Age- and Gender-Specific Normative Values for the Self-Reported Foot and Ankle Score (SEFAS)

Maria C. Cöster, MD, PhD, Björn E. Rosengren, MD, PhD, Magnus K. Karlsson, MD, PhD, and Åke Carlsson, MD, PhD

Abstract
Background: The Self-Reported Foot and Ankle Score (SEFAS) is a foot- and ankle-specific patient-reported outcome measurement (PROM) score that has been validated with good results for a variety of foot and ankle disorders. SEFAS is sensitive detecting improvement or deterioration after surgery. However, normative values, required to put a specific patient’s summary score into perspective, are lacking.
Methods: In this report, we included 396 population-based men and 383 women (43% of the invited individuals), age 20–89 years, who had completed the SEFAS questionnaire and questions regarding anthropometrics and health. We used Mann-Whitney U test to test gender differences and Spearman correlation coefficients to determine any association between SEFAS score and age. We present gender-specific median SEFAS scores with range and 5th to 95th percentiles and mean with standard deviation.
Results: The SEFAS normative values were median 48 in men (range 11–48), 5th to 95th percentiles 31 to 48 and mean 45 ± 6, and in women, median 47 (range 6–48), 5th to 95th percentiles 23 to 48 and mean 43 ± 8 (gender comparison P < .001). SEFAS normative values correlated inversely with age (r = −0.12, P < .001).
Conclusion: In the general population, older age was associated with lower SEFAS value, and men had higher values than women. The population-based normative SEFAS values provided in this study can facilitate quantification of disability related to foot and ankle with and without surgery in the foot and ankle.
Level of Evidence: Level II, prospective comparative study.

Keywords: SEFAS, foot, ankle, normative values, age categories, gender

Patient-reported outcome measures (PROMs) address the perspective of the patient and are valuable for measuring pain, function, and quality of life. SEFAS is a foot- and ankle-specific PROM based on the New Zealand total ankle questionnaire (NZAQ), with the NZAQ originally derived from the validated Oxford-12 hip questionnaire. The NZAQ was in 2007 translated into Swedish and culturally adapted according to a standardized cross-cultural adaptation procedure. In 2010 we made a few minor changes in the SEFAS score, making it usable for patients with both foot and ankle disabilities. Furthermore, the quality of the SEFAS was assessed using the COSMIN guidelines, with measurement properties face validity, content validity, construct validity, reliability (including internal consistency, test-test reliability, and measurement error), and responsiveness, all with good results. Studies have also examined floor and ceiling effects and minimal important change (MIC) for the score. The SEFAS has recently been compared with the Manchester-Oxford Foot Questionnaire (MOXFQ). The conclusion was that both these PROMs were valid and reliable scores for patients with foot and ankle disabilities. SEFAS is now available and used in the 2 Swedish National registries for foot and ankle surgery Riksfoot and SwedAnkle, recently validated for the German language and is also available in different languages and used in several countries.

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SEFAS has so far only been used to estimate the disability and the changes from before to after operative procedures in different foot and ankle disorders. However, it would be an advantage to be able to relate a SEFAS summary score for a specific patient or group of patients to normative values for SEFAS in the general population. Population-based normative values are available for the generic PROMs SF-36 and EQ-5D, but not for SEFAS or any other region-specific foot and ankle score. The primary aim was therefore to identify, in a population-based cohort of men and women normative, SEFAS values within the ages of 20-89 years. The secondary aim was to evaluate if the normative SEFAS values differed by age and gender.

Methods

Subjects
We invited, by help of Statistics Sweden, a random sample of 1820 age- and gender-stratified men and women of ages 20-89 years (980 men and 840 women) in the Swedish Population Registry (7 592 822 individuals). Statistics Sweden sent letters to the selected individuals and asked them to complete the enclosed Swedish version of the SEFAS questionnaire and answer some general questions regarding anthropometrics, diabetes, inflammatory joint diseases, impaired circulation in the lower leg, paralysis in the leg, and previous surgery on the forefoot, hindfoot, and/or ankle. All side-specific questions were referred to the right foot and/or ankle. For those individuals who did not respond, Statistics Sweden sent 2 additional letters within an interval of 2 to 3 weeks. After the second reminder, 835 individuals (46 %) had returned letters with completed SEFAS. Fifty-six of the 835 completed SEFAS scores had to be excluded, in 52 cases due to incorrectly completed scores and in 4 cases since the study participants were nonwalkers or amputated in the right leg, thereby unable to answer the SEFAS questions concerning pain and function of the foot and/or ankle. This report therefore includes 779 individuals (42.8%) (396 men and 383 women) (Figure 1). In a nonresponder analysis, we compared the 835 individuals who completed the questionnaires with the ones who did not answer. In the responder group, 51.5% were men, 86.3% were born in Sweden, 60.1% were married or lived with a partner, and 64.5 lived in a larger city. The corresponding values for the nonresponders were 55.9%, 75.1%, 39.8%, and 69.8%, respectively. There was a large difference between the groups regarding the marital status, but we believe that this does not affect our results regarding foot and ankle problems.

Self-Reported Foot and Ankle Score (SEFAS)
The SEFAS is a foot- and ankle-specific patient-reported score that has been described in previous publications. In summary, the score contains 12 questions with 5 response options, and each question scores from zero to 4 points. A summary score of zero represents the most severe disability, and 48 represents normal function. The score covers different constructs such as pain, function, and quality of life, not separated in subscales. The measurement properties for the SEFAS have been evaluated with good results in patients with osteoarthritis or inflammatory disease in the ankle joint and in patients with a variety of disorders in the forefoot, midfoot, and hindfoot/ankle. SEFAS did not have any floor or ceiling effects in these patient populations. Minimal important change (MIC) values have been identified to 5 score points, thereby facilitating the use of the score for evaluation of individual patients. Furthermore, in a recent review by Schrier et al, the authors concluded that the SEFAS together with the MOXFQ was identified as the most suitable PROM for assessment of hallux valgus treatment. The English version of the SEFAS score is presented in Figure 2.

Statistical Analyses
We performed statistical calculations with Statistical Package of Social Science (SPSS) software, version 23.0.
The individuals were stratified in 14 strata according to gender and age within the age categories 20-29, 30-39, 40-49, 50-59, 60-69, 70-79, and 80-89 years. Data for the different age categories are presented as numbers, range, mean ± standard deviation (SD), and median together with the 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles.

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<tr>
<th>Question</th>
<th>Options</th>
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<tr>
<td>1. How would you describe the pain you usually have from the foot/ankle in question?</td>
<td>None, Very mild, Mild, Moderate, Severe</td>
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<td>2. For how long have you been able to walk before severe pain arises from the foot/ankle in question?</td>
<td>More than 30 minutes, 16-30 minutes, 5-15 minutes, Less than 5 minutes, Unable to walk at all because of the pain</td>
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<td>3. Have you been able to walk on uneven ground?</td>
<td>Yes, easily, With little difficulty, With moderate difficulty, With extreme difficulty, No, impossible to walk on uneven ground</td>
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<td>4. Have you had to use an orthotic, shoe insert, heel lift or special shoes?</td>
<td>Never, Occasionally, Often, Most of the time, Always</td>
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<td>5. How much has the pain from the foot/ankle in question interfered with your usual work including housework and hobbies?</td>
<td>Not at all, A bit, Moderately, Greatly, Totally</td>
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<td>6. Have you been limping when walking because of the foot/ankle in question?</td>
<td>Never, Only one or two days, Some days, Most days, Every day</td>
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<td>7. Have you been able to climb a flight of stairs?</td>
<td>Yes, easily, With little difficulty, With moderate difficulty, With extreme difficulty, No, impossibly</td>
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<td>8. Have you been troubled by pain from the foot/ankle in question in bed at night?</td>
<td>Never, Only one or two nights, Some nights, Most nights, Every night</td>
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<td>9. How much has pain from the foot/ankle in question affected your usual recreational activities?</td>
<td>Not at all, A bit, Moderately, Greatly, Totally</td>
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<td>10. Have you had swelling of your foot?</td>
<td>None at all, Occasionally, Often, Most of the time, All the time</td>
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<td>11. After a meal (sat at table), how painful has it been for you to stand up from a chair because of the foot/ankle in question?</td>
<td>Not at all painful, Slightly painful, Moderately painful, Very painful, Unbearable</td>
</tr>
<tr>
<td>12. Have you had a severe sudden pain shooting, stabbing or spasm from the foot/ankle in question?</td>
<td>Never, Only one or two days, Some days, Most days, Every day</td>
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**Figure 2.** The English version of the Self-Reported Foot and Ankle Score (SEFAS), a foot- and ankle-specific PROM.
We used Spearman correlation coefficient to estimate associations between the summary score and age and Mann-Whitney U test for gender difference.

The study was approved by the ethics committee of our university and performed according to the Declaration of Helsinki.

**Results**

Gender-specific background data are presented in Tables 1 and 2 and gender-specific SEFAS normative values in Tables 3 and 4 and Figure 3. The SEFAS normative summary scores were in men median 48 (range 11-48), 5th to 95th percentiles 31 to 48, mean 45 ± 6; and in women median 47 (range 6-48), 5th to 95th percentiles 23 to 48, mean 43 ± 8 (gender comparison $P < .001$). None of the individuals had a summary score of zero points whereas 199 men (50%) and 160 women (42%) scored the maximum score of 48 points. The SEFAS normative values correlated inversely with age ($r = −0.12$, $P < .001$ [in men $r = −0.14$, $P = .006$; and in women $r = −0.12$, $P = .02$]).

**Discussion**

We found that the SEFAS normative values in general were lower in individuals with higher than lower ages and in women compared to men. The gender- and age-specific normative SEFAS values presented in this article thus facilitate the interpretation of the summary score of a specific patient in relation to the general population. This applies...
both at the time of diagnosis but also at follow-up after treatment of foot and ankle trauma or foot and ankle disorders regardless of the treatment method chosen.

PROMs are nowadays used in almost all national registries to evaluate treatments of patients with different kinds of disorders and disabilities. SEFAS is a foot- and ankle-specific PROM that has been used to evaluate patient-reported outcome of treatments in patients with flatfoot deformity, ankle osteoarthritis, and hallux valgus. Even if age-, gender-, and country-specific normative values are available for the generic scores SF-36 and EQ-5D, anatomic region-specific normative PROM values improve our ability to evaluate operative procedures in the foot and ankle, because the region-specific PROMs are more sensitive in detecting improvement after surgery than the generic PROMs. This is why normative values have been collected for region-specific scores in the spine, shoulder, knee, and hand, and now in the present study also for a foot and ankle score.

Several foot- and ankle-specific scores are available, such as the Foot and Ankle Outcome Scale (FAOS), the Manchester-Oxford Foot Questionnaire (MOXFQ), the Foot Function Index (FFI), the American Orthopaedic Foot & Ankle Society (AOFAS), and the Low Extremity Functional Scale (LEFS). However, to our knowledge, no population-based normative values are published for any of these. Normative values are missing for FAOS and MOXFQ, whereas FFI, AOFAS, and LEFS have normative values published, but based on examinations of volunteers such as hospital employees. That is, our study provides the first population-based normative foot- and ankle-specific PROM values, reflecting the general population, with data collected in a similar way as for the generic scores SF-36 and EQ-5D. By this approach, we found that

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<th>Table 3. SEFAS Summary Scores for Women Reported in 10-Year Categories.†</th>
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<tr>
<td><strong>SEFAS Score</strong></td>
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<td><strong>Age Category</strong></td>
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Abbreviation: SEFAS, Self-Reported Foot and Ankle Score.
†Data are reported as number of individuals and range, mean ± SD, and 5th to 95th percentiles.

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<th>Table 4. SEFAS Summary Scores for Men Reported in 10-Year Categories.†</th>
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Abbreviation: SEFAS, Self-Reported Foot and Ankle Score.
†Data are reported as number of individuals and range, mean ± SD, and 5th to 95th percentiles.
SEFAS normative values correlated inversely with age, similar to what has been found for the PROMs FFI, AOFAS, and LEFS, and that men have higher SEFAS values than women, similar to the scores SF-36, AOFAS, FFI, and LEF.

We found in this normative sample large ceiling effects. This concept is however not of interest when evaluating groups of individuals without foot and ankle problems. The concern would be if there are large ceiling effects in individuals with foot and ankle problems. We have previously shown that there are not any floor or ceiling effects for SEFAS when evaluating patients with different foot and ankle disorders. This enables us to conclude that the SEFAS can safely be used to measure changes after foot and ankle surgery even if a great proportion in the general population have the highest possible score.

The strengths of this study include the large sample size and the population-based inclusion of both women and men in different ages. Weaknesses include the fact that only 43% of the invited individuals returned usable information and that the normative values may only be applicable to the Swedish population. We therefore suggest that normative SEFAS values are collected in other countries, in line with what has been done for the generic scores SF-36 and EQ-5D.

Conclusion

In this first population-based examination of normative SEFAS values, we found that the SEFAS summary score in general was lower in individuals with higher than lower ages and in women compared to men. The normative SEFAS values presented in this article facilitate the interpretation of the score of a specific patient in relation to the general population. This would apply both at the time of diagnosis and also at follow-up after treatment regardless of the treatment method chosen.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Maria C. Cöster, MD, PhD, Björn E. Rosengren, MD, PhD, and Åke Carlsson, MD, PhD, report grants from Kock’s foundation, grants from Herman Järnhardt’s foundation, grants from Skofondens utvecklingsbransch (the Foot-wear branch), grants from the Region Skane Foundations, during the conduct of the study. Maria C. Cöster, MD, PhD, and Åke Carlsson, MD, PhD, report grants from the Swedish Association of Local Authorities, during the conduct of the study. ICMJE forms for all authors are available online.

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