prompt athletes to seek medical care if symptoms do not resolve.

**Parental knowledge**

Parents and guardians must understand and recognize the signs and symptoms of concussion to increase their athlete's safety during the management and return-to-play process. Although fewer studies have examined parental knowledge,\textsuperscript{14,18,22} the studies examined here suggest that parents are generally knowledgeable about concussion, signs and symptoms, and even the protracted recovery timeline for youth athletes. The majority of parents reported that an athlete should not return-to-play immediately following a concussive injury, but fewer parents were knowledgeable about what to expect during the recovery process and the long-term return-to-play protocols. Future efforts should assess parental knowledge of concussion management and return-to-play protocols with respect to athletic and academic outcomes.

The most common source of parental concussion knowledge was physicians and other medical professionals.\textsuperscript{22} This suggests that parent knowledge may be from interactions with medical professionals during pre-participation physicals or after an athlete is suspected of or has sustained a concussion. Future studies should examine when and how parents receive concussion information from medical professionals. Coaches and ATs were often the least utilized source of concussion knowledge, suggesting the need to determine why parents consider other sources or do not talk to coaches and ATs regarding concussion. Efforts to improve parent and coach communication may improve preemptive knowledge of concussion to parents of youth and high school athletes.

**Limitations and future directions**

The lack of a standardized concussion knowledge assessment precludes the direct comparison of knowledge levels across studies. The current assessments vary in the difficulty of questions, number of questions, type of questions, and domains of knowledge assessed. Differences in the signs and symptoms of concussion, as well as distractor symptoms, were evident between studies. In fact, “numbness in arms or legs” was considered a distractor by Hecimovich et al.,\textsuperscript{14} Mannings et al.,\textsuperscript{18} and Shenouda et al.,\textsuperscript{19} but was considered a legitimate symptom of concussion by Kay et al.\textsuperscript{15} These inconsistencies obfuscate accurate estimates of coach and parent knowledge levels.

Another limitation was variance in sampling procedures. Many studies distributed their surveys through league listervs or newsletters,\textsuperscript{19} athletic associations,\textsuperscript{3,4,12–14,20} school boards,\textsuperscript{5} and online tools such as Mechanical Turk.\textsuperscript{9,21} Others used convenience samples of parents attending informational meeting,\textsuperscript{7,15} those attending games/matches or practices,\textsuperscript{10,16,18} and patients at emergency rooms, pediatric hospitals, or orthopedic clinics.\textsuperscript{17,22} However, the large number of participants included in this review (1030 coaches, 3775 parents, and 5231 unspecified) may mitigate some of the concerns regarding the use of convenience samples.

Future studies should determine the most crucial concussion concepts for parents and coaches. Education for both groups should continue to cover general knowledge, signs and symptoms, proper concussion management, and proper return-to-play protocol. For coaches, the focus of these programs should be placed on proper concussion management as this is a knowledge gap compared to sign and symptom recognition. Education programs for parents should continue to focus on sign and symptom recognition, particularly those related to emotional regulation and sleep. These symptoms may be reported/observed by parents during management and return-to-play. Although recent legislation in 47 states requires that parents of youth athletes receive an information sheet regarding concussion prior to participation,\textsuperscript{8} the efficacy and value of this information sheet for parental knowledge of concussions are unclear.

Future studies should investigate the factors that influence coach and parent knowledge. The lack of
knowledge differences between coaches with and without access to an AT points to a need for further investigation of the methods of communication between ATs and coaches. Additionally, future programs are needed to assist ATs with communicating or providing concussion education to coaches and parents.

Few studies examined youth athletes below high school age. Data from Gilchrist et al. suggest that sports are a common cause of non-fatal traumatic brain injury requiring an emergency department visit for children as young as five years. Therefore, as the number of very young athletes increases, it is vital to study this population. Younger athletes may take longer to recover and may show different signs and symptoms than high school age athletes. Very young athletes may have difficulty reporting their signs and symptoms. Thus, it is imperative that future studies examine this population and ensure that parents of young athletes and coaches receive education specific to this age range.

The majority of current education programs are aimed at identifying a concussion, how to properly manage symptoms, and how to safely return an athlete to play after a concussion. There is a lack of education regarding coaching and safety techniques aimed at reducing the incidence of concussion. Other sports leagues or educational programs should consider sport-specific recommendations to parents and coaches similar to that created by the Heads Up Football program (i.e., Player Safety Coaches and equipment evaluation) aimed at modifying practice plans to reduce the chances of head impacts. Additionally, further research is needed to investigate how subjective opinion of concussion influences safe practice. Future education efforts should address attitudes and beliefs as well as concussion knowledge.

Conclusions and policy implications

This study evaluated the knowledge of coaches and parents of youth athletes regarding different facets of youth sport concussion and identified several key knowledge gaps to help improve the quality of sport concussion education to these two populations. Knowledge levels among coaches and parents may be due to changes in state laws regarding youth sport concussion education, management, and return-to-play. It is important to note that the youth sport concussion laws in all 50 states and Washington DC apply to interscholastic sports. According to data collected in 2015, only 23 states and Washington DC had extended these laws to apply to non-interscholastic sports. Coaches and parents of youth athletes who only participate in non-interscholastic sports may not receive the same concussion education and information as those who are involved in interscholastic sports. It may be useful for all states to mandate both coach and parent concussion education as well as systematize the content of materials distributed to coaches/parents regarding concussion prior to and immediately following a suspected concussion.

The ultimate goal of education programs is to increase awareness of youth sport concussion to improve the safety of young athletes, reduce the occurrence of youth sport concussions, and minimize long-term consequences once a concussion has been sustained. Future epidemiological studies are necessary to evaluate the long-term impact of education programs on youth athlete health outcomes.

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Supplementary material

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