

Parents' and Child's Concussion History as Predictors of Parental Attitudes and Knowledge of Concussion Recognition and Response

Melissa C. Kay,* MS, LAT, ATC, Johna K. Register-Mihalik,*[†] PhD, LAT, ATC, Cassie B. Ford,* PhD, Richelle M. Williams,[‡] PhD, ATC, and Tamara C. Valovich McLeod,[‡] PhD, ATC, FNATA

Investigation performed at the University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA, and A.T. Still University, Mesa, Arizona, USA

Background: Parents' knowledge of and attitudes toward concussions are often vital factors that affect care for injured adolescent athletes. It is important to understand the role that parents' personal experiences with concussions play with regard to current concussion knowledge and attitudes so that clinicians may tailor their educational approaches.

Purpose/Hypothesis: The purpose of this study was to determine an association between parents' personal experiences and their child's experiences with concussions as well as parental concussion knowledge and attitudes. We hypothesized that parents who have personally experienced symptoms or have a child who has experienced symptoms would have better knowledge and more favorable attitudes toward concussions.

Study Design: Cross-sectional study; Level of evidence, 3.

Methods: Parents of youth sport athletes (N = 234 [82 male, 144 female, 8 unreported]; mean age, 44.0 ± 6.3 years) completed a prevalidated survey for concussion knowledge (maximum score possible, 29) and attitudes (maximum score possible, 49). Higher scores indicated better knowledge and more favorable attitudes toward concussive injuries. Parents reported the frequency of concussion diagnoses and/or experiences of concussion-related symptoms and whether their child had suffered a diagnosed concussion or experienced concussion symptoms (yes/no). Spearman rank correlation and multivariable regression were used to examine the association between experience of symptom clusters (self or child) and concussion knowledge and attitudes.

Results: Knowledge was moderate (mean, 23.3 ± 2.5 of 29), while attitudes prioritized disclosure (mean, 46.3 ± 3.7 of 49). Parents' experience of the sleep-arousal symptom cluster was positively associated with concussion attitudes ($r = 0.22$, $P = .002$; $\beta = -3.301$, $P = .011$). Parents with children who experienced sleep-arousal and vestibular-somatic symptom clusters were weakly associated with parental concussion knowledge (sleep-arousal: $r = 0.15$, $P = .041$; vestibular-somatic: $r = 0.17$, $P = .020$; $\beta = 0.540$, $P = .012$).

Conclusion: Our findings suggest that parents' personal experiences with concussion-related symptoms have little effect on parental knowledge and attitudes as a whole. However, clinicians should consider particular symptom clusters that may provide insight into targets for future concussion education. According to these findings, parents of youth sport participants would benefit from increased concussion education focusing on the types of symptoms as well as the consequences of suffering a concussion.

Keywords: concussion; knowledge; attitudes; symptom clusters; education

A concussion is a complex injury often defined by 4 primary characteristics: (1) a direct blow to the head or body, (2) rapid onset of short-lived neurological impairments, (3) functional deficits rather than structural impairments, and (4) graded clinical symptoms that sequentially resolve.¹⁷ As the level of

sport participation rises, a greater incidence of concussions is seen, particularly within contact and collision sports²³; however, it is unknown whether it is truly an increase in the number of injuries or an increase in those reporting injuries, as nondisclosure of a concussion is a reported issue within athletics.^{16,21} Another possible reason for the increase in concussions may be the presence of on-site medical providers who are trained to recognize and evaluate such injuries. Without proper disclosure of concussion-related symptoms

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by athletes, it is difficult to effectively diagnose, manage, and treat these injuries.

Because concussions are primarily a functional injury, which infrequently result in structural damage to the brain as visible through currently available neuroimaging modalities, they are diagnosed primarily by the presence of symptoms. These symptoms are commonly assessed subjectively through patient reporting; however, in early adolescents (ages 8-12 years), it may be difficult to gauge a child's understanding of the symptoms because of misunderstandings with the terminology as well as symptom overlap with other abnormalities that may not be specific to a concussion.^{3,14} Therefore, it is advocated that the parent be included as an integral part of the concussion evaluation process as a supplement to not only how the patient feels but also how he or she acts in the home environment.⁶

Previous reports have suggested that the greatest influence on child care-seeking behavior is parental involvement.²⁷ Common themes relating to parental influence include discrepancies in the parent's versus child's perception of illness severity as well as the parent's wanting to do what is best for the child.^{8,18} Parents are often the source of care-seeking for their child after a concussion. Therefore, they play a vital role in the management of sport-related concussions, from initial recognition and response through to recovery. Parents have the ability to provide insight to those providing care about their child's demeanor and functioning before and after the injury⁶ and may supplement and/or verify the child's description. As such, concussion education targeted toward parents may be important to ensure appropriate recognition of the injury. In a sample of youth rugby players, most parents stated that they were able to recognize a potential concussive injury in their teenager, with nearly all being aware of the consequences of playing through a concussion; however, only half were actually aware of the return-to-play guidelines to be followed after the injury.²⁵ Stevens et al²⁴ observed that parents reported their child as asymptomatic despite he or she having postconcussive symptoms. Therefore, even though parents may be able to provide insight into injury recognition, they should not replace the athlete's self-report and the authority of medical personnel regarding concussion recognition and management.

Many organizations have attempted to target education for parents regarding the signs and symptoms of a concussion along with red flags that would warrant the immediate referral to a medical professional.¹² Without proper knowledge, parents may be less inclined to seek appropriate care for their child and therefore be more susceptible to negative outcomes of an injury. Parents' reports of their child's symptoms are often used to supplement the self-reports of young athletes.^{2,6} As such, parental attitudes

TABLE 1
Components of Positive and Negative Attitudes

Positive (Favorable) Attitudes

It is serious when an athlete experiences a headache or dizziness after a blow to the head or body.
It is important for an athlete not to participate in activity when experiencing signs and/or symptoms of a concussion.
It is important to be informed of how concussions happen.
It is important to be informed of how concussions can be prevented.
It is important to know the steps to follow if an athlete has a concussion.
It is important for an athlete to report possible symptoms to a medical professional or coach.

Negative Attitudes

It is not serious when an athlete experiences a headache or dizziness after a blow to the head or body.
It is not important for an athlete not to participate in activity when experiencing signs and/or symptoms of a concussion.
It is not important to be informed of how concussions happen.
It is not important to be informed of how concussions can be prevented.
It is not important to know the steps to follow if an athlete has a concussion.
It is not important for an athlete to report possible symptoms to a medical professional or coach.

toward a concussive injury are of great importance. If attitudes are negative, or hesitant to disclosure, they may be less inclined to report their child's symptoms or be cognizant of the injury occurring. Specific components of positive versus negative attitudes are listed in Table 1. These attitudes and parental knowledge may also be influenced by previous experiences of concussions through their own experience or that of their child.

The purpose of this study was to determine if there was an association between parents' own personal experience of suffering a concussion or their child suffering a concussion and their knowledge and attitudes toward concussions. By identifying this link, clinicians can better target parents needing supplemental information. We hypothesized that parents who have prior exposure to concussion symptoms, through either their own or their child's experience, would have better knowledge and more positive attitudes, indicating disclosure as a priority, of concussive injuries than those who have never experienced concussion-related symptoms. We further hypothesized that such prior experience of the vestibular-somatic and cognitive-sensory concussion-related symptom clusters may influence parental concussion-related knowledge and attitudes.

†Address correspondence to Johna K. Register-Mihalik, PhD, LAT, ATC, University of North Carolina at Chapel Hill, 209 Fetzer Hall, CB#8700, Chapel Hill, NC 27599, USA (email: johnakay@email.unc.edu).

*University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA.

‡A.T. Still University, Mesa, Arizona, USA.

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Ethical approval for this study was obtained from the WakeMed Institutional Review Board (IRBNet No. 317759-1, WakeMed study No. 907), the University of North Carolina at Chapel Hill Institutional Review Board (IRB No. 12-1232), and the A.T. Still University Institutional Review Board (IRB No. 2012-53).

TABLE 2
Parents' Demographics (N = 234)

Variable	n (%)
Age (n = 15 missing)	
18-24 y	1 (0.4)
25-34 y	15 (6.4)
35-44 y	108 (46.2)
45-54 y	85 (36.3)
55-64 y	8 (3.4)
≥65 y	2 (0.8)
Sex (n = 8 missing)	
Male	82 (35.0)
Female	144 (61.5)
Formal concussion education (n = 10 missing)	
Yes	48 (20.5)
No	176 (75.2)
Concussion history	
Parent (self-reported)	
Diagnosed	63 (26.9)
Symptoms	98 (41.9)
Child (parent-reported)	
Diagnosed	19 (8.1)
Symptoms	61 (26.1)

METHODS

Institutional review board approval was attained before commencement of this study. A convenience sample of 234 youth sport parents (82 male, 144 female, 8 unreported) participated in this study. Cross-sectional surveys were distributed to parents in attendance at an educational meeting as part of a larger study aimed at exploring concussion education. This survey aimed to identify parental knowledge and attitudes regarding the recognition and response to concussions. The study sample included parents from North Carolina and Arizona, representing 3 middle schools and 21 youth sport teams (including football, boys' and girls' soccer, boys' and girls' basketball, boys' and girls' ice hockey, boys' lacrosse, and baseball). Parent participants were between the ages of 19 and 68 years (mean age, 44.0 ± 6.3 years). Demographics for participants in this study are listed in Table 2.

The survey was piloted and assessed for content validity on 19 youth sport parents before commencement of the study. The survey (see the Appendix) was modified from one that had previously been used.^{20,21} Internal consistency was acceptable for both the knowledge and attitude constructs, with Cronbach alpha beyond .70. The research team presented the study, approved consenting participants, and distributed the surveys to and collected the surveys from parents at preseason parent meetings. The survey took approximately 15 to 20 minutes to complete.

Descriptive statistics were calculated to summarize concussion knowledge and attitude questions and total scores. Parental concussion knowledge was assessed through a series of 29 questions, with a total score calculated by summing the number answered correctly. The higher the score, the better the knowledge of concussions (possible range, 0-29). Attitudes were assessed with a

TABLE 3
Symptom Clusters^a

Cluster	Parent Experience	Child Experience (Parent-Reported)
Vestibular-somatic	1.6 ± 2.3 ^b	0.5 ± 1.3 ^b
Headache	84 (39.8)	52 (23.5)
Feeling dazed or confused	66 (31.6)	21 (9.5)
Dizziness or balance problems	49 (23.4)	13 (5.9)
ringing in ears/bothersome loud noises	25 (12.0)	3 (1.4)
Vision problems	27 (12.9)	4 (1.8)
Nausea or vomiting	26 (12.5)	6 (2.7)
Blacking out	38 (18.1)	4 (1.8)
Trouble returning to activity	17 (8.1)	10 (4.5)
Coordination problems	13 (6.2)	6 (2.7)
Cognitive-sensory	0.6 ± 1.0 ^b	0.2 ± 0.6 ^b
Trouble concentrating	33 (15.8)	10 (4.5)
Feeling slowed down or fatigued	41 (19.7)	20 (9.0)
Feeling in a fog or something not right	41 (19.6)	13 (5.9)
Sleep-arousal	0.1 ± 0.2 ^b	0.0 ± 0.1 ^b
Sleep problems	13 (6.2)	3 (1.4)
Affective	0.1 ± 0.3 ^b	0.0 ± 0.2 ^b
Becoming more emotional or irritable	15 (7.2)	7 (3.2)

^aData are shown as n (%) of participants reporting the symptom from a total sample experiencing a diagnosed concussion or symptoms of a concussion unless otherwise indicated.

^bMean ± SD number of symptoms within the cluster experienced by the parent or child.

7-item questionnaire, which was scored by summing the number of favorable/correct responses. Higher scores indicated a more favorable attitude (see Table 1) toward the need for concussion education, reporting, and treatment (possible range, 7-49).

Symptoms were grouped into 4 clusters for the parents' and child's experiences: vestibular-somatic, affective, sleep-arousal, and cognitive-sensory.¹⁰ These clusters were modified based on the literature of protracted symptom recovery¹¹ as well as the ease of understanding. The specific symptoms that fall into each category are provided in Table 3. The total number of symptoms that each parent endorsed as having either experienced himself or herself (parents' symptom report) or experienced by their child (child's symptom report) was summed respectively to calculate each symptom cluster score (8 total: 4 parent, 4 child). To examine the association between each individual symptom cluster and the outcome variables of interest (knowledge and attitude totals), correlations (Spearman rank) were performed because of the nonnormal distribution of data. Symptom clusters were also used to create a multivariate model for parents' experience, and an independent multivariate model for the child's experience, on parental knowledge and attitudes of concussions. Data were analyzed in their entirety using an alpha level of .05 (set a priori) with SAS 9.4 software (SAS Institute).

RESULTS

Concussion Knowledge and Attitudes

Overall, parents showed moderate concussion-related knowledge (23.3 ± 2.5 of 29) but high (positive) attitudes (46.3 ± 3.7 of 49). For knowledge, incorrect answers consisted of both errors of omission (concussion-related symptoms not identified as such) and errors of commission (inaccurately responding that a nonconcussion symptom is associated with a concussion). The concussion symptoms most often omitted by participants included numbness or tingling in the arms (27.5% incorrect), nausea/feeling sick (15.7% incorrect), and trouble sleeping (10.3% incorrect). The symptoms most often improperly reported as being concussion related included chest pain (68.1% incorrect), bleeding from the mouth (56.9% incorrect), and having a black eye (47.9% incorrect). It is important to note that participants often seemed to overestimate the effects of a concussion, having more commission than omission errors. Headache and loss of consciousness were the most common correctly identified symptoms (97.6% correct), followed closely by dizziness (96.7% correct) (Table 4).

The attitude variables with the largest differences in their responses included the amount of attention currently placed on concussions in sport (6.0 ± 1.6 ; range, 1-7) and how serious parents think a headache or dizziness is after a blow to the head or body (6.3 ± 1.0 ; range, 3-7). Variables with the most protective attitudes (see Table 1) included the importance of reporting possible concussion symptoms to someone in authority (6.9 ± 0.4 ; range, 5-7) and the importance of knowing the steps to follow once a concussion occurs (6.9 ± 0.4 ; range, 5-7) (Table 5).

Symptom Clusters

Separate clusters were formed from all possible symptoms experienced by both the parent and the child. The specific symptoms within each cluster and their respective incidence can be found in Table 3. For parents' symptom reports, the vestibular-somatic symptom cluster had the widest potential range of 0 to 9, with parents experiencing a mean of 1.60 ± 2.33 symptoms at some point during their life. The cognitive-sensory symptom cluster had a potential range of 0 to 3, with the parent experiencing a mean of 0.55 ± 0.98 symptoms related to cognition. The sleep-arousal and affective symptom clusters each had a range of 0 to 1, with the parent experiencing a mean of 0.06 ± 0.24 and 0.07 ± 0.26 symptoms, respectively. The same symptoms comprised the child's symptom reports. Parents reported the following mean values for each symptom cluster for their child: vestibular-somatic (0.54 ± 1.26), cognitive-sensory (0.19 ± 0.62), sleep-arousal (0.01 ± 0.11), and affective (0.03 ± 0.18).

Associations Between Symptom Clusters and Outcomes

A series of bivariate Spearman rank correlations revealed 3 statistically significant relationships, despite weak

TABLE 4
Parental Knowledge of Concussion-Related Symptoms

Variable	Yes/ No	Correct Response/Total Response, n (%)
Signs and symptoms		
Things smell funny	No	117/213 (54.9)
Things taste funny	No	119/213 (55.9)
Problems remembering things	Yes	201/212 (94.8)
Fuzzy vision	Yes	205/213 (96.2)
Black eye	No	110/211 (52.1)
Bleeding from the ear	No	139/212 (65.6)
Bleeding from the mouth	No	91/212 (43.1)
Headache	Yes	207/213 (97.6)
Trouble sleeping	Yes	191/213 (89.7)
Blacking out	Yes	200/211 (94.8)
Stomach hurts or feel sick	Yes	177/210 (84.3)
Numbness or tingling in the arms	Yes	153/211 (72.5)
Weakness in neck movements	No	163/208 (78.4)
Chest pain	No	67/210 (31.9)
Trouble understanding things	Yes	201/210 (95.7)
Dizziness (feeling woozy)	Yes	204/211 (96.7)
A concussion only occurs if an athlete loses consciousness (blacks out)	No	207/212 (97.6)
The brain is the body part hurt/injured with a concussion	Yes	194/202 (96.0)
Consequences of suffering a concussion		
No bad things can ever happen	No	213/214 (99.5)
One may be more likely to get another concussion	Yes	162/214 (75.6)
Skin rash	No	208/214 (97.2)
Brain damage	Yes	176/214 (82.2)
Consequences of suffering multiple concussions		
No bad things can ever happen	No	215/215 (100.0)
One may be more likely to get another concussion	Yes	139/215 (64.5)
Skin rash	No	210/215 (97.7)
Brain damage	Yes	207/215 (96.3)
Trouble remembering things	Yes	148/215 (68.7)

correlations: parents' sleep-arousal cluster and attitudes ($r = 0.22$, $P = .002$, $r^2 = 0.048$), child's sleep-arousal cluster and knowledge ($r = 0.15$, $P = .041$, $r^2 = 0.023$), and child's vestibular-somatic cluster and knowledge ($r = 0.17$, $P = .020$, $r^2 = 0.020$). For parents, the experience of sleep-arousal symptoms was associated with their total attitude score. Total parental knowledge was associated with their child's experience of both the sleep-arousal and vestibular-somatic symptom clusters. All other relationships were not statistically significant (Table 6). Multivariate regression models were then conducted to explore these relationships while controlling for multiple comparisons.

Multivariate Regression Models

To examine the effects of experienced symptom cluster scores on the 2 outcomes of interest (attitudes and knowledge), separate multiple regression models were conducted, predicting each outcome of interest (total parental knowledge score or total attitude score) from either the child's

TABLE 5
Parental Attitudes of Sport-Related Concussions

Variable	Range	Mean
1. How serious do you think it is when an athlete experiences a headache and dizziness after a blow to the head or body?	3-7 (not to very serious)	6.3 ± 1.0
2. How important do you think it is for an athlete not to participate in physical activity when experiencing signs and symptoms of a concussion?	1-7 (not to very important)	6.7 ± 0.9
3. How important do you think it is to be informed about how concussions happen?	4-7 (not to very important)	6.7 ± 0.7
4. How important do you think it is to be informed about how concussions can be prevented?	3-7 (not to very important)	6.8 ± 0.6
5. How important do you think it is to know the steps to follow if an athlete has a concussion?	4-7 (not to very important)	6.9 ± 0.4
6. How important is it for an athlete to report possible concussion symptoms to a medical professional or coach?	5-7 (not to very important)	6.9 ± 0.4
7. Currently, there is too much attention and focus on concussions in sports.	1-7 (disagree to strongly agree)	6.0 ± 1.6

TABLE 6
Influence of Symptom Clusters on Parental Knowledge and Attitudes

Symptom Cluster	Spearman Correlation Coefficient (r)	Correlation P Value	r ² Value (Effect Size)	Raw Regression Coefficient (β)	P Value
Knowledge					
Parent					
Vestibular-somatic	0.14	.063	0.020	0.150	.261
Cognitive-sensory	0.12	.125	0.014	0.002	.996
Sleep-arousal	0.10	.206	0.010	-0.921	.315
Affective	-0.01	.865	0.000	0.597	.440
Child					
Vestibular-somatic	0.17	.020 ^a	0.029	0.540	.012 ^a
Cognitive-sensory	0.00	.980	0.000	-0.574	.163
Sleep-arousal	0.15	.041 ^a	0.023	-0.902	.705
Affective	0.09	.236	0.008	0.097	.938
Attitudes					
Parent					
Vestibular-somatic	0.05	.465	0.003	0.052	.797
Cognitive-sensory	0.01	.926	0.000	-0.507	.323
Sleep-arousal	0.22	.002 ^b	0.048	-3.301	.011 ^a
Affective	0.05	.503	0.003	-0.816	.478
Child					
Vestibular-somatic	0.00	.970	0.000	-0.219	.477
Cognitive-sensory	0.08	.230	0.006	0.672	.237
Sleep-arousal	0.13	.064	0.017	-3.004	.251
Affective	0.10	.158	0.010	-0.029	.986

^aSignificance at alpha level of .05.

^bSignificance at alpha level of .01.

symptom cluster or parents' symptom cluster total scores. In each of the 4 models, all symptom clusters were included as explanatory variables. These variables were kept separate because of the potential independent effects of each cluster. Within the 2 multivariate models testing the effects of the parents' past symptom experience on concussion knowledge and attitudes, respectively, only parents' experience of sleep-arousal concussion symptoms emerged as a significant predictor of the total parental attitude score ($\beta = -3.301, P = .011$) (Table 6). This indicates that parents who have experienced sleep-arousal-related symptoms also have better attitudes toward concussions. Within the 2 multivariate models for the child's experience of symptom clusters, only the child's

experience of vestibular-somatic-related concussion symptoms had a significant effect on the total parental knowledge score ($\beta = 0.540, P = .012$) (Table 6).

DISCUSSION

Nearly double the number of parents, compared with their children, reported experiencing concussion-related symptoms during their lifetime. The primary reason for this is likely that parents have had more time to accumulate a concussion history. However, the difference in reports may also be overestimated because of the lack of reporting from the young athletes.²⁰ Many of the young athletes in this

sample may also have not yet experienced a concussive injury, which thus may influence the knowledge and attitudes of the parent. This is important, as parents may learn and absorb concussion education most effectively after a concussion has been experienced in some capacity. Recent research highlights that athletes with a concussion history have been found to have more negative attitudes, lessening their likelihood of concussion disclosure, but no significant effect has been found related to concussion-related knowledge.²² No studies prior to ours have examined this relationship in parents. As these are parents of youth athletes (not high school age), they are often not exposed to concussion education through the school environment (as in secondary school); therefore, clinicians should be engaged in concussion education with this population in conjunction with coaches to support and promote its inclusion.

Another reason for higher parents' self-reports may include the types of symptoms assessed through common symptom scales. Some current symptom scales, such as the Acute Concussion Evaluation,⁵ have been shown to be less valid in younger populations because of the terminology used to describe the symptoms.⁶ Parents may not have recognized their child's concussion presentation because of their child complaining of symptoms not directly listed on the survey (even if they were similar) as well as the injury's often not presenting an outward appearance.¹⁷ Therefore, without the child complaining of symptoms, the parent may not know that an injury occurred. This is supported in the literature related to other injuries. For example, in a study by Brudvik et al,² parents' perceptions of their child's injury only moderately correlated with their child's self-report. Parents have been found to both underestimate and overestimate the amount of pain that their child was in for a variety of diagnoses.^{19,23,26} The current literature suggests that parents and athletes have difficulty identifying concussion symptoms within themselves, and parents may underestimate the number of symptoms that their child is experiencing,⁴ while children do not feel that symptoms are a reason to stop participation when they are not severe or burdensome.³

Parental knowledge encompassed the ability to identify signs and symptoms of a concussion as well as distractors that are not actually signs/symptoms or consequences of a concussion. Parents most commonly correctly identified vestibular-somatic and cognitive-sensory symptoms including headache, blacking out, dizziness, trouble understanding, and trouble remembering. This is consistent with previous literature stating that physical signs of an injury are the most commonly recognized by parents.¹⁵ It is also important to note that headache and dizziness were the 2 symptoms most commonly experienced by participants, potentially indicating a link (although not found to be statistically significant) between personal experience and knowledge on an item-specific level. These physical signs of an injury are also most often focused on in concussion education provided by clinicians. Nearly all participants were also able to identify that a concussion can occur without a loss of consciousness. This is evidence of a knowledge shift, as years ago, this was a common misconception of

concussive injuries.^{9,13} Despite this increased knowledge, the consequences of suffering a concussion are still less known. Therefore, clinicians should discuss potential long-term implications (eg, depression and mood disorders, memory problems, persistent symptoms, and the potential for repeat injuries) that may occur if the injury is not managed and treated properly. Such concussion education efforts should be made at all levels and should include coaches, parents, and athletes themselves.¹⁷

Overall, the diversity of responses related to concussion attitudes was minimal, indicating that participants may have positive attitudes around the constructs examined or simply "know" the right answer and how they should respond to a concussive injury. This finding is consistent with other studies showing that attitudes are typically more favorable on self-reported surveys, indicating that participants would do the right thing.¹² Parents agreed that it is important to be informed of how concussions happen, how they can be prevented, the steps to follow once a concussion occurs, and the role of disclosure; however, participants had less agreement on actions that would reflect these attitudes, such as removing someone from play or thinking the amount of attention placed on concussions in sports is too high. These attitudes could potentially lead to risky parental decision making related to concussions, particularly within youth sports. If the coaches and/or parents have poor attitudes toward follow-through on these injuries, youth athletes may not be getting the proper care to avoid negative outcomes after an injury. They also have a risk of dismissing symptoms that a child is self-reporting by thinking that there is too much attention placed on concussions within sport.

Although our initial hypothesis posited that personal experience (via self or child) of particular concussion-related symptom clusters would influence parental knowledge and attitudes, the findings of this study do not fully support this hypothesis. Despite several statistically significant correlations, there were no clinically meaningful relationships. There was a weak positive correlation between the parents' experience of sleep-arousal symptoms and better attitudes toward concussions. One of the potential reasons for this relationship is the disruption of daily life caused by sleep problems and other health-related disorders.^{1,7} However, only 5% of the variance in concussion-related attitudes was associated with sleep-arousal symptom experience (and vice versa).

There was also a weak positive correlation found between the child's experience of vestibular-somatic symptoms and parental knowledge toward concussions. This finding may indicate the bidirectionality of parental knowledge. One explanation is that increased parental knowledge causes parents to ask their kids about these symptoms, resulting in a higher symptom presence. An alternative interpretation is that children may be telling their parents about symptoms that they are experiencing, resulting in increased parental knowledge. The present study does not include a way to differentiate the mechanism driving this relationship. Another reason is that these symptoms are most often associated with a concussion, as many of these same symptoms were also assessed via the

symptom checklist for knowledge.¹⁷ However, only 3% of the variance in concussion-related knowledge was because of the experience of vestibular-somatic concussion symptoms (and vice versa). Because of the weak relationships and small effect sizes, these results should be interpreted with caution. Another potential limitation is that the total pool of parents who participated is unknown; however, all parents who attended the educational meeting participated in the survey. Future concussion education efforts should primarily focus on parents and children who have not experienced a concussive injury as well as the cognitive-sensory and the affective symptom clusters, which may not be experienced as often.

CONCLUSION

Our findings suggest that personal experience of concussion-related symptoms has little effect on parental knowledge and attitudes as a whole. However, this does not imply that clinicians should stop educational efforts. In fact, particular symptom clusters may provide insight into targets for future concussion education because of their impact on parental knowledge and attitudes. Parents of youth sport participants would benefit from increased education targeting the consequences of suffering a concussion as well as symptom clusters that do not receive as much attention, such as cognitive-sensory and affective symptoms; therefore, clinicians conducting concussion education should make these areas the primary target of discussion. Larger efforts should be made to educate parents of youth sport athletes, as they are frequently in a position to identify potential injuries, and current knowledge within this sample is low. Clinicians have the ability to expedite this need by providing targeted concussion education to parents of youth in their respective locations.

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APPENDIX
Survey Constructs for Current Study



Draft

Today's Date: _____

Sport:

ID:

(office use only)

PARENT CONCUSSION SURVEY - PRETEST

INFORMATION ABOUT YOU

NAME:

FIRST NAME

LAST NAME

Your Age:

Your Age:

Male

Female

Have you ever had a concussion? No Yes

Have you ever been hit in the head or body and experienced any of the following symptoms <i><u>IF YES, proceed across the row</u></i>	How many times?	
	YES	NO
Headache		
Feeling dazed or confused	<input type="checkbox"/>	<input type="checkbox"/>
Dizziness or balance problems		
Trouble concentrating	<input type="checkbox"/>	<input type="checkbox"/>
Ringing in your ears/loud noises bothering you		
Feeling slowed down or fatigued	<input type="checkbox"/>	<input type="checkbox"/>
Problems with vision		
Feeling in a fog or something not right	<input type="checkbox"/>	<input type="checkbox"/>
Becoming more emotional or irritable		
Nausea or vomiting	<input type="checkbox"/>	<input type="checkbox"/>
Blacking out		
Trouble returning to activity	<input type="checkbox"/>	<input type="checkbox"/>
Sleep problems		
Problems with coordination	<input type="checkbox"/>	<input type="checkbox"/>

INFORMATION ABOUT YOUR CHILD/CHILDREN PLAYING THE SPORT YOU ARE HERE FOR TODAY

Child/Children's Name(s) and Team Name(s)

Child 1.

FIRST NAME

LAST NAME

TEAM NAME

Child 2.

FIRST NAME

LAST NAME

TEAM NAME

Child 3.

FIRST NAME

LAST NAME

TEAM NAME

(continued)



Draft

INFORMATION ABOUT YOUR CHILD/CHILDREN PLAYING THE SPORT YOU ARE HERE FOR TODAY

PLEASE ANSWER THE FOLLOWING QUESTIONS ABOUT YOUR CHILD/CHILDREN	CHILD 1		CHILD 2		CHILD 3	
	No	Yes	No	Yes	No	Yes
Does your child participate in more than ONE organized sport?						
How many times has your child been diagnosed with a concussion?						
How many times has your child had a concussion as a result of sports in the past 12 months?						
How many times has your child been knocked unconscious?						
How many times has your child been knocked unconscious while playing sports in the past 12 months?						
How many times has your child had his/her "bell rung"/"dinged"?						
How many times has your child had his/her "bell rung"/"dinged" while playing a sport in the past 12 months?						

How many times, after a hit or a fall while playing a sport in the past 12 months, has your child experienced any of the following symptoms? Write the number in the blanks beside each question corresponding with the answer for each child. Put 0 if it has never happened.	CHILD 1		CHILD 2		CHILD 3	
Headache						
Feeling dazed or confused						
Dizziness or balance problems						
Trouble concentrating						
Ringing in their ears/loud noises bothering them						
Feeling slowed down or fatigued						
Problems with vision						
Feeling in a fog or something not right						
Becoming more emotional or irritable						
Nausea or vomiting						
Blacking out						
Trouble returning to activity						
Sleep problems						
Problems with coordination						

Please answer the following questions about your child/children's experience with the symptoms listed above. (check N/A if this does not apply to your child)	CHILD 1 <input type="checkbox"/> N/A	CHILD 2 <input type="checkbox"/> N/A	CHILD 3 <input type="checkbox"/> N/A
Total number of times your child was hit or fell during a sport that resulted in ANY of the signs/symptoms listed above			
How many times was your child withheld or removed from activity/sport when experiencing these signs/symptoms?			
How many times was your child seen by a medical professional (doctor, athletic trainer, etc) following the hit or fall that resulted in the above signs/symptoms			

(continued)

PARENT



Please answer the following questions about concussion to the best of your ability.

Check YES beside all of the things that show how a person may feel or what might happen to a person because of a concussion. Check NO if you think it would not happen.

- Things smell funny NO YES
- Things taste funny NO YES
- Problems remembering things NO YES
- Fuzzy vision NO YES
- Black eye NO YES
- Bleeding from the ear NO YES
- Bleeding from the mouth NO YES
- Headache NO YES
- Trouble sleeping NO YES
- Blacking out NO YES
- Stomach hurts or feels sick NO YES
- Numbness or tingling in arms NO YES
- Weakness in neck movements NO YES
- Chest pain NO YES
- Trouble understanding things NO YES
- Dizziness (feeling woozy) NO YES

A concussion only occurs if an athlete loses consciousness (blacks out).

- Yes, I think this is true
- No, I do not think this is true
- I don't know

What part of the body is hurt/injured with a concussion? (check only 1 box)

- Skull
- Face
- Brain
- Neck
- I don't know what body part is hurt with a concussion

Place a check mark in the box beside the things listed below you think can happen from someone returning to their sport too soon after a concussion.

- No bad things can ever happen
- You may be more likely to get another concussion
- Skin rash
- Brain damage
- I don't know what might happen

Of the following, who would you refer your child to FIRST if you suspect he/she has a concussion ?(check only 1 box)

- No referral source
- School Nurse
- EMT/Paramedic
- Certified Athletic Trainer
- Physician
- Other

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Place a check mark in the box beside the things listed below you think could be consequences of suffering multiple concussions.

- No bad things can ever happen
- You may be more likely to get another concussion
- Skin rash
- Brain damage
- Trouble remembering things
- I don't know what might happen

(continued)



PARENT

Rate on a scale of 1-7 how serious you think it is when an athlete experiences a headache and dizziness following a blow to the head or body.

- 1 not serious 2 3 4 moderately serious 5 6 7 very serious

Rate on a scale of 1-7 how important you think it is for an athlete not to participate in physical activity (game or practice) when experiencing signs and symptoms of concussion.

- 1 not important 2 3 4 moderately important 5 6 7 very important

Rate on a scale of 1-7 how important you think it is to be informed about how concussions happen?

- 1 not important 2 3 4 moderately important 5 6 7 very important

Rate on a scale of 1-7 how important you think it is to be informed about how concussions can be prevented?

- 1 not important 2 3 4 moderately important 5 6 7 very important

Rate on a scale of 1-7 how important you think it is to know the steps to follow if an athlete has a concussion?

- 1 not important 2 3 4 moderately important 5 6 7 very important

Rate on a scale of 1-7 how important it is for an athlete to report possible concussion symptoms to a medical professional (doctor, athletic trainer, etc) or a coach.

- 1 not important 2 3 4 moderately important 5 6 7 very important

Rate on a scale of 1-7 your level of agreement with the following statement: In general, parents are under-educated (don't know enough) about concussions.

- 1 disagree 2 3 4 moderately agree 5 6 7 strongly agree

Rate on a scale of 1-7 your level of agreement with the following statement: Currently, there is too much attention and focus on concussion in sports.

- 1 disagree 2 3 4 moderately agree 5 6 7 strongly agree

Rate on a scale of 1-7 your level of agreement with the following statement: A coach should be actively involved in the prevention and return to play decisions following concussion in an athlete.

- 1 disagree 2 3 4 moderately agree 5 6 7 strongly agree