**Arthritis Care & Research**
Vol. 72, No. S10, October 2020, pp 294–320
DOI 10.1002/acr.24208


American College of Rheumatology
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# Measures of Foot Pain, Foot Function, and General Foot Health

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## INTRODUCTION

Foot and ankle pain is common, with an estimated point prevalence of 20% (1). For adults aged older than 55, the foot/ankle is the third most common site of self-reported joint pain, following the knee and the hand/wrist (2). In a rheumatology setting, 64% to 93% of patients with inflammatory arthritis self-report experiencing foot pain that is moderate to severe (3–5), and patients with rheumatoid arthritis whose debut joint is a foot/ankle joint experience higher disease activity, higher disability, and lower quality of life (6). Given the common presentation and significant impact of musculoskeletal symptoms involving the foot and ankle, valid and reliable patient-reported outcome measures can improve assessment and management. The aim of this review was to provide an overview of the most common outcome measures used to evaluate foot pain, foot function, and general foot health for adults with musculoskeletal symptoms of the foot and ankle. Specific objectives were to demonstrate the practical application of each outcome measure, to describe the psychometrics of each instrument, and to provide a critical appraisal of each instrument to the rheumatology community.

To identify outcome measures for inclusion, we used a recently published systematic review of patient-reported outcome measures for foot and ankle conditions (7). Outcome measures were eligible if they evaluated the foot or foot and ankle (but not the ankle only); evaluated pain, function, or general foot health; and evaluated musculoskeletal symptoms. Outcome measures were excluded if they evaluated specific conditions (eg, Achilles tendinopathy) or were generic pain or function measures (eg, visual analog scale [VAS] or 36-Item Short Form Health Survey [SF-36]). Eligible outcome measures were ranked based on how frequently they have been used over the past 10 years. To determine the rank, we searched the title of the outcome measure in PubMed and Google Scholar and used the number of times the original article describing the outcome measure had been cited. This information is provided in the Supplementary Material.

The 10 most frequently used outcome measures over the past 10 years are the American Orthopaedic Foot and Ankle Society (AOFAS) Clinical Rating Scales, the Foot and Ankle Ability Measure (FAAM), the Foot and Ankle Outcome Score (FAOS), the Foot Function Index–Revised (FFI-R), the Foot Health Status Questionnaire (FHSQ), the Leeds Foot Impact Scale for Rheumatoid Arthritis (LFIS-RA), the Manchester Foot Pain and Disability Index (MFPDI), the Manchester-Oxford Foot Questionnaire (MOXFQ), the Self-Reported Foot and Ankle Score (SEFAS), and the Visual Analog Scale–Foot and Ankle (VAS-FA).

## AMERICAN ORTHOPAEDIC FOOT AND ANKLE SOCIETY CLINICAL RATING SCALES: ANKLE/HINDFOOT (AOFAS-AH), MIDFOOT (AOFAS-M), HALLUX (AOFAS-HJ), AND LESSER (AOFAS-LJ)

### Description

**Purpose.** To provide a standardized method of reporting the clinical status of the foot and ankle (8).

**Content or domains.** The AOFAS Clinical Rating Scales are four separate outcome measures that evaluate different anatomic regions of the foot and ankle: the ankle/hindfoot (AOFAS-AH), the midfoot (AOFAS-M), the hallux metatarsophalangeal-interphalangeal (AOFAS-HJ), and the lesser metatarsophalangeal-interphalangeal (AOFAS-LJ). Each outcome measure evaluates pain (one item), function (five to seven items) and alignment (one item).

**Number of items.** AOFAS-AH: nine items; AOFAS-M: seven items; AOFAS-HJ: eight items; and AOFAS-LJ: eight items.

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No potential conflicts of interest relevant to this article were reported.
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Submitted for publication February 3, 2020; accepted in revised form April 2, 2020.

**Response options/scale.** A combination of subjective patient-reported items that are scored by using 3- or 4-point Likert scales and clinician-led objective measures that are scored by using 2- to 3-point Likert scales.

**Recall period for items.** Unspecified.

**Cost to use.** Free.

**How to obtain.** Each outcome measure is described in the original article (8). An online calculator is also available at www.orthotoolkit.com.

## Practical application

**Method of administration.** Patient and clinician administered with paper and pencil.

**Scoring.** Each item is scored from 0 (representing the worst foot status) to scores that range from 5 to 40, depending on the item (representing the best foot status). The items are summed to give a total score of 100.

**Score interpretation.** Total scores range from 0 (representing the worst foot status) to 100 (representing the best foot status). Normative data from a sample of 625 people who were visitors or employees of a hospital in Germany have been published (9).

**Respondent time to complete.** Five minutes.

**Administrative burden.** Calculation of the total score takes less than 1 minute per participant. The clinician is required to perform a joint range of motion assessment and observational gait analysis.

**Translations/adaptations.** The AOFAS-AH has been translated and culturally adapted into Dutch (10), German (11), Italian (12), Persian (13,14), Portuguese (15), and Turkish (16).

## Psychometric information

**Floor and ceiling effects.** No floor or ceiling effects were observed for the AOFAS-AH in people with an acute ankle sprain (17) or for people with any foot or ankle condition (13,18,19). A ceiling effect was observed for the AOFAS-M in people with Lisfranc joint injury (20). No floor or ceiling effects were observed for the AOFAS-HJ in people with any foot or ankle condition (19). Ceiling effects were observed for the AOFAS-LJ in people with rheumatoid arthritis and people with no foot or ankle complaints (21).

**Reliability.** The AOFAS published a position statement in 2011 that outlined the AOFAS Clinical Rating Scales as not reliable (22). However, a recent article found moderate internal consistency (Cronbach's $\alpha = 0.75$) for the AOFAS-M for 117 people with Lisfranc joint injury (20).

**Validity.** The AOFAS published a position statement in 2011 that outlined the AOFAS Clinical Rating Scales as not valid (22).

**Responsiveness.** Responsiveness of the AOFAS Clinical Rating Scales (assessed by combining scores from each version and reported by using the standardized response mean [SRM] and effect sizes) was evaluated in a relatively small sample of 25 people with a foot or ankle condition that required surgical intervention. An SRM of 1.10 and an effect size of 1.12 suggest an acceptable responsiveness to change (23). Acceptable responsiveness to change was reported for the AOFAS-AH in a larger sample of 117 patients who underwent surgery for ankle arthritis (SRM 1.34; effect size 1.69) (24) and for 91 people with hallux valgus (area under the receiver operating characteristic [ROC] curve of all scales ranged between 0.80 and 0.87) (25).

**Minimally important differences.** Minimally important differences have been determined from a sample of 446 patients who underwent hallux valgus surgery. These scores ranged from 7.9 to 30.2, depending on the method of calculation (26).

**Generalizability.** The AOFAS Clinical Rating Scales are the most frequently used outcome measures in orthopedic settings (27,28). However, it is difficult to determine whether this questionnaire is generalizable to other populations because the scales are not reliable or valid (22).

**Use in clinical trials.** The AOFAS Clinical Rating Scales are among the most frequently used outcome measures in foot and ankle research (29), despite recommendations against their use. The questionnaires have been used as outcome measures of clinical trials evaluating rheumatoid arthritis (30), ankle arthritis (31), ankle sprain (32), tibial fracture (33), ankle fracture (34), calcaneal fracture (35), Lisfranc injury (36), metatarsal fracture (37), Achilles tendinopathy (38), plantar fasciitis (39), and hallux valgus (40–43).

## Critical appraisal of overall value to the rheumatology community

**Strengths.** The AOFAS Clinical Rating Scales are individualized to different anatomical regions of the foot and ankle. The AOFAS-AH is responsive for certain conditions. The AOFAS Clinical Rating Scales are easy to administer and score and can be performed quickly in a clinical setting.

**Caveats and cautions.** The AOFAS Clinical Rating Scales are not reliable or valid, and the use of these scales is discouraged by the AOFAS (22).

**Clinical usability.** The use of the AOFAS Clinical Rating Scales in clinical practice should be discouraged, despite the ease of use of these questionnaires.

**Research usability.** The use of the AOFAS Clinical Rating Scales in a research setting should be discouraged because of the lack of reliability and validity (22). Furthermore, it has been suggested that these scales produce a skewed distribution, and the interpretation of research findings based on the AOFAS Clinical Rating Scales should be regarded with caution (44).

## FOOT AND ANKLE ABILITY MEASURE

### Description

**Purpose.** To evaluate changes in self-reported physical function for individuals with leg, ankle, and foot musculoskeletal conditions (45).

**Content or domains.** The FAAM evaluates two domains: activities of daily living (21 items) and sports (6 items).

**Number of items.** Twenty-nine items.

**Response options/scale.** Five-point Likert scales.

**Recall period for items.** One week.

**Cost to use.** Free.

**How to obtain.** The formatted questionnaire can be downloaded from https://www.aaos.org/quality/research-resources/patient-reported-outcome-measures/lower-extremity-performance-measures/. An online calculator is also available at www.orthotoolkit.com/faam.

### Practical application

**Method of administration.** Self-administered with paper and pencil.

**Scoring.** Each item is scored from 0 ("unable to do") to 4 ("no difficulty"). An "N/A" option is available for each item, and if this option is selected, the item is excluded from the total score. The activities of daily living subscale and the sports subscale are scored separately. The total score is calculated by dividing the summed score by the maximum possible score (ie, for the activities of daily living subscale, if all items are answered, a summed score of 60 would be divided by 84. If one item was marked "N/A," the summed score of 60 would be divided by 80). This figure is then multiplied by 100 and reported as a percentage (45).

**Score interpretation.** Subscale scores range from 0 (representing the worst physical function) to 100 (representing the best physical function). Normative data from a sample of 271 people from the general population in the United States have been published in a conference abstract (46). The average FAAM activities of daily living subscale score was 92.3 (SD 12.3), and the average FAAM sports subscale score was 85.1 (SD 20.2).

**Respondent time to complete.** Five to 10 minutes.

**Administrative burden.** Self-study of the scoring documentation (45).

**Translations/adaptations.** The FAAM has been translated and culturally adapted into Brazilian Portuguese (47), Chinese (48), German (49), Italian (50), Japanese (51), Spanish (52), and Turkish (53). Translation without cultural adaptation has been performed for Dutch (54), French (55), Persian (56), and Thai (57).

### Psychometric information

**Floor and ceiling effects.** No floor or ceiling effects were found in the original study, which has also been reported for translations of the FAAM in Turkish, Dutch, and Persian (45,53,54,56). One study that evaluated the responsiveness of the FAAM in a sample of participants with diabetes found a floor effect for the sports subscale (58).

**Reliability.** For the activities of daily living subscale, internal consistency (Cronbach's $\alpha$) in the original study of 164 patients with a new leg, ankle, or foot musculoskeletal condition was 0.98, and for 79 patients with an existing leg, ankle, or foot musculoskeletal condition, it was 0.96. For the sports subscale, Cronbach's $\alpha$ was calculated for new and existing patients combined and was 0.98 (45). Similar internal consistency (by using the Rasch measurement model) was observed for the activities of daily living subscale (0.87) and the sports subscale (0.89) in a study of 456 patients who underwent surgery for an ankle injury (59). Test-retest reliability (intraclass correlation coefficients) for 79 patients with an existing leg, ankle, or foot musculoskeletal condition was 0.89 for the activities of daily living subscale and 0.87 for the sports subscale (45).

**Validity.** Content validity was demonstrated in the original publication by using item response theory and an evaluation of individual items by expert clinicians. Criterion validity has not been evaluated because of the absence of a gold standard measure of foot function. Construct validity has been demonstrated by the observation of high associations (Pearson's $r$) between the FAAM subscales and the SF-36 physical function subscale (activities of

daily living subscale: 0.84; sports subscale: 0.78) (45) and the 12-Item Short Form Health Survey physical components subscale (activities of daily living subscale: 0.83; sports subscale: 0.78) (59). In patients with hallux valgus, a high association was observed between the FAAM activities of daily living subscale and the Patient-Reported Outcomes Measurement Information System physical function scale (0.70) (60).

**Responsiveness.** Responsiveness (assessed by using mean differences, Guyatt Index, and area under the ROC curves) was evaluated in the original publication for a sample of participants (N = 164) with leg, ankle, and foot pain. Adequate responsiveness was found for the FAAM activities of daily living subscale (mean difference: 17.1 [SD 19.8]; Guyatt Index: 2.75; ROC: 0.80) and the sports subscale (mean difference: 17.2 [SD 24.8]; Guyatt Index: 1.40; ROC: 0.72) (45). In a sample of participants with diabetes and a foot or ankle orthopedic condition, responsiveness was evaluated at a group level (by using analysis of variance) and an individual level (by using area under the ROC curves) for the FAAM activities of daily living subscale. Similar responsiveness to the original publication was observed (mean difference: 17.0 [SD 19.0]; ROC: 0.73) (58). Adequate responsiveness was reported for the Turkish versions of the FAAM (effect size: 1.40) (53).

**Minimally important differences.** Minimally important differences have been reported from a sample of participants with lower-limb musculoskeletal conditions (activities of daily living subscale: 8 points; sports subscale: 9 points) (45), those with diabetes (9 points) (58), and those attending a university orthopedic clinic (activities of daily living subscale: range between 3 and 25 points; sports subscale: range between 9 and 77 points, depending on the method of calculation) (61).

**Generalizability.** The FAAM was originally developed for use in patients with a musculoskeletal condition of the leg, ankle, or foot and is therefore generalizable to a variety of patient groups and conditions. Psychometric properties have been evaluated in both surgical and nonsurgical samples. However, the sports subscale may not be relevant for some patient populations, as demonstrated by the floor effect in patients with diabetes (58).

**Use in clinical trials.** The FAAM has been used as an outcome measure in clinical trials of ankle injuries (62–64), plantar heel pain (65–68), taping for exercise-related leg pain (69), and edema in patients with ankle/hindfoot fractures (70).

### Critical appraisal of overall value to the rheumatology community

**Strengths.** Key strengths of the FAAM are its availability in several languages, its extensive psychometric evaluation (including Rasch analysis) in both surgical and nonsurgical samples, and its simple administration and scoring.

**Caveats and cautions.** The use of the FAAM with certain patient groups should be considered. Rasch measurement modeling identified that the FAAM activities of daily living subscale items 10 (coming up on your toes) and 11 (squatting) may not be appropriate to evaluate ankle ability and that the wording may need revision (59). Also, a floor effect was identified for the sports subscale in patients with diabetes (58).

**Clinical usability.** The FAAM is a feasible outcome measure to evaluate physical function in patients with conditions affecting the leg, ankle, and foot. The American Physical Therapy Association recommends that the FAAM to be used by clinicians to evaluate treatment for plantar heel pain (71). A consensus statement from the International Ankle Consortium recommended that the FAAM be used to evaluate the efficacy of treatments after acute ankle sprain (72).

**Research usability.** The FAAM is a robust outcome measure to evaluate physical function in patients with conditions affecting the leg, ankle, and foot. The minimally important differences vary depending on the method of calculation, which may impact the interpretation of findings.

## FOOT AND ANKLE OUTCOME SCORE

### Description

**Purpose.** The FAOS is an adaptation of the Knee Injury and Osteoarthritis Outcome Score, which was originally developed in 1998 to assess short- and long-term patient-relevant outcomes following knee injury (73). In 2001, Roos et al (74) substituted "knee" with "foot/ankle" and validated the new tool in 213 in patients undergoing surgical reconstruction of lateral ankle ligaments. The FAOS has primarily been used as a foot and ankle surgical outcome measure.

**Content or domains.** The FAOS has five foot-health–related domains: pain (9 items), other symptoms (7 items), activities of daily living (17 items), sport and recreational activities (5 items), and foot and ankle-related quality of life (4 items).

**Number of items.** Forty-two items.

**Response options/scale.** Five-point Likert scale (no, mild, moderate, severe, and extreme).

**Recall period for items.** One week.

**Cost to use.** Free.

**How to obtain.** The formatted questionnaire and user's guide can be downloaded from www.koos.nu. An online calculator is also available at www.orthotoolkit.com/faos.

## Practical application

**Method of administration.** Self-administered with paper and pencil.

**Scoring.** Each item is scored from 0 to 4. Raw subscale scores are calculated first by adding each item, and then each subscale is converted to a metric from 0 to 100, in which 100 denotes the most severe condition.

**Score interpretation.** Subscale scores range from 0 (representing optimal foot health) to 100 (representing worst foot health). Higher scores therefore represent worse foot health (74). There are no published normative data.

**Respondent time to complete.** Ten minutes.

**Administrative burden.** Calculation of subscale scores takes less than 5 minutes per participant.

**Translations/adaptations.** The FOAS has been translated into Chinese (75), Danish (76), Dutch (77), German (78), Korean (79), Persian (80), Thai (81), and Turkish (82). Arabic, Estonian, Finnish, Norwegian, Polish, Portuguese, Brazilian Portuguese, Spanish, and Swedish versions are available at www.koos.nu, although validation is still in progress.

## Psychometric information

**Floor and ceiling effects.** In the original study (74), no floor effects were observed, although ceiling effects were evident for the pain (34% of patients recording the highest possible score), other symptoms (24%), activities of daily living (44%), sport and recreation (30%), and quality of life (19%) subscales. Ceiling effects were also observed in a study of 136 patients undergoing surgery for ankle osteoarthritis, in which 29% of patients recorded the highest possible score for the sport and recreation subscale (83).

**Reliability.** Internal consistency (Cronbach's $\alpha$) in the original study of 213 patients undergoing surgical reconstruction of lateral ankle ligaments for each subscale was as follows: pain, 0.94; other symptoms, 0.88; activities of daily living, 0.97; sport and recreation, 0.94; and quality of life, 0.92 (74). Subsequent studies have reported similar findings regarding pain (0.81-0.96), activities of daily living (0.88-0.97) and sport and recreation (0.79-0.96), although internal consistency is generally lower for other symptoms (0.39-0.86) and quality of life (0.62-0.91) (75,79–85).

Test-retest reliability (intraclass correlation coefficients) over a 30-day period in 38 patients from the original study was as follows: pain, 0.78; other symptoms, 0.86; activities of daily living, 0.70; sport and recreation, 0.85; and quality of life, 0.92 (74). Subsequent studies have reported similarly high test-retest reliability for pain (0.76-0.97), other symptoms (0.63-0.96), activities of daily living (0.70-0.99), sport and recreation (0.68-0.99) and quality of life (0.70-0.99) (75–77,79,80,82,84,85).

**Validity.** Content validity was originally examined by asking patients to rate the relevance and importance of each item on a scale of 1 to 3 and to suggest additional items. All items had a mean relevance score above 2.0, and no other items were suggested (74). Criterion validity has not been evaluated because of the absence of a gold standard measure of foot pain or function. Construct validity has been demonstrated by the observation of moderate associations (Spearman's $\rho$ or Pearson's $r$) between FAOS subscale scores and the Karlsson score (0.58-0.67) (74), the Western Ontario and McMaster Universities Osteoarthritis Index (pain, 0.49; other symptoms, 0.37; activities of daily living, 0.52; sport and recreation, 0.45) (84), the AOFAS score (pain, 0.49; other symptoms, 0.30; activities of daily living, 0.40; sport and recreation, 0.43; quality of life, 0.45) (77), the numerical rating scale for pain (pain, 0.98; other symptoms, 0.63; activities of daily living, 0.89; sport and recreation, 0.74; quality of life, 0.66) (75), the visual analog pain scale (pain, 0.66-68; other symptoms, 0.45-0.46; activities of daily living, 0.53-0.62; sport and recreation 0.46-0.58; quality of life, 0.50-0.63) (77,79), and the SF-36 physical function (pain, 0.37-0.72; other symptoms, 0.12-0.73; activities of daily living, 0.46-0.77; sport and recreation, 0.21-079; quality of life, 0.09-0.71) (75,77,80–83,85,86), role physical (pain, 0.28-0.62; other symptoms, 0.02-0.59; activities of daily living, 0.24-0.64; sport and recreation, 0.18-0.57; quality of life, 0.05-0.72) (75,77,80,81,83,85,86), and bodily pain subscales (pain, 0.26-0.78; other symptoms, 0.08-0.71; activities of daily living, 0.24-0.75; sport and recreation, 0.18-0.67; quality of life, 0.10-0.76) (75,77,80–83,85,86). Generally, the construct validity has been reported to be lower for the other symptoms and quality of life subscales.

**Responsiveness.** Responsiveness (effect size) in patients undergoing hindfoot/ankle surgery and surgery for ankle osteoarthritis, hallux valgus, and flatfoot deformity has been shown to be moderate to high for the pain (0.51-1.06) and quality of life (0.90-1.58) subscales and low to high for the activities of daily living (0.27-0.87), other symptoms (0.12-0.55), and sport and recreation (0.01-1.02) subscales (83,85–87).

**Minimally important differences.** Minimally important differences for the Dutch version of the FAOS (by using two different anchor methods) were reported as follows: pain, 7/13 points; other symptoms, 15/13 points; activities of daily living, 18/14 points; sport and recreation, 23/33 points; and quality of life, 22/22 points. However, these values varied according to baseline scores and had large confidence intervals, indicative of poor reliability (87).

**Generalizability.** Although the FOAS has been evaluated in a variety of patient groups and conditions, it has primarily been used in surgical studies. Its psychometric properties in nonsurgical studies are relatively limited.

**Use in clinical trials.** The FAOS has been used as the primary outcome measure in randomized trials of rehabilitation (88–90) and surgical repair (91–93) after ankle sprain and in randomized trials of laser treatment (94) and bracing (95) for Achilles tendinopathy.

### Critical appraisal of overall value to the rheumatology community

**Strengths.** Key strengths of the FAOS include its broad coverage of five distinct domains of foot health and its availability in several languages.

**Caveats and cautions.** The FAOS items were derived from a knee outcome score rather than being specifically developed for the foot. This is particularly evident in items 4 ("Can you straighten your foot/ankle fully?") and 5 ("Can you bend your foot/ankle fully?") which are appropriate for the knee but have questionable applicability to the foot. The other symptoms, sports and recreation, and quality of life subscales do not perform as well as the pain and activities of daily living scales in terms of internal consistency, construct validity, and responsiveness. Ceiling effects have been observed for each subscale, and minimal important differences vary according to baseline scores and have large confidence intervals. A Rasch analysis has not yet been performed on the FAOS, so it is unclear as to whether the overall subscale scores summed from each ordinal item can be considered linear, interval-level variables (96).

**Clinical usability.** The FAOS is relatively long compared with other scales (42 items) and may therefore be too burdensome for routine clinical use. An evaluation of the Korean version demonstrated that paper and electronic (tablet) formats provided equivalent results, although patients found the electronic version easier to complete (97).

**Research usability.** The FAOS was the second most commonly used outcome measure in 2015-2016 (98). However, because of several psychometric shortcomings, particularly ceiling effects and the absence of robust minimally important difference values and Rasch analysis, further development of this outcome measure is required before it can be recommended for use in clinical trials.

## FOOT FUNCTION INDEX–REVISED

### Description

**Purpose.** To evaluate foot-health–related quality of life.

**Content or domains.** The Foot Function Index (FFI) was developed in 1991 to measure the impact of foot pathology on function in terms of pain, disability, and activity restriction (99). In 2006, the FFI was revised (FFI-R) to evaluate four domains: pain and stiffness (20 items), difficulty (20 items), activity limitation (9 items), and social/emotional issues (19 items) (100).

**Number of items.** There are two versions of the FFI-R, a short and long form. The short form contains 34 items, and the long form contains 68 items.

**Response options/scale.** The FFI-R uses a 4-point Likert scale from 1 ("no pain," "no stiffness," "no difficulty," and "none of the time") to 4 ("severe pain," "severe stiffness," "severe difficulty," "all of the time," and "most of the time"). A score of 5 can be selected for items that are not applicable. The original version of the FFI-R used a 6-point Likert scale (100), but this was revised to the current 4-point scale in 2013 (101).

**Recall period for items.** One week.

**Cost to use.** Free.

**How to obtain.** The formatted FFI-R short and long forms are available in a review article (101).

### Practical application

**Method of administration.** Self-administered with paper and pencil.

**Scoring.** Scores for each subscale are summed then divided by the maximum total score for the subscale items that the patient indicated were applicable, after which they are multiplied by 100 and reported as a percentage. The pain and stiffness subscale scores should be combined and reported as a single pain/stiffness score, despite the outcome measure indicating that each subscale has an individual score. The scoring of pain and stiffness as separate subscales was revised during the development of the FFI-R (100).

**Score interpretation.** Scores range from 0%-100%, with higher scores representing a worse foot function. The long form FFI-R can be used to obtain a total score and individual subscale scores. The short form FFI-R was developed to obtain a total foot function score (100). Normative data have been derived from the German version of the FFI but not from the FFI-R (102).

**Respondent time to complete.** Less than 30 minutes for the long form and 10 minutes for the short form.

**Administrative burden.** Self-study of the scoring documentation (101).

**Translations/adaptations.** The original FFI was revised in 2006 to the FFI-R. The FFI-R has been adapted to a short form (34 items) and a long form (68 items). The FFI-R has been translated and culturally adapted into Brazilian Portuguese (103), Polish (104), and Turkish (105).

## Psychometric information

**Floor and ceiling effects.** A floor effect was demonstrated for 4.5% of the sample used to develop the FFI-R (100).

**Reliability.** Internal consistency was analyzed in the original study of 92 patients from a foot arthritis clinic at a Veterans Health Administration hospital. A Rasch analysis of the FFI-R total score found a person reliability of 0.96 and an item reliability of 0.93. The item reliabilities for the subscales were as follows: pain and stiffness, 0.93; disability, 0.92; activity limitation, 0.90; and social/emotional issues, 0.84 (100). For the short form FFI-R, the person reliability was 0.95, which suggests the total score of the short form FFI-R is similar to the total score for the long form FFI-R. The test-retest reliability has not been determined for the FFI-R.

**Validity.** Content validity of the FFI-R was evaluated by using the original FFI, a literature review, interviews with foot specialists, reviews by foot specialists in a focus group, interviews with patients about their experiences, and reactions to completing a draft of the FFI-R (100). Criterion validity has not been evaluated because of the absence of a gold standard measure of foot pain or function. Construct validity has been evaluated by using Rasch item maps and the correlation with the time taken to walk 50 ft. Rasch item maps found that items of low-severity foot problems (eg, standing on tip toes) were found at the bottom (low disability) of the item hierarchy. Conversely, items of high severity (eg, being bed-bound) were found at the top (high disability) of the item hierarchy. Construct validity was also evaluated by correlating the FFI-R with a timed 50-ft walk, and a small to moderate correlation of 0.31 ($P = 0.018$) was found (100).

**Responsiveness.** Responsiveness of the FFI-R was not reported in the original article (100). The responsiveness of the FFI-R short form (assessed by using Guyatt Index and the SRM) was evaluated in a sample of 88 people with first metatarsophalangeal joint osteoarthritis (106). The authors reported responsiveness by subscale and found that responsiveness ranged from medium to very large depending on the method. Responsiveness for each subscale is as follows: pain, SRM of 1.05 and Guyatt Index of 1.73; stiffness, SRM of 0.68 and Guyatt Index of 1.17; and difficulty, SRM of 0.70 and Guyatt Index of 1.42. The sensitivity to change (minimal detectable change) of the FFI-R long form was reported in a study that included 30 participants with midfoot pain who were evaluated after the use of foot orthoses for 4 weeks (107). The changes for each subscale were as follows: pain, 5 points; stiffness, 6 points; disability, 7 points; activity limitation, 7 points; social/emotional issues, 7 points; and total score, 5 points.

**Minimally important differences.** Minimally important differences have not been reported for the FFI-R. As discussed in the section above, the minimal detectable change has been reported in a study that included 30 participants with midfoot pain (107).

**Generalizability.** The FFI-R was developed with patients who were predominantly middle-aged (mean of 69 years) men with foot arthritis (100). The questionnaire has also been used as an outcome measure for surgical studies (108,109).

**Use in clinical trials.** The FFI-R has been used as an outcome measure in clinical trials of medial knee osteoarthritis (110), first metatarsophalangeal joint osteoarthritis (111), plantar fasciitis (67,112,113), and diabetic foot ulcers (114) and has been used to evaluate surgical implants (109).

## Critical appraisal of overall value to the rheumatology community

**Strengths.** The FFI-R underwent a robust development by using Rasch analysis and classical test theory in combination with patient and expert clinician interviews. The outcome measure is responsive, is easy to administer and score, and is provided in a short form (34 items) if users are interested in a total score rather than subscale scores.

**Caveats and cautions.** The validity and reliability of the FFI-R has been evaluated in a relatively small sample (N = 92) of predominantly middle-aged men. In addition, the psychometric properties of this outcome measure have not been independently evaluated. Therefore, independent evaluation in a large diverse sample would strengthen the validity and reliability. Regarding administration and scoring, studies have differentially scored and reported the FFI-R. The original study reported the FFI-R to have four subscales (pain and stiffness, difficulty, activity limitation, and social/emotional issues); however, several studies have reported pain and stiffness as separate scales. Similarly, the original article reported that the FFI-R short form should only be used to calculate a total score; however, several studies have reported the FFI-R short form by subscale (100).

**Clinical usability.** The FFI-R is a feasible tool for use in clinical practice. The time taken to complete the 68 items of the long form FFI-R may be somewhat time consuming during clinical encounters. However, a total score can be established by using the short form (34 items), which is feasible during clinical encoun-

ters. The lack of robust clinically important difference values limits the interpretability of findings in clinical practice.

**Research usability.** The methods used to develop the FFI-R were robust because of the use of Rasch analysis and patient and expert interviews. Accordingly, the FFI-R has been used in several randomized trials. However, its psychometric properties require independent evaluation by using a larger and more diverse sample than was used for its development.

## FOOT HEALTH STATUS QUESTIONNAIRE

### Description

**Purpose.** The FHSQ was developed in 1998 to measure foot-health–related quality of life (115,116).

**Content or domains.** The FHSQ has four foot-health–related domains: pain (four items), function (four items), footwear (three items), and general foot health (two items).

**Number of items.** Thirteen items.

**Response options/scale.** Five-point Likert scales.

**Recall period for items.** One week.

**Cost to use.** The current price is $129.95 Australian dollars (approximately US $90).

**How to obtain.** The questionnaire and scoring program are available from the CareQuest website at www.fhsq.org.

### Practical application

**Method of administration.** Self-administered with paper and pencil.

**Scoring.** There is a dedicated FHSQ software program. When less than 50% of the responses for any one scale is missing, the missing responses are assigned with the average value of the completed questions for that scale (116).

**Score interpretation.** Subscale scores range from 0 (representing poorest state of foot health) to 100 (representing optimal foot health). Higher scores therefore represent better foot health (115,116). There are no published normative data.

**Respondent time to complete.** Five to 10 minutes.

**Administrative burden.** Calculation of subscale scores by using the software takes less than 5 minutes per participant.

**Translations/adaptations.** The FHSQ has been translated and culturally adapted into Brazilian Portuguese (117), Danish (118), French (119), Spanish (120), and Valencian (121). Turkish, Persian, and Thai versions are also under development.

### Psychometric information

**Floor and ceiling effects.** Not reported.

**Reliability.** Internal consistency (Cronbach's $\alpha$) was originally reported in 111 podiatry patients as follows: pain, 0.88; function, 0.86; footwear, 0.85; and general foot health, 0.88 (115). Similar internal consistency was observed for the Brazilian Portuguese (pain, 0.68; function, 0.81; footwear, 0.82; and general foot health, 0.76) (117) and French (pain, 0.90; function, 0.90) (119) versions. Test-retest reliability (intraclass correlation coefficients) was originally reported in 72 patients who completed the survey before and after a week of routine care: pain, 0.86; function, 0.92; footwear, 0.74; and general foot health, 0.78 (115), and similar reliability was observed by using the French version over a 2-day period (pain, 0.98; function, 0.96) (119).

**Validity.** Content validity was demonstrated in the original publication by noting that individuals with minor foot complaints (such as superficial skin conditions) produced higher scores on all FHSQ subscales (indicating better health status) compared with individuals with more severe musculoskeletal foot problems (115). Similarly, in a study of 784 older people, the FHSQ foot function scales were shown to differ between those with minor skin or nail problems (mean score 89), structural deformity (mean score 78), and acute foot disease (average score 54) (122). Criterion validity has not been evaluated because of the absence of a gold standard measure of foot pain or function. Construct validity has been demonstrated by the observation of moderate associations (Pearson's $r$) between FHSQ subscale scores and the visual analog pain scale (pain, –0.40 to –0.52; function, –0.45 to –0.51) (118,119), numerical rating scale (pain, –0.85; function, –0.60) (117), Health Assessment Questionnaire (pain, –0.43; function, –0.64) (117), and EuroQOL 5D (pain, –0.45; function, –0.58) (120).

**Responsiveness.** High responsiveness (assessed by using Guyatt Index) was reported in a sample of 59 older people who received extra-depth footwear to treat their foot pain over a 16-week period for the pain (1.70) and function (1.22) subscales, but responsiveness of the footwear (0.21) and general foot health (0.68) subscales was lower (123). Similarly, in a sample of 88 people with first metatarsophalangeal joint osteoarthritis who received rocker-sole footwear or foot orthoses over a 12-week period, high responsiveness was observed for the pain (1.30) and function (1.23) subscales (106).

**Minimally important differences.** Minimally important differences have been reported in several participant groups, including individuals with plantar heel pain (pain, 13 points; function, 7 points; footwear, 2 points; general foot health, 0 points) (124), older people with foot pain (pain, 12 points; function, 10 points; footwear, 1 point; general foot health, 10 points) (123), and individuals with first metatarsophalangeal joint osteoarthritis (pain, 11 points; function, 10 points) (106).

**Generalizability.** The FHSQ has broad generalizability across a wide range of conditions and participant groups.

**Use in clinical trials.** The FHSQ has been widely used as an outcome measure in clinical trials of treatments for nonspecific foot pain (123,125), plantar heel pain (126–131), first metatarsophalangeal joint osteoarthritis (111,132), interdigital neuroma (133), pes cavus (134), and rheumatoid arthritis (135).

### Critical appraisal of overall value to the rheumatology community

**Strengths.** Key strengths of the FHSQ include its coverage of four distinct domains of foot health (pain, function, footwear, and general foot health), its substantial psychometric evaluation, its availability in several languages, responsiveness of the pain and function subscales, and ease of completion and scoring.

**Caveats and cautions.** The sample on which the original factor analysis was performed was relatively small (N = 225), and it has been argued that the factors are not sufficiently distinct and may therefore contain some redundant items (136). A Rasch analysis has not yet been performed on the FHSQ, so it is unclear as to whether the overall subscale scores summed from each ordinal item can be considered linear, interval-level variables (96). The FHSQ footwear and general foot health subscales do not appear to perform as well as the pain and function subscales in terms of reliability and responsiveness.

**Clinical usability.** Because of the ease of completion and scoring, routine clinical administration of the FHSQ is feasible, and it has been used in several audit studies to document patient outcomes, particularly following foot surgery (137,138). An analysis of readability found that the FHSQ is suitable for patients with at least seventh-grade reading skills (139).

**Research usability.** The FHSQ is one of the most commonly used outcome measures in randomized clinical trials because of its relatively robust psychometric profile, its responsiveness, and the availability of minimally important difference values across a range of foot conditions and patient populations. Further investigation is required to evaluate floor and ceiling effects and to perform Rasch analysis.

## LEEDS FOOT IMPACT SCALE FOR RHEUMATOID ARTHRITIS

### Description

**Purpose.** The LFIS-RA was developed in 2005 to evaluate the efficacy of multidisciplinary foot-health care in rheumatoid arthritis, both for routine clinical purposes and for research (140).

**Content or domains.** There are two subscales: impairment/footwear (21 items) and activity limitation/participation restriction (30 items).

**Number of items.** Fifty-one items.

**Response options/scale.** "True" and "not true."

**Recall period for items.** At the moment.

**Cost to use.** Free.

**How to obtain.** The LFIS-RA can be viewed in an appendix to an article describing its translation and cross-cultural validation for use in four European languages (141). Users are required to register use with the University of Leeds (Leeds, UK) at https://eprovide.mapi-trust.org/instruments/leeds-foot-impact-scale-for-rheumatoir-arthristis.

### Practical application

**Method of administration.** Self-administered with paper and pencil.

**Scoring.** A "true" response is scored as 1 point, and a "not true" response is scored as 0. Item scores in each subscale are then totaled to provide separate subscale scores that can be summated to provide an overall score (maximum overall score of 51).

**Score interpretation.** A higher score indicates greater disability. A score of greater than 7 on the impairment/footwear subscale indicates moderate to high levels of foot impairment, and a score greater than 10 on the activity limitation/participation restriction subscale indicates moderate to high levels of foot disability (142).

**Respondent time to complete.** Not reported.

**Administrative burden.** Self-study of the scoring documentation (140).

**Translations/adaptations.** The LFIS-RA has been translated and culturally adapted into Dutch, German, and Hungarian (141,143).

## Psychometric information

**Floor and ceiling effects.** No floor or ceiling effects were observed for the LFIS-RA in a study of 30 people with rheumatoid arthritis (144).

**Reliability.** Test-retest reliability (intraclass correlation coefficients) over a 2-week period in the original study was 0.84 for the impairment/footwear subscale and 0.96 for the activity limitation/participation restriction subscale (140).

**Validity.** Candidate questionnaire items were derived from qualitative interviews with patients with rheumatoid arthritis and foot problems and then tested by patients with rheumatoid arthritis in the presence of an interviewer, ensuring content validity (140). Selection of the final subscale items was performed by fitting them to the Rasch unidimensional measurement model. The 21 items in the final impairment/footwear subscale displayed a good fit to the Rasch model and no significant deviation from model expectation across the trait (overall mean item of –0.25 [SD 1.07], mean person of –0.34 [SD 0.71], and item-trait interaction $\chi^2$ statistic of 45.07; $P = 0.35$ [42 degrees of freedom]). Similarly, the 30 items in the activity limitation/participation restriction subscale had a good fit to the Rasch model, with no significant deviation from model expectation (overall mean item of –0.38 [SD 0.93], mean person of –0.29 [SD 0.80], and item-trait interaction $\chi^2$ statistic of 64.4; $P = 0.18$ [60 degrees of freedom]). Neither scale showed differential item function for age, sex,or disease duration. Person separation was 0.808 for the impairment/footwear subscale and 0.908 for the activity limitation/participation restriction subscale, indicating the ability to discriminate groups of patients. Furthermore, scores for both subscales showed highly significant differences between groups of patients categorized into quartiles according to their scores for the MFPDI, FFI, and Health Assessment Questionnaire. However, the original validation did not include strict tests of unidimensionality. In a subsequent adaptation and cross-cultural validation study, the original UK version demonstrated multidimensionality and limited fit to the Rasch model, but adaptation satisfactorily resolved these violations of the Rasch model (141).

**Responsiveness.** A study of 30 patients with rheumatoid arthritis undergoing foot surgery found that the LFIS-RA was less responsive than the FFI (144). Over a mean follow-up of 38 months, the within-group standard effect size for the LFIS-RA was 0.58, the SRM was 0.58, and Guyatt Index was 0.90, indicating moderate internal responsiveness. In relation to being much improved or very much improved on an anchor question about change since surgery, the area under the curve within the ROC curve was 0.656 and the optimal cutoff point was 1.5 points, with a sensitivity of 75% and specificity of 57%.

**Minimally important differences.** Minimally important differences have not been reported for the LFIS-RA.

**Generalizability.** The LFIS-RA was developed for use in rheumatoid arthritis. It has been used in patients with psoriatic arthritis (5,145), gout (146–149), and systemic lupus erythematosus (150), although its psychometric properties in conditions other than rheumatoid arthritis have not been evaluated.

**Use in clinical trials.** The LFIS-RA has been used as an outcome measure in clinical trials of podiatry care and footwear and orthoses interventions in rheumatoid arthritis and gout (151–153).

## Critical appraisal of overall value to the rheumatology community

**Strengths.** Key strengths of the LFIS-RA include its emphasis on footwear, its broad coverage of other issues related to foot health in rheumatoid arthritis (impairments, activity limitation, and participation), and its availability in several languages.

**Caveats and cautions.** The LFIS-RA was developed for use in rheumatoid arthritis. Although it has been used in diseases other than rheumatoid arthritis, its psychometric properties for these conditions has not been evaluated. There are limited data on its responsiveness, and minimal important differences have not been reported.

**Clinical usability.** Although it was designed for use for both clinical and research purposes, the LFIS-RA is the second longest instrument included in this review and may therefore be time consuming to use during clinical encounters. Its interpretability in clinical practice is limited by the lack of robust clinically important difference values.

**Research usability.** The original validation of the LFIS-RA suggested that it is valid and reliable. However, further independent evaluation of its psychometric properties, including its responsiveness, the assessment of minimally important difference values, and its performance in diseases other than rheumatoid arthritis, is required.

# MANCHESTER FOOT PAIN AND DISABILITY INDEX

## Description

**Purpose.** The MFPDI was developed in 2000 for use in a population survey and aimed to be sufficiently sensitive to identify a range of disabilities associated with foot pain (154).

**Content or domains.** Its original validation identified three domains: pain intensity (5 items), functional limitation (10 items), and personal appearance (2 items) (154). Two additional items about work and leisure activities were excluded from this analysis because they were thought not to be relevant to all people. Subsequently, independent exploratory factor analyses undertaken in separate populations identified different factor structures. Menz et al (155) identified four domains: functional limitation (seven items), activity restriction (two items), pain intensity (six items), and personal appearance (two items). Cook et al (156) found two domains: foot and ankle function (nine items) and pain and appearance (seven items), with one item removed. In a confirmatory factor analysis investigating the suitability of these three different factor structures, the original three-factor structure performed best (157). Non-English language versions have identified further different factor structures.

**Number of items.** Nineteen items.

**Response options/scale.** Items are reported as occurring none of the time, on some days, or on most days/every day.

**Recall period for items.** One month.

**Cost to use.** The license fee depends on whether the use is for a commercial or an academic study, on the number of times the measure is to be used, on language requirements, and on whether the user manual is required.

**How to obtain.** The MFPDI can be viewed in an appendix to the original article (154). A license to access the questionnaire and user manual should be requested from Oxford University Innovation at https://innovation.ox.ac.uk.

## Practical application

**Method of administration.** Self-administered with paper and pencil.

**Scoring.** In the original description, it was stated that individual subscale (domain) scores could be derived to produce an overall disability measure (154), although scoring was not described. Various authors have allocated different scores to item responses to produce total and individual domain scores: "none of the time" = 0 or 1, "on some days" = 1 or 2, and "on most days/every day" = 2 or 3, so the total score ranges from 0 to 34 or 17 to 51 depending on which scoring is used (155,156,158,159).

**Score interpretation.** Higher scores indicate worse foot pain/disability. The Rasch unidimensional measurement model has shown that the function and pain subscales are unidimensional, and interval-level scores can be obtained (160). A categorical definition of disabling foot pain (present/absent) can also be derived. Garrow et al (158) defined disabling foot pain as a problem occurring on at least 1 of the 17 pain, function, or appearance items on at least some days in the last month. It has been argued that this cutoff is too infrequent for "disabling" foot pain, which should be defined by using only the functional limitation items without the pain intensity and personal appearance items. An alternative definition requiring a problem to occur on at least 1 of the 10 functional limitation items on most days/every day in the last month has been validated (157).

**Respondent time to complete.** Not reported.

**Administrative burden.** Self-study of the scoring documentation (154).

**Translations/adaptations.** The MFPDI has been translated and culturally adapted into Greek (161), Portuguese (162), Spanish (163), Danish (164), Dutch (165), and Chinese (166).

## Psychometric information

**Floor and ceiling effects.** Neither floor nor ceiling effects were examined in the original study (154). When using the Dutch translation in a clinical trial in people with forefoot problems, investigators observed no floor or ceiling effects for the pain and function subscales (165). The lowest possible score (0 or 1) was scored by 7.4% and 8.8% of participants for the pain and function subscales, respectively.

**Reliability.** Internal consistency (Cronbach's $\alpha$) was 0.99 (19 items) in the original validation (154) and 0.89 (17 items) in the subsequent evaluation by Menz et al (155). Cronbach's $\alpha$ values of 0.74, 0.92, and 0.77 have been reported for the pain intensity, functional limitation, and appearance domains, respectively (157).

Test-retest repeatability for disabling foot pain was poor for pain intensity, fair for functional limitation, and good for appearance ($\kappa$ = 0.34, 0.57, and 0.61, respectively) when problems were required to occur on at least some days in the last month, and it was fair for pain intensity (0.55), good for functional limitation (0.72), and poor for appearance (0.34) at the more stringent cutoff of most days/every day (157).

**Validity.** Content validity was achieved by interviewing patients attending foot clinics about pain, disability, activity limitation, and footwear (154). The proportion reporting disability was highest for participants consulting a rheumatologist, followed by those consulting their general practitioner and then population survey respondents; among the latter, the proportion was higher in those who had consulted a health care professional than in those who had not, demonstrating construct validity. Criterion

validity has not been evaluated because of the absence of a gold standard measure of foot pain or function. Construct validity was demonstrated subsequently by the observation of lower median SF-36 physical function subscale scores in those reporting problems in the functional limitations domain (157). Menz et al (155) identified associations between disabling foot pain and lower arch height, and between disabling foot pain and less ankle joint motion as well as correlations (Pearson's *r*) between MFPDI scores and the Goldberg Anxiety and Depression Scale depression subscale (total, 0.34; pain intensity, 0.23; functional limitation, 0.32; appearance, 0.28) and the SF-36 mental health (functional limitation, 0.20) and general health (activity limitation, 0.21) subscales.

**Responsiveness.** Responsiveness (effect size) over 16 weeks in a randomized trial of extra-depth footwear in Australian veterans with persistent, disabling foot pain was small for pain (0.21) and functional limitation (0.34) and negligible for personal appearance (0.08) (123). In the Dutch translation study, responsiveness was moderate, with only one of seven a priori stated hypotheses about correlations between change in MFPDI subscales and other foot pain outcome measures being met and with correlation with a global perceived effect question not reaching an acceptable level ($r < 0.5$) (165).

**Minimally important differences.** Only one study has attempted to evaluate a minimal important change (MIC) (165). However, the MFPDI was not responsive enough to calculate an MIC.

**Generalizability.** The MFPDI was designed for use in a population survey. It was developed and validated in people with varying foot health profiles attending rheumatology clinics, consulting with their general practitioner, or responding to a postal population survey (154). Its psychometric properties have been evaluated subsequently in community-dwelling adults across the age range (155–157,161), in people consulting with clinical services about foot problems (163,164,166), and in participants in clinical trials (123,165).

**Use in clinical trials.** The MFPDI has been used as an outcome measure in clinical trials in forefoot problems (165), Morton neuroma (167,168), plantar callosities/corns (169,170), plantar heel pain (171), osteoporosis (172), midfoot osteoarthritis (173), and systemic sclerosis (174) and in older people with foot pain or foot problems (159,175,176).

### Critical appraisal of overall value to the rheumatology community

**Strengths.** Key strengths of the MFPDI include its coverage of multiple distinct domains of foot health, its availability in several languages, its psychometric evaluation (including Rasch analysis), and it being short and easily administered and scored. It is also suitable for use in population surveys and can generate both foot pain/disability scores and a categorical definition of disabling foot pain.

**Caveats and cautions.** Several different domain structures have been proposed, and uncertainty remains over the most appropriate structure. The original three-factor structure is the most commonly used. There has been debate concerning the inclusion of foot problems occurring only on some days in the categorical definition of disabling foot pain. Its responsiveness appears to be limited, and as yet, a minimal important difference has not been calculated.

**Clinical usability.** The MFPDI is short and easily completed and could be feasible to use in clinical practice. However, limited responsiveness and lack of a robust clinically important difference may impair its interpretability.

**Research usability.** The MFPDI has been widely used in population surveys and is particularly valuable in observational studies requiring a case definition for disabling foot pain. Although it has been used in several clinical trials, further investigation of its responsiveness and minimally important difference values is required.

## MANCHESTER-OXFORD FOOT QUESTIONNAIRE

### Description

**Purpose.** The MOXFQ is derived from the MFPDI (154) and was originally developed in 2006 as an outcome measure for hallux valgus surgery (177). It has recently been amended and validated for use among patients with a variety of foot or ankle problems (178).

**Content or domains.** The MOXFQ has three foot-health–related domains: walking/standing problems (seven items), pain (five items), and issues related to social interaction (four items). An overall summary index score can also be calculated (179).

**Number of items.** Sixteen items.

**Response options/scale.** Five-point Likert scales.

**Recall period for items.** Four weeks.

**Cost to use.** The license fee depends on whether the use is for a commercial or an academic study, on the number of times the measure is to be used, on the language requirements, and on whether the user manual is required.

**How to obtain.** A license to access the questionnaire and user manual can be requested from Oxford University Innovation at https://innovation.ox.ac.uk.

## Practical application

**Method of administration.** Self-administered with paper and pencil.

**Scoring.** Each item is scored from 0 to 4, with 4 denoting most severe. Raw scale scores are then each converted to a metric from 0 to 100, in which 100 denotes the most severe (177). The summary index score is simply calculated as the sum of the three subscale scores and is also converted to a metric from 0 to 100 (179).

**Score interpretation.** Subscale scores and the summary index score range from 0 (representing optimal foot health) to 100 (representing worst foot health). Higher scores therefore represent worse foot health (177). There are no published normative data.

**Respondent time to complete.** Five to 10 minutes.

**Administrative burden.** Calculation of subscale scores takes less than 5 minutes per participant.

**Translations/adaptations.** The MOXFQ has been translated and culturally adapted into Chinese (180), Dutch (181), German (182), Italian (183), Korean (184), Persian (185), Spanish (186), and Turkish (187). Danish, Finnish, Welsh, Lithuanian, Norwegian, and French versions are also available from Oxford University Innovation.

## Psychometric information

**Floor and ceiling effects.** In the original study, no items exhibited a ceiling effect, but 2 items on the 20-item scale exhibited a floor effect and were therefore excluded from the final 16-item version (177). Subsequent studies using the 16-item scale have generally shown floor and ceiling effects of less than 15% (178,182,185,186,188). However, the Spanish version exhibited a 20% ceiling effect for the walking/standing subscale because more than 50% of participants selected the highest score option for items 2 through 6 (186).

**Reliability.** Internal consistency (Cronbach's $\alpha$) in the original study of 100 patients undergoing hallux valgus surgery for each subscale was as follows: walking/standing, 0.92; foot pain, 0.86; and social interaction, 0.73 (177). Similar results were subsequently observed in the translated versions, with the range of Cronbach's $\alpha$ for each subscale as follows: walking/standing, 0.77 to 0.99; pain, 0.78 to 0.98; and social interaction, 0.70 to 0.99 (180–188). Test-retest reliability (intraclass correlation coefficients) in 257 patients undergoing various foot and ankle surgical procedures for each subscale has been reported as follows: walking/standing, 0.96; pain, 0.94; and social interaction, 0.92 (178). Across the various language translations, test-retest reliability has been reported as follows: walking/standing, 0.82 to 0.97; pain, 0.81 to 0.98; and social interaction, 0.82 to 0.96 (180–188).

**Validity.** Content validity was originally examined by using exploratory, semistructured interviews conducted with 10 patients who were attending hospital surgical outpatient clinics for hallux valgus, followed by patients completing and commenting on the MFPDI. This resulted in the rewording of some MFPDI items, the addition of two items specifically addressing pain severity and pain frequency at nighttime, and the increasing of the response categories from three to five per item (177). Criterion validity has not been evaluated because of the absence of a gold standard measure of foot pain or function. Construct validity has been demonstrated by the observation of moderate associations (Spearman's $\rho$) between MOXFQ subscale scores and the AOFAS score (walking/standing, 0.47-0.56; pain, 0.37-0.60; and social interaction, 0.29-48) (177,186,188); the SF-36 physical functioning (walking/standing, 0.53-73; pain, 0.39-0.66; and social interaction, 0.31-0.68), role physical (walking/standing, 0.30-0.64; pain, 0.35-0.66; and social interaction, 0.31-0.63), and bodily pain (walking/standing, 0.32-0.71; pain, 0.36-0.69; and social interaction, 0.27-0.70) subscales (180–188); the FFI (walking/standing, 0.70; pain, 0.71; and social interaction, 0.43) (180); and the EuroQOL 5D (walking/standing, 0.70; pain, 0.71; and social interaction, 0.63) (180).

**Responsiveness.** In the original validation sample of 100 patients undergoing hallux valgus surgery, responsiveness at 12 months (calculated by using effect sizes) was as follows: walking/standing, 1.12; pain, 1.57; and social interaction, 1.52 (177). More recently, similar responsiveness at 6 to 12 months has been reported in patients undergoing a range of foot and ankle surgical procedures: walking/standing, 0.86 to 2.60; pain, 1.10 to 2.30; and social interaction, 0.80 to 2.10 (186,188–190).

**Minimally important differences.** Minimally important differences in 91 patients undergoing hallux valgus surgery have been reported for each of the subscales as follows: walking/standing, 16 points; pain, 12 points; and social interaction, 24 points (25). In 671 patients undergoing a range of foot and ankle surgical procedures, minimally important differences were reported as follows: walking/standing, 16 points; pain, 10 points; and social interaction, 9 points (191).

**Generalizability.** Although the original MOXFQ was focused on evaluating the outcomes of hallux valgus surgery (177), it has also been found to be a useful outcome measure for

other types of foot surgery (178,188). Its application in nonsurgical studies, however, has not been as thoroughly examined.

**Use in clinical trials.** The MOXFQ has been used as an outcome measure in clinical trials of various injection therapies for neuroma (192) and plantar heel pain (193,194), in clinical trials of bracing for ankle fracture (195), and in clinical trials of surgery for hallux valgus (40) and ankle osteoarthritis (196).

### Critical appraisal of overall value to the rheumatology community

**Strengths.** Key strengths of the MOXFQ include its coverage of three distinct domains of foot health (walking/standing, pain, and social interaction), its extensive psychometric evaluation, its availability in several languages, its high test-retest reliability and responsiveness, and ease of completion and scoring.

**Caveats and cautions.** The social interaction subscale does not perform as well as the walking/standing and pain subscales in terms of internal consistency, test-retest reliability, and responsiveness. Footwear difficulties are limited to one item ("I feel self-conscious about the shoes I have to wear"), which may not reflect broader footwear issues related to foot problems.

**Clinical usability.** The MOXFQ is a feasible tool for use in clinical practice (189) and has been endorsed by the British Orthopaedic Foot and Ankle Society and the College of Podiatry (UK) as a standard instrument for assessing patient-reported outcomes after foot surgery (197). An analysis of readability has found that the MOXFQ is suitable for patients with at least fifth-grade level reading skills (139).

**Research usability.** The MOXFQ has been demonstrated to be an excellent tool for the evaluation of foot surgery outcomes, particularly hallux valgus, because it has a robust psychometric profile, has high test-retest reliability, and is highly responsive. Further development is required to assess its performance in nonsurgical studies.

## SELF-REPORTED FOOT AND ANKLE SCORE

### Description

**Purpose.** The SEFAS is a patient-reported foot- and ankle-specific questionnaire adapted in 2012 (198) from the New Zealand Total Ankle Replacement Questionnaire (199), which was originally derived from the Oxford-12 Total Hip Replacement Questionnaire (200).

**Content or domains.** The SEFAS questionnaire assesses different constructs, including pain, function, limitation of function, and other symptoms, that are not separated into domains (198).

**Number of items.** Twelve items.

**Response options/scale.** Five-point Likert scales: specific responses vary across items.

**Recall period for items.** Not stated.

**Cost to use.** Free.

**How to obtain.** The formatted questionnaire can be downloaded from http://www.swedankle.se/.

### Practical application

**Method of administration.** Self-administered with paper and pencil.

**Scoring.** Each item is scored from 0 to 4, in which 0 denotes the most severe and 4 denotes the least severe. Item scores are then summated to range between 0 and 48.

**Score interpretation.** The final score ranges between 0 and 48, in which 0 represents the most severe disability and 48 represents normal function (198). Age- and sex-specific normative data in 779 healthy people aged 20 to 89 years have been published (201).

**Respondent time to complete.** Three minutes (19).

**Administrative burden.** Calculation of the final score takes less than 5 minutes per participant.

**Translations/adaptations.** The SEFAS exists as an English and Swedish version (198). It has been adapted into German (202) and Norwegian (203) versions.

### Psychometric information

**Floor and ceiling effects.** The SEFAS does not demonstrate floor or ceiling effects. In the original study, the Swedish SEFAS was administered to 135 individuals with ankle osteoarthritis undergoing ankle surgery and demonstrated no floor or ceiling effects (198). This was confirmed in a subsequent study of 118 individuals with forefoot disorders and 106 individuals with midfoot, hindfoot, and ankle disorders (204). These findings have been supported for the German SEFAS (202).

**Reliability.** In the original study using the Swedish SEFAS total score, internal consistency (Cronbach's $\alpha$) was evaluated in 62 individuals with forefoot disorders and was 0.96 (198). Similar findings were reported in a subsequent study of individuals with forefoot and midfoot, hindfoot, and ankle disorders (Cronbach's $\alpha$ = 0.84 and 0.86, respectively) (204).These findings were confirmed by using the German SEFAS total score (Cronbach's $\alpha$ = 0.89) (202) and the Norwegian SEFAS total score (Cronbach's $\alpha$ = 0.93) (203). Test-retest reliability (intraclass correlation coefficients) of the SEFAS total score has been reported as follows: Swedish SEFAS, 0.92 to 0.93 (198,204); German SEFAS, 0.97 (202); and Norwegian SEFAS, 0.93 (203).

**Validity.** Content validity was determined by asking a group of orthopedic surgeons, physical therapists, and nurses, as well as 10 patients, to review the items and provide feedback, including the need to revise, exclude, or add items. Minor revisions were made to the items; no items were excluded or added. A separate group of 40 patients with forefoot disorders were then asked to rate the importance of each item from a scale of 1 to 3, in which 1 represented an unimportant item, 2 represented an important item, and 3 represented a highly important item. Items with a mean score of 2 or greater were considered relevant. Item scores ranged from 2.0 to 2.8 (mean score 2.6), indicating good construct validity (204). Criterion validity has not been examined because of the absence of a gold standard measure of foot and ankle pain and function. Construct (convergent) validity has been demonstrated by the observation of moderate associations (greater than or equal to 0.4; Spearman's $\rho$ or Pearson's $r$) between the SEFAS total score and several outcome measures. The SEFAS total score has a moderate association with domains of FAOS: pain, 0.82 to 0.83; other symptoms, 0.50 to 0.70; activities of daily living, 0.68 to 0.77; sport and recreational activities, 0.42 to 0.62; and quality of life, 0.67 to 0.82 (198,204). Moderate associations have been found for the MOXFQ walking/standing problems (0.73), pain (0.73), and issues related to social interaction (0.57) domains and the summary score (0.77) (188). Moderate associations have been found for the SF-36 physical functioning (0.64-0.72), role physical (0.30-0.44), bodily pain (0.71-0.76), vitality (0.46-0.52), and social functioning (0.39-0.51) domains and the physical component summary score (0.51) (198,204). Finally, moderate associations have been found for the EuroQOL 5D index score (0.53-0.76) and the VAS score (0.41-0.65) (198,204).

**Responsiveness.** Responsiveness (6 months, calculated with the effect size and SRM) of the Swedish SEFAS total score was evaluated in 35 individuals with ankle osteoarthritis undergoing replacement or fusion and was 1.44 and 1.00, respectively (198). Additionally, the responsiveness (6 months) of the Swedish SEFAS was evaluated in 66 individuals with forefoot disorders and 70 individuals with midfoot, hindfoot, and ankle disorders undergoing surgery (204). The effect size and SRM were 1.29 and 1.27, respectively, for the forefoot disorders group and 1.05 and 0.99, respectively, for the midfoot, hindfoot, and ankle disorders group. Responsiveness (6 months) of the German SEFAS total score was determined by using 177 individuals undergoing foot and/or ankle surgery for musculoskeletal disorders, and lower responsiveness was reported (effect size 0.71; SRM 0.65) (202).

**Minimally important differences.** The minimally important difference for the Swedish SEFAS calculated in 163 patients undergoing a range of foot and ankle surgical procedures by using an anchor-based approach has been reported to be 5 points (205).

**Generalizability.** The SEFAS was originally developed and validated in individuals undergoing total replacement or fusion surgery for disorders of the ankle (198), but its psychometric properties have also been evaluated in individuals undergoing foot surgery (188,202,204). Its application in nonsurgical studies has not been rigorously examined.

**Use in clinical trials.** The SEFAS has not been used in any randomized trials. However, it has been used in studies investigating clinical improvement following surgery for hallux valgus (206), posterior tibial tendon dysfunction (207), ankle joint disorders (208), and ankle fractures (209,210) as well as studies investigating clinical improvement following ankle fusion and replacement (211). The SEFAS has also been used in studies evaluating clinical improvement following corticosteroid injection for midfoot osteoarthritis (212).

## Critical appraisal of overall value to the rheumatology community

**Strengths.** Key strengths of the SEFAS include it being designed for a range of foot and ankle disorders; it being freely available, fast to administer, and easy to score; its substantial psychometric evaluation (by using the total score rather than separate domains); and its availability in several languages.

**Caveats and cautions.** The SEFAS questionnaire assesses different constructs, including pain, function, limitation of function, and other symptoms, but these were not separated into domains when it was originally developed, and a psychometric evaluation of these domains was not performed (198,204). Psychometric evaluation has not occurred for the English version of the SEFAS. Further psychometric evaluation has primarily occurred in individuals awaiting foot and/or ankle surgery, so the generalizability is limited. Finally, a Rasch analysis has not yet been undertaken.

**Clinical usability.** The SEFAS is a feasible outcome for use in clinical practice. It is simple and efficient to administer and score. However, a significant limitation is that the items that contribute to its domains were not clearly defined when it was originally developed.

**Research usability.** The psychometric properties of the English SEFAS requires further investigation. Additionally, although the total score of the SEFAS (non-English) has undergone substantial psychometric evaluation, the psychometric properties of its domains have not been evaluated.

## VISUAL ANALOG SCALE–FOOT AND ANKLE

### Description

**Purpose.** The VAS-FA was developed in 2006 to evaluate the effectiveness of surgical and nonsurgical interventions for foot and ankle disorders (213).

**Content or domains.** The VAS-FA questionnaire assesses three domains: pain (4 items), function (11 items), and other complaints (5 items) (213).

**Number of items.** Twenty items.

**Response options/scale.** VAS (0-100 mm).

**Recall period for items.** The wording of the items does not specify a recall period. However, participants can be provided with instructions to respond to the items referring to one of three options: 1) the period before the accident/surgery, 2) the period between the accident/surgery and implant removal, or 3) the period since implant removal.

**Cost to use.** Free.

**How to obtain.** The VAS-FA instructions and score form can downloaded from https://www.krankenhaus-rummelsberg.de/fuss-und-sprunggelenkchirurgie/spezielle-methoden-implantate/visual-analog-skala-fuss-und-sprunggelenk-vas-fa/.

### Practical application

**Method of administration.** Self-administered with paper and pencil.

**Scoring.** Each item is scored by using a VAS that ranges from 0 to 100, in which 0 denotes the most severe and 100 denotes the least severe. The scores from each item are summated, and this value is then divided by 20, resulting in a possible total score ranging from 0 to 100. To obtain scores for each domain, the summated scores for the items that make up each domain (pain, 4 items; function, 11 items; other complaints, 5 items) are divided by the number of items for that domain. When there are missing responses to items, the developers recommend dividing the summated score by the number of remaining items (213).

**Score interpretation.** The total score ranges from 0 to 100. Each domain score also ranges from 0 to 100. A score of 0 (for the total score or each domain) represents the most severe state, and 100 represents the least severe state. Normative data from 121 healthy individuals have been published (214).

**Respondent time to complete.** Respondent time to complete is reported to range from 20 seconds to 6 minutes (213,215).

**Administrative burden.** Thirty seconds when using the evaluation matrix provided on the website (213).

**Translations/adaptations.** The VAS-FA was originally presented as a German version with the English translation provided (213) and has subsequently been translated and culturally adapted into Finnish (216), Indian (Malayalam language) (217), Thai (215), and Turkish (218).

### Psychometric information

**Floor and ceiling effects.** No floor or ceiling effects have been reported for the total score of the Thai VAS-FA (215) or the total and domain scores of the Finnish VAS-FA (216). However, several items within each domain (Finnish VAS-FA) have been reported to demonstrate ceiling effects (216).

**Reliability.** Internal consistency (Cronbach's $\alpha$) of the Thai VAS-FA has been reported for the total score as greater than 0.99. Additionally, internal consistency (Cronbach's $\alpha$) of the Turkish VAS-FA total and domain scores has been reported for individuals with foot pain (0.75-0.92) and without foot pain (0.93-0.96) (218). Finally, internal consistency (Cronbach's $\alpha$) of the Finnish VAS-FA total and domain scores was evaluated in 165 individuals who had undergone foot and/or ankle surgery and was reported as follows: total, 0.96; pain, 0.91; function, 0.94; and other complaints, 0.81 (216).

Test-retest reliability of the total score of the Thai VAS-FA in 42 individuals has been reported as 0.99 (95% confidence interval [CI] 0.99-1.00) (215). In addition, test-retest reliability (intraclass correlation coefficients) of the Turkish VAS-FA in 128 individuals (63 with foot disorders and 65 asymptomatic individuals) for the total score and each domain score has been reported as follows: total, 0.93 (95% CI 0.90-0.96); pain, 0.88 (95% CI 0.819-0.928);

function, 0.88 (95% CI 0.82-0.93); and other, 0.93 (95% CI 0.90-0.96) (218). Similarly, test-retest reliability (intraclass correlation coefficients) of the total score of the Finnish VAS-FA was 0.93 (216).

**Validity.** Content validity was not examined in the original study (213). Criterion validity has not been determined because of the absence of a gold standard measure of foot and ankle pain and function. Construct validity has been demonstrated by the observation of moderate associations (greater than or equal to 0.4; Spearman's $\rho$ or Pearson's $r$) between the German VAS-FA total score and the SF-36 domain scores: overall, 0.6; pain, 0.5; function, 0.6; and other complaints, 0.5 (213). Similarly, associations of varying magnitude have been shown between the Thai VAS-FA total score and SF-36 domain scores, with stronger relationships for the physical component summary score (physical functioning, 0.55; role physical, 0.60; bodily pain, 0.61; general health, 0.37) than the mental component summary score (vitality, 0.22; social functioning, 0.36; role emotional, 0.35; and mental health, 0.18), suggestive of good convergent and divergent validity (215). Associations (Pearson's $r$) between the Turkish VAS-FA total and domain scores and the SF-36 (total, 0.34-0.55; pain, 0.03-0.52; function, 0.27-0.32) have been reported in individuals with and without foot pain (218). Supporting these findings, the Finnish VAS-FA total and domain scores have been reported to have associations (Spearman's $\rho$ or Pearson's $r$) with the total score and dimensions of the 15-Dimensional Health-Related Quality of Life Questionnaire, particularly the dimensions of mobility, usual activities, discomfort and symptoms, and vitality (216,219).

Associations (Pearson's $r$) between the Turkish VAS-FA total and domain scores with the FFI (total, 0.40-0.51; pain, 0.47-0.48; function, 0.05-0.53) and FAOS (total, 0.50-0.55; pain, 0.47-0.54; function, 0.34-0.37; other complaints, 0.19-0.28) have been reported for individuals with and without foot pain (218). Supporting these findings, the Finnish VAS-FA total score has been reported to have a strong association (Spearman's $\rho$) with the Lower Extremity Functional Scale (0.86) and the Western Ontario and McMaster Universities Osteoarthritis Index total score and subscales (0.75-0.84) (216,219,220).

**Responsiveness.** Responsiveness of the VAS-FA has not been reported.

**Minimally important differences.** The minimally important difference values for the VAS-FA total score or domains have not been reported.

**Generalizability.** The VAS-FA has broad generalizability. It was originally developed to be used to evaluate the effectiveness of surgical and nonsurgical interventions for foot and ankle disorders (213). Its psychometric properties have been evaluated in individuals with a range of osseous (eg, infection, tumors, fractures, and osteoarthritis) (216–219) and soft tissue (eg, nonspecific arthritis, plantar fasciitis, tarsal tunnel syndrome, tenosynovitis, bursitis, and ankle sprains) disorders of the foot and ankle (218).

**Use in clinical trials.** The VAS-FA has been used in a limited number of randomized trials. These trials include the evaluation of active controlled movement in individuals after surgery for unstable ankle fracture (221), endoscopic versus open excision of symptomatic os trigonum for posterior ankle impingement syndrome (222), intraoperative pedobarography for individuals undergoing foot and/or ankle surgery (223), and extracorporeal shockwave therapy for insertional Achilles tendinopathy (224).

## Critical appraisal of overall value to the rheumatology community

**Strengths.** Key strengths of the VAS-FA include its broad generalizability, its inclusion of two key distinct domains of foot health (pain and function), it being freely available and relatively quick to administer and score, its availability in several languages, its excellent reliability, and its substantial construct validity.

**Caveats and cautions.** The VAS-FA was originally described by using asymptomatic individuals. Content validity has not been evaluated. The VAS-FA is most weighted for the function domain (11 items) relative to the other domains of pain and other complaints (4 and 5 items, respectively). The responsiveness and minimally important difference values have not been reported. Finally, a Rasch analysis has not yet been undertaken.

**Clinical usability.** The VAS-FA is a feasible outcome for use in clinical practice. It is simple and quick to administer and score. The scoring system accommodates for missing values.

**Research usability.** Although the VAS-FA has undergone substantial psychometric evaluation for its construct validity, its content validity, its responsiveness, and the minimally important difference values require evaluation.

## CONCLUSIONS

This review has outlined the most frequently used patient-reported outcome measures that evaluate pain, function, and general health for people with foot and ankle conditions. Table 1 provides a summary of the practical application of each patient-reported outcome measure, and Table 2 outlines the psychometric properties of each patient-reported outcome measure. The outcome measures reviewed have undergone varying degrees of psychometric validation, and each has advantages and disadvantages. The selection of the most appropriate measure is therefore dependent on the context (ie, clinical or research use), the condi-

tion and population being evaluated, and the usability/acceptability to patients or research participants.

Based on our evaluation of the literature, we recommend the use of the FFI-R, FHSQ, or MOXFQ for clinical trials of general foot disorders; the FAAM for sports-related ankle conditions; the LFIS for inflammatory disorders; and the MOXFQ or SEFAS for foot surgery. The MFPDI appears to be better suited to population surveys than clinical trials, and both the FAOS and VAS-FA require more psychometric development (specifically calculation of minimally important difference values and responsiveness and a Rasch analysis) before they can be recommended for research use. Despite being widely used, the AOFAS advises against using the AOFAS scales because of questionable validity and reliability.

Further research is required to improve the performance of foot and ankle outcome measures in both clinical practice and research settings. Specifically, many of these measures lack population-based normative data or minimally important differences, few have undergone Rasch analysis, and few have been validated in populations beyond the initial validation studies. Addressing these shortcomings will help optimize the assessment and management of individuals with musculoskeletal foot disorders.

## AUTHOR CONTRIBUTIONS

All authors drafted the article, revised it critically for important intellectual content, and approved the final version to be published.

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**Table 1.** Practical application*

| Measure | No. of Items | Content/Domains | Method of Administration | Recall Period | Response Format | Range of Scores | Score Interpretation | Availability of Normative Data | Cross-Cultural Validation |
|---|---|---|---|---|---|---|---|---|---|
| AOFAS | AOFAS-AH = 9, AOFAS-M = 7, AOFAS-HJ = 8, AOFAS-LJ = 8 | Pain (1 item), function (5-7 items), and alignment (1 item) | Patient and clinician administered, paper and pencil | Unspecified | Varying Likert scales | 0-100 | Higher scores represent better foot health | Yes | Yes: Dutch, German, Italian, Persian, Portuguese, and Turkish |
| FAAM | 29 | Activities of daily living (21 items) and sports (6 items) | Self-administered, paper and pencil | 1 wk | 5-point Likert scales | 0-100 | Higher scores represent better foot health | Yes | Yes: Brazilian Portuguese, Chinese, Dutch, French, German, Italian, Japanese, Persian, Spanish, and Turkish |
| FAOS | 42 | Pain (9 items), other symptoms (7 items), activities of daily living (17 items), sport and recreational activities (5 items), and foot- and ankle-related quality of life (4 items) | Self-administered, paper and pencil or tablet | 1 wk | 5-point Likert scales | 0-100 | Higher scores represent worse foot health | No | Yes: Chinese, Danish, Dutch, German, Korean, Persian, Thai, and Turkish |
| FFI-R | Long form = 68, short form = 34 | Pain and stiffness (20 items), difficulty (20 items), activity limitation (9 items), and social/emotional issues (19 items) | Self-administered, paper and pencil | 1 wk | 4-point Likert scales | 0-100 | Higher scores represent worse foot health | No | Yes: Brazilian Portuguese, Polish, and Turkish |
| FHSQ | 13 | Foot pain (4 questions), foot function (4 questions), footwear (3 questions), and general foot health (2 questions) | Self-administered, paper and pencil | 1 wk | 5-point Likert scales | 0-100 | Higher scores represent better foot health | No | Yes: Brazilian Portuguese, Valencian, Spanish, French, and Danish |

(Continued)

**Table 1.** (*Cont'd*)

| Measure | No. of Items | Content/Domains | Method of Administration | Recall Period | Response Format | Range of Scores | Score Interpretation | Availability of Normative Data | Cross-Cultural Validation |
|---|---|---|---|---|---|---|---|---|---|
| LFIS-RA | 51 | Impairment/ footwear (21 items) and activity limitation/ participation restriction (30 items) | Self-administered, paper and pencil | At the moment | 2 response options: true and not true | 0-51 | Higher scores represent worse foot health | No | Yes: Dutch, Hungarian, and German |
| MFPDI | 19 | Pain intensity (5 items), functional limitation (10 items), and personal appearance (2 items), plus 2 items about work and leisure activities | Self-administered, paper and pencil | 1 mo | 3 response options: none of the time, on some days, or on most days/every day | 0-34 or 17-51† | Higher scores represent worse foot health | No | Yes: Greek, Portuguese, Spanish, Danish, Dutch, and Chinese |
| MOXFQ | 16 | Walking/standing problems (7 items), pain (5 items), and issues related to social interaction (4 items); an overall summary index score can also be calculated | Self-administered, paper and pencil | 4 wk | 5-point Likert scales | 0-100 | Higher scores represent worse foot health | No | Yes: Chinese, Dutch, German, Italian, Korean, Persian, Spanish, and Turkish |
| SEFAS | 12 | Pain, function, limitation of function, and other symptoms, (that are not separated into domains) | Patient and clinician administered, paper and pencil | Unspecified | 5-point Likert scales | 0-48 | Higher scores represent less severe pain and disability | Yes | Yes: Swedish, German, and Norwegian |
| VAS-FA | 20 | Pain, function, and other complaints | Patient and clinician administered, paper and pencil | Unspecified | Visual analog scales | Total score and each domain: 0-100 | Higher scores represent less severe pain, disability, and symptoms | Yes | Yes: German, Finnish, Indian (Malayalam), Thai, and Turkish |

* AH = ankle/hindfoot; AOFAS = American Orthopaedic Foot and Ankle Society; FAAM = Foot and Ankle Ability Measure; FAOS = Foot and Ankle Outcome Score; FFI-R = Foot Function Index–Revised; FHSQ = Foot Health Status Questionnaire; HJ = hallux metatarsophalangeal-interphalangeal; LFIS-RA = Leeds Foot Impact Scale for Rheumatoid Arthritis; LJ = lesser metatarsophalangeal-interphalangeal; M = midfoot; MFPDI = Manchester Foot Pain and Disability Index; MOXFQ = Manchester-Oxford Foot Questionnaire; SEFAS = Self-Reported Foot and Ankle Score; VAS-FA = Visual Analog Scale–Foot and Ankle.
† Depending on the method used to calculate the scores.

**Table 2.** Psychometrics*

| Measure | Floor, Ceiling Effects | Reliability† | Validity | Responsiveness‡ | Minimally Important Differences | Generalizability | Use in RCTs |
|---|---|---|---|---|---|---|---|
| AOFAS | Ceiling effect for AOFAS-M and AOFAS-LJ | Internal consistency: unknown; test-retest: unknown | Content: no; criterion: no; construct: no | AOFAS-AH: high | AOFAS-AH: 7.9-30.2 | Predominantly orthopedic | Extensive |
| FAAM | Floor effect for sports subscale in certain populations | Internal consistency: excellent; test-retest: excellent | Content: yes; criterion: no; construct: yes | Activities of daily living: very high; sports: very high | Activities of daily living: 3-25; sports: 9-77 | Broad | Extensive |
| FAOS | Ceiling effects | Internal consistency: fair to excellent; test-retest: good to excellent | Content: yes; criterion: no; construct: yes | Pain: moderate to high; other symptoms: low to high; activities of daily living: low to high; sport and recreation: low to high; quality of life: moderate to high | Pain: 7-13; other symptoms: 13-15; activities of daily living: 14-18; sport and recreation: 23-33; quality of life: 22 | Predominantly surgical | Limited |
| FFI-R | No | Internal consistency: excellent; test-retest: unknown | Content: yes; criterion: no; construct: yes | Pain: very high; stiffness: medium to high; difficulty: medium to high (FFI-R short form) | Unknown | Broad | Limited |
| FHSQ | Uncertain | Internal consistency: excellent; test-retest: good to excellent | Content: yes; criterion: no; construct: yes | Pain: very high; function: very high; footwear: low; general foot health: moderate | Pain: 11-13; function: 7-10; footwear: 1-2; general foot health: 0-10 | Broad | Extensive |
| LFIS-RA | No | Internal consistency: unknown; test-retest: good to excellent | Content: yes; criterion: no; construct: yes | Moderate | Unknown | Rheumatoid arthritis | Limited |
| MFPDI | No | Internal consistency: good to excellent; test-retest: poor to good | Content: yes; criterion: yes; construct: yes | Pain intensity: small; functional limitation: small; personal appearance: negligible | Unknown | Broad | Limited |
| MOXFQ | No | Internal consistency: excellent; test-retest: excellent | Content: yes; criterion: no; construct: yes | Walking/standing: moderate to very high; pain: very high; social interaction: very high | Walking/standing:16; pain: 10-12; social interaction: 9-24 | Predominantly surgical | Limited |
| SEFAS | No | Internal consistency: excellent; test-retest: excellent | Content: yes; criterion: no; construct: yes | Very high | Total score: 5 | Predominantly surgical | None |
| VAS-FA | No | Internal consistency: excellent; test-retest: excellent | Content: no; criterion: no; construct: yes | Unknown | Unknown | Broad | Limited |

* AH = ankle/hindfoot; AOFAS = American Orthopaedic Foot and Ankle Society; FAAM = Foot and Ankle Ability Measure; FAOS = Foot and Ankle Outcome Score; FFI-R = Foot Function Index–Revised; FHSQ = Foot Health Status Questionnaire; LFIS-RA = Leeds Foot Impact Scale for Rheumatoid Arthritis; LJ = lesser metatarsophalangeal-interphalangeal; M = midfoot; MFPDI = Manchester Foot Pain and Disability Index; MOXFQ = Manchester-Oxford Foot Questionnaire; RCT = random controlled trial; SEFAS = Self-Reported Foot and Ankle Score; VAS-FA = Visual Analog Scale–Foot and Ankle.
† Descriptors based on the following scale, irrespective of reliability statistics used: poor (<0.40), fair (0.40-0.59), good (0.60-0.74), and excellent (0.75-1.00).
‡ Descriptors based on an aggregate of the responsiveness statistics reported for each measure.