# Cross-cultural Adaptation and Validation of the French Version of the Diabetic Foot Self-care Questionnaire of the University of Malaga

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Background: Diabetic foot care management is directed at patients with a history of complications, especially those with rising levels of hemoglobin $A_{1c}$, and those who have had diabetes for several years. The aim of this study was to cross-culturally adapt a French-language version of the Diabetic Foot Self-care Questionnaire of the University of Malaga (DFSQ-UMA) for use in France.

Methods: Cross-cultural adaptation was performed according to relevant international guidelines (International Society for Pharmacoeconomics and Outcomes Research), and the factor structure was determined. Internal consistency was measured using the Cronbach a. Item-total and inter-item correlations were assessed.

Results: The French data set comprised 146 patients. The mean 6 SD patient age was 62.60 6 15.47 years. There were 47 women and 99 men. The structure matrix (with three factors) was tested by confirmatory factor analysis. The 16-item questionnaire had a Cronbach a of 0.92. The mean value for inter-item correlations was 0.48 (range, 0.17–0.86). The rotated solution revealed a three-factor structure that accounted for 48.10% of the variance observed. A significant inverse correlation was observed between questionnaire scores and hemoglobin $A_{1c}$ levels ($r$¼–0.17; $P$ , .01).

Conclusions: This study validates the French-language version of the DFSQ-UMA, which can be used as a self-reported outcome measure for French-speaking patients in France.

Foot ulcers affect 15% to 25% of patients with diabetes at some time in their lives, and the associated complications can have a severe effect on persons with this condition.[1]

In general, foot care education for people with diabetes is directed at patients with a history of complications, especially those with rising levels of hemoglobin $A_{1c}$ ($HbA_{1c}$), and those who have had diabetes for several years.[2] In addition, although many studies have focused on preventing ulcers and reducing the risk of amputation,[3-6] very few have sought to determine the level of foot self-care in the population with diabetes mellitus.[2,7-10] In most clinical guidelines, patient education and self-care are recommended to prevent complications of the diabetic foot.[11]

Patient-reported outcome questionnaires are commonly used in this context.[12] However, there must be evidence to support the interpretation of the scores obtained by such instruments.[13]

Many instruments are available for evaluating care and self-care in diabetic patients, including the Neuropathy Total Symptom Score[14] and the Social Support Scale for Self-care in Middle-Aged Patients with Type II Diabetes,[15] but very few specifically address foot self-care, and even these combine questions about self-care with others regarding general care (eg, the Diabetic Foot Ulcer Scale[16] and the Diabetic Foot Ulcer Scale–Short Form[17]). Currently available instruments that more specifically address foot self-care are inadequate in

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various areas, such as having an excessive number of items[18] or having undergone an incomplete or insufficiently rigorous validation process.[8]

On the other hand, a valid and reliable questionnaire to assess foot self-care by diabetic patients without amputation—the Diabetic Foot Self-care Questionnaire of the University of Malaga (DFSQ-UMA)[19]—has been proposed, but to date only the Spanish-language version has been validated.

This study has two main aims: 1) to perform a cross-cultural adaptation of the DFSQ-UMA into French and 2) to determine the psychometric properties of the French-language version of the DFSQ-UMA (DFSQ-UMA-Fr).

## Methods

The study was approved by the medical research ethics committees of the University of Malaga (Spain) and Institute National de Podologie (France) and it was conducted in accordance with the provisions of the Declaration of Helsinki. All of the participants gave their signed consent. They were recruited at the Institute National de Podologie (Paris, France) and the following inclusion criteria were applied: age 18 years or older, diabetic, French mother tongue, and able to read, understand, and complete the questionnaire unaided.

### Cross-cultural Adaptation

The cross-cultural adaptation process was conducted following the guidelines of the International Society for Pharmacoeconomics and Outcomes Research for the translation and validation of patient-reported outcome measures.[20] The process took place in eight stages: 1) forward translation, 2) forward translation reconciliation, 3) back translation, 4) back translation review, 5) harmonization, 6) pilot testing/cognitive debriefing, 7) pilot testing/cognitive debriefing review, and 8) proofreading. The process is summarized in Figure 1.

Forward Translation. Two forward translations into French were performed from the original Spanish version of the DFSQ-UMA by two health professionals, working independently, who were native French speakers, residents of France, and fluent in both Spanish and French. Both translators based their translations on the International Society for Pharmacoeconomics and Outcomes Research guidelines.

Forward Translation Reconciliation. The two forward translations were reconciled into a single version (draft 1) by the two original translators, together with a third, independent translator and with input from the project leader (G.G-N.).

Back Translation. The reconciled French-language version (draft 1) was back translated into Spanish by two professional Spanish native translators resident in France, working independently. These translators had no previous knowledge of the DFSQ-UMA and were not given the original wording of the Spanish version of the DFSQ-UMA.

Back Translation Review. The senior investigator, a native French speaker resident in Spain and fluent in both languages, reviewed the back translation for any discrepancies in meaning or terminology. Any problematic item was discussed until the discrepancies were resolved. This process resulted in a second draft of the French translation (draft 2).

Harmonization. To produce the final French language translation, a harmonization meeting was held with the three French translators, the project leader, and the developer of the original DFSQ-UMA. During this meeting, any discrepancies or issues arising from the back translation were discussed, the translated version of the DFSQ-UMA was evaluated, and a final version was agreed on.

Pilot Testing/Cognitive Debriefing. Once the translation process was completed, the translation was formatted to match the original version. The translated DFSQ-UMA was initially assessed for comprehensibility by five patient participants, who were French residents and native speakers, met the inclusion criteria, and had a low educational background without being illiterate. At this stage, each participant was asked by the in-country investigator to perform the following tasks:

- Complete the translated DFSQ-UMA and note the time needed to do so.
- Comment on the response options provided.
- Comment on any wording that was difficult to understand.
- Suggest alternative wording/phrasing for any wording that was difficult to understand.
- Describe in their own words what the wording meant to them. These responses were recorded verbatim and translated into Spanish. The five patients' responses were summarized by the senior investigator. This summary also reflected the changes, recommendations, and suggestions indicated by the participants and the in-country investigators.

Pilot Testing/Cognitive Debriefing Review. To improve the translated questionnaire, the pilot

Nous aimerions connaitre comment vous prenez soin de vos pieds ;

Merci de bien vouloir choisir la réponse la plus proche de votre réalité ;

Répondre à toutes les questions.

1/En général, est-ce vous-même qui examinez vos pieds ?
- a) Plusieurs fois par jour
- b) Une fois par jour
- c) 2 à 3 fois par semaine
- d) Une fois par semaine
- e) Je ne les examine pas

2/ Surveillez-vous, par vous-même, la présence de blessures ou l'état de la peau de vos pieds ?
- a) Une fois par jour
- b) 2 à 3 fois par semaine
- c) Une fois par semaine
- d) Parfois
- e) Je ne les examine pas

3/ Inspectez-vous l'état de vos ongles ? *ne pas répondre, si vous avez subi une amputation des orteils*
- a) Tous les jours
- b) Une fois par semaine
- c) Une fois toutes les 2 semaines
- d) Une fois par mois
- e) Je ne les examine pas

4/Quel degrés d'importance donnez-vous à la fréquence des soins personnels de vos pieds ?
- a) je considère que c'est très important et je les examine et les soigne quotidiennement personnellement
- b) je considère que c'est assez important, les examine quotidiennement, mais je ne prête pas attention au soin personnel
- c) je considère que c'est important et je les soigne personnellement, bien que je ne les examine pas quotidiennement
- d) je considère que c'est peu important, parfois je les examine et les soigne
- e) je considère que ce n'est pas important, je ne les examine pas et les soigne pas

5/ Je respecte les recommandations sur la façon de prendre soin, moi-même, de mes pieds.
- a) j'ai reçu des informations et je prends soin de mes pieds
- b) j'ai reçu des informations mais je n'en prends pas soin moi même
- c) je n'ai pas reçu d'informations sur le soin des pieds mais j'essaie d'en prendre soin
- d) j'ai reçu des informations sur le soin des pieds mais je n'en tiens pas compte
- e) je n'ai pas reçu d'information, et je ne sais pas comment faire

6/Pour traiter vous-même les lésions de la peau comme des « duretés » et « callosités » :
- a) j'utilise une crème hydratante et une lime douce
- b) j'utilise seulement une lime douce
- c) j'utilise une lame ou un bistouri
- d) j'utilise un produit « callicide »
- e) je ne prête pas attention à mes pieds

7/ Pour sécher les pieds :
- a) j'utilise une serviette spéciale pour mes pieds et je sèche la plante et entre les orteils
- b) j'utilise une serviette spéciale pour mes pieds et je sèche la plante
- c) j'utilise la même serviette que pour le corps et je sèche la plante et entre les orteils
- d) je laisse sécher à l'air libre
- e) je ne peux pas les sécher

8/ Vous est-il difficile de trouver des chaussures confortables à cause de vos pieds ?
- a) ce n'est pas difficile à trouver
- b) c'est un peu difficile à trouver
- c) c'est assez difficile à trouver
- d) c'est très difficile à trouver
- e) c'est impossible à trouver

9/ A quelle fréquence coupez-vous ou traitez-vous vos ongles de pieds ? *ne pas répondre, si vous avez subi une amputation des orteils*
- a) je le fais avec une fréquence de 1 à 15 jours
- b) je le fais avec une fréquence de 15 à 30 jours

Figure 1. Cross-cultural adaptation process. DFSQ-UMA, Diabetic Foot Self-care Questionnaire of the University of Malaga. *(continued on next page)*

c) je le fais avec une fréquence de 1 à 2 mois
d) je le fais avec une fréquence supérieure à 2 mois
e) je ne le fais pas

10/ Vous apparait-il difficile de vous sécher les pieds après la douche ? *ne pas répondre, si vous avez subi une amputation des orteils*

a) ce n'est pas difficile à faire
b) c'est un peu difficile à faire
c) c'est assez difficile à faire
d) c'est très difficile à faire
e) c'est impossible à faire

11/ Vous est-il difficile de trouver des chaussettes adéquates à cause de vos pieds ?

a) ce n'est pas difficile à trouver
b) c'est un peu difficile à trouver
c) c'est assez difficile à trouver
d) c'est très difficile à trouver
e) c'est impossible de trouver des chaussettes adéquates

12/ Concernant les chaussures classiques, avant de les porter :

a) je vérifie qu'il n'y a pas d'objet à l'intérieur, qu'elles soient sans coutures et suffisamment de capacité et cordons ???
b) il est important pour moi qu'elles soient amples et je vérifie l'intérieur
c) il est important pour moi qu'elles soient confortables et souples mais sans le vérifier
d) il est important pour moi que le design soit attrayant/attractif
e) je n'accorde pas d'importance aux chaussures

13/Concernant les chaussettes

a) je m'assure qu'elles soient en fibres naturelles et sans coutures
b) je m'assure qu'elles ne compriment pas la jambe et le pied
c) je porte des chaussettes en fibres synthétiques
d) la matière m'est indifférente
e) je ne porte ni chaussettes ni bas

14/ Concernant les chaussures neuves

a) il est important pour moi qu'elles soient confortables, sinon je les change
b) si elles ne sont pas confortables, j'alterne en portant d'autres plus confortables
c) j'essaie de m'adapter en les portant de temps en temps
d) il n'est pas important pour moi qu'elles soient inconfortables
e) je ne prête pas attention aux chaussures neuves

15/ Concernant les chaussures d'été, lors de forte chaleur

a) je porte des chaussures adaptées à la chaleur (transpiration)
b) j'alterne les chaussures ouvertes et fermées
c) je porte des tongs ou des sandales
d) je marche souvent pieds nu
e) je n'y prête ni attention ni importance

16/ Pour réchauffer les pieds

a) je porte des chaussettes de laine ou de fibres naturelles
b) j'utilise des sources de chaleur comme un poêle ou radiateur
c) j'utilise des bouilloires
d) je fais des bains d'eau chaude
e) je ne m'en soucis guère

Figure 1. continued

test results were reviewed by the in-country investigators. At this stage, any item that caused comprehension difficulties for more than 40% of the participants was reviewed, and any modifications suggested by the respondents were considered for incorporation in the final translated version.

Proofreading. The project leader and another translator not involved in the initial translation process independently proofread the final formatted translation and discussed possible changes. Furthermore, the Flesch Reading Ease test and the Flesch-Kincaid Grade Level test were conducted to determine the readability of the text.[21]

The draft of the DFSQ-UMA, translated and culturally adapted into French for France, was thus finalized and the cross-cultural validation phase begun to obtain the final draft. The following data for each participant were recorded: age, sex, occupational status, education level, and diabetes-related diagnosis.

Once the definitive items were designated, a scale with five options representing the adequacy of the patient's self-care behavior was incorporated into the questionnaire: 1, very inadequate; 2, inadequate; 3, fair; 4, adequate; 5, very adequate. Exceptionally, for some items that explored the frequency of a particular self-care activity, the following scale was

used: 1, never; 2, rarely; 3, sometimes; 4, often; 5, always (Fig. 2).

### Data Analysis

For the descriptive statistics, means, standard deviations, and absolute and relative frequencies were calculated. The normality of the distributions was evaluated by the Kolmogorov-Smirnov test and by analysis of symmetry and kurtosis. Internal consistency was calculated using Cronbach a, for which a score of 0.70 to 0.95 was considered ''good.''[22] Item-total and inter-item correlations were also assessed. Pearson correlations were calculated to assess the convergent validity between DFSQ-UMA and $HbA_{1c}$ level.

Floor and ceiling effects were evaluated, taking values between 1% and 15% as optimal.[23] To evaluate test-retest reliability, a subsample of patients (n ¼ 30) was asked to repeat the questionnaire. Kappa statistics with 95% confidence intervals (CIs) were computed to verify the level of interrater agreement concerning the different care categories (minimum, intermediate, semi-intensive, and intensive).

Exploratory factor analysis was conducted, and the factor structure was determined using principal component analysis with nonorthogonal rotation (oblimin). The Kaiser-Meyer-Olkin test and the Bartlett test of sphericity were used to assess the appropriateness of the sample for the factor analysis. Eigenvalues greater than 1 and a scree plot were used to determine the number of factors. Factor loadings of 0.4 or greater were considered appropriate.[10] Criterion validity was analyzed by parametric and nonparametric correlation coefficients between the questionnaire and $HbA_{1c}$ and glucose levels. This test was conducted because of the high risk of foot complications derived from $HbA_{1c}$ values greater than 7%[24] and the relation between $HbA_{1c}$ levels and patient self-care.

All of the statistical analyses were performed with IBM SPSS Software for Windows, Version 20.0 (IBM Corp, Armonk, New York).

## Results

### Translation and Cross-cultural Adaptation Process

The DFSQ-UMA was translated into French and then culturally adapted (Fig. 1). The resulting text was termed *DFSQ-UMA-Fr* (Fig 2). The pilot test revealed no discrepancies in meaning or terminology between the French and Spanish versions of the questionnaire. Moreover, the respondents did not request assistance in interpreting the questionnaire, and, therefore, no modification to the text was required.

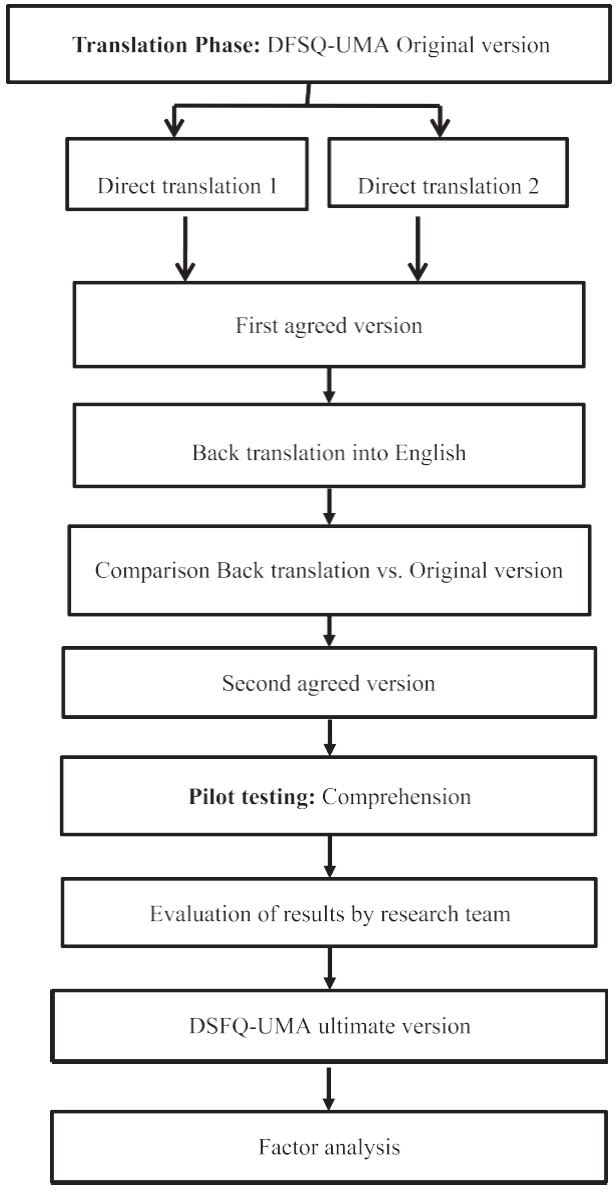


Figure 2. French questionnaire: the Diabetic Foot Self-care Questionnaire of the University of Malaga.

### Evidence of Validity

A total of 146 patients were included in this study, although one was excluded from the data analysis after failing to complete the questionnaire. Of these 146 respondents, 47 were women and 99 were men, with a mean 6 SD age of 62.60 6 15.47 years. The characteristics of the study sample are presented in Table 1.

The mean 6 SD score for each item in the foot health questionnaire was 2.55 6 1.47 points. The highest mean 6 SD score (2.90 6 1.28) was obtained for the question *Do you generally examine your foot yourself?* and the lowest score (2.16 6 1.66) for *Is it hard to find socks that are right for your feet?* Table 2 shows the distribution of the scores. No ceiling/floor effect was detected.

## Reliability Analysis

A Cronbach a of 0.922 was obtained, and the mean value for inter-item correlations was 0.48 (range, 0.17–0.86). Table 2 lists the distribution of scores and item-total correlations. The inter-item correlation matrix is detailed in Table 3.

## Interrater Reliability

Two independent researchers each assessed the foot health of 15 patients using the questionnaire. The interrater levels of agreement ranged from kappa 0.84 (95% CI, 0.37–0.98) to 0.97 (95% CI, 0.93–1.0), and the intraclass correlation ranged from 0.89 (95% CI, 0.78–0.94) to 0.92 (95% CI, 0.81–0.96) (Table 4).

Table 1. Characteristics of the 146 Study Patients

| | Men (n ¼ 99) | ICC | Women (n ¼ 47) | ICC | Total (N ¼ 146) | *P* Value |
|---|---|---|---|---|---|---|
| Age (mean 6 SD [years]) | 61.62 6 16.09 | 56.17–65.11 | 64.07 6 15.53 | 60.3–66.56 | | .02 |
| Duration of diabetes (mean 6 SD [years]) | 13.28 6 10.23 | 12.57–17.16 | 16.37 6 11.42 | 11.67–18.58 | | .187 |
| Glucose (mean 6 SD [mg/dL]) | 129.57 6 37.30 | 128.45–150.28 | 143.23 6 39.77 | 112.14–136.45 | | .470 |
| $HbA_{1c}$ (mean 6 SD [g/dL]) | 7.19 6 1.02 | 7.04–7.36 | 7.02 6 0.89 | 6.59–7.13 | | .057 |
| BMI (mean 6 SD) | 27.02 6 6.34 | 26.65–28.83 | 29.53 6 6.89 | 26.79–29.09 | | .640 |
| Type of diabetes (No. [% by gender] | | | | | | |
| Type I | 8 (61.54) | | 5 (38.46) | | 13 | |
| Type II non–insulin-dependent | 20 (33.9) | | 39 (66.1) | | 59 | .368 |
| Type II insulin-dependent | 34 (45.95) | | 40 (54.05) | | 74 | |
| Educational level (No. [%]) | | | | | | |
| Minimum | 2 (28.57) | | 5 (71.43) | | 7 | |
| Primary | 20 (44.44) | | 25 (55.6) | | 45 | .249 |
| Secondary | 29 (50.87) | | 38 (49.13) | | 67 | |
| University | 26 (70.27) | | 11 (29.73) | | 37 | |

Abbreviations: BMI, body mass index; $HbA_{1c}$, hemoglobin $A_{1c}$; ICC, intraclass correlation coefficient.

Table 2. Descriptive Scores and Reliability of Items

| Item | Score (Mean 6 SD) | Corrected Item-Total Correlation | Cronbach a if Item Deleted |
|---|---|---|---|
| 1. Do you generally examine your foot yourself? | 2.9 6 1.28 | 0.471 | 0.921 |
| 2. Do you look for sores and examine the state of the skin of your feet by yourself? | 2.7 6 1.65 | 0.559 | 0.919 |
| 3. Do you inspect your nails? | 2.67 6 1.48 | 0.619 | 0.917 |
| 4. How important do you consider personal care of your feet? | 2.59 6 1.38 | 0.754 | 0.914 |
| 5. Regarding the recommendations on how to take care of your own feet … | 2.49 6 1.58 | 0.83 | 0.911 |
| 6. To treat skin sores, dry skin patches, and calluses | 2.37 6 1.74 | 0.731 | 0.914 |
| 7. To dry your feet … | 2.49 6 1.49 | 0.763 | 0.913 |
| 8. Is it hard to find comfortable shoes for your feet? | 2.64 6 1.55 | 0.581 | 0.918 |
| 9. How often do your cut or treat your toenails? | 2.87 6 1.08 | 0.267 | 0.925 |
| 10. Is it hard for you to dry your feet after showering? | 2.25 6 1.55 | 0.781 | 0.912 |
| 11. Regarding socks ... | 2.16 6 1.66 | 0.769 | 0.912 |
| 12. Regarding conventional footwear, before using it … | 2.68 6 1.30 | 0.646 | 0.917 |
| 13. Is it hard to find socks that are right for your feet? | 2.7 6 1.38 | 0.41 | 0.923 |
| 14. Regarding new shoes … | 2.44 6 1.6 | 0.712 | 0.914 |
| 15. Regarding summer footwear, with excessive heat, … | 2.6 6 1.37 | 0.716 | 0.915 |
| 16. To warm your feet ... | 2.6 6 0.79 | 0.382 | 0.925 |

Table 3. Inter-item Correlation Matrix

| Item | Item No. 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. | 16. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Do you generally examine your foot yourself? | 1 | | | | | | | | | | | | | | | |
| 2. Do you look for sores and examine the state of the skin of your feet by yourself? | 0.589 | 1 | | | | | | | | | | | | | | |
| 3. Do you inspect your nails? | 0.573 | 0.607 | 1 | | | | | | | | | | | | | |
| 4. How important do you consider personal care of your feet? | 0.529 | 0.508 | 0.596 | 1 | | | | | | | | | | | | |
| 5. Regarding the recommendations on how to take care of your own feet .. . | 0.406 | 0.49 | 0.594 | 0.746 | 1 | | | | | | | | | | | |
| 6. To treat skin sores, dry skin patches, and calluses .. . | 0.31 | 0.351 | 0.46 | 0.64 | 0.701 | 1 | | | | | | | | | | |
| 7. To dry your feet … | 0.387 | 0.492 | 0.518 | 0.667 | 0.666 | 0.675 | 1 | | | | | | | | | |
| 8. Is it hard to find comfortable shoes for your feet? | 0.233 | 0.419 | 0.367 | 0.375 | 0.611 | 0.461 | 0.492 | 1 | | | | | | | | |
| 9. How often do you cut or treat your toenails? | 0.155 | 0.407 | 0.284 | 0.279 | 0.224 | 0.188 | 0.169 | 0.173 | 1 | | | | | | | |
| 10. Is it hard for you to dry your feet after showering? | 0.159 | 0.315 | 0.343 | 0.533 | 0.714 | 0.756 | 0.661 | 0.629 | 0.164 | 1 | | | | | | |
| 11. Regarding socks ... | 0.256 | 0.394 | 0.402 | 0.523 | 0.66 | 0.741 | 0.703 | 0.623 | 0.12 | 0.857 | 1 | | | | | |
| 12. Regarding conventional footwear, before using it .. . | 0.385 | 0.26 | 0.393 | 0.554 | 0.61 | 0.418 | 0.5 | 0.342 | 0.138 | 0.508 | 0.428 | 1 | | | | |
| 13. Is it hard to find socks that are right for your feet? | 0.203 | 0.297 | 0.183 | 0.321 | 0.32 | 0.141 | 0.276 | 0.176 | 0.094 | 0.34 | 0.273 | 0.459 | 1 | | | |
| 14. Regarding new shoes .. . | 0.314 | 0.327 | 0.411 | 0.546 | 0.638 | 0.557 | 0.569 | 0.401 | 0.198 | 0.623 | 0.652 | 0.585 | 0.359 | 1 | | |
| 15. Regarding summer footwear, with excessive heat, … | 0.137 | 0.298 | 0.348 | 0.528 | 0.646 | 0.557 | 0.651 | 0.477 | 0.179 | 0.742 | 0.687 | 0.542 | 0.41 | 0.657 | 1 | |
| 16. To warm your feet ... | 0.225 | 0.108 | 0.261 | 0.273 | 0.253 | 0.339 | 0.212 | 0.115 | 0.037 | 0.372 | 0.298 | 0.442 | 0.409 | 0.344 | 0.306 | 1 |

Table 4. Factor Analysis

| Factor | Component 1 | 2 | 3 |
|---|---|---|---|
| 10. Is it hard for you to dry your feet after showering? | 0.897 | | |
| 7. To dry your feet ... | 0.721 | | |
| 6. To treat skin sores, dry skin patches, and calluses ... | 0.783 | | |
| 15. Regarding summer footwear, with excessive heat, ... | 0.766 | | |
| 11. Regarding socks.. | 0.881 | | |
| 14. Regarding new shoes.. . | 0.636 | | |
| 8. Is it hard to find comfortable shoes for your feet? | 0.703 | | |
| 5. Regarding the recommendations on how to take care of your own feet ... | 0.727 | | |
| 1. Do you generally examine your foot yourself? | | 0.784 | |
| 3. Do you inspect your nails? | | 0.75 | |
| 2. Do you look for sores and examine the state of the skin of your feet by yourself? | | 0.81 | |
| 9. How often do you cut or treat your toenails? | | 0.511 | |
| 4. How important do you consider personal care of your feet? | | 0.581 | |
| 16. To warm your feet ... | | | 0.767 |
| 12. Regarding conventional footwear, before using it ... | | | 0.663 |
| 13. Is it hard to find socks that are right for your feet? | | | 0.758 |

### Construct Validity (Factor Analysis)

The Kaiser-Meyer-Olkin test result was 0.89, and the Bartlett test of sphericity was significant ($P$ , .001). Therefore, the study sampling technique was assumed to be adequate. The rotated solution revealed a three-factor structure for the questionnaire, and these factors jointly accounted for 48.10% of the variance observed: factor 1, (items 5-8, 10, 11, 14, and 15), factor 2 (items 1-4 and 9), and factor 3 (items 12, 13, and 16.)

### Criterion Validity

The correlation between questionnaire scores and $HbA_{1c}$ levels was significant and inverse ($r$ ¼ –0.17; $P$ , .01).

## Discussion

This study provides evidence to support use of the DFSQ-UMA-Fr for French speakers, following the successful translation and cross-cultural adaptation of the original Spanish version. During the pilot study, the participants had no difficulty understanding the questionnaire, and the translated version obtained good results in the readability tests. Further evidence of its validity was provided by factor analysis and assessment of the criterion validity.

In general, the results obtained for the psychometric performance of the DFSQ-UMA-Fr are similar to those of the Spanish version.[19] The DFSQ-UMA-Fr presents excellent internal consistency, with a Cronbach a score of 0.922. Because this is the first cross-cultural adaptation and validation of the DFSQ-UMA, it cannot be compared with other translations.

It has been reported that $HbA_{1c}$ values greater than 7% constitute a risk factor for the development of foot ulcers,[24] and, therefore, we hypothesize that patients with poorer self-care of the feet will tend to have elevated $HbA_{1c}$ values. Accordingly, the DFSQ-UMA-Fr could be used to help detect patients with risk factors for foot ulcers, although further research, with a larger sample, is needed to confirm this hypothesis.

Almost 40% of the patients (n¼ 57) who obtained a questionnaire result of less than 32 points, corresponding to inadequate or very deficient self-care behavior,[19] had $HbA_{1c}$ values of 7% or greater, although the difference is not statistically significant. In addition, these patients with a questionnaire score less than 32 points and $HbA_{1c}$ values greater than 7% may have lower levels of health-related quality of life.[25] However, we lack questionnaire data with which to confirm or reject this possibility.

Questionnaire items 1 (*Do you generally examine your foot yourself?),* 2 (*Do you look for sores and examine the state of the skin of your feet by yourself?),* and 9 (*How often do your cut or treat your toenails?)* received the highest mean scores and may also be those of greatest importance because one of the most dangerous complications of diabetes is the formation of foot ulcers,[4] a condition that can lead to amputation and, in severe

cases, is associated with increased mortality.[26] Therefore, correct self-care of the feet by patients with diabetes could help prevent the formation of ulcers and their consequences.

This study has certain limitations. First, convenience sampling was used, with the patients being recruited exclusively from the National Institute of Podiatry (Paris, France). Nevertheless, although the sample was not prespecified to be explicitly representative, it did include patients of different ages, from different educational backgrounds, and with different types of employment status. Moreover, because the statistical analysis confirmed the validity of the DFSQ-UMA-Fr, the sampling approach is unlikely to have had a significant influence on the conclusions drawn. Because this study validates this French-language version of the DFSQ-UMA specifically for use in France, further cross-cultural validation would be required if the questionnaire were to be used in other French-speaking countries, such as Canada or elsewhere. Finally, it should be acknowledged that the sample size is insufficient for a confirmatory analysis to be conducted to provide the results with more consistency. An increase in the sample size would be in line with the approach taken with the original DFSQ-UMA.

## Conclusions

This study validates the French-language version of the DFSQ-UMA, enabling its use as a self-reported outcome measure for French-speaking patients, both in clinical practice and in the research context.

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