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original research

Qualitative Examination of Adolescent Health-Related Quality of Life at 1 Year Postconcussion

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Context: Moderate to severe traumatic brain injuries can negatively influence health-related quality of life (HRQOL) in adolescent patients. The effect of sport-related concussion on adolescent HRQOL remains unclear.

Objective: To investigate the perceptions of adolescent student-athletes and their parents regarding the adolescents' HRQOL 1 year after sport-related concussion.

Design: Qualitative study.

Setting: Secondary school.

Patients or Other Participants: Seven adolescent student-athletes (age range, 12–16 years) who sustained a sport-related concussion at least 1 year (15.3 ± 2.8 months) before the study participated along with their primary care-giving parents (n = 7).

Data Collection and Analysis: Fourteen semistructured face-to-face interviews (7 adolescents, 7 parents) were completed. Interviews were transcribed and inductively analyzed by a team of 3 athletic trainers with 32 combined years of professional experience. Themes were negotiated through a consensual review process. Participant checks were completed to ensure trustworthiness of the results.

Results: Four major themes emerged from the interviews: (1) significant effect of symptoms, (2) feelings of frustration, (3) influence on school attendance and activities, and (4) nature of interpersonal and team relationships. Participants indicated that the physical symptoms of the concussion substantially affected their emotional and academic function. The influence of the concussion on social interactions seemed to depend on the nature of interpersonal relationships.

Conclusions: Sport-related concussion can negatively influence physical and emotional function, academics, and interpersonal interactions as perceived by adolescent student-athletes and their parents. Education of parents and their children, school professionals, coaches, and teammates remains critical to effectively recognize and manage sport-related concussion. Secondary school districts also play a critical role in the concussion-management process by establishing and implementing accommodation policies that alleviate student concerns about falling behind while ensuring a healthy return to normal school routines. Furthermore, adolescent support systems must be considered throughout the recovery process.

Key Words: concussions, postconcussion recovery, secondary schools

Key Points

- Concussion affected multiple health-related quality-of-life domains in adolescents.
- Participants reported strong frustration levels related to substantial physical symptoms and the overall recovery process.
- Adolescents with concussion, their primary care-giving parents, and other individuals in routine contact with the adolescents should be educated on the nature and management of postconcussion symptoms.
- Secondary schools should adopt academic accommodation policies designed to alleviate student anxiety about falling behind while ensuring a safe, expeditious return to a regular school routine.

Health-related quality of life (HRQOL) represents a multidimensional construct centered on the link between injury or illness and a patient's subjective evaluation of his or her physical and mental well-being.[1] In an adolescent population, HRQOL is largely defined by perceptions of function in the academic, physical, social, and emotional domains.[2] Identified as a critical health indicator,[3] HRQOL has been shown to decrease in response to both chronic and acute conditions, including concussions.[4] This is especially concerning in an adolescent population considering the increased prevalence of concussions, susceptibility to lingering postconcussion symptoms, and vulnerability to the long-term effects of neurologic injury.[4]

Whereas most patients with diagnosed sport-related concussions report symptom resolution within 7 to 10 days, symptoms can persist for weeks or months after a concussion, especially in children.[5] Researchers[6] have argued that, although postconcussion symptoms originate from physical injury, persistent postconcussion symptoms might actually be caused or maintained by factors beyond the neurobiology of the concussion. Unfortunately, the nature and persistence of postconcussion symptoms may place adolescent patients at risk for substantial declines in HRQOL.[7] Investigators have demonstrated that adolescent brain injuries, including concussions, negatively influence HRQOL by affecting sleep patterns; fatigue levels; anxiety and depression symptoms; executive functions; behavioral and social concerns; and attention, cognition, and memory.[8]

Furthermore, decreased HRQOL appears to become more prevalent with a history of multiple concussions and may persist for months or years beyond the initial injury.[8]

Despite the importance of HRQOL as a subjective health measure, ascertaining the full effect of a condition on HRQOL remains a challenge. Various quantitative measurement tools may not fully capture childrens' perceptions of their subjective health due to the complexity of HRQOL.[9] In addition, children have more limited capacities to fully comprehend and accurately answer self-report questions and to subjectively evaluate their own health status.[10] This is evident in the divergence between parents' and childrens' perceptions of quality of life, with parents often reporting greater declines in their children's HRQOL than the children themselves report.[11] Regardless of these challenges, qualitative measures and inclusion of a parental perspective have been advocated and successfully used in determining children's overall satisfaction with HRQOL.[12]

The influence of sport-related concussion, the associated potential for long-term disability, and the challenges inherent in understanding HRQOL in child and adolescent patients highlight the need for multifaceted, longitudinal research that includes the perspective of a primary care-giving adult. Therefore, the purpose of our study was to evaluate concussed adolescents' and their parents' perspectives of the effects of a single concussion on the concussed adolescent's HRQOL at 1 year postdiagnosis. The following research questions served as the foundation for this study:

1. How does a sport-related concussion influence the physical function of adolescent student-athletes?
2. What is the influence of a concussion on emotional function in adolescent student-athletes?
3. How does a sport-related concussion influence interpersonal relationships in adolescent student-athletes?
4. How does a sport-related concussion influence academic performance in adolescent student-athletes?

METHODS

Participants

Adolescents who had sustained a single concussion during the 2011–2012 academic year while participating in interscholastic sports in the upper Midwest and their primary care-giving parents participated in this study. To be eligible for the study, adolescents had to be in seventh to 12th grade, must have sustained a single physician-diagnosed concussion at least 1 year before the interview, and must have been actively involved in interscholastic sports. Volunteers were excluded if they self-reported a history of multiple physician-diagnosed concussions before or after the concussion being studied. Twenty-two adolescents were eligible for participation; 7 adolescents (2 boys, 5 girls; age = 14.14 ± 1.35 years; time of return to unrestricted cognitive and physical activities = 19.67 ± 10.03 days) and their primary care-giving parents (n = 7) volunteered to participate. Summary data for participant demographics is provided in Table 1. Participant pseudonyms and their individual data are provided in Table 2.

Given the differences in parent-child reporting of postconcussion symptoms and the potential influence of a child's brain injury on the entire family construct, we interviewed both the concussed participants and their primary care-giving parents. Researchers[13–16] have indicated that parents and their concussed children judge and report postconcussion symptoms differently. Furthermore, families of children affected by mild to severe traumatic brain injury (TBI), including concussions, have reported levels of sustained stress and family burden that are different from those of other health conditions.[17–19]

We recruited participants from 7 school districts (prekindergarten–12th-grade enrollment range, 261–2929 students) enrolled in an ongoing sport-related concussion-recognition and concussion-management project to improve postconcussion outcomes for rural youth sports participants. One school district in this project received athletic training coverage through a full-time athletic trainer employed at the school. The remaining 6 schools received outreach athletic training coverage from 1 of 2 graduate-assistant athletic trainers jointly employed through a local university and a prominent sports medicine clinic. The athletic trainers who provided coverage at each of these 7 school districts were responsible for the initial examination of all concussed athletes, which consisted of a self-report symptom survey and neurocognitive and balance assessments. Results of this examination were provided to athletes and their parents during a postconcussion consultation designed to facilitate the referral process.

Each adolescent adhered to the steps in the protocol. In keeping with the postconcussion protocol and the state's recently adopted law, each adolescent participant was referred for follow-up examination and diagnosis to a medical provider of the parent's designation. These providers, all medical doctors, were ultimately responsible for the final injury diagnosis and determination of clearance to resume full participation in sports activities. All participants provided written informed consent or assent, and the study was approved by the institutional review board of South Dakota State University.

Table 1. Participants' Demographic Information

Characteristic	Mean ± SD	Range
Age, y	14.14 ± 1.35	12–16
Length of recovery, d[a]	19.67 ± 10.03[b]	12–44

[a] *Length of recovery* represented the time from initial injury to the time of clearance by a physician to resume all sport activities.
[b] Represents all adolescent participants except Rebecca, who chose not to return to volleyball.

Table 2. Demographic Information by Adolescent Participant

Participant Pseudonym	Age, y	Sex	Grade in School	Sport in Which Injured	Length of Recovery, d
Alex	16	Male	11th	Football	12
Amy	15	Female	9th	Basketball	44
Brittany	14	Female	9th	Basketball	15
Heather	13	Female	8th	Basketball	31
Molly	12	Female	7th	Basketball	33
Rebecca	14	Female	9th	Volleyball	Not applicable[a]
Steven	15	Male	10th	Football	18

[a] Rebecca did not have a physician-clearance date because she chose not to return to volleyball after her injury.

Procedures

We hand delivered an information packet describing the purpose and the possible risks and benefits of participation in the study to the parents of the concussed adolescents. When we received the completed informed consent and child assent forms, the parent participants received a follow-up telephone call to answer any potential questions and to schedule a mutually agreeable time to complete the face-to-face interview.

Data Collection

To capture the perceptions of adolescents and their parents about the effect of sport-related concussion on the adolescent's HRQOL, we used a semistructured interview approach. A face-to-face, semistructured interview is appropriate when the primary focus is gaining insight into and understanding of life events and when depth of meaning is important to the research.[20] Semistructured interviews are common in health care, especially when the available evidence is limited.[21] The aim of semistructured interviews is to thoroughly explore the topic being discussed, explore what people say in as much detail as possible, and uncover new areas or ideas that were unanticipated at the outset of the research.[20]

Face-to-face interviews with the 7 adolescents and their parents were completed separately. On average, participants were interviewed 15.3 ± 2.8 months after a sport-related concussion incurred during interscholastic athletics. This postinjury period was chosen on the basis of previous research in which investigators indicated that a substantial percentage of children exhibited emotional, behavioral, or cognitive difficulties that negatively affected their quality of life beyond 5 years post-TBI.[19,22] Furthermore, we also chose this time point on the basis of the need for routine post-TBI follow-up care that extends beyond the acute recovery period. Limond et al[22] indicated that poorer post-TBI outcomes were linked to the absence of systematic, long-term follow-up and care.[22]

Each interview lasted approximately 9.05 ± 2.04 minutes and was centered on the participant's perceptions of the effect of the sport-related concussion on the adolescent's physical and emotional function, academic performance, and social interactions, which are the primary elements of adolescent HRQOL. Responses were obtained via a semi-structured interview guide based on 5 open-ended questions (Appendix). The interview guide was based on the work of Varni et al[2] and McCarthy et al,[23] who studied the effect of acute and chronic conditions, including TBIs, on child and teen quality of life. The interview questions were reviewed for word structure and level of language by an independent researcher with experience in qualitative research using structured and semistructured interviews in rehabilitation counseling.[24] Interviews started with the lead researcher encouraging participants to respond freely to the open-ended questions. Based on participants' responses to these questions, the interviewer asked related questions to obtain any necessary clarification. At the end of each interview, participants could elaborate on anything of importance that may not have been addressed through the preceding questions. All interviews were recorded digitally and transcribed verbatim by the lead author.

Data Analysis

Data analysis for this study was completed through a process of qualitative consensual review.[25] The interview transcriptions were analyzed individually by a research team of 3 athletic trainers (C.I., T.R., M.B.Z.) with 32 combined years of professional experience. The data analysis involved the following steps: (1) reading each transcript in its entirety to gain a sense of the participant's perceptions and experience, (2) identifying and coding important pieces of information or phrases from each transcript, (3) arranging the meaning units into clusters of themes, and (4) conducting verification procedures with participants. When the individual transcript review was complete, the 3 researchers met as a team to discuss the results and reach consensus on common themes. The lead author then presented individual responses and common themes to each participant via e-mail. Follow-up telephone calls encouraged participant responses. We instructed participants to make any additions or deletions they believed were necessary and to verify the accuracy of the common themes. The feedback that participants provided through this process served as a validity check for the research.

RESULTS

Four major themes emerged out of the largely consistent responses from the adolescent and parent interviews: (1) significant effect of symptoms, (2) feelings of frustration, (3) influence on school attendance and activities, and (4) nature of interpersonal and team relationships. Table 3 illustrates the hierarchy of statements that were clustered into each of the themes. The identities of the adolescents are protected by the use of pseudonyms.

The emergent theme of *significant effect of symptoms* reflected the effect of postconcussion physical symptoms on multiple aspects of adolescents' daily lives. Fatigue, headaches, forgetfulness, and nausea affected their ability to function in school, complete daily tasks, and interact with others. Postconcussion physical symptoms directly affected the themes of *feelings of frustration* and *influence on school attendance and activities*. The final theme, *nature of interpersonal and team relationships*, was linked to the physical symptoms of concussion and also affected adolescent participants' social interactions.

Significant Effect of Symptoms

Widespread agreement was present among participants that physical symptoms were the greatest postconcussion challenge. Both the adolescent and parent participants spoke about the immediate physical effect of symptoms, including nausea, tiredness, headaches, dizziness, sensitivity to light and sound, balance difficulties, and blurred vision. Amy, a 15-year-old basketball player, reported the following:

> I was dizzy, and everything was kind of a blur. I don't really remember a whole lot of it actually. My parents said I repeated the same questions over and over again. They would answer them, and I would ask them again a few minutes later. My coach said I was acting strangely and saying things that were out of the ordinary.

Table 3. Hierarchy of Topics That Participants Referenced

Topic	Characteristics
Significant effect of symptoms	Nausea
	Headaches
	Dizziness
	Sensitivity to light
	Sensitivity to sound
	Decreased reaction time
	Balance deficits
	Blurry vision: seeing stars
	Symptoms still bother me
	Trouble sleeping
	Forgetfulness
	Hard to concentrate
	Confusion
Feelings of frustration	Anger or frustration
	Was emotional or upset
	Irritability
	Anxiety
	Nervousness
Influence on school attendance and activities	Academic accommodations
	Left school early due to symptoms
	Decrease in grades
	Wanted to be in school
Nature of interpersonal and team relationships	Seemed "not right"
	Change: interpersonal relationship
	Teammate support

Amy's mother elaborated on the physical symptoms of the concussion:

> Headache, forgetfulness—for instance she would ask me probably 10 or 12 times what time her appointment was the next day. I hadn't made it yet, so I kept telling her, "We haven't made the appointment yet; we have to call in the morning at 9." Then I got the "Well, when is my appointment?" and so it was that forgetfulness and repeating questions over. There was a lot of irritability as far as a lot of anxiety about it, not wanting to miss school or practice. Part of it was the anxiety of missing out of the whole experience. I'm trying to think of what else. Lethargy—she was very, very tired and didn't seem to have an awful lot of energy.

Headaches were the most commonly reported physical symptom. All 7 adolescent participants reported postconcussion headaches, whereas 6 of the 7 parent participants mentioned headaches as one of their child's postconcussion symptoms. Both adolescent and parent participants talked about the effect of the headaches, including the effect on academic performance. The mother of Rebecca, a 14-year-old volleyball athlete, noted: "In the beginning, she missed quite a bit of school, and then there were times where she would try and go back and she would have to come home early or go in late because her headaches were so bad."

Of the 14 participants interviewed, 2 adolescents revealed that recurrent headaches still affected their physical function 1 year postconcussion. Rebecca discussed this concern: "I still get headaches pretty often. Like, it depends if I get enough sleep or not. I notice if I don't get enough sleep, I get a headache. It depends on the lights in the gym[nasium]. If they are really bright or really dull, then I will get a headache."

Aside from headaches, 6 of the 14 participants (1 adolescent, 5 parents) reported fatigue as a substantial postconcussion problem. Rebecca provided this perspective: "I don't think it really affected me that way [feelings or emotions]. I was just really tired all the time." These sentiments were echoed by Rebecca's mother, who pointed out: "what I remember the most is her being tired all the time; she didn't want to do much."

Feelings of Frustration

Given multiple factors, including physical symptoms, a *strong sense of frustration* emerged as a commonly reported theme throughout the interviews. Seven participants (5 adolescents, 2 parents) used the words *frustration*, *anger*, or *upset* to describe the emotional toll of the concussion. Amy's mother noted the effect that her daughter's frustration had on their interpersonal relationship: "Immediate changes as a result of that was mostly the irritability, which caused everybody to be kind of tense. That would probably be it. That immediate sense of grrrrr, that I'm angry at the world and not feeling well and having a headache."

The mother of Alex, a 16-year-old football player, commented: "He was tired, angry at me because I took his TV and phone away and I wouldn't let him go to the state fair."

Of the 7 participants who reported feelings of frustration, 2 parents and 1 adolescent attributed the cause to having to miss normal athletic participation. Alex's mother stated that her son's missed football practices "frustrated him . . . he was very determined because he wanted to get back into football." Amy also talked about her frustration: "I was pretty emotional. I was upset that I couldn't play and the whole asking things over and over and not getting the answer that I wanted . . . also made me emotional." Amy's mother provided the following perspective:

> She felt that she just didn't want to get behind. She is competitive. She didn't want to lose playing time as a result of it, but she knew that she couldn't, so she was feeling a little bit helpless and lacking control. I think that was part of what she was feeling more than anything. But she understood it and she understood the process and that's just the way things were.

The emotional toll of the concussions that the adolescent participants experienced was evident in the feelings-of-frustration theme. Physical symptoms of the concussion; inability to participate in sport or other desired activities, including school; and team and family relationships led to varying degrees of postconcussion emotional upheaval.

Influence on School Attendance and Activities

Participants consistently alluded to the influence of the concussion on school attendance and activities throughout the postconcussion recovery process. Participants reported trouble concentrating (6 adolescents, 1 parent), confusion (1 adolescent, 2 parents), and feelings of forgetfulness (1 adolescent, 1 parent) when engaging in academic activities. When asked about her difficulties with school, Brittany, a

14-year-old basketball player, explained: "I had trouble concentrating on a lot of stuff . . . the teachers would have to print off the worksheets if they were on the computer because I couldn't look at the screen for too long." Rebecca also discussed her difficulties: "it was really hard to focus during class, to like look at the board and stuff, so I only did half a day for about a week."

Generally, school officials made academic accommodations when they were aware of the postconcussion circumstances. When asked about academic concerns related to her daughter's concussion, Amy's mother talked about the accommodations that were made:

> No, her grades maintained. She didn't have any issues with teachers. Everybody was really good about accommodating her if necessary. So everything worked very smoothly. We had a lot of good communication with teachers and coaches, so there was [were] no relationship issues with understanding what was going on.

Even with academic accommodations, 5 of the 7 adolescent participants reported leaving school early due to ongoing or intensifying symptoms. Amy noted: "when I was diagnosed with a concussion, I tried to go to school that afternoon, and I took a science test. After the science test, I had to go home because I couldn't handle it anymore."

We found it interesting that the adolescents' insistence on returning to school seemed to be an important reason for attendance despite the presence of postconcussion symptoms. Amy's mother observed: "She still performed okay, she came to school, insisted, took a test, and got an A, but then she would crash and have to go home for a couple hours." Alex's mother also described her son's insistence on attending school: "He did go home, finally at noon. He called and said, 'I can't do it.' But he was very determined. He wanted to be here; he wanted to be in school. So he probably should not have gone to school, but he wanted to be here."

Whereas adolescent participants demonstrated resolve in wanting to attend school, the physical symptoms of the concussion substantially affected school attendance and activities. Despite this, the postconcussion physical symptoms did not appear to have negative consequences on all academic components, given that adolescents' grades seemed largely unaffected.

Nature of Interpersonal and Team Relationships

The *nature of participants' interpersonal and team relationships* emerged as an important point of emphasis throughout the interviews. Seven adolescent and 4 parent participants provided information about team and family relationships and how these relationships, as well as the postconcussion physical symptoms and feelings of frustration, were linked to the concussed adolescents' social interactions.

Rebecca talked about her interactions with her teammates: "At first, teammates did not understand . . . then they were supportive." Amy also spoke about her teammates, indicating that they "felt bad but I still tried to be motivational to the team . . . they appreciated that." The mother of Heather, a 13-year-old basketball player, mentioned that teammates "were very supportive. The teammates were real concerned with her and asked how she was doing." Despite this perceived support, some participants discussed a sense of feeling left out. Molly, a 12-year-old basketball player, described her teammates as "really supportive" yet she still struggled: "I felt like I wasn't actually a part of the team." Steven, a 15-year-old football player, alluded to similar feelings: "It felt like I was a little bit on the outside because, how it's looked upon by the team with the diagnosis of a concussion, is sort of like a reason to sit out . . . I felt kind of distant from the team."

Whereas most (11 of 14) participants noted little change in friend relationships, interactions with immediate family members were portrayed as confrontational. Molly addressed her postconcussion relationship with her siblings: "Sometimes they [siblings] got annoyed because I'd always have a headache." In reference to her parents, Amy commented: "I did get a little frustrated with them when I didn't know what was going on, but now that I have been cleared of a concussion, I feel back to normal." Amy's mother acknowledged this frustration: "Although she fought us more than she did a lot of other people in the circumstance, I think more than anything it's where she was."

When viewing the emergent themes as a whole, the direct influence of postconcussion physical symptoms on multiple aspects of the adolescents' lives was apparent. The symptoms affected adolescents' abilities to engage in normal school and sports activities, although the desire and willingness to maintain their regular routines remained unchanged; this paradox seemed to serve as a source of the adolescents' frustration. Frustration also was evident in the adolescents' family relationships, whereas teammate relationships were generally viewed as supportive during the recovery process.

DISCUSSION

The purpose of our study was to investigate parent and adolescent perspectives of the effects of a single concussion on the concussed adolescents' HRQOL at least 1 year postdiagnosis. Our results suggested that the concussions resulted in substantial symptoms that emotionally, physically, and academically affected the adolescents. Postconcussion feelings of frustration and a lack of academic accommodation were common. Furthermore, whereas the adolescents' interpersonal relationships remained largely unchanged, the nature of the adolescents' relationships was important to the postconcussion recovery process.

Our findings of substantial postconcussion symptoms mirrored those reported by many researchers regarding short-term impairments.[5] Whereas most concussions resolve in a relatively short period (7–10 days),[5] 2 of our adolescent participants reported the continued presence of physical symptoms at least 3 months postinjury. This finding is supported by Barlow et al,[26] who investigated 670 children in a prospective, consecutive controlled cohort study. They reported that 14% of children aged 6 to 18 years who had sustained mild TBIs remained symptomatic 3 months postinjury and 2.3% of children aged 0 to 18 years were symptomatic 1 year postinjury.

In addition to the toll of physical symptoms, participants consistently described feelings of postconcussion frustration. Postconcussion emotional dysfunction, including frustration, is not uncommon, especially in adolescent patients. In their study of parental ratings of child quality of life after a TBI, Limond et al[22] described persistent emotional and behavioral difficulties for the affected child. The feelings of frustration noted in our study appeared to stem from varied sources, including the nature and longevity of the physical symptoms, interpersonal relationships, and time missed from school and sport. Although these observations validate previous research,[27] the causes of postconcussion emotional dysfunction remain unclear. Physiologic factors, stress and anxiety, not being understood by others, and psychological components may contribute alone or in combination to postconcussion emotional dysfunction.[28]

Most of our participants reported the presence of substantial symptoms while trying to maintain a normal academic schedule and requirements. Various difficulties, including forgetfulness and trouble concentrating, occurred both at home and at school. This is problematic because investigators have indicated that lingering symptoms can negatively affect a student-athlete's postconcussion return to the classroom.[29] Changes in sleep cycles due to postconcussion symptoms can cause fatigue that may make it hard for the student-athlete to participate in a full school day.[29] Furthermore, even if an athlete claims to be symptom free, cognitive deficits can exist, thereby limiting school participation and success.[30] Decreased academic success did not appear to be a concern in our study, but participants commented on substantial exacerbations of symptoms in the school environment, which ultimately led to limitations in school participation.

These findings seem to indicate that academic accommodations may have been lacking during the earliest stages of the adolescent participants' postconcussion recovery. In fact, poor communication with school personnel has been cited as a cause of accommodation difficulties.[31] Despite this, our participants did not believe that a lack of accommodation was the reason for heightened symptoms in the school environment. On the contrary, participants generally noted that school personnel were very accommodating when assisting them through the postconcussion recovery process. Rather, the exacerbation of symptoms that eventually led to limitations in school participation seemed to stem from the desires of adolescent participants to maintain their normal life schedules, including school. These desires caused adolescent participants to attempt to return to normal cognitive and physical activities before their symptoms had subsided fully. This finding supports previous research[27] in which investigators have asserted that adolescents would rather attempt to manage their postconcussive symptoms while attending school than address the anxiety of missed class time or assignments.

Researchers[32] have strongly suggested that social interactions and interpersonal relationships are important characteristics that shape one's perception of HRQOL. Whereas our participants generally did not perceive any postconcussion changes in the adolescents' social interactions, the nature of their interpersonal relationships did reveal some intriguing results. Interactions among the adolescent participants and their immediate family members were characterized by irritability and frustration. Wade et al[17] found that compared with families of children with orthopaedic injuries, families of children with moderate and severe TBIs reported increased stress due to concerns about the injured child's welfare. Furthermore, Rivara et al[18] suggested that families who report higher levels of premorbid stress and strained personal relationships may experience postinjury stress or dysfunction, which may intensify rather than diminish over time. It is plausible to suggest that families of concussed student-athletes who experience symptoms of longer duration or greater severity may be more apt to develop some type of interpersonal distress or dysfunction. Ganesalingam et al[19] observed that families of children who sustained loss of consciousness associated with a mild TBI described higher levels of family burden 3 months postdiagnosis than families of children who sustained orthopaedic injuries.

In contrast to family interactions, interactions with teammates were characterized as supportive and understanding. This finding is similar to the findings of Hardy et al,[33] who suggested that teammates can provide both emotional and informational support, possibly because of similarities in age or a history of similar injury. The finding of teammate support is important considering that adolescents, parents, and health care professionals alike note the positive effect of friendships and social inclusion on recovery from brain injuries.[34]

It is interesting that, despite feeling supported by teammates, 2 adolescent participants and even 1 parent described a sense of abandonment, as if the adolescent was alone and no longer a part of the team. This interpretation is significant in light of the results of Levin et al,[35] who found that children's postinjury social adjustment can be predicted by their social skills and ability to correctly process social information. The ability to correctly process social information is critical because it may assist the brain-injured patient in ignoring negative social cues and focusing on successes.[36] The sense of abandonment could also be linked to a loss of personal identity due to the inability to participate in athletics.[37] Self-imposed pressure or pressure from coaches, parents, and teammates may leave injured athletes believing that they have let down these key individuals. Subsequently, feeling abandoned and "on the outside" could lead to further emotional, behavioral, or social dysfunction.

Limitations

The sample of adolescent participants in this study was small and consisted mostly of girls; the preponderance of female participants could have served as a sex bias, considering that TBIs most commonly occur among males.[38] Furthermore, only primary care-giving parents provided the parent perspectives in this study.

In accordance with a semistructured interview method, we infused the 5 essential interview-guide questions into each interview and included similar probes.[20,21] However, the occasional deviations in sentence structure and language could be viewed as a limitation given the differences in age and type (parent, adolescent) of participants. We realize that the retrospective nature of the study could have influenced the length of the interview.

In the future, researchers should interview a larger number of participants with a more equal distribution of boys and girls, as well as both parents when feasible. Given the similarities in the ethnicities of participants and a limited geographic region, the results of this study should be interpreted with caution. A larger and more diverse sample would assist in determining whether the perspectives provided in this study are unique or representative of the broader population. Investigators should also focus on efforts to improve interview participation: 22 adolescents met the participation criteria in our study but only 7 volunteered to participate. Such efforts may include data collection during home visits, increased personalization of contact and follow-up with families, and possible financial incentives. Because of the qualitative nature of the research, the data gathered from participants were anecdotal and depended on the adolescents' and parents' abilities to retrospectively recall events from 1 year earlier. Future study in this area may benefit by examining participants' responses over time.

Clinical Implications

Several implications can be drawn from this study. First, adolescents and their parents acknowledged that sport-related concussions can negatively influence adolescent quality of life, especially in the physical domain. Furthermore, this influence can persist over long periods, even up to 1 year postinjury. Therefore, adolescents who sustain sport-related concussions and their primary caregiving parents should be educated on the nature and management of postconcussion symptoms. This education should include information on cognitive rest and the importance of avoiding activities that exacerbate the symptoms. In addition, researchers have indicated that factors beyond the neurobiology of a concussion, including school-related stress, depressive symptoms, sleep disturbances, or even cervicogenic or vestibuloocular disorders, may be partially or solely responsible for causing or maintaining persistent postconcussion symptoms. Therefore, as a part of the education process, patients and parents should be apprised that persistent postconcussion symptoms warrant additional investigation to determine their underlying causes.[39–41] After returning to play, planned, routine follow-up assessments should be conducted to ensure the adolescent's quality of life is not being compromised. Clinicians need to acknowledge the potential for postconcussion emotional sequelae and work with the injured adolescent to identify potential causes, thereby easing the transition to full recovery. In concert with parents and health care professionals versed in the recognition and management of sport-related concussion, school districts would be wise to adopt academic accommodation policies designed to alleviate student anxiety over falling behind and ensure a safe, expeditious return to a regular school routine. Communication strategies are essential in providing adolescent care after a concussion because our results showed the substantial effect of symptoms on multiple aspects of life. Parents, health care providers, and school officials need to coordinate their efforts in providing this care to ensure that deficits in adolescents' quality of life are minimized. Finally, coaches, teachers, parents, and teammates need to be apprised of the importance of their interpersonal relationships with concussed adolescents and how those relationships translate into social support throughout the recovery process.

CONCLUSIONS

We evaluated parent and concussed adolescent perspectives of the effects of a single concussion 1 year postdiagnosis on the concussed adolescents' HRQOL. The participant interviews revealed that multiple quality-of-life domains were affected after the sport-related concussion. Participants described the substantial effects of physical symptoms while also expressing a strong sense of frustration with the recovery process. They reported a satisfactory level of academic accommodation but substantial difficulties in trying to maintain a normal academic schedule. Furthermore, participants provided an illuminating perspective on the differential nature of interpersonal relationships during recovery.

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Appendix. Semistructured Interview Guide

1. How did the sport-related concussion influence your/your child's ability to engage in physical activity?
2. In what ways did the sport-related concussion affect your/your child's feelings or emotions?
3. Tell me about the impact of the sport-related concussion on your/your child's interpersonal relationships and interactions with others.
4. How did the sport-related concussion affect your/your child's academic performance?
5. Is there anything else related to your concussion experience that you feel is important to share?

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