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original research

Recent Injury and Health-Related Quality of Life in Adolescent Athletes

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Context: Health-related quality of life (HRQOL) is a global concept that takes into account the physical, psychological, and social domains of health. Determining the extent to which injury affects HRQOL is an important aspect of rehabilitation practice, enabling comparisons of clinical outcomes across different conditions in diverse patient groups.

Objective: To examine the extent to which a self-reported recent injury affected HRQOL in adolescent athletes using 2 generic patient self-report scales.

Design: Cross-sectional study.

Setting: High school classrooms and athletic training facilities.

Patients or Other Participants: A convenience sample of uninjured (n = 160) and injured (n = 45) adolescent athletes.

Intervention(s): The independent variable was injury status: uninjured versus injured. All participants completed a self-administered brief health status questionnaire and the Short Form–36 Health Survey Questionnaire (SF-36) and Pediatric Outcomes Data Collection Instrument (PODCI) in a counterbalanced manner.

Main Outcome Measure(s): Dependent variables included 8 subscale and 2 composite scores of the SF-36 and 5 subscale scores and 1 global score of the PODCI. Group differences were assessed with the Mann-Whitney *U* test ($P \leq .05$) and reported as median and interquartile range.

Results: On the SF-36, the injured group demonstrated lower scores ($P < .008$) for physical functioning, limitations due to physical health problems, bodily pain, social functioning, and the physical composite. On the PODCI, the injured group reported lower scores ($P < .01$) on the pain and comfort subscale and the global score.

Conclusions: Adolescent athletes with self-reported injuries demonstrated lower HRQOL than their uninjured peers. As expected, recent injury affected physical functioning and pain. Social functioning (on the SF-36) and global HRQOL (on the PODCI) also decreased, suggesting that injuries affected areas beyond the expected physical component of health. Clinicians need to recognize the full spectrum of negative influences that injuries may have on HRQOL in adolescent athletes.

Key Words: patient-oriented evidence, POEM, clinical outcomes, children

Key Points

- Compared with an uninjured cohort, adolescent athletes with self-reported recent injuries displayed lower scores on 2 generic measures of health-related quality of life: the Short Form–36 Health Survey Questionnaire and the Pediatric Outcomes Data Collection Instrument.
- The lower scores were noted not only in the areas of physical functioning and pain but also in social and global functioning.
- Incorporating patient self-report measures of health-related quality of life can provide a more holistic evaluation of the patient's overall health status.

More than 30 million children and adolescents participate in organized sports, such as interscholastic athletics, summer camps, club leagues, and sports enhancement programs in the United States.[1–3] Although significant benefits are derived from participation in athletics, there are also risks, including sport-related injury. An estimated 12 million athletes between the ages of 5 and 22 years suffer a sport-related injury annually, which leads to 20 million lost days of school[4] and approximately $33 billion in health care costs.[5] Unfortunately, evidence regarding the short- and long-term effects of injury in this vulnerable population is lacking.

Traditional examination of athletic injuries predominantly occurs via clinician-based assessments, which include measures of range of motion and strength, radiographs, and special tests.[6] Although clinician-based outcome measures are informative to the clinician regarding the physiologic state of the tissues or the patient's impairments, these measures have significant shortcomings because they do not provide insight into the patient's perception of his or her health status,[7] nor do they always correlate strongly with an individual's overall health status.[8–12] As a result of these shortcomings, the medical community has started to assess patient-oriented evidence, which includes the evaluation of the effect of the injury or illness and subsequent health care services from the patient's perspective.[13]

Professional orthopaedic and sports medicine organizations, including the American Academy of Orthopaedic Surgeons,[14,15] the American Orthopaedic Society for Sports Medicine,[16] and the National Athletic Trainers' Association,[17,18] have emphasized the need for clinical outcomes data using both generic and specific patient-based outcomes measures. Information gained through assessment of patient-based outcome measures is necessary to determine effective treatments and interventions.[6,19]

Health-related quality of life (HRQOL) is an important patient-based outcome measure that is often described as a measure of treatment effectiveness. Health-related quality of life measures the physical, psychological, and social domains of health that are affected by personal experiences, expectations, and perceptions.[20] The Short Form–36 Health Survey Questionnaire (SF-36; QualityMetric Inc, Lincoln, RI)[21] and the Pediatric Outcomes Data Collection Instrument (PODCI; American Academy of Orthopaedic Surgeons, Rosemont, IL)[22] are 2 generic measures of HRQOL. These tools have been used to evaluate the HRQOL of adults,[23,24] collegiate athletes,[7] and adolescents[25,26] with a variety of musculoskeletal conditions. Surprisingly, given the large number of injuries resulting from participation in athletics and the associated high costs of health care, very few investigations have been conducted into the HRQOL of athletic populations.[7,27,28] Despite the known physical and psychological benefits of physical activity and sport and the known prevalence of sport-related injury, HRQOL in athletes remains poorly studied. One group[7] reported that HRQOL was decreased in collegiate athletes who sustained either mild or serious sport-related injury; however, whether this trend exists in younger adolescent athletes remains unknown.

For a variety of reasons, investigating sport-related injuries in adolescent athletes should be an area of high priority for the sports medicine community. For example, sports are the number-one cause of musculoskeletal injury in the 30 million children who participate in sports yearly.[29] This finding is problematic, because sport-related injury represents a potential impediment to continued physical activity in the athlete. A large body of research provides strong evidence demonstrating the positive effect of physical activity on various psychosocial factors affecting children and adolescents.[30–34] Furthermore, physical activity in the adolescent is the best predictor of physical activity in the adult.[35] Research also suggests a strong relationship between physical activity and perceived life satisfaction in high school adolescents.[31] However, despite these facts, few authors to date have examined the effect of injury on the HRQOL in this vulnerable population. Therefore, the purpose of our study was to examine the extent to which self-reported, recent injury was associated with HRQOL in adolescent athletes compared with uninjured adolescent athletes.

METHODS

Participants

A convenience sample of uninjured (n = 160: 83 females, 77 males, age = 16.0 ± 1.1 years, grade = 10.8 ± 1.0) and injured (n = 45, 25 females, 20 males, age = 15.9 ± 1.1 years, grade = 10.7 ± 1.0) adolescent athletes was recruited from 8 local high schools (6 public, 1 public charter, 1 private, size = 1789.7 ± 935.7 students, sports = 11.4 ± 2.3 teams). The athletes were recruited to participate via athletic trainer and coach contacts at each school. Before completing the survey, the participant's parent or guardian completed a consent form, approved by the university's institutional review board, and the participant assented.

All volunteers completed a self-administered brief health status questionnaire followed by the SF-36 (version 2.0) and PODCI in a counterbalanced manner. The surveys were administered in a classroom or the athletic training facility at the high school and took approximately 30 minutes to complete.

Instrumentation

Brief Medical Questionnaire. Demographic data (age, sex, year in school) and information regarding participation in sports and scholastic activities were obtained through a brief medical questionnaire. Participants were also asked if they had sustained any injuries in the past week. The injury question was intentionally left broad and did not ask solely about sport-related injury. Persons indicating a recent injury were asked to describe the body part injured and type of injury using an open-ended response format. The questionnaire did not ask about injuries occurring before the study time frame (the week before survey completion) or past injuries.

Short Form–36. The SF-36 is a widely used generic measure of HRQOL. Patients provide Likert-style answers to questions, and a score ranging from 0 to 100 is given for each of the 8 subscales: physical functioning (PF), role limitations due to physical health problems (RP), bodily pain (BP), general health perceptions (GH), vitality (VT), social functioning (SF), role limitations due to emotional problems (RE), and mental health (MH). Two composite scores are also calculated: the physical composite score (PCS) and mental composite score (MCS) subscales. A lower score indicates lower HRQOL. The SF-36 is appropriate for use in individuals as young as 14 years.[36,37] Although the SF-36 has been shown to be both valid and reliable (α = .78–.93),[38] most of the data and normative values have been established in an adult population.[38–40]

Pediatric Outcomes Data Collection Instrument. The PODCI is a generic HRQOL scale created for the evaluation of musculoskeletal conditions in the adolescent population.[25,41,42] Like the SF-36, the PODCI also uses Likert-style answers to evaluate the self-perceived health status of adolescents. The PODCI consists of 83 questions and 5 subscale scores: upper extremity and physical functioning (UE), transfer and basic mobility (TBM), sports and physical functioning (SPF), pain/comfort (PC), and happiness (HAP) and a PODCI global function score. Scores for each PODCI subscale range from 0 to 100, with lower scores indicating lower HRQOL. The internal consistency (α = .76–.92), test-retest reliability (r = 0.87–0.97), construct validity, and sensitivity to change of the PODCI have been previously reported.[22] This instrument has been commonly used in the pediatric medical literature to investigate idiopathic scoliosis,[43] upper extremity amputees,[25] and cerebral palsy[44]; however, to our knowledge, there are no published investigations with this instrument in a sample of athletes with sport-related musculoskeletal injury.

Statistical Analysis

Before the statistical analysis, we converted raw data to norm-based scores via a linear z-score transformation, with all subscales and composites scored with a mean of 50 and an SD of 10.[37,45] Using this norming procedure allowed for meaningful comparisons across subscales and between groups. Additionally, normed data values permit easy calculation of effect sizes, in that each 1-point change in

Table 1. Primary Sport indicated by Participants in Each Group, No. (%)

	Injured	Uninjured
Baseball	2 (4.8)	8 (5.6)
Basketball	2 (4.8)	9 (6.3)
Cheerleading	10 (23.8)	15 (10.4)
Football	7 (16.7)	24 (16.7)
Golf	2 (4.8)	2 (1.4)
Soccer	7 (16.7)	17 (11.8)
Swimming/diving	2 (4.8)	7 (4.9)
Tennis	1 (2.4)	4 (2.8)
Track/cross-country	2 (4.8)	22 (15.3)
Volleyball	0 (0)	18 (12.5)
Wrestling	5 (11.9)	6 (4.2)

score equates to an effect size of 0.1. Effect sizes were calculated for all subscale and composite scores for both the SF-36 and the PODCI by subtracting the normed mean score for the injured group from the normed mean score for the uninjured group.

Dependent variables included the 8 SF-36 subscale scores, the 2 composite SF-36 scores, and the 5 PODCI subscale scores and global function score. The independent variable was injury status: uninjured or injured.

An initial Kolmogorov-Smirnov test indicated that all dependent variables violated the assumption of normality (SF-36 variables = 1.55–4.69, $P < .01$; PODCI variables = 2.03–6.70, $P < .001$). Therefore, we used the nonparametric Mann-Whitney U test ($P \leq .05$) to determine group differences, with results reported as median and interquartile range. A modified Bonferroni correction for multiple analyses was employed, and testwise α was determined to be $P = .008$ for the SF-36 and $P = .01$ for the PODCI.

RESULTS

Participant Demographics

The groups did not differ on age ($P = .54$) or grade level ($P = .68$). The primary sports listed by each group are presented in Table 1. Thirty-one percent of our injured group and 31.3% of our uninjured group indicated that they participated in multiple interscholastic sports.

Injury Status

Twenty-two percent of our sample (45 of 205) self-reported a recent injury on the brief medical questionnaire. Most of these injuries were to the lower extremity (65.5%, n = 36), followed by the upper extremity (29.1%, n = 16) and head or spine (5.5%, n = 3). The reported injuries were divided among overuse (21.1%, n = 12), sprains (17.5%, n = 10), and strains (15.8%, n = 9), with small numbers of contusions (10.5%, n = 6), fractures (7.0%, n = 4), head injuries (3.5%, n = 2) and postsurgical injuries (1.8%, n = 1). Twenty-three percent of respondents (n = 13) did not specify the type of injury.

Short Form–36

On the SF-36, the injured group reported lower subscale scores on the PF, RP, BP, and SF subscales and for the SF-36 PCS score ($P < .008$; Table 2). Differences were not noted for the GH, VT, RE, or MH subscales or MCS score. Mean subscale and composite scores and SDs are provided in Figure 1. Moderate effect sizes were noted for the BP (0.73) and RP (0.49) subscale scores and the PCS (0.52), whereas small effect sizes were noted for the PF (0.28), SF (0.30), and RE (0.20) subscales.

Pediatric Outcomes Data Collection Instrument

The injured group reported lower scores for the PC subscale and the global functioning score ($P < .01$; Table 3). The UE, TBM, SPF, and HAP subscales did not reveal differences between groups. Mean PODCI subscale and global scores and SDs are provided in Figure 2. We found large effect sizes for the PC (1.25) and global functioning score (1.14), moderate effect sizes for the SPF (0.46) and TBM (0.60) subscales, and small effect sizes for the UE (0.35) and HAP (0.16) subscales.

DISCUSSION

Adolescent athletes with self-reported injuries had lower scores on the SF-36 subscales that affected physical functioning, pain, and social functioning and lower scores on the PODCI for global HRQOL. In addition, we noted moderate effect sizes on several subscales and composite scores, indicating that some nonsignificant differences may

Table 2. Short Form–36 Subscale and Composite Scores

	Median Interquartile Range			
	Injured Group	Uninjured Group	U (P Value)	Effect Size
Subscale				
Physical functioning	55.1 (51.0, 57.1)	57.1 (55.1, 57.1)	2072.5 (<.001)[a]	0.28
Role physical limitations	49.5 (44.7, 56.6)	56.6 (51.9, 56.6)	2291.0 (<.001)[a]	0.49
Bodily pain	45.1 (40.5, 50.1)	54.2 (50.1, 60.9)	1916.5 (<.001)[a]	0.73
General health perceptions	49.6 (46.1, 54.3)	49.6 (44.9, 54.3)	3520.0 (.817)	0.06
Vitality	52.0 (39.9, 60.9)	52.0 (46.0, 58.0)	3286.5 (.370)	0.19
Social functioning	51.0 (40.3, 56.4)	56.4 (51.0, 56.4)	2569.5 (.001)[a]	0.30
Role emotional limitations	51.9 (42.4, 55.7)	55.7 (48.1, 55.7)	3435.0 (.613)	0.20
Mental health	52.3 (46.8, 57.9)	52.3 (46.8, 57.9)	3466.0 (.702)	0.06
Composite				
Physical	50.9 (45.9, 54.4)	54.8 (52.0, 56.7)	1893.0 (<.001)[a]	0.52
Mental	51.1 (43.6, 57.5)	51.8 (45.4, 56.2)	3505.0 (.787)	0.03

[a] Lower subscale score in the injured group ($P \leq .008$).

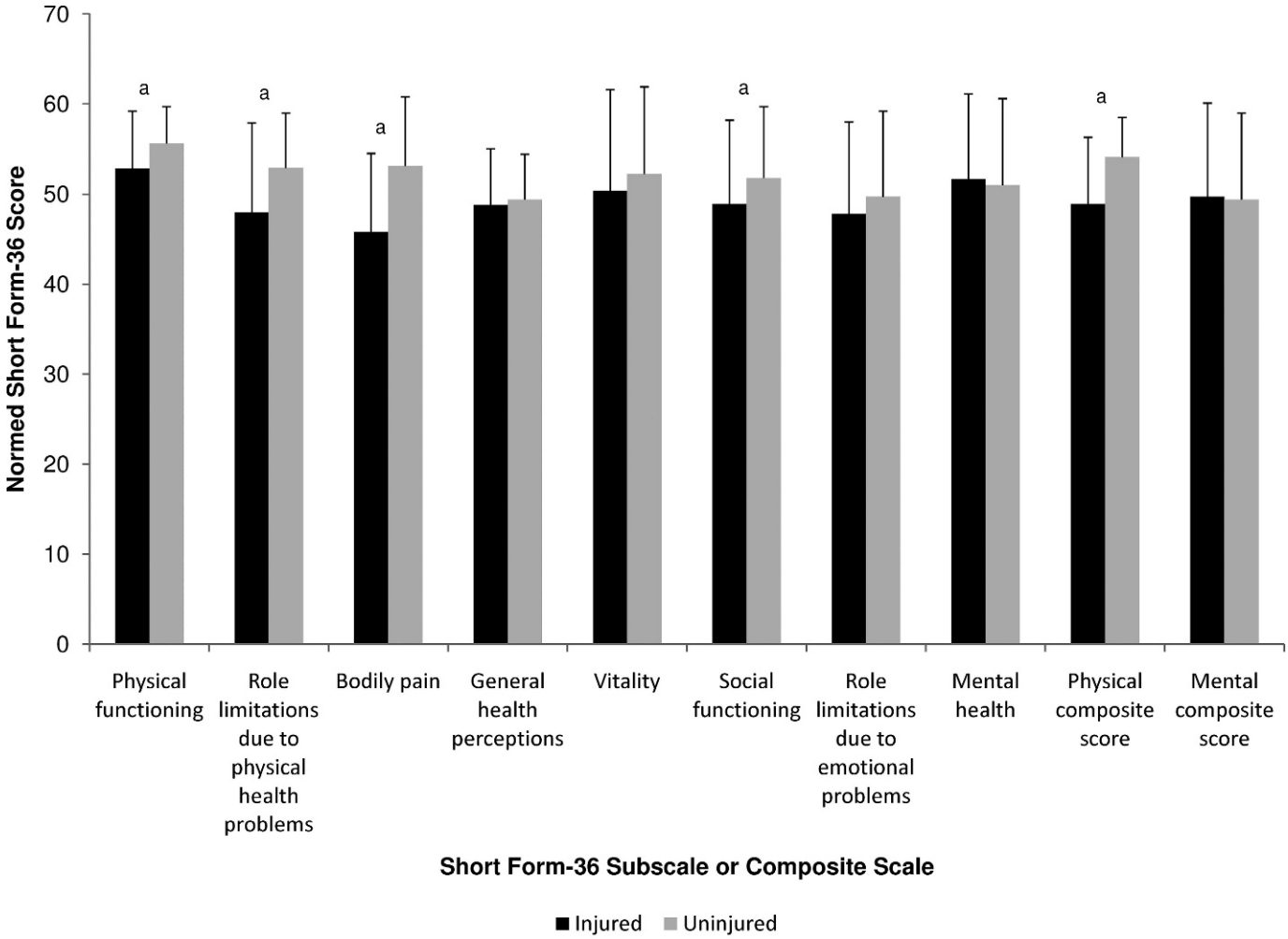

Figure 1. Short Form–36 subscale and composite normed scores in the injured and uninjured groups (mean ± SD). [a] Indicates lower subscale score in the injured group ($P \leq .008$).

have clinical implications that warrant further evaluation. Our results indicate that in adolescent athletes, a recent injury affected areas beyond the expected physical component of health and can negatively influence other domains of HRQOL. These findings speak strongly to the need to incorporate patient self-report measures that assess the effects of injury across a broad spectrum of health status factors and provide a more holistic assessment of HRQOL.

McAllister et al[7] compared collegiate athletes who reported a current mild or serious injury with uninjured athletes and found that those with a serious injury demonstrated a decrease in the raw SF-36 score for each of the 8 subscales and the 2 composite scores. Athletes classified with a mild injury scored lower than uninjured peers on the PCS and the RP, BP, SF, and GH subscales.[7] These data are consistent with our finding that injuries can have a wide range of negative effects on various dimensions of HRQOL.

More recently, Huffman et al[28] published normative SF-36 data for healthy collegiate athletes. In general, the athlete population scored better on all subscales (except bodily pain) compared with published, age-appropriate norms. In a secondary analysis, athletes with a self-reported history of injury scored lower ($P < .05$) on all SF-36 subscales except RE.[28] Again, these data are

Table 3. Pediatric Outcomes Data Collection Instrument Subscale and Global Function Scores

	Median (Interquartile Range)			
	Injured Group	Uninjured Group	*U* (*P* Value)	Effect Size
Subscale				
Upper extremity function	52.5 (44.2, 52.5)	52.5 (52.5, 52.5)	3502.5 (.694)	0.35
Transfer and basic mobility	51.9 (45.4, 51.9)	51.9 (51.9, 51.9)	3173.5 (.135)	0.60
Sports and physical functioning	53.0 (44.0, 55.8)	55.8 (51.1, 55.8)	2890.0 (.028)	0.46
Pain and comfort	31.7 (24.9, 39.3)	48.5 (38.2, 53.3)	1494.0 (<.001)[a]	1.25
Happiness	54.4 (46.1, 57.2)	54.4 (48.9, 60.0)	3090.0 (.140)	0.16
Global	38.3 (29.7, 45.4)	48.4 (43.6, 54.8)	1526.0 (<.001)[a]	1.14

[a] Lower subscale score in the injured group ($P \leq .01$).

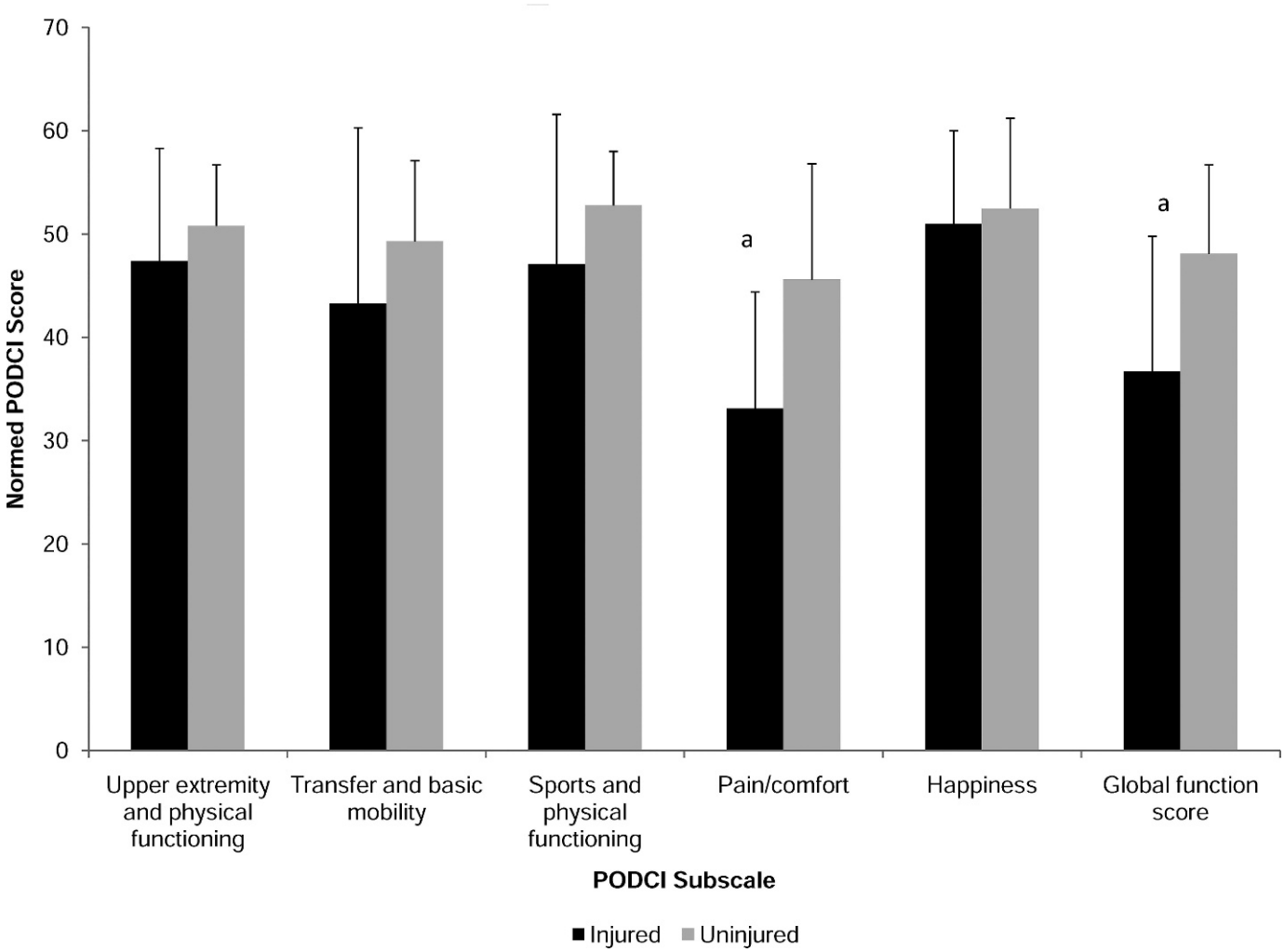

Figure 2. Pediatric Outcomes Data Collection Instrument (PODCI) subscale and global normed scores for the injured and uninjured groups (mean ± SD). [a] Indicates lower subscale score in the injured group ($P \leq .01$).

consistent with our findings in adolescent athletes and demonstrate that HRQOL is potentially diminished as the result of injury across a wide age range of athletes.

The effect of injury on HRQOL was also studied by Marchi et al.[27] These authors conducted a 12-year follow-up on young (ages 6–15 years) individuals who had reported to local hospitals as a result of injuries sustained in sports.[27] Of those sustaining moderate to severe injuries, 30.9% (n = 67) reported subjective or objective sequelae, such as limited joint mobility, pain on pressure, and weakness, at a 3-year follow-up, and 15% (n = 33) had permanent sequelae, such as pain at rest or during exercise and sense of unsteadiness, at the 12-year follow-up (participants were then 18–27 years old).[27] Similarly, Friery and Bishop[46] surveyed former collegiate athletes nearly 2 decades after they completed their collegiate athletic careers. When compared with their nonathlete classmates, former athletes differed in the degree to which previous athletic injuries affected both their daily and physical activities. Although the authors did not specifically measure HRQOL, their results provide clear evidence for the long-term effects of sport-related injuries on the lives of former athletes.

Data from previous investigators and our study indicate that injury negatively affects HRQOL. Our findings are similar to those in the 2 published studies using the SF-36 in collegiate athletes, with the injured participants demonstrating lower HRQOL on several SF-36 subscales. However different samples (adolescent versus collegiate athletes) and injury definitions (1-week self-report history versus self-report history of any previous injury versus current injury) make it difficult to directly compare the findings of the 3 studies. We report lower HRQOL for the PF, RP, BP, and SF subscales and for the SF-36 PCS score, whereas Huffman et al[28] found lower scores across all subscales, except RE in Division I and II collegiate athletes with a history of injury, and McAllister et al[7] noted lower scores on the PCS and the RP, BP, SF, and GH subscales in Division I collegiate athletes with a current mild injury. The differences in results across the 3 studies may be the result of the populations investigated, definitions of injury, statistical analyses employed, and our smaller sample size of injured athletes.

Our injured sample reported lower HRQOL primarily in the subscales and composite scores related to pain and physical function. These findings are not surprising, because the overwhelming majority of injuries reported were musculoskeletal in nature. Deficits in physical functioning and increased pain are often associated with any musculo-

skeletal injury and are the basis for most clinician-based outcomes measures. Because the PCS comprises scores from the PF, RP, BP, and GH subscales, the decreased PCS score in the injured group was also expected.

Interestingly, our injured adolescents also demonstrated lower HRQOL with respect to RP and SF, subscales that measure the effect of injury on domains other than physical health. The RP subscale assesses any role limitations due to physical health problems. Lower scores indicate the awareness of the patient that physical health status is associated with problems at work or in the performance of other daily activities.[21] This is important because the RP subscale essentially captures the concept of *disability*, which is the inability of a person to fulfill his or her desired or necessary personal or social roles.[47–49] Unfortunately, patient evaluation is often narrowly focused and fails to consider the whole person according to the framework of disablement models.[50] Our injured athletes' lower HRQOL on the RP subscale indicates that they felt their injuries were inhibiting their ability to fulfill their personal or societal roles and expectations. A deficit in RP is a significant marker of disability according to most contemporary disablement models. It is also interesting to note that although our median injured group score of 49.5 was just below the population mean for this subscale, our healthy adolescent athletes scored 6.6 points higher than the population mean. The higher RP score is a sign that uninjured adolescent athletes tend to have fewer problems with work or other activities as a result of their physical health, possibly as a result of their physical activity habits.

Similarly, the lower SF subscale score in the injured adolescent athletes further demonstrates that injury can affect areas of health beyond the physical domain. The SF subscale is intended to assess the effect of physical health status or emotional problems on the individual's ability to participate in social activities.[21] Social functioning used in this context aligns with the disablement components of disability and societal limitations, which are typically neglected in patient evaluations that emphasize clinician-based measures of outcome. Disablement models frame patient health status in a whole-person spectrum, from pathophysiology to societal influences.[49] Athletes, especially in their adolescent years, are affected by their identities as athletes as well as their social interactions and family life.[51] Our findings speak to the need to implement a more holistic approach to patient care using the framework of disablement models, for without this patient-centered, whole-person perspective, issues affecting the overall well-being of adolescents may be overlooked.

Although we noted differences in the aforementioned subscales and with the PCS, we demonstrated no differences between adolescent athletes with and without recent injuries on the GH, VT, RE, and MH subscales or the MCS. These findings seem to indicate that the reported recent injuries did not affect the injured adolescents' perception of their personal health, mental state, or level of fatigue or energy or contribute to problems with work or other daily activities as a result of emotional problems.[21] These findings may be due to the types of injuries reported by our participants and the fact that these athletes may have not been dealing with these injuries for a long enough time for them to affect HRQOL. With the exception of those individuals reporting fractures (7%) and postsurgical status (1.8%), the majority of reported injuries were sprains, strains, and overuse musculoskeletal injuries. Although time-loss data were not obtained as part of this investigation, it is likely that most of the injured athletes were still participating in their sport to some extent, therefore limiting the effect of significant change, such as lack of participation, on the mental health subscales and composite score.

Furthermore, we also noted that the normed scores for most of the SF-36 subscales and some of the PODCI subscales revealed that the injured adolescent athletes scored at or above the population mean. These findings support the notion that adolescent athletes function at high physical and mental levels and corroborate the findings of Huffman et al[28] that collegiate athletes scored higher than the adult population means established for the SF-36. This is an important finding, especially considering the perceived roles of adolescent athletes. For example, our injured group scored similarly to the population mean on the RP subscale (49.5), but their score was lower than that of their uninjured peers (56.6), indicating that the injury caused changes in their perceived roles. Although at first glance it might appear that the athlete is not disabled based on scores being close to the population means, a level of RP that is lower than that of peers suggests that the athlete perceives himself or herself as not being able to fulfill the expected roles that are important to him or her, such as starting quarterback or team captain.

In addition, a subsequent analysis of the frequency distributions of both scales in the injured group demonstrates potential ceiling effects, a phenomenon in which participants score toward the upper end of a scale. Scores on the SF-36 PF, RP, GH, VT, SF, RE, and MH subscales; the PCS; and the MCS were all negatively skewed. Also, ceiling effects may be demonstrated when more than 10% of participants achieve perfect scores on subscales. Specifically, the percentages of injured volunteers who were found to have scores of 100 (perfect HRQOL) on each of the SF-36 subscales were as follows: PF (44%, n = 20), RP (38%, n = 17), BP (22%, n = 10), GH (4%, n = 2), VT (0%, n = 0), SF (49%, n = 22), RE (44%, n = 20), and MH (9%, n = 4). Similarly, the PODCI UE, TBM, SPF, and HAP and global scores were negatively skewed and injured participants with perfect scores of 100 were noted in the UE (78%, n = 35), TBM (53%, n = 24), SPF (47%, n = 21), and HAP (16%, n = 7) subscales. Ceiling effects were not noted for the PC subscale score (7%, n = 3) or the PODCI global score (4%, n = 2). Although the values were not significant, we noted moderate effect sizes for the TBM and SPF subscales of the PODCI, suggesting that these domains may also be affected after sport-related injury. These results indicate the potential presence of ceiling effects when using the SF-36 and PODCI in adolescent athletes. Even the injured participants tended to score at the higher end of these instruments (better HRQOL), reflecting the high-functioning nature of these athletes and insensitivity to differences resulting from predominantly minor injuries.

We are not aware of any investigators who have studied adolescent athletes using the PODCI. However, several groups have reported differences between healthy individuals and those with idiopathic scoliosis[43] and upper extremity amputations,[25] as well as between individuals

with different diseases and disease severities.[26] Lerman et al[43] noted deficits in TBM, SPF, PC, and PODCI global in adolescents with idiopathic scoliosis compared with healthy adolescents. Similarly, decreased scores for UE, TBM, SPF, and PODCI global were reported in a study of upper extremity amputees.[25]

Implications

In this investigation, we found decreases in HRQOL for pain and global functioning in the injured adolescent athletes. In general, the findings in our uninjured group were similar to the population mean values for the PODCI. These findings differ from those of the SF-36, on which the adolescent athletes tended to report higher levels of HRQOL than the population mean; this may be explained by the natures of the generic outcomes measures. That is, the SF-36 was created for adolescents to adults,[37] whereas the PODCI was created specifically for adolescents. Therefore, although both instruments address the physical component and provide a global score, the scores in the injured group differed between the instruments. The PODCI was developed to assess adolescents with more serious musculoskeletal conditions or disease states and may not ask questions that are meaningful for physically active adolescents with minor injuries, as noted by the ceiling effects discussed previously. More investigation is needed to test the sensitivity of these instruments in measuring HRQOL in physically active adolescents with musculoskeletal injuries.

Developing our understanding of the effect of injury in adolescents is important for several reasons. First, injury incurred as the result of sport participation may lead to dropout from physical activity and, subsequently, the myriad of negative long-term health consequences associated with inactivity (eg, obesity, adult-onset diabetes, cardiovascular disease). Next, poorly managed musculoskeletal injuries sustained during adolescence may lead to some of the significant and disabling long-term health problems that have become a national health care concern, such as osteoarthritis. Finally, negative health-related consequences associated with injury may have other, as yet unknown, sequelae that may affect areas of the adolescent's life outside of athletic activities, such as study habits, personal relationships, and risk for substance abuse.[31] Treating an ankle sprain in an adolescent basketball player as nothing more consequential than an isolated ligament tear fails to address the whole person. Therefore, efforts should be undertaken to evaluate the effect of sport-related injury on HRQOL in this vulnerable population.

Limitations and Future Directions

Limitations of this study include the use of a convenience sample of adolescent athletes and the facts that all of the injuries were self-reported and may have resulted from causes other than sport. Additionally, we did not have enough information on the types of injuries to classify by severity or to conduct separate analyses by injury location, nor were we able to follow up with those athletes who ultimately sought evaluation and treatment from an athletic trainer or physician. We also acknowledge an unequal distribution of athletes by sport between our groups and believe future authors could attempt to stratify by sport or sex when looking at differences between injured and uninjured athletes. We did note large amounts of variability in most subscales on both instruments, which may reflect the large range of perceived effects of injury on HRQOL and the self-report nature of our injury status questionnaire.

Future researchers should prospectively assess the influence of documented injury on HRQOL in athletic populations with sport-related injury using both generic and region-specific outcomes measures and study other sport-related injuries and conditions, such as mild traumatic brain injury, asthma, and chronic overuse injuries. Not only will these investigations contribute to our understanding of how athletic injury affects the whole person, but they will also enhance the clinician's ability to practice in a manner that uses generic and specific clinical outcomes to improve patient care and to ensure that adolescents who sustain sport-related injury are able to return to their activities and remain physically active throughout adulthood.

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