Foot and Ankle Surgery xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Foot and Ankle Surgery

journal homepage: www.journals.elsevier.com/foot-and-ankle-surgery

EFAS score – Validation of Mandarin and Cantonese versions by the Score Committee of the European Foot and Ankle Society (EFAS)

Martinus Richter [a,1,*], Per-Henrik Agren [b,2], Jean-Luc Besse [c,d,2], Maria Coester [e,2], Hakon Kofoed [f,2], Nicola Maffulli [g,h,i,2], Martijn Steultjens [j,3], Yong-Zhan Zhu [k,4], Guodong Shen [k,4], Wen-Bo Bai [k,4], Xue Li [k,4]

[a] Department for Foot and Ankle Surgery Rummelsberg and Nuremberg, Schwarzenbruck, Germany
[b] Stockholms Fotkirurgklinik, Sophiahemmet University, Stockholm, Sweden
[c] Laboratoire de Biomecanique et Mecanique des Chocs, LBMC UMR_T 9406, Université Lyon 1, Lyon, France
[d] Service de Chirurgie Orthopedique et Traumatologique, Hospices Civils de Lyon Centre Hospitalier Lyon-Sud, Pierre-Benite Cedex, France
[e] Department of Clinical Surgeries, Uppsala University, University Hospital Uppsala, Sweden
[f] Charlottenlund, Denmark
[g] Department of Trauma and Orthopaedic Surgery, Faculty of Medicine and Psychology, Sapienza University of Rome, Rome, Italy
[h] Centre for Sports and Exercise Medicine, Barts and the London School of Medicine and Surgery, Queen Mary University of London, London, UK
[i] Institute of Science and Technology in Medicine, Guy Hilton Research Centre, School of Medicine, Keele University, Stoke-on-Trent, UK
[j] The Science Citizen, Utrecht, the Netherlands
[k] Department of Foot and Ankle Surgery, Foshan Hospital of Traditional Chinese Medicine, The 8th Clinical Medical College, Guangzhou University of Chinese Medicine, Foshan, China

ARTICLE INFO

Keywords:
Score
Foot
Ankle
Validation
Patient reported outcome measure (PROM)
Mandarin
Cantonese

ABSTRACT

Background: The Score Committee of the European Foot and Ankle Society (EFAS) developed, validated, and published the EFAS Score in 14 languages. Currently, the Mandarin and Cantonese versions 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 Mandarin/Cantonese versions (Cronbach's Alpha 0.83/0.80). The Standard Error of Measurement (SEM) was 0.36/0.35 and is similar to other language versions. Between baseline and follow-up, 80 %/84 % of patients showed an improvement on their EFAS score, with good responsiveness (effect size 1.34/1.52).
Conclusions: The Mandarin and Cantonese EFAS Score versions were successfully validated in patients with a wide variety of foot and ankle pathologies. All score versions are freely available at www.efas.net.

1. Introduction

The Score Committee of the European Foot and Ankle Society (EFAS) developed, validated, and published the EFAS Score in 14 languages (English, German, French, Italian, Polish, Dutch, Swedish, Finnish, Turkish, Persian, Portuguese, Spanish, Estonian, Mandarin/Cantonese (in order of validation))[1–6]. The EFAS score covers pain and physical function, and is internally consistent, unidimensional 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-

* Correspondence to: Score Committee European Foot and Ankle Society (EFAS), European Foot and Ankle Society (EFAS), MCO Congrès - Villa Gaby, 285, Corniche Kennedy, Marseille 13007, France.
E-mail address: efassecretary@mcocongres.com
[1] Score Committee European Foot and Ankle Society (EFAS): Head and core member
[2] Score Committee European Foot and Ankle Society (EFAS): Core member
[3] Score Committee European Foot and Ankle Society (EFAS): Outcome measure development expert and core member
[4] Score Committee European Foot and Ankle Society (EFAS): National affiliate member

https://doi.org/10.1016/j.fas.2025.03.004
1268-7731/

Please cite this article as: M. Richter, P.-H. Agren, J.-L. Besse et al., EFAS score – Validation of Mandarin and Cantonese versions by the Score Committee of the European Foot and Ankle Society (EFAS), Foot and Ankle Surgery, https://doi.org/10.1016/j.fas.2025.03.004

Table 1
Demographic data. N = sample size; F = Female; L/R/B = Left/Right/Bilateral.

	n	Age (mean ± SD)	Sex (% F)	Affected side (% L/R/B)
Mandarin	100	35.1 ± 19.0	44.6	36.6/37.6/25.7
Cantonese	101	37.1 ± 18.3	45.5	42.6/35.6/20.8

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)[6]. 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, 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, Estonian in 2023, and Mandarin/Cantonese in 2024[2–6]. After having covered 65 % of native speakers in Europe and 3 billion total speakers worldwide, the EFAS Score Committee decided to progress with other widespread extra-European languages such as Mandarin and Cantonese[6]. Mandarin is the largest branch of the Sinitic languages (Ethnologue, Wikipedia 2025). Mandarin varieties are spoken by 70 % of all Chinese speakers over a large geographical area, by a total of 1.1 billion native speakers (Ethnologue, Wikipedia 2025). Cantonese is the traditional prestige variety of Yue Chinese, a Sinitic language belonging to the Sino-Tibetan language family, which has over 85 million native speakers (Ethnologue, Wikipedia 2025). Data acquisition in Mandarin and Cantonese 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].

2.2. 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].

Table 3
Responsiveness of the EFAS Score.

	Mandarin	Cantonese
Duration of follow up in days: mean (std)	192 (25)	195 (10)
DISTRIBUTION-BASED METRICS		
Effect Size	1.34	1.52
SEM (baseline)	0.36	0.35
% of patients improving > SEM	80.0	84.0
ANCHOR-BASED METRIC		
Pearson correlation between change in EFAS Score and patient-reported improvement	0.495	0.327

std, standard deviation; SEM, standard error of measurement

2.3. 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 ≥ 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 unidimensional l[1].

2.4. 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].

2.5. Confirmatory analysis and responsiveness Mandarin/Cantonese versions

Data collection stage of the validation was performed in China. Inclusion criteria for participants were being scheduled for foot and ankle surgery and age ≥ 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

Table 2
Prevalence of primary diagnoses, in %, based on International Statistical Classification of Diseases and Related Health Problems (ICD) 10 codes.

	Osteoarthritis (M19)	Deformities (M20-21, Q66)	Soft-tissue disorders (M60-79)	Other musculoskeletal (M)	Other diagnoses
Mandarin	2.0	91.0	7.0	0.0	0.0
Cantonese	1.0	46.5	6.0	30.9	15.6

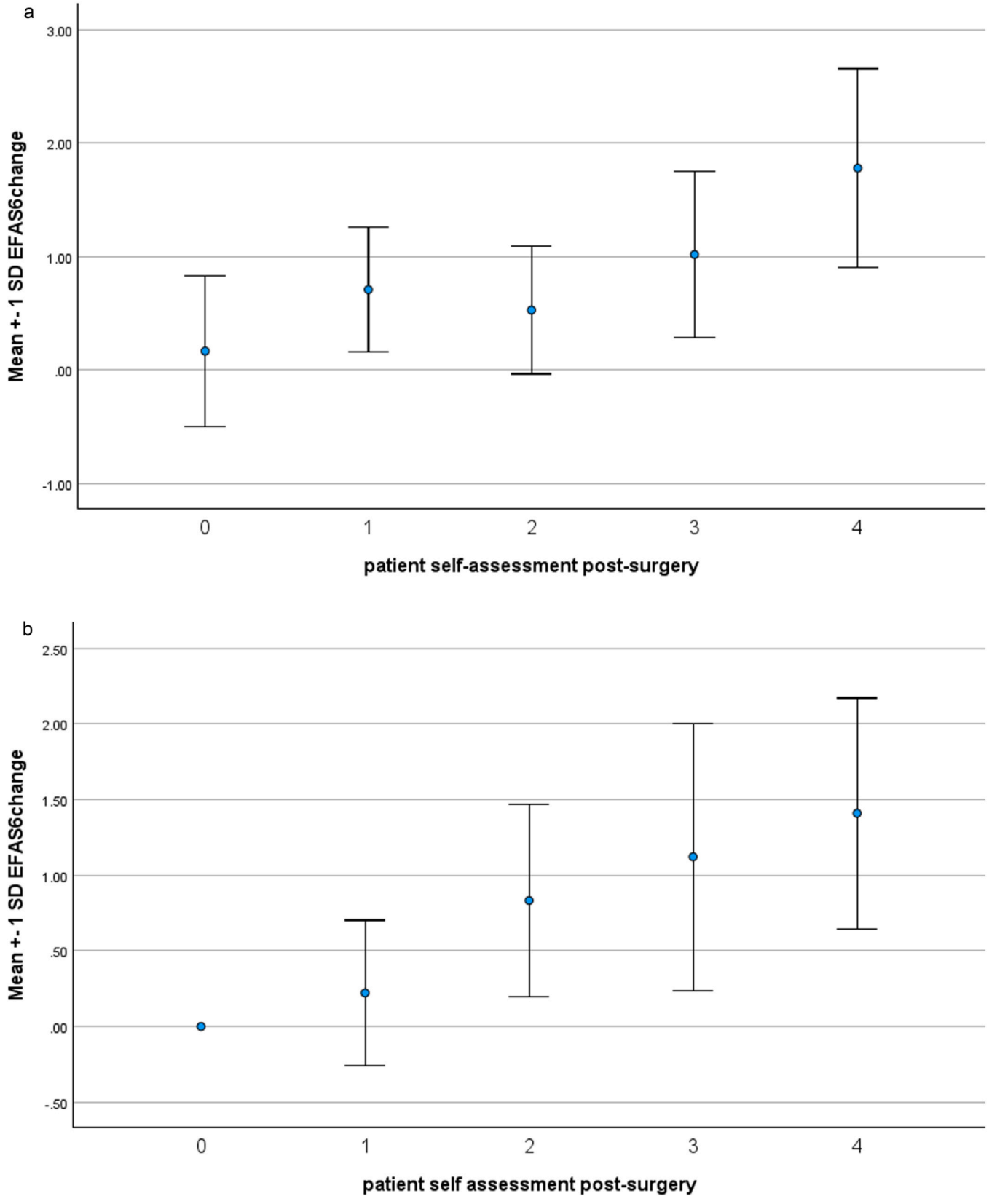

Fig. 1. a and b. Association between change in EFAS Score Mandarin (Fig. 1a)/Cantonese (Fig. 1b) versions from pre- to post-surgery and patient self-reported improvement.

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]:

$$SEM = SD^* \quad \sqrt{1 - r} \tag{1}$$

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).

2.6. 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 Mandarin/Cantonese versions (Cronbach's Alpha 0.83/0.80). The Standard Error of Measurement (SEM) was 0.36/0.35 and is similar to other language versions. Between baseline and follow-up, 80 %/84 % of patients showed an improvement on their EFAS score, with good responsiveness (effect size 1.34/1.52).

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, and 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, the Portuguese, Persian, and Danish versions were published alone [3,4,6]. Following the results of the present study, it can be concluded that the EFAS Score was successfully cross culturally validated in Mandarin and Cantonese. The internal consistency was high and comparable to other language versions[1–3,6]. The precision (SEM) was adequate and similar to other language versions. Between baseline and follow-up, 80 % (Mandarin) and 84 % (Cantonese) of patients showed an improvement on their EFAS score, which shows that the Mandarin and Cantonese EFAS scores have 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 Scores. We observed some differences of the Mandarin/Cantonese cohorts to the previous cohorts from other countries/languages[1–6]. The mean age of the Mandarin/Cantonese cohorts with 35/37 years was lower than the previous cohorts[1–6]. The lowest mean age was so far observed for the Persian cohort with 41 years and the highest for the French cohort with 57 years. The prevalence of osteoarthritis (International Statistical Classification of Diseases and Related Health Problems (ICD) M19) with 2 %/1 % (Mandarin/Cantonese) was lower than all other cohorts except Portuguese with 2 %[1–6]. The highest prevalence of osteoarthritis was observed in the German cohort with 37 %. These wide variances of age and pathologies reflect the international differences do also show the robustness of the EFAS Score.

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[1–3,6]. This implies that the IRT modelling did not result in a unidimensional EFAS Sports Score[1–6]. Based on the findings of the IRT model, a 4-item EFAS Sports Score could be considered, as this was the best-performing option[1–6]. 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 be changed during the process[1–6].

In conclusion, the Mandarin and Cantonese EFAS Score versions were 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.

Declaration of Competing Interest

None

Acknowledgements

The EFAS Score Committee thanks Markus Walther, Schön Klink München Harlaching - FIFA Medical Centre, München, Germany for his valuable networking with the study group in China.

Appendix

Appendix 1, EFAS Score, Mandarin version

欧洲足踝外科协会(EFAS)

www.efas.net

EFAS 分数

下表是 6 个关于您足和踝的问题。

请根据您最近一周的情况对下面的问题进行作答，每个问题设置有 5 分，左右两端为最小值和最大值。

如果问题与你的情况不相符，请勾选左侧的 N/A。

问题

序号	问题	作答
1 N/A ◯	您在休息时是否会感到足和/或踝疼痛?	总是 0 1 2 3 从不 4
2 N/A ◯	您在走多远时，足和/或踝会感到疼痛?	无法行走 0 1 2 3 无限制 4
3 N/A ◯	由于足和/或踝的问题，您的步态（即走路方式）改变了多少?	极端步态改变 0 1 2 3 无改变 4
4 N/A ◯	您在凹凸不平的地面上行走有困难吗?	总是 0 1 2 3 从不 4
5 N/A ◯	当您走路时，足和/或踝会疼痛吗?	总是 0 1 2 3 从不 4
6 N/A ◯	在身体活动时，您的足和/或踝多久会痛?	总是 0 1 2 3 从不 4

运动问题

如果您定期参与体育活动，请回答一下问题。不适用于您体育活动的问题，请勾选左侧的 N/A。

序号	问题	作答
S1 N/A ◯	您能跑步吗?	无法完成 0 1 2 3 无限制 4
S2 N/A ◯	您能慢跑吗?	无法完成 0 1 2 3 无限制 4
S3 N/A ◯	您在跳跃后落地有困难吗?	无法完成 0 1 2 3 无限制 4
S4 N/A ◯	您可否以您常用的技术完成体育活动?	无法完成 0 1 2 3 无限制 4

您已完成了问卷评分，非常感谢您的配合!

Appendix 2, EFAS Score, Cantonese version

欧洲足踝外科协会(EFAS)

www.efas.net

EFAS 分数

下表喺 12 个关于你嘅足和踝嘅问题。

请根据你最近一个星期嘅情况对以下嘅问题进行回答，每个问题设置有 5 个分值，左右两边分别为最小值同最大值。

如果问题同你嘅情况唔符合，请勾选左边嘅 N/A。

问题

序号	问题	作答
1 N/A ◯	你喺休息时有无冇觉得足和/或踝疼痛?	一直都有 0 1 2 3 从来都冇 4
2 N/A ◯	你行几远时候，足和/或踝会感觉到疼痛?	完全唔行得 0 1 2 3 冇限制 4
3 N/A ◯	由于足和/或踝嘅问题，你嘅步态（即喺行路嘅方式）改变咗几多?	极端改变 0 1 2 3 冇改变 4
4 N/A ◯	你喺凹凸不平嘅地面上行路有冇困难?	一直都有 0 1 2 3 从来都冇 4
5 N/A ◯	当你行路嘅时候，足和/或踝有冇疼痛?	一直都有 0 1 2 3 从来都冇 4
6 N/A ◯	喺身体育动嘅时候，你嘅足和/或踝几耐会痛?	一直都有 0 1 2 3 从来都冇 4

运动问题

如果你成日参加运动，请回答以下问题。如果同你嘅体育活动情况问题唔符合，请勾选左边嘅 N/A。

序号	问题	作答
S1 N/A ◯	你可唔可以跑步?	完全唔可以 0 1 2 3 无限制 4
S2 N/A ◯	你可唔可以慢跑?	完全唔可以 0 1 2 3 无限制 4
S3 N/A ◯	你起跳之后落地有冇困难?	完全唔可以 0 1 2 3 无限制 4
S4 N/A ◯	你可唔可以用你平时嘅方式进行运动?	完全唔可以 0 1 2 3 无限制 4

你已完成咗问卷评分，好多谢你嘅配合!

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, Miettinen 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.

[6] Richter M, Agren PH, Besse JL, Coester M, Kofoed H, Maffulli N, Steultjens M, Nielsen M, Johansen JK. EFAS score - validation of danish version by the score committee of the european foot and ankle society (EFAS). Foot Ankle Surg 2024;30(4):294–8.