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Functional Ankle Instability and Health-Related Quality of Life

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Context: To our knowledge, no authors have assessed health-related quality of life (HR-QOL) in participants with functional ankle instability (FAI). Furthermore, the relationships between measures of ankle functional limitation and HR-QOL are unknown.

Objective: To use the Short Form–36v2 Health Survey (SF-36) to compare HR-QOL in participants with or without FAI and to determine whether HR-QOL was related to functional limitation.

Design: Cross-sectional study.

Setting: Sports medicine research laboratory.

Patients or Other Participants: Sixty-eight participants with FAI (defined as at least 1 lateral ankle sprain and 1 episode of giveway per month) or without FAI were recruited (FAI group: n = 34, age = 25 ± 5 years, height = 1.71 ± 0.08 m, mass = 74.39 ± 12.78 kg, Cumberland Ankle Instability Tool score = 19.3 ± 4; uninjured [UI] group: n = 34, age = 23 ± 4 years, height = 1.69 ± 0.08 m, mass = 67.94 ± 11.27 kg, Cumberland Ankle Instability Tool score = 29.4 ± 1).

Main Outcome Measure(s): All participants completed the SF-36 as a measure of HR-QOL and the Foot and Ankle Ability Measure (FAAM) and the FAAM Sport version (FAAMS) as assessments of functional limitation. To compare the FAI and UI groups, we calculated multiple analyses of variance followed by univariate tests. Additionally, we correlated the SF-36 summary component scale and domain scales with the FAAM and FAAMS scores.

Results: Participants with FAI had lower scores on the SF-36 physical component summary (FAI = 54.4 ± 5.1, UI = 57.8 ± 3.7, $P = .005$), physical function domain scale (FAI = 54.5 ± 3.8, UI = 56.6 ± 1.2, $P = .004$), and bodily pain domain scale (FAI = 52.0 ± 6.7, UI = 58.5 ± 5.3, $P < .005$). Similarly, participants with FAI had lower scores on the FAAM (FAI = 93.7 ± 8.4, UI = 99.5 ± 1.4, $P < .005$) and FAAMS (FAI = 84.5 ± 8.4, UI = 99.8 ± 0.72, $P < .005$) than did the UI group. The FAAM score was correlated with the physical component summary scale ($r = 0.42$, $P = .001$) and the physical function domain scale ($r = 0.61$, $P < .005$). The FAAMS score was correlated with the physical function domain scale ($r = 0.47$, $P < .005$) and the vitality domain scale ($r = 0.36$, $P = .002$).

Conclusions: Compared with UI participants, those with FAI had less HR-QOL and more functional limitations. Furthermore, positive correlations were found between HR-QOL and functional limitation measures. This suggests that ankle impairment may reduce overall HR-QOL.

Key Words: functional limitations, Short Form–36, Foot and Ankle Ability Measure, disability

Key Points

- Compared with the uninjured group, participants with functional ankle instability demonstrated worse health-related quality of life along the physical dimension but not the mental dimension of the Short Form–36.
- As evident from their Foot and Ankle Ability Measure (FAAM) and the FAAM Sport scores, the functional ankle instability group experienced functional limitations.
- Positive correlations between the Short Form–36 and the FAAM and FAAM Sport indicated that functional limitations at the ankle probably contributed to a worse health-related quality of life.

Ankle sprains are one of the most common injuries experienced by youths and adults involved in physical activity.[1,2] Ankle sprains account for 10% to 44% of injuries in physically active populations,[3–5] with 42% to 70% of these people having a history of at least 1 ankle sprain.[6,7] Thirty-two to 74% of patients with a previous ankle sprain report some type of chronic symptom,[8–11] and 32% to 47% report functional ankle instability (FAI; ie, the sense of giving way) at follow up.[8,9,11] Furthermore, approximately 6% of FAI patients remain occupationally limited,[12] with 13% to 15% being limited from 9 months to 6.5 years.[12,13] Based on these reports, it is clear that ankle sprains and FAI in particular are a significant health risk to the physically active population. With increasing government and societal emphasis on exercise and physical activity, it is reasonable to expect that the numbers will remain constant or increase as more people become physically active.

Despite the effect of ankle sprains on the health of individual patients, to our knowledge the effect of sprains on health-related quality of life (HR-QOL) has not been examined. Using the National Center for Medical Rehabilitation Research[14] disablement model for rehabilitation research, traditional rehabilitation researchers have focused on the disease or pathophysiology of injury (eg, proprioception or joint laxity) or the organ dysfunction[15] resulting from injury (eg, ankle weakness, impaired balance, range-of-motion loss). Recently, ankle instability researchers have moved further up the disablement

continuum to include measures of functional limitation such as the Foot and Ankle Ability Measure (FAAM),[16] the Foot and Ankle Disability Index (FADI),[17] the FADI sport version, and the Cumberland Ankle Instability Tool (CAIT).[18] These measures assess a person's ability to perform common functional tasks, such as walking and going up stairs, and are described as condition specific but generic in that they assess overall joint function rather than a pathologic condition or organ dysfunction.[19] Regardless of the measure, these authors have shown that patients with FAI have more functional limitation than uninjured (UI) participants. What remains unknown is how FAI affects a person's HR-QOL.

Health-related quality of life addresses functioning in everyday life and personal evaluation of well-being. It typically includes 5 broad dimensions: physical health, mental health, everyday functioning, role in activities, and general perceptions of health.[20] In the case of the Short Form–36v2 Health Survey (SF-36), the more specific dimensions of bodily pain, social functioning, physical role, and emotional role are included. *Role* is an important added dimension in that it assesses whether physical and emotional health interferes with a person's ability to participate in normal daily activities. Ware[21] argued that the relative burdens of diseases or the effects of one treatment versus another are more validly estimated from generic measures. When health status is measured generically, as by the SF-36, research findings can be applied in studies of health regardless of the disease or population of interest.[19,20] Another advantage is that treatments may be assessed more comprehensively. For example, a treatment may result in improved function but result in a loss of quality of life.[21] In other words, a rehabilitation protocol may be effective in improving joint stability, but the patient may find the rehabilitation too onerous because it lasts too long or requires special equipment. Consequently, participating in the rehabilitation may overburden quality of life. It is also possible that equally effective treatments may affect quality of life differently.[21] For instance, ankle strength and balance training may be equally effective in improving joint stability. However, balance training can affect multiple joints and produce a greater overall improvement. This level of improvement may be missed with a condition-specific scale such as the FAAM. Finally, generic measures allow the assessment of comorbidities, whereas condition-specific measures (eg, FAAM) reflect primarily joint-specific effects.[19] For example, a higher body mass index has been associated with repeated ankle injuries.[22] Generic measures of HR-QOL permit differentiation between the effects of ankle injury and body mass index on health. Thus, generic HR-QOL measures permit a broader assessment of the effects of not only condition-related disease but also associated comorbidities on health status.

The SF-36 has been used to assess HR-QOL in patients with ankle conditions such as ankle arthrosis, osteoarthritis, and fracture.[16,23–29] However, to our knowledge, only one set of authors[8] has used the SF-36 in a retrospective study of patients with acute inversion ankle sprains treated at a large metropolitan hospital, and therefore this sample represents the closest approximation to patients with FAI. Specifically, long-term outcomes after acute injury were measured in adolescents and young adults. Compared with UI participants, those with a history of acute ankle injury had lower scores on the general health domain scale of the SF-36. However, HR-QOL data are unavailable for those with chronic symptoms of instability. Therefore, the purposes of our study were to use the SF-36 to compare HR-QOL in participants with and participants without FAI, apply the FAAM and FAAM Sport (FAAMS) to compare functional limitations in participants with and participants without FAI, and determine whether HR-QOL was related to functional limitation as measured by the FAAM and FAAMS.

METHODS

Participants

Sixty-eight volunteers with FAI (defined as at least 1 lateral ankle sprain and 1 episode of giveway per month) or without FAI (FAI group: n = 34, age = 25 ± 5 years, height = 1.71 ± 0.08 m, mass = 74.39 ± 12.78 kg, CAIT score = 19.3 ± 4; UI group: n = 34, age = 23 ± 4 years, height = 1.69 ± 0.8 m, mass = 67.94 ± 11.27 kg, CAIT score = 29.4 ± 1) were recruited from the local university and the metropolitan community via personal contacts and fliers. All volunteers self-reported at least 3 hours of moderate to vigorous physical activity weekly. The FAI participants were free of acute ankle symptoms and had no history of other lower extremity injury. The UI group had no history of any lower extremity injury. Before the investigation began, all participants signed a consent form approved by the institutional review board, which also approved the study.

Outcome Measures

To assess functional limitations, participants completed the FAAM and the FAAMS. For the FAAM (a 21-item questionnaire with a maximum of 84 points, which are converted to a percentage scale) and FAAMS (an 8-item questionnaire with a maximum of 40 points, which are converted to a percentage scale), higher scores represent better function. Both have good reliability (intraclass correlation coefficient [ICC] = 0.89 and 0.87, respectively) and good construct validity (as correlated with the SF-36, $r = 0.84$ and 0.78, respectively).[30] For assessment of HR-QOL, participants completed the SF-36, which is designed to address a person's HR-QOL. From its 36 items, 8 domain scales are formed: physical function, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health. These scales are combined to create the physical component summary (PCS) and the mental component summary (MCS). The SF-36 has good reliability (ICC = 0.87)[31] and good construct validity (as measured with factor analysis).[32] The norm-based versions of these domain scales and component summaries were used for analysis to allow easy comparison with population values. The norm-based measures have a population mean of 50 and a standard deviation of 10. Additionally, participants completed the CAIT as a demographic descriptor of FAI. Scores on the CAIT of less than 28 indicated FAI.[18] All measures were completed electronically using a desktop computer, and all responses were directly downloaded to computerized databases, thus eliminating data input errors.

Statistical Analysis

Demographic characteristics were compared using independent *t* tests with the α level set at $\leq .05$. The functional limitation scales (FAAM and FAAMS) were analyzed separately from the SF-36 measures (PCS, MCS, and domain scales). For both sets of measures, we initially completed a 2-group (FAI versus UI)

multiple analysis of variance (MANOVA). Significant MANOVAs were followed by univariate tests for the included variables. When a domain scale was different between the groups, we performed an additional 2-group MANOVA that included the items from that domain scale. The α level for all MANOVAs was $\leq .05$. We also correlated the FAAM and FAAMS with the 8 SF-36 domain scales, the PCS, and the MCS. Alpha levels for these 10 correlations were Bonferroni corrected, setting the α level at .005.

RESULTS

Demographics

Means, standard deviations, and statistical tests for demographic variables are reported in Table 1. As expected, the FAI group scores were poorer for number of giveways, initial severity, and CAIT score. Unexpectedly, the FAI group weighed more than the UI group. None of the remaining demographic variables were different.

Comparisons Between FAI and UI Groups

The MANOVA for FAAM and FAAMS was significant for group (Wilk $\lambda_{2,63}=0.39$, $P<.005$). Means, standard deviations, and univariate statistical tests for FAAM and FAAMS are reported in Table 2. The FAI group scored worse on both the FAAM and the FAAMS.

The MANOVA for SF-36 measures (PCS, MCS, and domain scales) was significant for group (Wilk $\lambda_{10,54}=0.68$, $P=.01$). Means, standard deviations, and univariate statistical tests for the SF-36 are reported in Table 2. The FAI group had poorer scores on the PCS and on 2 domain scales, physical functioning (PFDS) and bodily pain (BPDS).

The MANOVA for the PFDS and BPDS domain scale items was significant for group (Wilk $\lambda_{9,56}=0.62$, $P=.001$). Means, standard deviations, and univariate statistical tests for the items are reported in Table 3. The FAI group scores were poorer for 3 of the 10 PFDS items (climbing stairs, bending/kneeling/stooping, and walking more than 1 mi [1.6 km]) and both BPDS items (pain magnitude and pain interference).

FAAM and FAAMS Correlations with SF-36 Domain Scales and Summary Measures

The SF-36 correlations with the FAAM and FAAMS are reported in Table 4. The FAAM was correlated with the PFDS and the PCS. The FAAMS was correlated with the PFDS and the vitality domain scale.

DISCUSSION

Our primary goal was to identify differences in functional limitations and HR-QOL between FAI and UI participants. Overall we found that our participants scored better than the general population (mean = 50 ± 10) on the SF-36 component scores and domain scales. However, despite the overall better performance on the SF-36, the FAI group scored worse than the UI group on several components of the SF-36 and the FAAM and FAAMS.

SF-36 PCS and Related Measures

For the PCS, the UI group had a better score (Table 2). Both groups had better PCS scores than the general population and average to better than average PCS scores (approximately 54) than for the age-matched population.[33] Data from the Medical Outcomes Study[34] showed that 6.2% and 6.0% of the general population with a PCS between 50 and 55 reported health-related job loss and inability to work, respectively. Also, a difference in the PCS as small as 3 points was associated with 25% and 40% higher risks of job loss and inability to work, respectively.[35] Based on these findings, our FAI group had a greater risk of job loss and work interference than did our UI group. Finally, general population data showed that 63% of people with PCS scores similar to those of our FAI group reported limitation of vigorous physical activity.[36] This is in contrast to 29% for the general population with PCS scores similar to those of our UI group.[36] However, it must be emphasized that these comparisons are based on general population data. The percentage of our participants reporting limitations in vigorous physical activity (Table 3) was much lower than the general population percentages, probably because of our participants' youth and activity levels. Because of their youth, our FAI group was unlikely to experience job loss or inability to work due

Table 1. Demographic Characteristics

	Group					
	Functional Ankle Instability		Uninjured			
Variable	Mean ± SD	95% Confidence Interval	Mean ± SD	95% Confidence Interval	*t* Value	*P* Value
Height, m	1.71 ± 0.08	1.68, 1.74	1.69 ± 0.08	1.67, 1.72	0.974	.33
Mass, kg	74.39 ± 12.78	70.26, 78.51	67.94 ± 11.27	63.82, 72.07	2.2	.03
Age, y	25 ± 5	23.07, 26.17	23 ± 4	21.63, 24.73	1.3	.19
Giveway episodes/mo	3.9 ± 5.2	2.58, 5.12	0 ± 0	NA	4.3	<.005
Initial severity, degree[a]	2.4 ± 0.4	2.31, 2.49	0 ± 0	NA	38.3	<.005
Exercise, h/wk	8 ± 5	6.68, 10.06	7 ± 5	4.96, 8.34	1.4	.16
Cumberland Ankle Instability Tool Score	19 ± 4	18.24, 20.29	29 ± 1	28.38, 30.44	13.9	<.005

Abbreviation: NA, not applicable.

[a] Severity of ankle injury based on the patient's recall of the health care provider's diagnosis.

to their injuries, but the observed differences on the PCS can be associated with typical health effects. Finally, the PCS measures general physical health, so it is unclear whether our group differences in PCS scores were solely or partially the result of the ankle instability.

Physical Function Domain Scale

For the PFDS (Table 2), both groups scored higher than the general population average, and the UI group (but not the FAI group) scored higher than the age-matched population (mean range approximately 53–54).[33] As suggested earlier, we suspect this is because of the physical activity level specified a priori for our participants. It is also possible that FAI reduced this age group's activity level below the expected level although not below the age-matched general population norm.

A marginal difference ($P = .052$) was noted between the groups for the average PFDS scores. Based on national norms, our PFDS scores predicted that 92% and 26% of our FAI and UI groups, respectively, would have limited vigorous activity.[36] In actuality, 38% of our FAI group and 15% of our UI group reported impairments with vigorous physical activity (Table 3). As with the PCS, these values are well below the national norms and, we believe, reflect our a priori inclusion criteria.

In addition to vigorous physical activity, 3 items were significant: climbing several flights of stairs; bending, kneeling, stooping; and walking more than 1 mi (1.6 km) (Table 3). For our participants, these factors may have contributed more to the PFDS than did vigorous physical activity and may represent more challenging or atypical tasks for a physically active population. Alternatively, difficulty performing these specific tasks may better characterize FAI than the more nebulous concept of *vigorous physical activity*.

Bodily Pain Domain Scale

Both groups had BPDS scores that were equal to or better than those of the general population (approximately 50)[37] and their age-matched norms (approximately 52) (Table 2).[33] On the BPDS as a whole and on the 2 individual items (pain magnitude and pain interference), the FAI group scored more poorly than did the UI group (Table 3).

Based on general population data, the scores for our UI group suggested that none of these participants experienced pain or pain interference with normal work (housework and work outside the home).[36] Yet 39% and 38% of our UI group reported pain interference and mild pain, respectively. The reasons for a young, healthy group to report pain and pain interference are not clear. We suspect that physical activity level may be responsible because physical activity can lead to bodily pain that may interfere with daily activities. However, the SF-36 does not address the specific cause of pain, and so the actual cause is unknown.

For our FAI group's scores, general population data indicated that 85% would have no pain to very mild pain.[36] In fact, 88% of the group reported very mild to moderate pain (Table 3). Thus, a greater number of our participants were reporting both pain and higher magnitudes of pain than the general population. Based on our FAI group's pain interference scores, general population data suggested that 37% would have some level of interference with normal work,[36] but 89% of our FAI participants reported same. Therefore, pain affected a large number of those in the FAI group.

The role of ankle instability in these pain scores is unclear. Our participants' pain may be due to their ankle injuries, other injuries, their physical activity level, or other factors that were not taken into consideration. It is also possible that these factors interacted to contribute to pain and pain interference. Nevertheless, our FAI group reported greater levels of pain and pain interference than did their UI counterparts, and more of our FAI participants reported pain and pain interference than would be expected based on general population data.

Correlation with FAAM and FAAMS

Correlations may provide insight regarding the ankle's contribution to function. As expected, the FAAM was correlated with the PCS and PFDS, with 17% and 37% of the variance

Table 2. Short Form–36 Component Summary and Norm-Based Domain Scale, Foot and Ankle Ability Measure, and Foot and Ankle Ability Measure–Sport Scores

			Group					
			Functional Ankle Instability		Uninjured			
Scale	Component Summary	Domain	Mean ± SD	95% Confidence Interval	Mean ± SD	95% Confidence Interval	$F_{1,66}$ Value	*P* Value
Short Form–36[a]								
	Physical		54.53 ± 5.07	52.96, 56.10	57.78 ± 3.67	56.21, 59.30	8.58	.005
		Physical function	54.48 ± 3.78	53.46, 55.47	56.60 ± 1.24	55.60, 57.57	9.03	.004
		Role-physical	54.10 ± 4.81	52.18, 56.01	54.98 ± 5.88	53.04, 56.81	0.38	.542
		Bodily pain	52.03 ± 6.72	49.78, 54.07	58.52 ± 5.25	56.29, 60.52	18.45	<.005
		General health	55.55 ± 7.62	52.50, 58.31	55.56 ± 8.58	52.63, 58.35	0.002	.967
	Mental		51.4 ± 7.40	48.75, 54.02	51.4 ± 7.40	48.60, 53.79	0.010	.919
		Vitality	53.32 ± 6.98	50.72, 55.22	56.04 ± 5.92	53.66, 58.09	3.39	.070
		Social functioning	52.55 ± 7.05	50.24, 54.60	52.84 ± 5.08	50.57, 54.87	0.04	.846
		Role-emotional	51.08 ± 7.24	48.36, 53.81	50.93 ± 8.15	48.25, 53.62	0.006	.938
		Mental health	52.99 ± 6.37	50.60, 55.05	53.65 ± 6.18	51.31, 55.70	0.19	.664
Foot and Ankle Ability Measure[b]			93.71 ± 6.15	91.53, 95.89	99.51 ± 1.35	99.03, 99.99	28.02	<.005
Foot and Ankle Ability Measure–Sport[c]			84.47 ± 8.40	82.53, 88.40	99.78 ± 0.72	99.53, 100.03	97.91	<.005

[a] Norm-based measures have a population mean of 50 and an SD of 10.

[b] Maximum raw score is 84; each score was then converted to a percentage.

[c] Maximum score is 40; each score was then converted to a percentage.

Table 3. Short Form-36 Physical Function and Bodily Pain Domain Scores

		Group							
		Functional Ankle Instability			Uninjured				
Domain Scale	Item	Mean ± SD	95% Confidence Interval	Percentage Reporting Impairment	Mean ± SD	95% Confidence Interval	Percentage Reporting Impairment	*F* Value	*P* Value
Physical functioning[a]									
	Vigorous activities	2.58 ± 0.56	2.38, 2.78	38	2.82 ± 0.46	2.65, 3.00	15	3.930	.052
	Moderate activities	2.97 ± 0.17	2.91, 3.03	3	3.00 ± 0.00	NA	0	1.031	.314
	Lift, carry groceries	2.94 ± 0.24	2.85, 3.03	6	3.00 ± 0.00	NA	0	2.128	.149
	Climb several stair flights	2.79 ± 0.42	2.64, 2.94	20	2.97 ± 0.17	2.91, 3.03	3	5.603	.021
	Climb 1 stair flight	2.97 ± 0.17	2.91, 3.03	3	3.00 ± 0.00	NA	0	1.031	.314
	Bend, kneel, stoop	2.76 ± 0.44	2.60, 2.92	24	3.00 ± 0.00	NA	0	10.555	.002
	Walk more than 1 mi (1.6 km)	2.88 ± 0.33	2.76, 2.99	12	3.00 ± 0.00	NA	0	4.550	.037
	Walk several hundred yards	2.94 ± 0.24	2.85, 3.03	6	3.00 ± 0.00	NA	0	2.128	.149
	Walk 100 y (91.4 m)	2.97 ± 0.17	2.91, 3.03	3	3.00 ± 0.00	NA	0	1.031	.314
	Bathe or dress	3.00 ± 0.00	NA	0	3.00 ± 0.00	NA	0	NA	NA
Bodily pain[b]									
	Pain magnitude	5.01 ± 0.81	4.76, 5.26	88[c]	5.64 ± 0.60	5.54, 5.74	38[d]	12.626	.001
	Pain interference	3.82 ± 1.07	3.43, 4.21	89[e]	5.12 ± 1.17	4.92, 5.32	39[f]	22.294	.000

Abbreviation: NA, not applicable.

[a] Scored 1–3.

[b] Scored 1–6.

[c] Percentage reporting very mild to moderate pain (no participant reported greater than moderate pain).

[d] Percentage reporting very mild to mild pain (no participant reported greater than mild pain).

[e] Percentage reporting “a little bit” to “quite a bit” of pain interference with “normal work” (no participant reported greater than “quite a bit” of interference).

[f] Percentage reporting “a little bit” to moderate pain interference with “normal work” (no participant reported greater than moderate interference).

Table 4. Correlations of Foot and Ankle Ability Measure and Foot and Ankle Ability Measure–Sport Scores with Short Form–36 Domain Scales and Summary Scores

		Foot and Ankle Ability Measure			Foot and Ankle Ability Measure–Sport		
Component Summary	Domain	*r*	95% Confidence Interval	*P* Value	*r*	95% Confidence Interval	*P* Value
Physical component		0.415	0.183, 0.599	.001[a]	0.329	0.088, 0.533	.007
	Physical function	0.610	0.427, 0.745	<.005[a]	0.473	0.255, 0.645	<.005[a]
	Role-physical	0.275	0.03, 0.49	.026	0.175	–0.077, 0.405	.161
	Bodily pain	0.179	–0.076, 0.406	.159	0.282	0.037, 0.495	.021
	General health	0.173	–0.077, 0.404	.163	0.101	–0.151, 0.34	.416
Mental component		–0.028	–0.271, 0.224	.841	0.092	–0.159, 0.332	.461
	Vitality	0.236	–0.013, 0.457	.056	0.364	0.128, 0.561	.002[a]
	Social functioning	–0.068	–0.309, 0.185	.598	0.080	–0.171, 0.322	.519
	Role-emotional	0.120	–0.13, 0.358	.340	0.130	–0.121, 0.366	.301
	Mental health	–0.022	–0.266, 0.23	.878	0.057	–0.193, 0.301	.646

[a] Significant after Bonferroni correction.

explained, respectively. The FAAMS was correlated with the PFDS, with 22% of the variance explained, but contrary to previous research,[16] it was not correlated with the PCS. The reason for this is unclear. However, the PCS is calculated from 4 domain scales (Table 2), including the PFDS. The other scales may have influenced the PCS and resulted in a nonsignificant finding. We should also note that the correlation between the FAAMS and the PCS was only marginally not significant ($P = .007$, $\alpha = .005$, 11% of explained variance) and would have been significant without the Bonferroni correction. Thus, in our judgment, this correlation could be interpreted as significant.

The correlations with the PCS and the PFDS suggest that ankle functional limitation is a contributor to the physical aspect of HR-QOL. However, because these correlations accounted for only 17% to 37% of the variance, other factors probably contribute. These low percentages of explained variance also emphasize the fact that despite similarities in items, the FAAM and FAAMS are only partially redundant with the SF-36, which becomes particularly apparent when the PFDS and PCS correlations are compared. The PCS is primarily a composite of 4 domain scales (PFDS, BPDS, Role-Physical Domain Scale, and General Health Domain Scale), with the other 4 domain scales providing smaller contributions. The PCS correlations with the FAAM and FAAMS were lower than the PFDS correlations with the FAAM and FAAMS. This result is possible only when the other domain scales add unique variance to the PCS. If these domain scales added nothing, we would expect the correlations of the PCS and PFDS with FAAM and FAAMS to be identical. On the other hand, if these domain scales added variance redundant with that of the FAAM and FAAMS, these correlations would have improved. In our view, this finding emphasizes the importance of collecting both sets of measures. Specifically, the SF-36 and its scales measure qualities that are not measured by the FAAM and FAAMS. Finally, of the 2, the FAAM was more strongly correlated with PFDS. We believe that this is logical because the FAAM focuses on activities of daily living, and the SF-36 is a measure of general quality of life.

Consistent with previous research,[16] these correlations also provide evidence for the validity (ie, convergent validity) of the FAAM and FAAMS as measures of functional limitation. It should be noted that our correlations were smaller than those reported by Martin et al,[16] probably because of our more homogeneous population. The participants studied by Martin et al differed in 2 important dimensions. First, the average age was 43 ± 15.6 years, compared with our average age of 23 ± 4 years. Second, our injured group was limited to participants with FAI, whereas Martin et al's participants were receiving physical therapy for leg, ankle, or foot musculoskeletal conditions. Thus, their participants were more diverse, which would have improved the correlations between the FAAM and FAAMS and the SF-36. The homogeneity in our scores is the most likely reason for the marginally nonsignificant correlation between the FAAMS and the PCS.

SF-36 Mental Component Summary

The MCS scores were identical for our groups. Furthermore, none of the scores on the domain scales were different between groups. Both groups were similar to the general population, but their scores were below the age-adjusted norms (approximately 53–54).[33] Because FAI is a chronic condition, we expected that it would affect participants' MCS scores, which would have been consistent with previous research in athletes.[38,39] The reason for no effect is unclear. However, previous data in elite athletes suggest that severity of injury is a factor.[39] In athletes with serious injuries (defined as injuries with a "significant effect on participation, practice, or play or those that resulted in the athlete's inability to participate"), scores on all MCS dimensions as measured by the SF-36 declined. In elite athletes with mild injuries, only the Social Function Domain Scale demonstrated a decline. This may suggest that our participants perceived FAI as a minor injury that did not have a measurable effect on their mental health.

Correlation with the FAAM and FAAMS

We found no correlation between the MCS and either the FAAM or FAAMS. These results are consistent with those of previous studies[16] and provide evidence of the validity (ie, divergent validity) of both the FAAM and FAAMS. Vitality was the only SF-36 domain scale that correlated with the FAAM or FAAMS. However, its correlation with FAAMS explained only 13% of the variance. Vitality might be described as a measure of energy or fatigue. The correlation between these items may result from the common connection through physical activity rather than ankle injury. For example, the FAAMS asks about a person's ability to participate as long as he or she likes and

whether normal technique can be used. Both of these factors could be affected by the more general fatigue that may accompany physical activity rather than functional limitations at the ankle. We suspect the correlation is probably caused by a combination of general fatigue and ankle function.

CONCLUSIONS

We found that FAI was associated with lower HR-QOL as measured along the physical dimensions of health but not the mental dimensions. Furthermore, differences between the FAI and UI groups on the FAAM and FAAMS indicate that FAI participants also experienced functional limitations. The positive correlations between the SF-36 and the FAAM and FAAMS suggest that ankle functional limitations probably contribute to the decrease in HR-QOL. Whether functional limitations would contribute to a model that includes more profound factors associated with HR-QOL (eg, chronic disease) is unknown. We must emphasize that this was not an experimental study and, therefore, the associations and correlations we report should not be construed as causative. Factors beyond those we measured may contribute to (or confound) our results. Therefore, we recommend that future researchers obtain these measures before and after rehabilitation to determine whether therapy decreases functional limitations and increases HR-QOL. Therapeutic improvement in these measures may be the best indicators of FAI's role in normal function and quality of life. Furthermore, including these measures in rehabilitation research will allow us to establish the minimal detectable important change and provide practical utility to the clinician.

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