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A Unique Patient Population? Health-Related Quality of Life in Adolescent Athletes Versus General, Healthy Adolescent Individuals

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Context: Normative scores for patient-rated outcome (PRO) instruments are important for providing patient-centered, whole-person care and making informed clinical decisions. Although normative values for the Pediatric Quality of Life Generic Core Scale (PedsQL) have been established in the general, healthy adolescent population, whether adolescent athletes demonstrate similar values is unclear.

Objective: To compare PedsQL scores between adolescent athletes and general, healthy adolescent individuals.

Design: Cross-sectional study.

Setting: Secondary schools.

Patients or Other Participants: A convenience sample of 2659 interscholastic athletes (males = 2059, females = 600, age = 15.7 ± 1.1 years) represented the athlete group (ATH), and a previously published normative dataset represented the general, healthy adolescent group (GEN).

Intervention(s): All participants completed the PedsQL during 1 testing session.

Main Outcome Measure(s): The PedsQL consists of 2 summary scores (total, psychosocial) and 4 subscale scores (physical, emotional, social, school), with higher scores indicating better health-related quality of life (HRQOL). Groups were stratified by age (14, 15, or 16 years old). Independent-samples *t* tests were conducted to compare between-groups and sex differences.

Results: The ATH group scored higher than the GEN group across all ages for total and psychosocial summary scores and for emotional and social functioning subscale scores ($P \leq .005$). For physical functioning, scores of the 15-year-old ATH were higher than for their GEN counterparts ($P = .001$). Both 14- and 15-year-old ATH scored higher than their GEN counterparts for the school functioning subscale ($P \leq .013$), but differences between 16-year olds were not significant ($P = .228$). Male adolescent athletes reported higher scores than female adolescent athletes across all scores ($P \leq .001$) except for social functioning ($P = .229$).

Conclusions: Adolescent athletes reported better HRQOL than GEN, particularly in emotional functioning. These findings further support the notion that ATH constitutes a unique population that requires its own set of normative values for self-reported, patient-rated outcome instruments.

Key Words: patient outcome assessment, patient-centered care, physical activity

Key Points

- Adolescent athletes reported better health-related quality of life than their general, healthy adolescent peers, particularly in emotional functioning.
- As part of the overall evaluation, health care providers should consider whether a patient participates regularly in physical activity because that may affect baseline emotional well-being.
- Adolescent athletes appear to constitute a unique patient population for whom normative values on patient-related outcome instruments should be established.

Health-related quality of life (HRQOL) is a multidimensional concept that represents an individual's overall satisfaction with his or her life and general sense of well-being.[1] Considered a clinically important patient-rated outcome (PRO) of patient care, HRQOL characterizes the perceived effect of a disease, condition, illness, injury, or treatment intervention on various health domains (eg, physical, emotional, social).[2–6] Because health domains are typically influenced by an individual's experiences, expectations, and beliefs, HRQOL is often regarded as an essential component of patient-centered, whole-person health care.[7–9] Given the importance of HRQOL in patient care, efforts have been directed over the last decade to developing generic PRO instruments to evaluate HRQOL during care.[10]

In conjunction with the development of generic PRO instruments, researchers[11] have attempted to establish normative values for distinct patient populations. Establishing normative values for distinct patient populations is important to the overall clinical utility of PRO instruments in providing a frame of reference by which clinicians can make informed clinical decisions for patient care.[11] Similar to normative values of clinician-rated outcome measures (eg, normal limits for range-of-motion measurements), normative values of PRO instruments can be used to identify potential HRQOL deficits in patients after an injury (eg, values beyond normal limits) and to track the recovery of HRQOL during the rehabilitation process (eg, values returning to normal limits over time). It should be noted that normative values for PRO instruments, like clinician-rated measures, can vary across patient populations, highlighting the need for these values in distinct groups of patients, such as athletes.

Despite the noted benefits of regular activity,[12–23] including decreased risk of chronic conditions (eg, diabetes, hypertension, obesity)[14] and improved mental well-being,[15,16] academic performance,[13] and self-esteem,[17] athletes are often considered to be members of the general, healthy population. Although this classification is logical, evidence[24–26] suggests that athletes may constitute their own unique patient population. Snyder et al[26] found that adolescent athletes generally reported higher scores than their nonathlete peers on 2 commonly used generic PRO instruments: the Medical Outcomes Short Form (SF-36) and the Pediatric Outcomes Data Collection Instrument (PODCI). Their findings suggest that adolescent athletes experience better overall HRQOL than their nonathlete counterparts, as well as enhanced mental, emotional, and social health.[26] In addition, previous authors[24,25] have noted similar trends in emotional and mental health when comparing adult athletes and their nonathlete peers using the SF-36. In fact, McAllister et al[25] noted that, even when injured, elite collegiate athletes reported higher emotional- and mental-functioning scores than general, healthy individuals. These group differences suggest that athletes may comprise a distinct patient population with its own normative values and further highlight the importance of establishing normative values for distinct patient populations.

A commonly used generic PRO instrument in the adolescent population is the Pediatric Quality of Life Inventory (PedsQL), which assesses the physical, emotional, social, and school-functioning health domains. The PedsQL may be an appropriate PRO instrument for the practice of athletic training as compared with other instruments because it was designed specifically for the adolescent age group (as opposed to the broad age range of the SF-36) and requires minimal time to complete (as opposed to the 83 items of the PODCI). Although normative values of the PedsQL have been reported for healthy individuals[27] and patients with chronic conditions (eg, cancer, asthma, diabetes, cerebral palsy),[10,28–31] little is known about normative values in adolescent athletes.

The purpose of our study was to compare HRQOL scores between adolescent athletes and general, healthy adolescent individuals by using a common pediatric-specific, generic PRO instrument, the PedsQL Generic Core Scales (GCS). We hypothesized that adolescent athletes would demonstrate higher scores across all scales on the PedsQL GCS, indicating better overall HRQOL than would general, healthy adolescents, further supporting the notion that adolescent athletes constitute their own distinct patient population with a different set of normative values. Additionally, we suggested that sex differences would occur in HRQOL between male and female adolescent athletes. Lastly, we proposed that no differences would be seen across age groups within the adolescent athlete group.

METHODS

Participants

Two distinct populations were selected to solicit participants for this study. One group, adolescent athletes (ATH), was represented by a convenience sample of healthy students who were participating in interscholastic sports at 16 high schools within the greater metropolitan area and were between the ages of 14 and 18 years. Participants were considered *healthy* if they were medically cleared for sport activity through a preparticipation examination, were currently involved in an interscholastic sport without restrictions, and did not self-report a current injury or illness.

The other group, general, healthy adolescents (GEN), was represented by values extracted from a published sample set of healthy adolescent individuals.[32] This methodological approach has been used in previous investigations[24,25] comparing HRQOL between adult athletes and their general, healthy counterparts. Although several studies have provided sample sets for a general, healthy adolescent population,[10,33–35] the values from these studies were often reported in a manner that made between-groups comparisons difficult for the present study (eg, delineated values for healthy individuals were reported as a single value for participants aged 2–18 years or delineated values for specific age groups were combined across study groups, such as a chronic condition group and a healthy group). Varni et al[32] were the only investigators to provide values for healthy individuals and stratified by age. Furthermore, participants from the Varni et al[32] study were similar to those in previously published sample sets for a general, healthy adolescent population with regard to age, sex, and ethnicity.[10,33–35]

Procedures

Before the study began, a parent or legal guardian of each participant in the ATH group signed an informed consent approved by the local institutional review board, which also approved the study. All ATH participants completed the PedsQL GCS during a preseason screening session in their high school's athletic training facilities. All GEN participants completed the PedsQL GCS during a routine wellness checkup at their physician's office.[32]

The Pediatric Quality of Life Inventory

The PedsQL GCS (version 4.0) is a self-report, generic PRO instrument that evaluates HRQOL in patients aged 2 to 18 years. The adolescent version of the PedsQL GCS is specifically designed for individuals aged 13 to 18 years and has been found to be a valid (concurrent validity: heterotrait-monomethod correlations = 0.45–0.48) and reliable PRO instrument (Cronbach α = 0.79–0.91).[34–36] The 23-item PedsQL GCS consists of 2 summary scores and 4 subscale scores. The total score (TS, 23 items) is a summary score of all subscale scores, and the psychosocial functioning score (PSF, 15 items) is a summary score of the emotional-functioning (EF), social-functioning (SOF), and school-functioning (SCF) subscale scores. The PedsQL GCS subscales include physical functioning (PF, 8 items), EF (5 items), SOF (5 items), and SCF (5 items). Each item

Table 1. Participants Stratified by Age, No.

Age Group, y	Adolescent Athletes	General, Healthy Adolescents[a]
14	507	301
15	753	289
16	690	139
17	559	0
18	150	0
Total	2659	729

[a] Values extracted from Varni et al.[32]

is rated on a 5-point Likert scale and is reverse scored and linearly transformed to a 0 to 100 scale (0 = 100, 1 = 75, 2 = 50, 3 = 25, 4 = 0), with higher scores indicating better HRQOL.[34–36]

Data Analysis

For between-groups comparisons (ATH versus GEN), independent-samples *t* tests were conducted to evaluate differences between age-stratified groups (ie, 14, 15, and 16 years old; Table 1) for the PedsQL GCS summary and subscale scores. Between-groups comparisons for 17- and 18-year olds were not conducted because the Varni et al[32] dataset did not report scores for these ages. However, scores for 17- and 18-year-old ATH were calculated and reported to provide a reference of normative scores for these age groups. Three pairwise comparisons (14-year-old ATH versus 14-year-old GEN, 15-year-old ATH versus 15-year-old GEN, 16-year-old ATH versus 16-year-old GEN) were conducted for each family of summary and subscale scores. A Bonferroni correction was used to account for multiple comparisons and protect against type I errors. The 2-tailed significance level for between-groups comparisons was set at $P < .017$.

For within-group comparisons for the ATH group, independent-samples *t* tests were conducted to evaluate differences between sexes for the PedsQL GCS summary and subscale scores. Six pairwise comparisons (male versus female) were calculated across all summary and subscale scores. A Bonferroni correction was used to account for multiple comparisons. The 2-tailed significance level for within-group sex comparisons was set at $P < .008$. In addition, a 1-way analysis of variance assessed age differences (14-, 15-, and 16-year olds) for the PedsQL GCS summary and subscale scores. The 2-tailed significance level for within-group age comparisons was set at $P < .05$. We used SPSS software (version 18.0; SPSS Inc, Chicago, IL) for data analysis.

To describe group differences, we calculated effect sizes (Cohen d) by dividing the difference between the mean values of the ATH and GEN groups by the pooled standard deviation of the 2 groups.[37] The same procedures were used to calculate effect sizes between males and females within the ATH group. The magnitude of the group effect was interpreted as a trace (<0.20), small (0.20–0.49), medium (0.50–0.79), or large (>0.80) effect.[37]

RESULTS

A total of 2659 high school athletes (males = 2059, females = 600, mean age = 15.7 ± 1.1 years) participated in the study and represented 19 interscholastic sports (Table 2). The GEN group was represented by values extracted from a published dataset for 14-, 15-, and 16-year-old healthy adolescent individuals (n = 729).[32]

The ATH had higher scores than the GEN across all ages for TS ($P < .001$), PSF ($P < .001$), EF ($P < .001$), and SOF ($P<.005$; Table 3, Figures 1–3). For PF, 15-year-old ATH scored higher than their GEN counterparts ($P = .001$), but the differences in PF between the 14- and 16-year-old groups were not significant (Table 3). For SCF, 14- and 15-year-old ATH demonstrated higher scores than their GEN counterparts ($P \leq .01$), but the difference in SCF scores between the 16-year-old groups was not significant ($P = .228$). Effect sizes for all scores ranged from trace (0.18) to medium (0.57), with the largest effect sizes reported for EF (d = 0.51–0.57; Table 3).

Male adolescent athletes reported higher scores than female adolescent athletes for TS ($P < .001$), PSF ($P < .001$), PF ($P < .001$), EF ($P < .001$), and SCF ($P = .001$; Table 4). Effect sizes for these scores ranged from trace (0.15) to small (0.34), with the largest effect size reported for EF (d = 0.34; Table 4). No sex differences were noted for SOF ($P = 0.229$), and no differences were evident between ATH age groups ($P \geq .05$).

DISCUSSION

The purpose of our study was to compare HRQOL differences, as measured by the PedsQL GCS, between ATH and GEN. Our primary finding indicates that ATH between the ages of 14 and 16 years reported higher scores than GEN, suggesting that the former experienced better overall HRQOL and enhanced health across several domains, particularly in emotional and social functioning. We also found that, within the ATH, males tended to report higher HRQOL scores than did females, but no differences were observed across age groups.

Our findings further support the notion that ATH constitute their own distinct patient population and require their own set of normative values with regard to PRO instruments. The issue of normative values for instrument interpretation is not new and, in fact, it is considered regularly with our traditional clinician-rated measures. The importance of normative values is clear when clinician-rated and patient-rated measures of function are compared. Like clinician-rated measures, normative values for PRO instruments can vary across different patient populations.[11] This, in turn, can affect the clinical usefulness of a PRO instrument for patient care. Just as clinicians would not use

Table 2. Primary Sports for Adolescent Athlete Group

Primary Sport	n (%)	Males, no.	Females, no.
Football	1033 (38.8)	1031	2
Soccer	348 (13.1)	209	139
Basketball	318 (12.0)	204	114
Baseball	312 (11.7)	310	2
Wrestling	229 (8.6)	229	0
Softball	193 (7.3)	0	193
Volleyball	117 (4.4)	17	100
Other[a]	131 (4.1)	59	50
Total	2659 (100)	2059	600

[a] Bicycle motocross, cheerleading, cross-country, diving, golf, gymnastics, ice hockey, kickboxing, lacrosse, swimming, tennis, and track and field.

Table 3. **Pediatric Quality of Life Generic Core Scale: Summary and Subscale Scores of Adolescent Athletes and General, Healthy Adolescents**

Age Group, y	Adolescent Athletes (Mean ± SD)	General, Healthy Adolescents[a] (Mean ± SD)	*P* Value	Effect Size (95% CI)
Total Score				
14	89.4 ± 9.6	85.7 ± 12.0	<.001[b]	0.35 (0.19, 0.48)
15	89.8 ± 9.6	84.7 ± 12.7	<.001[b]	0.48 (0.29, 0.56)
16	89.6 ± 10.1	85.8 ± 11.4	<.001[b]	0.37 (0.16, 0.53)
17	90.1 ± 9.7	NA	NA	NA
18	90.5 ± 10.2	NA	NA	NA
Psychosocial Summary Score				
14	88.6 ± 10.6	84.0 ± 13.3	<.001[b]	0.39 (0.23, 0.51)
15	88.9 ± 10.7	82.7 ± 14.2	<.001[b]	0.52 (0.32, 0.60)
16	88.5 ± 11.5	84.0 ± 13.0	<.001[b]	0.38 (0.17, 0.53)
17	88.8 ± 11.1	NA	NA	NA
18	89.3 ± 11.2	NA	NA	NA
Physical Functioning				
14	91.1 ± 10.6	89.0 ± 13.2	.020	0.18 (0.03, 0.31)
15	91.5 ± 11.2	88.6 ± 13.6	.001[b]	0.24 (0.09, 0.27)
16	91.8 ± 10.4	89.1 ± 12.7	.023	0.24 (0.03, 0.40)
17	92.5 ± 10.1	NA	NA	NA
18	92.8 ± 11.2	NA	NA	NA
Emotional Functioning				
14	88.8 ± 13.9	81.0 ± 17.8	<.001[b]	0.51 (0.33, 0.62)
15	88.8 ± 14.6	79.7 ± 18.6	<.001[b]	0.57 (0.38, 0.65)
16	88.4 ± 15.6	80.2 ± 18.0	<.001[b]	0.51 (0.28, 0.65)
17	88.8 ± 14.8	NA	NA	NA
18	89.0 ± 14.3	NA	NA	NA
Social Functioning				
14	92.6 ± 11.0	89.8 ± 14.7	.004[b]	0.22 (0.06, 0.35)
15	94.0 ± 10.0	89.1 ± 14.5	<.001[b]	0.43 (0.23, 0.50)
16	93.6 ± 11.2	90.3 ± 12.6	.005[b]	0.29 (.08, 0.45)
17	94.4 ± 9.9	NA	NA	NA
18	94.5 ± 9.9	NA	NA	NA
School Functioning				
14	84.1 ± 14.8	81.2 ± 17.1	.013[b]	0.19 (0.04, 0.32)
15	83.9 ± 15.0	79.3 ± 17.9	<.001[b]	0.29 (0.13, 0.40)
16	83.4 ± 15.9	81.5 ± 17.4	.228	0.12 (−0.07, 0.29)
17	83.1 ± 16.4	NA	NA	NA
18	84.3 ± 11.2	NA	NA	NA

Abbreviations: CI, confidence interval; NA, not available.

[a] Values extracted from Varni et al.[32]

[b] Higher for adolescent athletes than general, healthy adolescents ($P < .017$).

the normal limits of active glenohumeral joint external-rotation range of motion for the general healthy population (normal range: approximately 0°–90°) as their benchmark when treating baseball pitchers (normal range: approximately 0°–135°), clinicians should not use the normative values of a PRO instrument from 1 distinct patient population (eg, general, healthy population) when providing care for another distinct patient population (eg, patients with asthma) because the values may not provide an accurate frame of reference on which to base clinical decisions.[11]

Other investigators who studied the normative values in other PROs have found similar results. Using the SF-36 and PODCI, Snyder et al[26] noted that adolescent athletes reported better overall HRQOL as well as better social functioning and mental functioning and more happiness than their nonathlete counterparts. Our results support those reported by Snyder et al in that our ATH scored higher than GEN on the total summary score, psychosocial-functioning summary score, and emotional, social, and school subscales. These findings suggest that, in general, ATH tend to be healthier emotionally (eg, less frequently afraid, sad, angry, or worried), socially (eg, more likely to get along with peers and less likely to have trouble making friends or being teased by others), and academically (eg, fewer problems paying attention in class, forgetting things, keeping up with schoolwork, or missing school) than GEN. These findings are not surprising given that regular physical activity has been associated with higher self-esteem,[14] improved emotional well-being,[14] and better academic performance.[13]

Similar to Snyder et al,[26] we found the largest differences between ATH and GEN for the EF subscale: ATH scored 7.8 to 9.1 points higher than GEN across all age groups (Table 3). In addition, the largest effect sizes were noted for the EF subscale (0.51–0.57). In conjunction with those

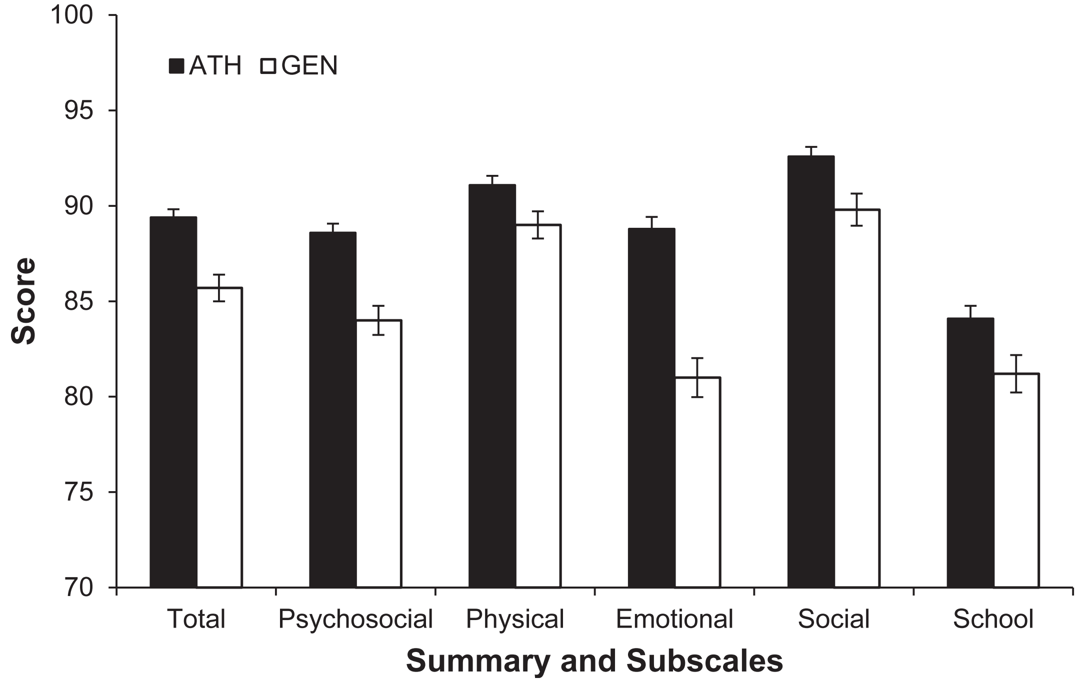

Figure 1. Pediatric Quality of Life Generic Core Scale summary and subscale scores for 14-year-old adolescent athletes (ATH) and general, healthy adolescents (GEN). ATH scored higher than GEN for all scores except physical functioning ($P < .017$). Error bars represent 95% confidence intervals.

reported by Snyder et al,[26] our findings indicate that ATH tend to experience greater emotional well-being than GEN and suggest that routine physical activity has the most influence on emotional health for adolescents between 14 and 16 years old. Additionally, although we did not compare instruments in our investigation, the similarity of findings between the instruments may provide clinicians with an opportunity to select a generic PRO measure that best fits their purpose. For example, the PedsQL may be desirable in busy athletic training rooms and for routine implementation in patient care due to the small number of questions and quick completion time when compared with other instruments, such as the PODCI (83 questions).

Furthermore, the emotional and mental benefits of regular physical activity may persist across age groups. In an investigation of college-aged individuals, Huffman et al[24]

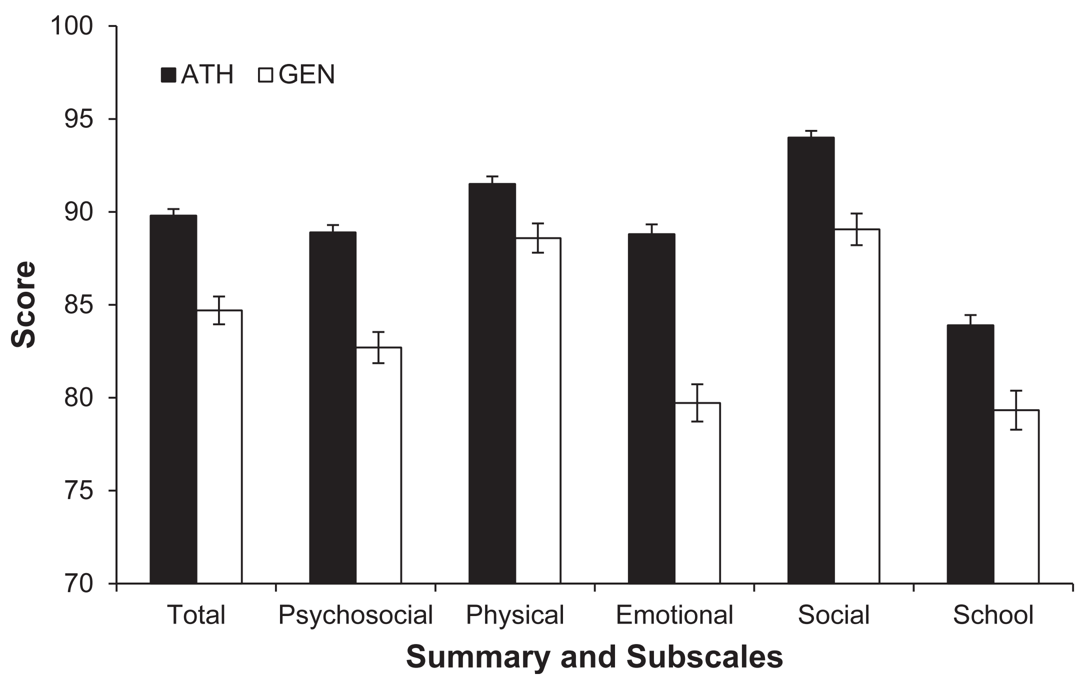

Figure 2. Pediatric Quality of Life Generic Core Scale summary and subscale scores for 15-year-old adolescent athletes (ATH) and general, healthy adolescents (GEN). ATH scored higher than GEN for all scores ($P < .017$). Error bars represent 95% confidence intervals.

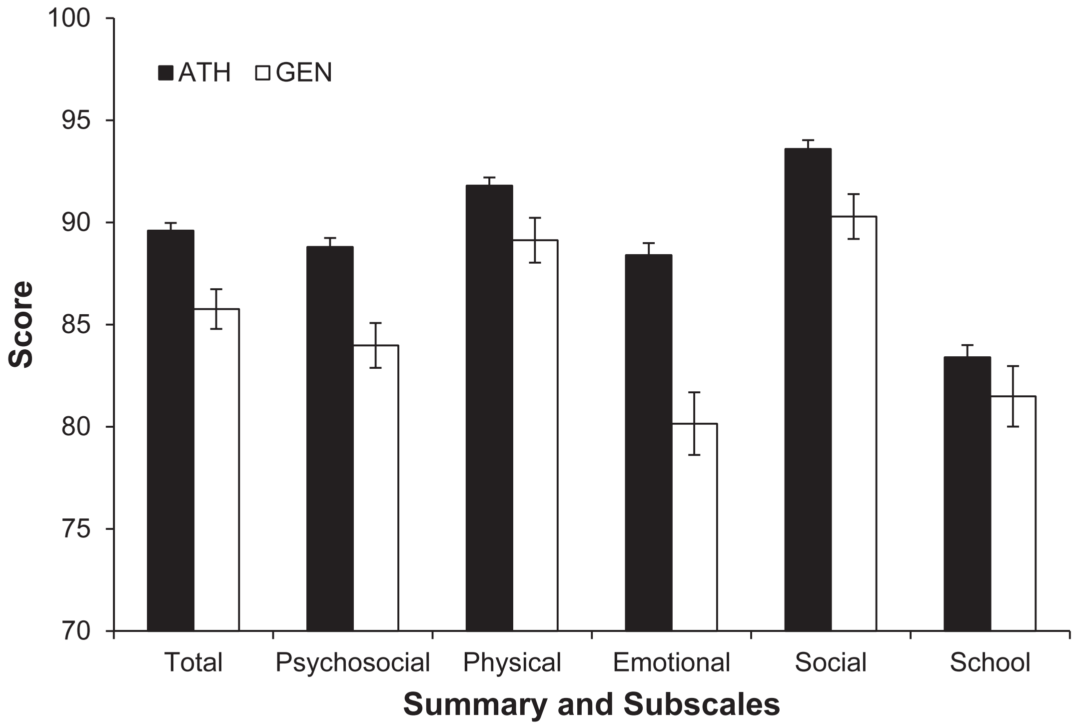

Figure 3. Pediatric Quality of Life Generic Core Scale summary and subscale scores for 16-year-old adolescent athletes (ATH) and general, healthy adolescents (GEN). ATH scored higher than GEN for all scores except physical and social functioning ($P < .017$). Error bars represent 95% confidence intervals.

found that collegiate athletes reported higher scores for vitality, emotional, and mental health subscales on the SF-36 when compared with the general, healthy population. Similarly, McAllister et al[25] observed that, even when injured, elite collegiate athletes reported higher emotional- and mental-functioning scores than general, healthy individuals. This finding highlights the importance of establishing normative values for distinct patient populations. Clinically, using normative values from the general, healthy population as a frame of reference may suggest that an injured athlete is within normal limits for emotional and mental health when, in fact, he or she is experiencing deficits. Thus, use of normative values from the general, healthy population in athletes could result in missed deficits, simply because the reference point was incorrect. Although we did not compare injured adolescent athletes with general, healthy adolescent individuals, it would not be surprising to detect similar findings in the adolescent population based on the large between-groups differences on the EF subscale we report. However, further research is needed.

Snyder et al[26] found that adolescent athletes reported higher physical functioning than nonathletes. Interestingly, ATH reported higher physical functioning scores than GEN across all age groups in our study, but we found group differences only for the 15-year olds. This discrepancy may be due to the different PRO instruments used in each study. Like Snyder et al, Huffman et al[24] and McAllister et al[25] used the SF-36 and reported differences in physical-functioning scores between athletes and the general, healthy population. These results suggest that the PedsQL GCS PF subscale may not be as sensitive as the SF-36 physical-functioning subscale. These instruments differ in the number of questions in each subscale (PedsQL GCS physical subscale = 8 items, SF-36 physical-functioning subscale = 10 items), which may explain the difference.

Between sexes, differences occurred across all PedsQL GCS scores except for SOF. The largest sex differences were noted for the EF subscale, which agrees with a previous investigation by Tanabe et al,[38] who found that

Table 4. Pediatric Quality of Life Generic Core Scale: Summary and Subscale Scores of Male and Female Adolescent Athletes

Score	Males (Mean ± SD)	Females (Mean ± SD)	*P* Value	Effect Size (95% CI)
Total	90.3 ± 9.3	87.9 ± 11.0	<.001[a]	0.33 (0.13, 0.42)
Psychosocial	89.3 ± 10.2	86.7 ± 12.3	<.001[a]	0.24 (0.13, 0.31)
Physical	92.2 ± 10.4	90.2 ± 11.4	<.001[a]	0.19 (0.09, 0.27)
Emotional	89.8 ± 13.5	84.9 ± 17.9	<.001[a]	0.34 (0.20, 0.38)
Social	93.9 ± 10.5	93.3 ± 10.5	.229	0.06 (−0.04, 0.15)
School	84.2 ± 15.4	81.8 ± 16.1	.001[a]	0.15 (0.06, 0.24)

Abbreviation: CI, confidence interval.

[a] Males scored higher than females ($P < .008$).

female adolescent athletes had lower scores for the vitality and mental composite score of the SF-36 and the happiness subscale of the PODCI when compared with their male counterparts. The authors suggested that emotional status in both females and males should be considered and managed on an individual basis due to potential differences between the sexes.[38] Females, with a lower emotional HRQOL at the start, may be affected more than males by a negative event such as an injury. Males, in contrast, may have a less accurate perception of their health[39] and, therefore, underreport their emotional HRQOL.

Our findings highlight current initiatives in health care, namely providing patient-centered, whole-person health care and assessing PROs during patient care.[9,40,41] Patient-centered, whole-person health care encourages health care professionals to shift the weight of assessment from a strong focus on a disease or condition to an approach that considers the greater influence of a health condition on a person's overall HRQOL.[2–6] In conjunction with previous investigations,[24–26] our study suggests that changes in the emotional well-being of athlete-patients may warrant attention. Athlete-patients generally experience a higher level of emotional functioning than do general, healthy individuals. Subsequently, a decrease in emotional well-being in an athlete may be significant and yet appear normal if the reference values are based on values from a general population and not a population of athletes. Thus, by recognizing that athletic individuals may not present in the same manner as typical patients, health care providers will be more prepared to identify potential emotional deficits efficiently and, in turn, provide better quality of care. Care may include referral to other health professionals, such as sports psychologists, should significant or long-term decrements occur. Research is needed in other athlete populations to further elucidate the differences between athlete and general population patients.

Unlike clinician-rated outcomes, which are evaluated from the clinician's point of view and focus on impairment-related changes (eg, range of motion, strength), PROs are evaluated from the patient's point of view and capture function- and disability-related changes, such as the patient's ability to perform functional tasks or to fulfill societal roles.[42–44] Because these types of changes are thought to be more meaningful and relevant to the patient, these types of outcomes may be more appropriate to guide patient care and answer questions related to best clinical practices.[42–46]

Although PRO instruments should be used when caring for athletic patients, health care providers should consider that these individuals likely constitute their own unique patient population. Our findings agree with those of previous studies that have shown that athletes score differently than their nonathlete counterparts on generic PRO instruments (eg, SF-36, PODCI).[24–26] Furthermore, recent evidence suggests that athletes also tend to score differently on region-specific PRO measures, such as the Oswestry Low Back Pain Disability Questionnaire[47] and the Disabilities of the Arm, Shoulder, and Hand measure.[48] Normative values often serve as a frame of reference to guide clinical decisions during patient care and act as a basis for investigating the effectiveness of treatment interventions, so future authors should focus on establishing normative values for the adolescent athletic population for commonly used PRO measures. Due to several limitations within our dataset (eg, restricted geographic diversity), the PedsQL GCS values we report are likely insufficient to establish normative values for an adolescent athletic population. However, until normative values are established, these PedsQL GCS values likely provide a better frame of reference for health care providers than previously published values for the general healthy population and may be helpful to health care providers who commonly use the PedsQL for the care of adolescent athletes.

Another limitation of this study is our use of a previously published dataset[32] to represent GEN. Although this type of method has been used in similar investigations[24,25] and we used the best available published dataset, our analysis was constrained by the data presented by Varni et al.[32] For instance, we were unable to include analyses related to 17- and 18-year-old athletes or to sex differences because these data were not reported by Varni et al.[32] In addition, the data presented by Varni et al[32] and by our group were collected within the same general geographic region of the United States. Therefore, the generalizability of our findings to other regions of the country or to other countries could be affected. Findings from our study and previous studies[24–26] indicate that individuals participating in interscholastic sports (eg, elite, subelite) experience better HRQOL than the general, healthy population, but whether recreational athletes or individuals who exercise routinely would report similar levels of improved HRQOL is unclear. Still, it is reasonable to hypothesize that these individuals' scores would trend similarly to those of athletes due to the association of regular physical activity with decreased levels of anxiety, depression, and stress.[12–17]

CONCLUSIONS

In general, ATH experienced better HRQOL than GEN. These results suggest that adolescent individuals should be encouraged to participate in sport and physical activities as a means of enhancing overall HRQOL. Additionally, health care providers should consider whether a patient participates in sports or regular physical activities as part of the overall evaluation because these patients may present differently than a general, healthy individual, particularly in emotional well-being. Lastly, in conjunction with previous findings,[24–26] our study adds to the current evidence that athletes are a unique patient population and that normative values related to PRO instruments should be established for these individuals in order to provide the best clinical care.

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