Health-Related Quality of Life Differs Between Adolescent Athletes and Adolescent Nonathletes

Alison R. Snyder, Jessica C. Martinez, R. Curtis Bay, John T. Parsons, Eric L. Sauers, and Tamara C. Valovich McLeod

Context: Patient-oriented outcome measures such as the Medical Outcomes Short Form (SF-36) and the Pediatric Outcomes Data Collection Instrument (PODCI) are important tools for determining the impact of events like sport-related injury on health-related quality of life (HRQoL). Unfortunately, there are no published studies using these instruments that compare adolescent athletes with their nonathlete peers, making interpretations of these measures in this population difficult. Objective: To compare HRQoL in adolescent athletes and nonathletes using 2 common instruments. Design: Cross-sectional. Setting: 7 high schools. Participants: 219 athletes and 106 nonathletes. Intervention: None. Main Outcome Measures: The SF-36 and the PODCI were completed in a counterbalanced manner during 1 session. Dependent variables included the 8 subscale and 2 composite scores of the SF-36 and the 5 subscale scores and 1 global score of the PODCI. Results: On the SF-36, athletes reported higher scores on the physical function, general health, social functioning, and mental health subscales and the mental composite score and lower scores on the bodily pain subscale than nonathletes. On the PODCI, athletes reported higher scores on the sport and physical function and happiness subscales and lower scores on the pain/comfort subscale. Conclusions: Athletes reported higher scores on a number of SF-36 and PODCI subscales related to mental, emotional, and physical well-being than nonathletes. Our findings suggest that athletic involvement may be a benefit to the overall health status of adolescents and imply that athletes may be a distinct adolescent group requiring their own normative values when using the SF-36 and PODCI.

Keywords: SF-36, PODCI, mental health, health status, patient-oriented outcomes

Regular physical activity such as athletic participation is important for preventing injury and chronic disease. In fact, regular physical activity is thought to produce many health benefits for people of all ages. Physical activity decreases the risk of developing diabetes, hypertension, cancer, and obesity, as well as

Snyder, Bay, Parsons, Sauers, and Valovich McLeod are with the Dept of Interdisciplinary Health Sciences, A.T. Still University, Mesa, AZ. Martinez is with the Athletic Dept., Providence College, Providence, RI.
cardiovascular and bone and joint diseases. In addition, it is consistently linked to improvements in a variety of psychological and social factors in adolescents. Improvements in mental well-being, academic performance, parental relationships, and self-esteem, as well as decreased anger, anxiety, and depression, have been noted in adolescents who engage in physical activity. Keeping adolescents active promotes lifelong physical and psychosocial health.

Participation in organized sports is a popular mechanism of achieving adolescent physical activity. It is estimated that over 30 million children and adolescents participate yearly in sport. Sport participation provides a number of health-related benefits, most of which overlap with the general benefits of physical activity identified above. However, sport participation also brings with it the risk of injury. Proper evaluation and management of sport-related injury is necessary to avoid a lengthy absence from activity or a failure to return to activity at all. Limiting the length of such absences is critical because physical activity appears to be a self-sustaining phenomenon among adolescents. That is, there is a strong correlation between previous physical activity as an adolescent and current physical activity as an adult, suggesting that adolescents who become active, especially in community-based physical activity programs (eg, Little League), tend to remain active throughout their lives. For example, adolescent sport participation completely mediates the relationship between childhood and young-adult sport participation and partially mediates the relationship between childhood sport participation and young-adult participation in physical fitness. It appears that maximizing time in athletic activities during the adolescent years is important in maintaining lifelong physical activity.

Evaluating health status with a whole-person perspective that assesses all spectrums of health from pathology to impairments and limitations in activity and participation is important for proper patient management. Evaluations that emphasize impairments such as limitations in range of motion and strength fail to address the larger psychosocial issues that potentially affect the individual and may result in barriers to future athletic participation. To assess the whole person, a broadly defined construct such as health-related quality of life (HRQoL) is valuable. HRQoL is defined as the physical, psychological, and social domains of health, influenced by personal experience, beliefs, preferences, and expectations, and is exemplified by the personal and societal levels of disablement models. HRQoL is usually assessed through self-report. Two common generic HRQoL measures are the Medical Outcomes Study Short Form Health Survey (SF-36) and the Pediatric Orthopedic Society of North America Pediatric Outcomes Data Collection Instrument (PODCI). Both measures are acceptable for individuals as young as 14 years old; however, the SF-36 is more frequently used in adult populations whereas the PODCI is exclusively for adolescents.

Lack of attention to patient-oriented measures of health status such as HRQoL may stem from the perception that these outcomes are difficult to measure reliably and less useful than other clinical outcomes. However, patient-oriented outcomes are critical in determining the impact of events like injury, illness, and disease on HRQoL and in identifying effective treatments and interventions. Although extensive efforts have been made to compute normative values of HRQoL in adult populations, little is known about various adolescent populations, including adolescent athletes, making interpretation of these measures in this population difficult. The inability to interpret change in these measures limits their usefulness.
in the care and management of adolescents, thus potentially affecting the quality of adolescents’ health care.

Although the SF-36 and the PODCI are widely used, there are no published studies using these common self-report measures comparing adolescent athletes with their nonathletic peers. This limited insight into adolescent athletes makes it difficult to interpret their reported HRQoL before or after sport-related injury. Previous investigations reported that college athletes score differently on generic HRQoL measures than their nonathlete peers. It has been suggested that, because of athletes’ high levels of physical activity and conditioning, along with their strong desire to succeed, it is inappropriate to use general-population norms as reference data. Similar studies have not been reported in younger athletic populations. Investigations into the characteristic self-report values of HRQoL of adolescent athletes are necessary to meaningfully interpret health care outcomes in this population and guide treatment decisions.

Therefore, the purpose of this study was to compare HRQoL in adolescent athletes and nonathletes. We hypothesized that adolescent athletes would score higher on the SF-36 and the PODCI subscales, indicating a better overall HRQoL than their nonathlete peers.

**Methods**

**Design**

A cross-sectional study design was used to compare HRQoL among adolescent athletes and nonathletes. The SF-36 and the PODCI were completed in a counterbalanced manner during 1 session.

Dependent variables from the SF-36 included 8 subscale scores (physical functioning, role limitations caused by physical health issues, bodily pain, general health perceptions, vitality, social functioning, role limitations caused by emotional problems, and mental health) and the 2 composite scores (physical and mental; Figure 1). The physical composite score is predominantly derived from the subscales for physical functioning, role limitations caused by physical health issues, general health perceptions, and bodily pain. The mental composite score is predominantly derived from the subscales for physical functioning, role limitations caused by physical health issues, general health perceptions, and bodily pain and the subscales for mental health, role limitations caused by emotional problems, vitality, and social functioning.

Dependent variables from the PODCI included 5 subscale scores (upper extremity and physical functioning, transfer and basic mobility, sports and physical functioning, pain/comfort, and happiness) and the PODCI global score (Figure 2).

**Participants**

A convenience sample of 325 high school students (7 high schools) participated in the study and were classified as either athletes (n = 219; 121 females, 98 males; age 16.0 ± 1.1 y, grade 10.8 ± 1.0) or nonathletes (n = 106; 61 females, 45 males; age 15.6 ± 1.3 y, grade 10.5 ± 1.1) based on self-report. Subjects were classified as athletes if they reported involvement in school-sponsored interscholastic or club
Before participating in the study, all subjects and their parents signed informed-consent and -assent documents, respectively, and were given an opportunity to ask the researcher questions regarding the investigation. The study was approved by the local Institutional Review Board for the Protection of Human Subjects.

Procedures

The SF-36 is composed of 36 questions that target individuals’ perception of their health status and physical functioning. Subject responses are evaluated through Likert-style questions, and a score ranging from 0 to 100 can be calculated for the 8 HRQoL dimensions of physical functioning, role limitations caused by physical health issues, bodily pain, general health perceptions, vitality, social functioning, role limitations caused by emotional problems, and mental health. In addition, there are summary scores for the physical and mental components of the scale. A lower score indicates lower HRQoL. Although the SF-36 has been shown to be both valid and reliable, most of the data and normative values have been established using an adult or elderly population.
Figure 2 — Subscales and composite scores of the Pediatric Orthopedic Society of North America Pediatric Outcomes Data Collection Instrument (PODCI).
The PODCI is a generic HRQoL scale that was designed specifically for adolescents.24–26 Like the SF-36, the PODCI uses Likert-style questions to evaluate a patient’s overall health status. There are 83 questions on the PODCI, with 5 subscales that address upper extremity and physical functioning, transfer and basic mobility, sports and physical functioning, pain/comfort, and happiness, as well as a global score. Scores for each PODCI subscale range from 0 to 100, with lower scores indicating lower HRQoL. The reliability, construct validity, and sensitivity to change of the PODCI have been established.13,27

Subjects completed a demographic questionnaire, the SF-36, and the PODCI in a single session during a class period or in the school’s athletic training facility. Data forms were counterbalanced, with some subjects completing the SF-36 first and others completing the PODCI first. Standard verbal directions were given to all subjects, specifically addressing the need to complete the forms independently and to the best of their ability.

**Statistical Analyses**

Before statistical analysis, SF-36 and PODCI raw data were converted to norm-based data using a linear $z$-score transformation, according to developers’ instructions. All subscales scored using the transformation have a mean of 50 and a standard deviation of 10.28,29 Normalizing the data allows for comparisons across subscales and groups of individuals. Preliminarily, Kolmogorov–Smirnov tests were conducted and indicated violations of the normality assumption. Therefore nonparametric methods were used for all analyses. All analyses were considered exploratory, and no adjustment was made for multiplicity. SPSS software (version 15.0; SPSS Inc, Chicago, IL) was used for data analysis.

Mann–Whitney U tests (test of mean ranks; $P < .05$) were conducted to evaluate group differences (athlete vs nonathlete), and summary scores are reported as mean ± SD.

**Results**

**SF-36**

Athletes reported higher scores than nonathletes on the subscales for physical functioning, general health perceptions, social functioning, and mental health and the mental composite score (Table 1). Athletes reported lower scores on the bodily pain subscale than nonathletes. There were no differences between athletes and nonathletes for the subscales for role limitations caused by physical health issues, vitality, or role limitations caused by emotional problems or the physical composite score. However, there was a trend, although not significant ($P = .052$), for athletes to report higher scores than nonathletes on the subscale for role limitations caused by emotional problems.

**PODCI**

Athletes reported higher scores on the subscales for sports and physical functioning and for happiness and lower scores on the pain/comfort subscale than nonathletes (Table 2). There were nonsignificant differences between the groups on the subscales...
HRQoL in Athletes and Nonathletes

Discussion

Our primary finding is that athletes reported significantly higher scores on a number of SF-36 and PODCI subscales pertaining to domains of health related to mental, emotional, and physical well-being, including physical functioning, general health, social functioning, and mental health and happiness, than students not involved in

Table 1  SF-36 Subscale Scores of Adolescent Athletes and Nonathletes, Mean ± SD

<table>
<thead>
<tr>
<th>SF-36 subscale</th>
<th>Athletes</th>
<th>Nonathletes</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical functioning</td>
<td>55.1 ± 4.5</td>
<td>53.0 ± 7.8</td>
<td>.015*</td>
</tr>
<tr>
<td>Role limitations due to physical health issues</td>
<td>52.2 ± 7.0</td>
<td>51.6 ± 7.1</td>
<td>.470</td>
</tr>
<tr>
<td>Bodily pain</td>
<td>52.1 ± 8.3</td>
<td>54.6 ± 7.0</td>
<td>.011†</td>
</tr>
<tr>
<td>General health perceptions</td>
<td>48.8 ± 5.4</td>
<td>46.2 ± 6.9</td>
<td>.002*</td>
</tr>
<tr>
<td>Vitality</td>
<td>51.8 ± 9.7</td>
<td>50.9 ± 10.4</td>
<td>.298</td>
</tr>
<tr>
<td>Social functioning</td>
<td>51.5 ± 8.1</td>
<td>49.1 ± 9.7</td>
<td>.022*</td>
</tr>
<tr>
<td>Role limitations due to emotional problems</td>
<td>49.6 ± 9.4</td>
<td>47.1 ± 11.1</td>
<td>.052</td>
</tr>
<tr>
<td>Mental health</td>
<td>51.2 ± 9.4</td>
<td>48.3 ± 11.3</td>
<td>.039*</td>
</tr>
<tr>
<td>Physical composite score</td>
<td>53.2 ± 5.4</td>
<td>53.3 ± 6.0</td>
<td>.665</td>
</tr>
<tr>
<td>Mental composite score</td>
<td>49.6 ± 9.5</td>
<td>46.6 ± 11.6</td>
<td>.043*</td>
</tr>
</tbody>
</table>

SF-36 indicates Medical Outcomes Study Short Form Health Survey.
*Athletes significantly higher than nonathletes (P < .05).
†Athletes significantly lower than nonathletes (P < .05).

Table 2  PODCI Subscale Scores in Adolescent Athletes and Nonathletes, Mean ± SD

<table>
<thead>
<tr>
<th>PODCI subscale</th>
<th>Athletes</th>
<th>Nonathletes</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper extremity and physical functioning</td>
<td>50.6 ± 6.5</td>
<td>50.1 ± 5.8</td>
<td>.157</td>
</tr>
<tr>
<td>Transfer and basic mobility</td>
<td>48.0 ± 10.6</td>
<td>48.2 ± 8.4</td>
<td>.711</td>
</tr>
<tr>
<td>Sports and physical functioning</td>
<td>50.6 ± 7.8</td>
<td>47.1 ± 9.3</td>
<td>.000*</td>
</tr>
<tr>
<td>Pain/Comfort</td>
<td>43.1 ± 12.1</td>
<td>47.5 ± 10.3</td>
<td>.002†</td>
</tr>
<tr>
<td>Happiness</td>
<td>51.6 ± 9.1</td>
<td>47.8 ± 12.0</td>
<td>.010*</td>
</tr>
<tr>
<td>Global PODCI score</td>
<td>45.5 ± 10.2</td>
<td>46.7 ± 9.5</td>
<td>.311</td>
</tr>
</tbody>
</table>

PODCI indicates Pediatric Orthopedic Society of North America/Pediatric Outcomes Data Collection Instrument.
*Athletes significantly higher than nonathletes (P < .05).
†Athletes significantly lower than nonathletes (P < .05).

for upper extremity and physical functioning and transfer and basic mobility, as well as the PODCI global score.
school-sponsored interscholastic athletics or club sports. These differences suggest that adolescent athletes may benefit from their participation in athletic teams across a number of health-related dimensions.

Research in the adolescent population has shown that those who are physically active lead healthier lifestyles and have higher levels of self-esteem than those not involved in athletic activity. Donaldson and Ronan found that greater participation in sport was linked to enhanced emotional and behavioral well-being, both of which contribute to overall HRQoL. In a review of the literature, Hallal et al. found that adolescents involved in physical activity reaped long-term benefits related to increased bone health and decreased risk of breast cancer and sedentary behaviors compared with adolescents who were not physically active. Self-esteem and mental health in adolescents were also found to be positively affected by physical activity. Our findings agree with previous research because the athletes in our study reported higher scores on mental and emotional health than their peers who are uninvolved with school-sponsored athletics or club sports. Higher scores on the SF-36 mental health subscale suggest that individuals experience feelings of peace, happiness, and calm more regularly, whereas higher scores on the PODCI happiness subscale highlight an adolescent’s satisfaction with his or her looks and sense of being similar to friends.

Athletes also scored higher than nonathletes on the SF-36 social functioning scale. This scale measures ability to perform typical social activities without the influence of physical or emotional problems. Because athletes scored higher on the subscales related to mental, emotional, and social functioning, it is not surprising that they also scored higher on the SF-36 mental component summary score. Higher scores on the mental composite score indicate positive affect, limited psychological distress, infrequent impact of emotional issues on social activities, and good general health. Altogether, these results suggest that athletes are mentally, emotionally, and socially healthier than their nonathlete peers.

Our athlete group also reported higher levels of sport and physical function than subjects not engaged in school athletics. The sport and physical-functioning subscale on the PODCI measures difficulty or limitations experienced as a result of participating in activities and sports. The SF-36 physical functioning subscore measures limitations in physical activities ranging from simple tasks like bending, lifting, and walking to an item related to self-care. Our findings suggest that athletes tend to have fewer difficulties and limitations than their peers in performing athletic tasks and physical activities. An interesting finding in our study is that although our athlete population reported higher levels of physical function and general health, they did not differ from nonathletes on the physical component summary score of the SF-36, a composite of the subscales for physical function, role physical, bodily pain, and general health. The lower scores on the bodily pain subscale may be the reason for this difference. In general, our sport and physical-functioning results are consistent with the idea that engagement in physical activity, such as sport participation, provides health benefits.

Despite the many health benefits gained through athletic participation, there are associated risks, such as risk of injury, that require proper evaluation and management so that the health-related benefits can be maximized. Injury is likely to cause an increase in reported pain and discomfort. In our study, although athletes scored higher on mental and emotional health, as well as physical and sport function, they
also reported lower values on subscales relating to bodily pain and comfort. This suggests that there is a negative physical impact on the body as a result of athletic participation. Even though our athlete group reported higher levels of pain and discomfort than their nonathlete peers (1 SF-36 and 1 PODCI subscale), they also reported higher overall HRQoL than their nonathlete peers (5 SF-36 and 3 PODCI subscales). The proportional contribution of each HRQoL domain to general health status is unknown.

Prior research in college athletes\textsuperscript{14,15,37} has led to the suggestion that athletes are a distinct population within their peer group and should be considered as such when evaluating measures of HRQoL. Our data support this suggestion. McAllister et al\textsuperscript{37} found that male and female elite college athletes, both injured and noninjured, scored higher on the SF-36 role-emotional and mental health scales than age-matched norms. Our study noted a difference between athletes and nonathletes in the mental health score, as well as a trend for higher scores in the role-emotional subscale. The studies on college athletes also reported that those playing different sports (eg, football, swimming, or baseball) scored differently on the various subscales of the SF-36. Future investigations should address these sport-specific differences in the adolescent population.

Huffman et al\textsuperscript{14} found that intercollegiate athletes report better SF-36 scores on all domains of health except bodily pain than an age-matched, nonathlete sample. The largest difference noted was in social functioning. Our athletes also reported lower scores on subscales related to bodily pain and comfort than nonathletes. A study by Wang et al\textsuperscript{15} found that SF-36 bodily pain scores were markedly lower in elite athletes than in age-matched control subjects. However, Wang et al\textsuperscript{15} also noted lower scores for physical role, general health, and social functioning in elite athletes, which differs from our study and the work of others.\textsuperscript{14,37} Further investigation into differences between athletes and their peers is needed to address these discrepancies. Our results in an adolescent population, coupled with those from previous investigations in college-age populations,\textsuperscript{15,37} suggest that athletes differ from their nonathlete peer groups on HRQoL. The normative values published for HRQoL measures, then, may not be accurate for athletes. Normative values for athletes may be more appropriate when evaluating patient-oriented outcome measures in the health care management of these high-functioning individuals. Current trends in health care demonstrate a shift from clinician-based measures to patient-oriented measures of outcome.\textsuperscript{38} Patient care traditionally emphasizes clinician-based measures such as range of motion, strength, and girth that are evaluated from the clinician’s perspective. In contrast, patient-oriented measures of outcomes are completed by the patient and reflect his or her perspective. There is an increasing push in medicine to assess health care outcomes such as HRQoL through the use of patient-based outcomes.\textsuperscript{39,40} Groups including the American Academy of Orthopaedic Surgeons have stated that the collection of population-based normative data is a necessary step that must be undertaken by health care professionals.\textsuperscript{41} Establishing normative values for the adolescent athletic population will provide a basis for investigation of clinical outcomes of treatment in musculoskeletal research,\textsuperscript{41} as well as address the effectiveness of treatments and interventions used in the management of athletic injuries.

A limitation of the current study is that although attempts were made to reach a variety of high schools, data were collected in a single geographic area, which
minimizes the generalizability of our findings to other regions of the country. Future research should consider the effects of gender, sport, and other nonathletic school activities on adolescent HRQoL, as well as the impact of sport-related injury on the overall health status of this vulnerable population.

**Conclusions**

Our findings support the notion that athletic involvement is a benefit to the overall health status of adolescents and highlight the need to promote physical activities in schools as a means of maintaining or improving HRQoL. In addition, our results suggest the need to incorporate patient-oriented outcome measures in injury-evaluation and -management strategies for adolescent athletes. Finally, our results imply that athletes are a distinct adolescent group and may warrant their own normative values for future studies using patient-based outcomes measures, including HRQoL.

**Acknowledgments**

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**References**


