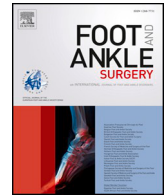




Contents lists available at ScienceDirect

## Foot and Ankle Surgery

journal homepage: [www.journals.elsevier.com/foot-and-ankle-surgery](http://www.journals.elsevier.com/foot-and-ankle-surgery)

## EFAS Score – Validation of Danish Version by the Score Committee of the European Foot and Ankle Society (EFAS)

Martinus Richter<sup>a,\*,1</sup>, Per-Henrik Agren<sup>b,2</sup>, Jean-Luc Besse<sup>c,d,2</sup>, Maria Coester<sup>e,f,2</sup>, Hakon Kofoed<sup>g,2</sup>, Nicola Maffulli<sup>h,i,j,2</sup>, Martijn Steultjens<sup>k,3</sup>, Mick Nielsen<sup>l,4</sup>, Jens Kurt Johansen<sup>m,4</sup>

<sup>a</sup> Department for Foot and Ankle Surgery Rummelsberg and Nuremberg, Schwarzenbruck, Germany

<sup>b</sup> Stockholms Fotkirurgklinik, Sophiahemmet University, Stockholm, Sweden

<sup>c</sup> Laboratoire de Biomecanique et Mecanique des Chocs, Universite Lyon, Lyon, France

<sup>d</sup> Service de Chirurgie Orthopedique et Traumatologique, Hospices Civils de Lyon Centre Hospitalier Lyon-Sud, Pierre-Benite Cedex, France

<sup>e</sup> Department of Surgical Sciences, Uppsala University, Uppsala, Sweden

<sup>f</sup> Department of Orthopaedics and Clinical Sciences, Lund University, Lund, Sweden

<sup>g</sup> Charlottenlund, Denmark

<sup>h</sup> Department of Trauma and Orthopaedic Surgery, Faculty of Medicine and Psychology, Sapienza University of Rome, Rome, Italy

<sup>i</sup> Centre for Sports and Exercise Medicine, Barts and the London School of Medicine and Surgery, Queen Mary University of London, London, UK

<sup>j</sup> Institute of Science and Technology in Medicine, Guy Hilton Research Centre, School of Medicine, Keele University, Stoke-on-Trent, UK

<sup>k</sup> The Science Citizen, Utrecht, the Netherlands

<sup>l</sup> Centre for Evidence-Based Orthopaedics (CEBO), Department of Orthopaedic Surgery, University Hospital Køge, Køge, Denmark

<sup>m</sup> Foot and Ankle Department, Hvidovre University Hospital, Hvidovre, Denmark

### ARTICLE INFO

#### Keywords:

Score  
Foot  
Ankle  
Validation  
Patient reported Outcome Measure (PROM)  
Danish

### ABSTRACT

**Background:** The Score Committee of the European Foot and Ankle Society (EFAS) developed, validated, and published the EFAS Score in 13 languages. Currently, the Danish version completed data acquisition and underwent further validation.

**Methods:** The data were collected pre-operatively and post-operatively at a minimum follow-up of 3 months and mean follow-up of 6 months. Item reduction, scale exploration, confirmatory analyses and responsiveness were executed using classical test theory and item response theory.

**Results:** The internal consistency was confirmed in the Danish version (Cronbach's Alpha 0.88). The Standard Error of Measurement (SEM) was 0.31 and is similar to other language versions. Between baseline and follow-up, 77.2% of patients showed an improvement on their EFAS score, with adequate responsiveness (effect size 1.05).

**Conclusions:** The Danish EFAS Score version was successfully validated in patients with a wide variety of foot and ankle pathologies. All score versions are freely available at [www.efas.net](http://www.efas.net).

© 2024 Published by Elsevier Ltd on behalf of European Foot and Ankle Society.

\* Correspondence to: Score Committee European Foot and Ankle Society (EFAS), European Foot and Ankle Society (EFAS), MCO Congrès - Villa Gaby, 285, Corniche Kennedy, 13007 Marseille, France.

E-mail address: [info@martinusrichter.de](mailto:info@martinusrichter.de) (M. Richter).

<sup>1</sup> Score Committee European Foot and Ankle Society (EFAS): Head and core member.

<sup>2</sup> Score Committee European Foot and Ankle Society (EFAS): Core member.

<sup>3</sup> Score Committee European Foot and Ankle Society (EFAS): Outcome measure development expert and core member.

<sup>4</sup> Score Committee European Foot and Ankle Society (EFAS): National affiliate member.

<https://doi.org/10.1016/j.fas.2024.03.009>

1268-7731/© 2024 Published by Elsevier Ltd on behalf of European Foot and Ankle Society.

### 1. Introduction

The Score Committee of the European Foot and Ankle Society (EFAS) developed, validated, and published the EFAS Score in 13 languages (English, German, French, Italian, Polish, Dutch, Swedish, Finnish, Turkish, Persian, Portuguese, Spanish, Estonian) [1–5]. The EFAS score covers pain and physical function, and is internally consistent, uni-dimensional and responsive to change in samples of orthopaedic foot and ankle surgery patients [1]. The score contains six questions. The maximum score is 24 points (best possible), and the minimum 0 points (worst possible) [1]. Language-specific cross-cultural validation of a given score is necessary because simple translation of a validated score

does not necessarily result in an instrument that provides valid scores in the target language [1]. This issue is especially important for Europe, where numerous languages are spoken [1]. The most widely spoken mother tongues in Europe are German (20%), English (15%), Italian (15%), French (14%), Spanish (9%), Polish (9%), Romanian (6%), Dutch (5%), Hungarian (3%) and Portuguese, Greek, Swedish, Czech and Bulgarian (2% each)[5]. Beyond Europe, Spanish (480 million), English (379 million) and Portuguese (221 million) are among the six most common mother tongues\*. A need for different language-specific (validated) scores was planned at the very inception [1]. After having initially validated the EFAS Score in seven languages (English, German, French, Italian, Polish, Dutch, Swedish), the data acquisition in 14 other languages (Arabic, Cantonese, Catalan, Danish, Estonian, Finnish, Hungarian, Norwegian, Mandarin, Persian, Portuguese, Spanish, Turkish, Welsh) started at different timepoints. The Finnish and Turkish data acquisition, analysis and publication was completed in 2020, Persian in 2021, Portuguese in 2022, and Spanish and Estonian in 2023 [2–5]. Data acquisition in Danish (5.5 million mother tongue in Europe (0.7% from European mother tongues)) was currently completed, and the results of the validation process and the score are presented.

## 2. Methods [1]

The EFAS patient-reported outcome measure (PROM), the ‘EFAS Score’, was developed and validated in three stages: 1) item identification, 2) item reduction and scale exploration, 3) confirmatory analyses and responsiveness [1].

### 2.1. Type of score (initial score development) [1]

A questionnaire-based PROM, with a 5-point Likert scale (0–4) was chosen [1].

#### Questions - Item identification (initial score development) [1].

In the first stage of the initial validation, potentially relevant items from existing questionnaires were identified [1]. Given the low relevance of items related to sports activities for some diagnostic groups, it was decided at this point to develop two separate scores: a general item score and a sports-specific score [1]. In total, 31 general items and 7 sports-specific items were taken forward into the second phase of the project [1].

### 2.2. Item reduction and scale exploration (initial score development) [1]

Through a process of forward and backward translation performed by bilingual translators, the original English pool of 38 items was translated into German, French and Swedish [1]. These four language versions were then used for the Stage 2 data collection [1]. Participants were recruited from orthopaedic foot and ankle surgery departments[1]. Inclusion criteria for participants were clinical and imaging indications for foot and ankle surgery and age  $\geq 18$  years [1]. No exclusion criteria were used other than an inability to complete a written questionnaire [1]. Data collection was performed in France, Germany, Sweden and Ireland [1]. In addition to providing an answer to each item on a 5-point scale, all participants also rated the relevance of the item to their situation on a 5-point scale [1].

Following data collection, the following analytic steps were taken to reduce the item pool into one general PROM and one sports PROM [1].

1. Items with a ceiling effect, low perceived relevance and a high proportion of missing values were noted and shortlisted for exclusion in subsequent steps [1].
2. A principal component analysis (PCA) was performed [1]. At the end of this step, the remaining items in their respective principal

components would provide optimal scale reliability according to classic test theory [1].

3. An item-response theory (IRT) analysis was performed for each of the identified scales (i.e., principal components) to further reduce the number of items and optimize scale unidimensionality [1].

### 2.3. Confirmatory analysis and responsiveness (initial score validation) [1]

Data collection for this final stage of the initial validation took place in the four original language versions, as well as Dutch, Italian and Polish [1].

### 2.4. Confirmatory analysis and responsiveness Danish version

Data collection stage of the validation was performed in Denmark. Inclusion criteria for participants were being scheduled for foot and ankle surgery and age  $\geq 18$  years. No exclusion criteria were used other than an inability to complete a written questionnaire. Data were collected preoperatively and at postoperative follow-up. A minimum postoperative follow-up of 3 months and mean follow-up of 6 months were planned, collecting at least 100 completed score sheets. To confirm the internal consistency for each language version, Cronbach's Alpha of the EFAS Score was computed for each language version separately [1]. To establish the responsiveness of the EFAS Scores, both distribution-based and criterion-based analyses were used [1]. Distribution-based measures of responsiveness included the effect size (ES) and minimal important difference (MID) [1]. The criterion-based measure of responsiveness used was the linear association (Spearman correlation) between improvement on the EFAS Score and a 5-point Likert scale anchor question: did the surgery improve the foot and/or ankle problem? (0 = no, not at all; 4 = yes, very much) [1].

The ES was calculated as the difference between the baseline and three to six-month follow-up mean EFAS Score, divided by the standard deviation of the baseline EFAS Score [1].

The MID was considered to be equal to the standard error of measurement (SEM) of the baseline EFAS Score. The SEM was calculated as [1]:

$$SEM = SD \cdot \sqrt{1 - r} \quad (1)$$

where:

SD = standard deviation of the EFAS Score baseline score.

r = value of Cronbach's Alpha for the EFAS Score at baseline.

To assess the responsiveness of the EFAS Score using the MID, the percentage of participants with an improvement in their EFAS Score between baseline and follow-up exceeding the MID was identified [1].

Statistical analyses were performed in SPSS (IBM SPSS Statistics 28.0.1, IBM, Armonk, NY, USA). The IRT modelling was performed in XCalibre 4 (Assessment Systems, Stillwater, MN, USA).

### 2.5. Ethics

Approvals from the relevant ethical committees in different contributing countries were obtained, adhering to local legislation.

## 3. Results

Table 1 shows the language-specific demographic data and Table 2 diagnoses for the patient samples.

### 3.1. Confirmatory analyses and responsiveness (Table 3)

The internal consistency was confirmed in the Danish version (Cronbach's Alpha 0.88). The Standard Error of Measurement (SEM) was 0.31 and is similar to other language versions. Between baseline

**Table 1**

Demographic data. N = sample size; F = Female; L/R/B = Left/Right/Both; N/A = not available.

n	Age (mean ± SD)	Sex (% F)	Affected side (% L/R/B)
101	55.9 ± 15.9	65.7	42.6/51.5/5.9

**Table 2**

Prevalence of primary diagnoses, in %, based on ICD-10 codes Danish data.

Osteoarthritis (M19)	Deformities (M20-21, Q66)	Soft-tissue disorders (M60-79)	Other musculoskeletal (M)	Other diagnoses
33.3	41.6	5.0	2.0	17.8

**Table 3**

Responsiveness of the EFAS Score Danish version.

Duration of follow up in days: mean (std)	259 (98)
DISTRIBUTION-BASED METRICS	
Effect Size	1.05
SEM (baseline)	0.31
% of patients improving > SEM	77.2
ANCHOR-BASED METRIC	
Pearson correlation between change in EFAS-PROM and patient-reported improvement	0.52

SEM, Standard Error of Measurement

and follow-up, 77.2% of patients showed an improvement on their EFAS score, with adequate responsiveness (effect size 1.05).

#### 4. Discussion

The EFAS Score Committee initially planned clustered publication of more than one score version, and this was successfully executed with seven versions together (English, German, French, Italian, Polish, Dutch, Swedish) initially, two versions together in two following publications (Finnish/Turkish, Spanish/Estonian) [1–3,5]. From the very beginning of this project, the data acquisition times differed markedly between countries, and the COVID crisis further delayed the data acquisition in some countries [5]. To allow for publication without delay caused by

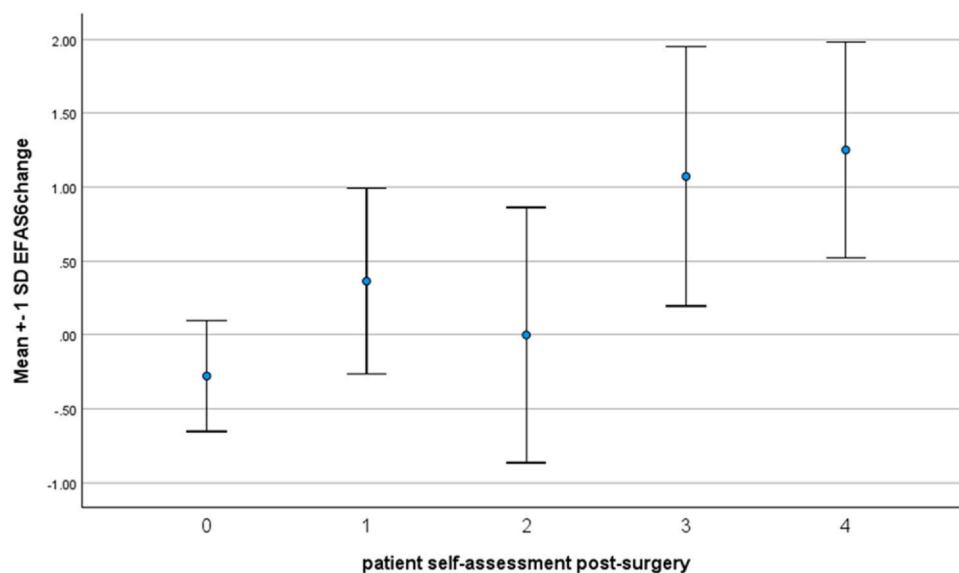
waiting for other versions, Portuguese and Persian versions were published alone [3,4]. Currently, complete data from Danish version was available, and the EFAS Score Committee decided to publish this also without delay. Following the results of the present study, it can be concluded that the EFAS Score was successfully cross culturally validated in Danish. The internal consistency was high and comparable to other language versions [1–3]. The precision (SEM) was adequate and similar to other language versions. Between baseline and follow-up, 77% of patients showed an improvement on their EFAS score, which shows that the Danish EFAS score has adequate responsiveness. Not all measurement properties of the EFAS Score have been established [1–5]. In particular test-retest reliability, i.e. reproducibility of the score in a stable (pre-surgery) population, was not included in the initial validation and the present study [1–5]. The MID as reported in this and the initial validation study was based on the internal consistency of the scale (Cronbach's Alpha) rather than test-retest reliability [1–5]. If the test-retest reliability becomes available, this may lead to an adjustment in the SEM and therefore MID of the EFAS Score. Fig. 1.

The process to develop the EFAS Sports Score was ultimately unsuccessful during the initial validation study [1]. The questions related to sports activities were not relevant to a large proportion of the patient samples, and suffered from a high proportion of missing values [1–3]. This implies that the IRT modelling did not result in a unidimensional EFAS Sports Score [1–5]. Based on the findings of the IRT model, a 4-item EFAS Sports Score could be considered, as this was the best-performing option [1–5]. The EFAS Sports Score was included in the data acquisition of all languages because this was part of the initially defined validation process that was decided not to be changed during the process [1–5].

In conclusion, the Danish EFAS Score version was successfully validated in the orthopaedic ankle and foot surgery patients, including a wide variety of foot and ankle pathologies. All score versions are freely available at [www.efas.net](http://www.efas.net).

#### Acknowledgements

The EFAS Score Committee thanks Jeannette Østergaard Penny and Anna Kathrine Pramming, Centre for Evidence-Based Orthopaedics (CEBO), Department of Orthopaedic Surgery, Zealand University Hospital, Roskilde, Denmark for their valuable contribution to the study.



**Fig. 1.** Association between change in EFAS Score Danish version from pre- to post-surgery and patient self-reported improvement.

## Appendix

Appendix 1, EFAS Score, Danish version.

# EUROPEAN FOOT AND ANKLE SOCIETY (EFAS)

[www.efas.co](http://www.efas.co)

## EFAS Score

Nedenfor finder du 6 spørgsmål relateret til dit fod/ankel problem.

Vær venlig at besvar hvert enkelt spørgsmål ved at vælge det svar som bedst beskriver din situation inden for den sidste uge. Hvert spørgsmål kan besvares på en 5-point skala, med beskrivelser af hvert af skalaens to endepunkter.

Hvis et spørgsmål ikke er relevant for dig, afkryds da venligst I/R i boxen til venstre.

## SPØRGSMÅL

Nr.	Spørgsmål	Svar
1 I/R <input type="radio"/>	Har du smerter i din fod/ankel når du holder dig i ro?	Altid <span style="margin-left: 150px;">1</span> <span style="margin-left: 150px;">2</span> <span style="margin-left: 150px;">3</span> <span style="margin-left: 150px;">4</span> 0 <span style="margin-left: 150px;">1</span> <span style="margin-left: 150px;">2</span> <span style="margin-left: 150px;">3</span> <span style="margin-left: 150px;">4</span>
2 I/R <input type="radio"/>	Hvor langt kan du gå før du får ondt i din fod/ankel?	Umuligt <span style="margin-left: 150px;">1</span> <span style="margin-left: 150px;">2</span> <span style="margin-left: 150px;">3</span> <span style="margin-left: 150px;">4</span> 0 <span style="margin-left: 150px;">1</span> <span style="margin-left: 150px;">2</span> <span style="margin-left: 150px;">3</span> <span style="margin-left: 150px;">4</span>
3 I/R <input type="radio"/>	Hvor meget har din gang (dvs. måden du går på) ændret sig på grund af dit fod og/eller ankel problem?	Ekstrem ændring i gangmønster <span style="margin-left: 150px;">1</span> <span style="margin-left: 150px;">2</span> <span style="margin-left: 150px;">3</span> <span style="margin-left: 150px;">4</span> 0 <span style="margin-left: 150px;">1</span> <span style="margin-left: 150px;">2</span> <span style="margin-left: 150px;">3</span> <span style="margin-left: 150px;">4</span>
4 I/R <input type="radio"/>	Har du problemer med at gå på ujævne overflader?	Altid <span style="margin-left: 150px;">1</span> <span style="margin-left: 150px;">2</span> <span style="margin-left: 150px;">3</span> <span style="margin-left: 150px;">4</span> 0 <span style="margin-left: 150px;">1</span> <span style="margin-left: 150px;">2</span> <span style="margin-left: 150px;">3</span> <span style="margin-left: 150px;">4</span>
5 I/R <input type="radio"/>	Har du smerter i din fod og/eller ankel når du går?	Altid <span style="margin-left: 150px;">1</span> <span style="margin-left: 150px;">2</span> <span style="margin-left: 150px;">3</span> <span style="margin-left: 150px;">4</span> 0 <span style="margin-left: 150px;">1</span> <span style="margin-left: 150px;">2</span> <span style="margin-left: 150px;">3</span> <span style="margin-left: 150px;">4</span>
6 I/R <input type="radio"/>	Hvor ofte har du smerter i din fod og/eller ankel under fysisk aktivitet?	Altid <span style="margin-left: 150px;">1</span> <span style="margin-left: 150px;">2</span> <span style="margin-left: 150px;">3</span> <span style="margin-left: 150px;">4</span> 0 <span style="margin-left: 150px;">1</span> <span style="margin-left: 150px;">2</span> <span style="margin-left: 150px;">3</span> <span style="margin-left: 150px;">4</span>

**Du er nu færdig med spørgeskemaet. Mange tak for dit samarbejde!**

**SPORTS SPØRGSMÅL**

Vær venlig kun at besvare disse spørgsmål hvis du jævnligt deltager i sports aktiviteter.  
Hvis et bestemt spørgsmål ikke passer til din valgte sport, vær venlig at krydse af i I/R  
boksen.

Nr.	Spørgsmål	Svar				
S1 I/R <input type="radio"/>	Kan du løbe?	Umuligt				Ingen begrænsning
		0	1	2	3	4
S2 I/R <input type="radio"/>	Kan du jogge?	Umuligt				Ingen begrænsning
		0	1	2	3	4
S3 I/R <input type="radio"/>	Har du problemer med landing efter hop?	Umuligt				Ingen begrænsning
		0	1	2	3	4
S4 I/R <input type="radio"/>	Er du i stand til at udføre din sport med din sædvanlige teknik?	Umuligt				Ingen begrænsning
		0	1	2	3	4

**References**

- [1] Richter M, Agren PH, Besse JL, Coster M, Kofoed H, Maffulli N, Rosenbaum D, Steultjens M, Alvarez F, Boszczyk A, Buedts K, Guelfi M, Liszka H, Louwerens JW, Repo JP, Samaila E, Stephens M, Witteveen AGH. EFAS Score - multilingual development and validation of a patient-reported outcome measure (PROM) by the score committee of the European Foot and Ankle Society (EFAS). *Foot Ankle Surg* 2018;24(3):185–204.
- [2] Richter M, Agren PH, Besse JL, Coester M, Kofoed H, Maffulli N, Steultjens M, Irgit K, Miittinen M, Repo JP, Uygur E. EFAS score – validation of Finnish and Turkish Versions by the Score Committee of the European Foot and Ankle Society (EFAS). *Foot Ankle Surg* 2020;26(4):250–3.
- [3] Richter M, Agren PH, Besse JL, Coester M, Kofoed H, Maffulli N, Steultjens M, Vosoughi AR, Bahari M. EFAS Score - Validation of Persian Version by the Score Committee of the European Foot and Ankle Society (EFAS). *Foot Ankle Surg* 2021;27(5):496–500.
- [4] Richter M, Agren PH, Besse JL, Coester M, Kofoed H, Maffulli N, Steultjens M, Corte-Real N, Dias R. EFAS score -validation of Portuguese Version by the Score Committee of the European Foot and Ankle Society (EFAS). *Foot Ankle Surg* 2022;28(6):709–13.
- [5] Richter M, Agren PH, Besse JL, Coster M, Kofoed H, Maffulli N, Steultjens M, Alvarez F, Espinal L, Metsna V, Raukas M. EFAS score-validation of Spanish and Estonian Versions by the Score Committee of the European Foot and Ankle Society (EFAS). *Foot Ankle Surg* 2023;29(3):180–7.