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Original article

An international study of the quality of life of adult patients treated with home parenteral nutrition

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Summary

Background & aims

Home parenteral nutrition-quality of life (HPN-QOL©) is a self-assessment tool for the measurement of QOL in patients on HPN. The aims of this study were: to re-assess the basic psychometric properties of the HPN-QOL© in a multinational sample of adult patients; to provide a description of QOL dimensions by short and long HPN treatment duration; to explore clinical factors potentially associated to QOL scores.

Methods

Patients (n = 699) from 14 countries completed the HPN-QOL©. The questionnaires were analysed to evaluate data completeness, convergent/discriminant validity and internal-consistency reliability. The association of overall QOL and HPN treatment duration as well as other clinical factors were investigated using multivariable linear regression models.

Results

The analysis of the multitrait-scaling and internal consistency indicates a good fit with the questionnaire structure for most items. Item discriminant validity correlation was satisfactory and psychometric evaluation of the HPN-QOL© in the different English, French and Italian language patient sub-groups confirmed psychometric equivalence of the three questionnaire versions. The results of the multivariable linear regression showed that QOL scores were significantly associated with HPN duration (better in long-term), underlying disease (better in Crohn's disease and mesenteric ~~ischemia~~ischaemia) and living status (worse in living alone) and, after adjusting for the other factors, with the number of days of HPN infusion per week.

Conclusions

The HPN-QOL©, is a valid tool for measurement of QOL in patients on HPN, to be used in the clinical practice as well as in research.

Keywords: Home parenteral nutrition; Quality of life; Patient reported outcomes; Intestinal failure

1 Introduction

Intestinal failure is defined as “the reduction of gut function below the minimum necessary for the absorption of macronutrients and/or water and electrolytes, such that intravenous supplementation is required to maintain health and/or growth” [1]. Home parenteral nutrition (HPN) is the primary therapy of chronic intestinal failure (CIF) [2]. The main aims of HPN are to increase long term survival of patients with chronic intestinal failure to improve quality of life (QOL) and to allow socio-economic rehabilitation [3]. Although patients on HPN may not achieve complete return to normality, scores can improve compared to pre-HPN [4].

Although HPN is a life-saving therapy for patients with CIF, it does involve the infusion of nutrients into a central vein, and can radically change the life of patients who may be faced with on-going symptoms of the underlying condition but also live a complex, technology-dependent lifestyle [5]. It is a time-consuming, invasive therapy used in patients who often have physical problems and who have to face many psychological difficulties as well. Anxiety and fear are common reactions to the threat of potentially life-threatening complications of treatment such as severe infection, thrombosis and liver failure [6], which realistically can still occur. Depression, anger, negative self-image and social limitations are frequently reported. Depression has been seen in up to 65% of patients on HPN and may have serious consequences for their therapy as it has been shown to lead to less careful catheter care and social impairment in 55% [7]. All of these factors may impact on QOL. Severe fatigue has been reported as one of the most frequent complaints - in up to 63% of HPN patients [8], which in turn consistently affect daily activities such as work and leisure.

In 2012, the period prevalence of HPN in 16 European countries was estimated to range from 3.25 to 66 patients per million of the population [9]. The most common indication for HPN in adults is short bowel arising from underlying diseases such as mesenteric ~~ischemia~~ ischaemia and Crohn's disease; motility disorders and bowel obstruction due to cancer [7]. About 60–79% of patients in USA and Europe receiving HPN for CIF due to non malignant diseases, survive for five years or more. At 10 years 84% are still dependent on HPN and a significant number of them live for 20 years or more [8–14]. In 2009 ESPEN published guidelines for the use of HPN in adults [15] recognised the lack of studies describing QOL in HPN patients using disease-specific tools and suggested that measurement of the QOL should be patient-based rather than the clinician's perspective.

The HPN-QOL©, a self assessment tool for measurement of QOL in patients on HPN, was originally devised within the Home Artificial Nutrition and Chronic Intestinal Failure (HAN&CIF) special interest group of the European Society for Clinical Nutrition and Metabolism (ESPEN), underwent psychometric validation in a small sample of English patients and was then translated into Danish, Dutch, French, German, Italian, Polish and Spanish to allow for its international use [16].

Hence there is the need of assessing the basic psychometric performance of the questionnaire in a larger number of patients and of translations into other languages as well as to provide a description of QOL dimensions in a sample of patients on HPN collected in different European countries. Moreover it was deemed interesting to explore whether some factors appear to be significantly correlated with patterns/items of QOL.

Therefore the aims of the present study are:

1. to re-assess basic psychometric properties of the HPN-QOL© in a multinational sample and in three most frequent language subsamples: English, French and Italian;
2. to provide a description of QOL dimensions in a sample of international patients, stratified by short and long HPN treatment duration;
3. to explore clinical factors potentially associated to QOL.

2 Methods

2.1 Study design

This is a cross-sectional observational multicentre study promoted by the ESPEN HAN&CIF working group in fourteen European, North American and Australian countries. The research was also supported by the Scientific Committee of ESPEN which assigned a grant to the principal investigator (JB) of the study. Adult patients were recruited; eligible if they were discharged from adult hospital services on HPN. Patients were excluded if they were unable to complete the questionnaire (either self-administered or by interview) because of mental impairment.

2.2 Quality of life measure and data collection procedure

The HPN-QOL© questionnaire was developed as a treatment specific instrument for the assessment of QOL in patients treated with HPN. It has been translated into Danish, Dutch, French, German, Italian, Polish and Spanish, using forward-backward methodology [16]. The French translation was adapted for use in Belgium and French-speaking Canada and the English version adapted for use in the US and Canada. Psychometric small-sample validation of the English version confirmed the scale structure of the questionnaire [17].

The questionnaire contains 7 multi-item functional scales and 1 single-item functional scale, as well as 6 multi-item and 3 single-item symptom scale [17]. The functional scales include General Health (GH), Ability to Holiday or Travel (HT), Coping (CO), Physical Function (PF), Ability to Eat and Drink (ED), Employment (EM), Sexual Function (SX), and Emotional Function (EF). The symptom or problem scales include Body Image (BI), Immobility (IM), Fatigue (FA), Sleep Pattern (SP), Gastrointestinal Symptoms (GI), other Pain (PA), Presence or Absence of a Stoma (ST), Financial Issues (FI), and Weight (WT). Two questions relate to nutrition teams and the availability of an ambulatory pump for infusion of HPN, in which a high score represents a good outcome. The questionnaire ends up with three 0–10 numerical rating scales (NRS) where high scores indicate high QOL. The first is a global QOL question and the other two respectively assess the effect of the underlying illness and of the HPN on overall QOL. The complete English version of the questionnaire can be found in the appendix of the present paper as well as of a previously published paper [17].

The questionnaire was completed by the patients, either self-administered or by interview, either at a scheduled outpatient visit or at home after mail delivery.

Socio-demographic and clinical data including age, gender, educational level, marital and employment status, underlying disease, reason for HPN (life prolonging, quality of life improving or maintaining), duration of HPN, characteristics of the HPN program (day of infusion per week and hours of individual infusion) and functional status, were collected by the treating clinicians.

The study was conducted with full regard to confidentiality of the individual patient. Ethical committee approval was obtained by the individual HPN centers according to local regulations.

2.3 Statistical analysis

The HPN-QOL© was scored according to scoring rules previously reported [17]. When more than 50% of items in a scale or for the whole questionnaire were missing, the scale score or the questionnaire were dropped from analysis on a patient basis; when the number of missed items was ≤50% for a single scale, the mean of the completed items was used for simple imputation. Scale scores were rescaled in order to range from 0 to 100 and, to further improve readability, made uniform so that high scores indicate “good condition” in all scales (i.e high function/good status as well as low symptom or problem intensity).

Psychometric analyses (Aim 1 of the study) evaluated the following aspects: data completeness, convergent/discriminant validity and internal-consistency reliability. Data completeness was measured by the percentages of missing scale scores. Convergent and discriminant validity were assessed through multitrait-scaling analysis [18] which explores the relationships of each item and hypothesized scales. Convergent validity indicates a relevant correlation between an item and the scale it belongs to; corrected for overlap Pearson correlation coefficients ≥0.4 support convergent validity [18]. Discriminant validity is supported whenever a correlation between an item and its hypothesized scale is higher than the correlation with the other scales. Internal-consistency reliability of multi-item scales was measured by Cronbach's alpha; alpha values above 0.7 are generally regarded as acceptable for group comparison [18]. Psychometric analyses were performed on the overall sample and within the three largest language subsamples: English, French and Italian. Items not fitting with the predefined psychometric criteria on the overall sample were evaluated for dropping or modification.

Aims 2 and 3 of the study were addressed with the use of a multivariable linear regression models in which the overall QOL assessment identified by the item 44 (how has your QOL been in the last week?) was handled as the dependent variable. In a first analysis (“main model”) the following variables were considered as predictors: HPN treatment duration (classified as short or long toward a 24-month cut off between reversible and irreversible intestinal failure) [7], age (as continuous covariate), gender, living status, functional status, presence of a stoma, language and underlying disease (all as categorical covariates). ~~Modeling~~ Modelling of the latter variable in particular was optimized by first coding the distinct categories and then backward deleting non-significant ones. The purpose was to avoid redundant categories and the consequent loss of statistical power when testing this covariate. Such an analysis was carried out in the set of 451 records with complete information. A second analysis (“extended model”) was carried out in a set of 424 records adding to the above specified predictors a number of HPN details (indication, type of supply, days and hours of infusion). Although of clinical interest, these features mostly reflected treatment characteristics that were likely tuned on patient and disease characteristics and may thus originate some degree of confounding. For such a reason we followed a “two-step” strategy, whereby the first model was aimed at exploring prognostic effects of patient and disease characteristics, the second one at exploring the effect of treatment details while adjusting for the other factors. Results are reported in terms of estimated regression coefficients beta, corresponding 95% confidence limits (95% CLs) and overall p values at the Wald's test, respectively for the main and extended models. The conventional two-sided 5% level was chosen as the threshold of statistical significance. Statistical analyses were carried out with SAS (version 9.2, SAS Institute, Cary, NC) and R software (version 3.1.1, R Foundation for Statistical Computing, Vienna, Austria) and STATA (version 13).

3 Results

3.1 Patient characteristics

Six hundred and ninety-nine patients accepted to participate into the study and returned the questionnaire. Statistical analyses included 691 patients, after excluding eight questionnaires with more than 50% missing items.

Most patients were women, with a median age of 54 years, were either married or living with a partner and had received at least compulsory school education. The most frequent underlying diseases were Crohn's disease, motility disorders and mesenteric ischaemia. The main reasons for HPN was to prolong life or to improve QOL. Duration of HPN infusion was <2 years in around one third of patients and >10 years in 26.4%. Regarding functional status, around one-third of patients required some or total help.

Despite various reminders to participating centres, many socio-demographic and clinical data collection forms were not returned thus resulting in missing data (see Table 1).

3.2 Psychometric evaluation of the HPN-QOL©

Preliminary multitrait-scaling and internal consistency analyses indicated a bad fit of items 4 (burden of HPN), 20 (ability to socialize), 30 (nausea and vomiting) and 41 (bowel movements) with respect to the original questionnaire structure. These items were therefore excluded from their respective scales (CO, PF, GI and NoST) and regarded as single item scales (Table 2). The two 0–10 NRS items assessing the effect of illness and the effect of HPN on global QOL showed 11% and 12% of missing data, respectively. These figures match with results from the previous validation study where patients reported a difficulty to distinguish between the effect of illness and of HPN on QOL [16]. For these reasons the two items were dropped from the analysis.

Table 1 Socio-demographic and clinical patients characteristics.

alt-text: Table 1

	N	%
Overall	691	100.0
Gender		
Female	348	61.6
Male	217	38.4
Missing	126	–
Age, *years*		
Median (range)	54	(17–94)
Marital status		
Married/with partner	341	65.7
Separated/divorced/widowed	55	10.6
Single	123	23.7
Missing	172	–
Living status		
Alone	95	17.5
With family	413	76.2
With other adults	34	6.3
Missing	149	–
Education		

Less than compulsory	35	7.8
Compulsory school	189	42.4
Post compulsory	155	34.8
University	67	15.0
Missing	245	–
Employment		
Student	19	4.3
Unemployed	107	23.9
Homemaker	43	9.6
Self employed	7	1.6
Part time	51	11.4
Full time	60	13.4
Retired	135	30.2
Other	25	5.6
Missing	244	–
Underlying Disease		
Cancer	38	6.3
Crohn disease	158	26.3
Mesenteric ischaemia	102	16.9
Motility disorders	105	17.4
Radiation Enteritis	47	7.8
Other	152	25.3
Missing	89	–
Predominant indication for HPN		
Short gut	346	60.8
Fistula	12	2.1
Obstruction	122	21.4
Other	89	15.7
Missing	122	–
HPN duration		
1–2 months	9	1.5
3–12 months	93	15.5
13–24 months	95	15.8
25–60 months	119	19.9

61–120 months	125	20.9
more than 120 months	158	26.4
Missing	92	–
HPN supply		
Total	165	29.4
Supplemental	397	70.6
Missing	129	–
HPN days of infusion per week		
Median (range)	5.6	(2–7)
Missing	128	
HPN hours of infusion per day		
2–11 h	190	31.8
12–13 h	290	48.5
More than 13 h	118	19.7
Missing	93	
Functional status		
Independent	425	70.3
Some help	143	23.6
Total help	37	6.1
Missing	86	–
Country		
United Kingdom	127	18.4
Italy	117	16.9
United States	81	11.7
France	76	11.0
Netherlands	64	9.3
Spain	43	6.2
Germany	40	5.8
Belgium	35	5.1
Poland	35	5.1
Canada	32	4.6
Denmark	20	2.9
New Zealand	12	1.7

Australia	9	1.3
Missing	–	–

Abbreviations: HPN: home parenteral nutrition, QOL: quality of life.

Table 2 Results of Item Scaling and Reliability: overall sample[a].

alt-text: Table 2

Scale	k[b]	Mean	SD	Missing %	Item-Internal Consistency[c]	Item-Discriminant Validity[d]	Reliability[e]
Immobility (IM)	5	68	25	1	0.50–0.73	0.03–0.49	0.84
Emotional Function (EF)	4	63	25	0	0.60–0.66	0.02–0.48	0.81
Physical Function (PF)	3	48	26	6	0.52–0.69	−0.04–0.59	0.78
Ability to Holiday/Travel (HT)	2	34	26	5	0.83	0.01–0.30	0.91
Coping (CO)	2	58	27	2	0.57	0.07–0.57	0.73
Ability to Eat/Drink (ED)	2	62	26	4	0.55	−0.04–0.36	0.71
Employment (EM)	2	36	32	5	0.49	−0.09–0.36	0.65
Sexual Function (SF)	2	22	25	17	0.63	−0.07–0.25	0.77
Body Image (BI)	2	66	33	1	0.76	−0.01–0.44	0.86
Fatigue (FA)	2	52	31	0	0.84	0.01–0.55	0.91
Gastrointestinal Symptoms (GI)	2	64	29	4	0.49	−0.07–0.29	0.66
Pain (PA)	2	64	29	0	0.48	0.04–0.41	0.65
Presence of Stoma (ST)	2	70	29	3	0.70	−0.05–0.39	0.82
Absence of Stoma (noST)	2	79	26	5	0.38	−0.01–0.38	0.54
Nutrition Team (NT)	1	77	31	4	–	−0.05–0.14	–
Ambulatory Pump (AP)	1	65	36	0	–	−0.02–0.22	–
General Health (GH)	1	75	24	2	–	0.06–0.32	–
Weight (WT)	1	70	33	0	–	−0.05–0.38	–
Sleep Pattern (SP)	1	60	35	0	–	0.01–0.35	–
Financial Issue (FI)	1	75	32	6	–	−0.09–0.26	–
Burden of HPN (item 4)	1	66	30	1	–	0.05–0.50	–
Ability to socialize (item 20)	1	50	33	2	–	−0.10–0.23	–
Nausea and vomiting (item 30)	1	74	32	0	–	0.06–0.35	–
Bowel movements (no stoma) (item 41)	1	46	33	5	–	−0.29–0.19	–
QOL Numeric Rating Scale (NRS)	1	58	21	3	–	0.14–0.53	–

a n = 691.

b Number of items.

[c] Range of correlations between items in the scale.

[d] Range of correlations between each item in the scale and other scales.

[e] Internal-consistency reliability (Cronbach's alpha).

Results of psychometric analyses carried out on the modified questionnaire structure are shown in Table 2. Most scale-specific average scores were consistently around 60 to 70, with the exception of sexual function, holiday/travel, employment and physical function which scored below 50. Item level missing-value rates -not shown in Table 2- were low, ranging from 0% to 6%, except for the two items related to sex (17% and 20% missing). Accordingly, completeness was good for most scales (Table 2), the only exception being sexual function (17% of missing), likely because of sensitivity issues in this area for some patients. Lower boundaries of item-internal consistency ranges indicate that all items in the questionnaire showed a satisfactory correlation with their own scale (≥0.4), with the only exception of items 42 ("difficulty with bowel movements") and 43 ("painful bowel movements") in the No-stoma scale (0.38 internal correlation). Item-discriminant validity correlation figures (Table 2) were also satisfactory for all the comparisons performed. QOL NRS in particular yielded a median correlation with other scales of 0.32, data not reported in table (range 0.14–0.53, 5 correlations>0.4). Internal consistency reliability was good for most of the multi-item scales, with Cronbach's α coefficients generally higher than the 0.70 benchmark, or only slightly below the benchmark for EM (α = 0.65), GI (α = 0.66), PA (α = 0.65) and noST (α = 0.54).

Psychometric evaluation of the HPN-QOL© in the different English, French and Italian language patient sub-groups (Supplementary Tables A1, A2 and A3) provided results similar to those in the overall sample, thus confirming the good quality of these cultural adaptations.

3.3 Investigation of QOL associated factors

Results of the multivariable linear regression modelling are shown in Table 3. In the "main model" age, gender, functional status, presence of stoma and language failed to achieve statistical significance. Better overall QOL scores were observed in patients with HPN duration longer than 24 months compared to patients with shorter duration (beta = 0.55, 95% CL: 0.12, 0.98; P = 0.013). With the procedure described in the Methods Section, two clusters were detected for underlying disease in terms of outcome. Better QOL was observed in patients with Crohn disease or mesenteric ischaemia compared to patients with other diseases (cancer, motility disorders, radiation enteritis or unspecified conditions). The corresponding beta coefficient was 0.65 (95% CL: 0.25, 1.06; P = 0.002). As regards living status, patients living alone tended to be disadvantaged in terms of QOL outcome compared to patients not living alone (beta = −0.64, 95%CL: −1.18, −0.10; P = 0.021). The whole profiles of standardized scale-specific scores according to HPN duration, underlying disease and living status are shown in Figs. 1–3. Out of 20 scales, a higher score was observed in 11 scales in patients with an HPN duration >2 years, in 16 of those with Crohn's disease or mesenteric ~~ischemia~~ ischaemia and in 12 of those not living alone.

Table 3 Results from the multivariable regression modelling used to investigate the factors associated with overall QOL.

alt-text: Table 3

Category (reference)	Beta (95% CI)	P
Main model (N = 451)[a]		
Age, years		
IQ range: 44–64	−0.9 (−3.6–1.9)	0.543
Gender		
Male (female)	0.4 (−3.7–4.4)	0.862
Underlying disease		
Crohn/Ischaemia (other)	6.5 (2.5–10.6)	0.002
Living status		
Alone (not alone)	−6.4 (−11.8−−1.0)	0.021
Functional status		
Some help (independent)	−1.6 (−6.3–3.1)	0.700
Total help (independent)	1.6 (−6.8–9.9)	

Stoma		
Yes (no)	−3.7 (−7.7–0.3)	0.073
HPN duration		
Long (short)	5.5 (1.2–9.8)	0.013
Language		
French (English)	3.6 (−2.1–9.3)	0.053
Italian (English)	−3.1 (−8.9–2.6)	
Other (English)	3.8 (−1.6–9.2)	
Extended model (N = 424)[b]		
Indication		
Obstruction (short gut)	−1.3 (−7.7–5.2)	0.468
Other/fistula (short gut)	−4.1 (−10.7–2.5)	
HPN supply		
Total (supplemental)	2.2 (−2.8–7.2)	0.392
HPN days of infusion per week		
IQ range: 4–7	−4.7 (−8.9−−0.5)	0.028
HPN hours of infusion per day		
12–13 (<12)	−5.1 (−10.5–0.3)	0.140
>13 (<12)	−5.7 (−12.2–0.8)	

Abbreviations: QOL: quality of life, CI: confidence interval, IQ: interquartile, HPN: home parenteral nutrition.

[a] Main model: HPN characteristics excluded because dependent on the underlying disease.

[b] Extended model: assessment of the HPN characteristics adjusted for the remaining factors.

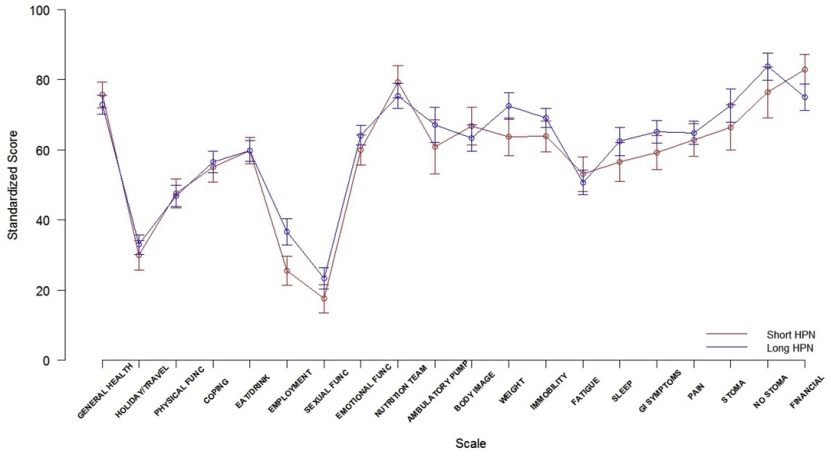

Fig. 1 Profiles of standardized scale scores according to HPN duration.

alt-text: Fig. 1

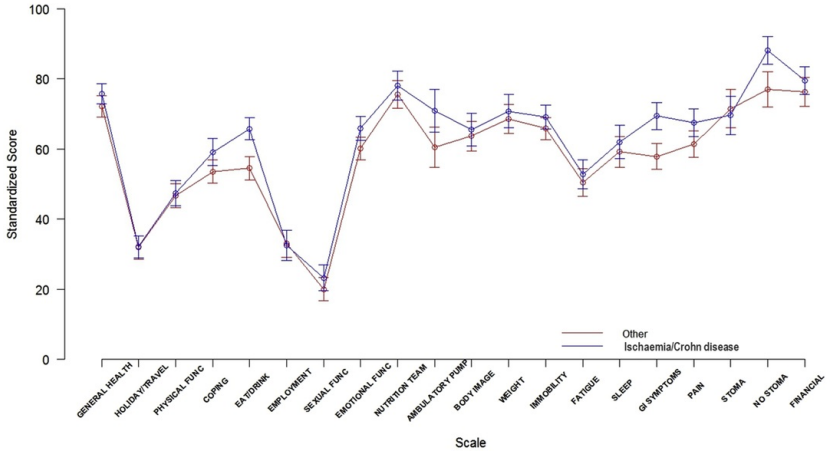

Fig. 2 Profiles of standardized scale scores according to underlying disease.

alt-text: Fig. 2

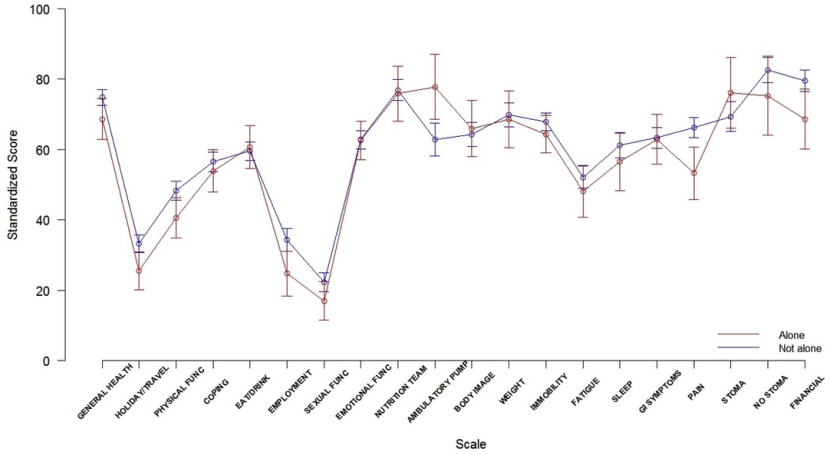

Fig. 3 Profiles of standardized scale scores according to living status.

alt-text: Fig. 3

The “extended model”, investigating the role of the HPN characteristics adjusted for the other factors showed a significant result only for HPN days of infusion per week. In particular, the negative coefficient denoted a worsening overall QOL for an increasing number of infusion days.

4 Discussion

This paper represents the final step of a research on QOL of HPN patients carried out on behalf the HAN&CIF Special Interested Group of ESPEN. It started with a review of the instruments used to assess QOL of adult patients with CIF receiving HPN and an evaluation of the state of art of this topic [3,19] and then progressed with generation of QOL issues, production of a provisional questionnaire and its pre-testing [16]. The scale structure of the questionnaire was initially tested with regard to reliability and validity in a preliminary sample of 100 patients and showed positive results under the psychometric and clinical profile [17].

The present study went further by analyzing the psychometric properties of the questionnaire in a wider multi-language sample. In particular, multitrait-scaling and internal consistency analyses indicated a good fit with respect to the original questionnaire structure for most items. Exceptions were items 4 (burden of HPN), 20 (ability to socialize), 30 (nausea and vomiting) and 41 (bowel movements) which failed to upload to their respective scales and had to be considered as separate single item scales. Also items 42 ("difficulty with bowel movements") and 43 ("painful bowel movements") in the No-stoma scale showed borderline internal correlation (0.38). The explanation for the poor consistency of these items is only hypothetical and probably reflects the heterogeneity of patients population on HPN. For instance, patients with a low burden of disease-related symptoms may overestimate the burden related to the management of HPN. In contrast, patients requiring intensive treatment of their primary disease/condition may understand HPN as an invaluable help and willingly accept it. A similar explanation may apply for the items regarding "bowel movements" since some patients (i.e. those on HPN for chronic intestinal obstruction) may consider "frequent bowel movements" as positive, whereas for others (e.g. patients with short bowel syndrome) it might indicate the need for an increase of the HPN volume, hours and/or days of infusion to compensate for the excessive fluid loss. Item discriminant validity analysis showed satisfactory correlation figures for all the comparisons performed; this confirms the non-overlapping meaning of distinct scales. Finally psychometric evaluation of the HPN-QOL© in the English, French and Italian language patient sub-groups provided results quite similar to those in the overall sample, thus confirming the psychometric equivalence of the questionnaire in the three language versions.

The "main model" of the multivariable linear regression showed that QOL score was significantly dependent on the type of the underlying disease, the duration of the HPN treatment and the living status. The "extended model" indicated that, when adjusted for factors identified by the "main model", the number of days of HPN per week has also a significant impact of QOL. Better QOL scores were observed in patients with Crohn disease or mesenteric ~~ischemia~~ ischaemia compared to patients with other kinds of disease (cancer, motility disorders, radiation enteritis or unspecified conditions). By showing better overall QOL in patients with longer HPN duration, this study is in agreement with the results of previous works [20,21] indicating that patients are able to cope with their illness over time with a possible improvement in QOL. Although reasonable, this interpretation must be taken with caution considering that the cross-sectional study design does not allow the more direct assessment of time trends that would be possible with a longitudinal design. As a matter of fact, the QOL is influenced by the gastrointestinal illness and the effects of HPN treatment. To disentangle these effects, it would be necessary to prospectively study QOL scores in a cohort of patient candidate to HPN prior and after HPN. Such a kind of evidence cannot be achieved by a cross-sectional study like the present one. The finding that living alone is associated with worst QOL scores was also expected and can be explained by the complex technology of HPN administration that requires expertise in managing aseptic techniques as well as the invaluable role of an always available caregiver. Also, it is expected that the population as a whole living alone is associated with lower QOL. A number of studies have assessed QOL of patients requiring HPN but their results cannot be compared with this study, as the majority of these studies relied on generic QOL tools that were not tailored to, or validated in this patient population [19].

The actual role of HPN characteristics on QOL of patients with CIF, such as days of infusion per week and hours of infusion per day, is a key question. Indeed, HPN is the primary therapy of CIF and therefore is dependent on the characteristics of the underlying disease as well as pathophysiological mechanism of CIF [1]. In a previous short term prospective follow up study on a small patient population, where QOL assessment was performed using the SF-36, a generic assessment tool, it was observed that the reduction of QOL was associated with an increase of HPN days of infusion per week. That result was considered to represent a deterioration of the intestinal failure [22]. Nevertheless, this study demonstrates that when adjusted for the major factors influencing QOL, the number of HPN infusion per week plays a significant role. This would be in agreement with data of a study on patients with short bowel syndrome, where QOL was assessed using a validated SBS-QOL™ scale [23]. In this cohort of patients, having the same underlying disease characteristics, the reductions of the volume of HPN infusion (and therefore of hours and/or days of infusions) were associated with improvements in QOL scores. In 2014, the ESPEN HAN&CIF group carried out an international multicentre study aimed to identify the top 3 most important outcome indicators (out of a list of 9 proposed), according to patients' perspectives [24]. QOL was the third of the top 3 indicators, the incidence of catheter-related infection and survival rate being the first two. Interestingly, for 1 of the 9 outcome indicators (freedom and independence), there was a significant difference among patients categories based on HPN regimen (number of HPN day per week) and on HPN experience. Independence was rated more important for less experienced patients (HPN duration <2 years). Most of the less experienced patients received HPN 7 days per week, whereas experienced patients had between 3 and 6 HPN days per week. Concerning the HPN regimen, patients with 6 or 7 HPN days consistently found independence important. This was not the case for patients with 5 HPN days or less per week [24]. Patients were also asked to propose new indicators. Among those, two new indicators related to QOL were identified "keeping the problems related to my underlying disease as low as possible" and "maximizing HPN-free days" [24]. Overall, our results and those from previous studies suggest that the burden of the underlying disease would play a primary role in determining QOL of patients on HPN for CIF and that, after optimizing the disease control, QOL could be further improved by reducing the HPN burden as lower as possible.

There are a few limitations of this study. In the first place, information on socio-demographic and clinical data was not complete for 35.5% of the patients originally entered into the study. This was due to administrative problem in some centres which performed only patient reported outcome assessment with HPN-QOL©. Secondly, in spite of the considerable overall sample size, the number of patients for some language versions (German, Dutch, Danish, Polish and Spanish) was too small for allowing distinct psychometric testing. More language specific data will be likely available if the HPN-QOL© becomes embedded into routine clinical practice. The measurement of QOL should be included in the list of clinical quality indicators identified as part of the global attempt at raising the quality of clinical care [19]; particularly since most patients were provided with HPN to either maintain or improve QOL. Finally, this study design could not address HPN-QOL© questionnaire's test-retest reliability and responsiveness to change, and these aspects will have therefore to be assessed in future studies.

In conclusion, this investigation sought to respond to the lack of evidence regarding QOL assessment in patients undergoing HPN, and thus has the potential to integrate ESPEN guidelines. The results have both theoretical and

practical implications. Many clinical services are inviting patients to respond to Patient Reported Outcome Measures including QOL and satisfaction with the service they receive. By embedding the assessment of QOL into routine clinical care clinicians will be provided with the necessary outcome evidence that ensures good 'patient centred care [25].

Statement of authorship

JPB designed the HPN-QOL© questionnaire and drafted the manuscript; DG, CB and LM performed data analysis and contributed to manuscript writing; FB and LP contributed to manuscript writing. All authors executed the study and reviewed the manuscript. PMF was the study statistician.

Conflict of interest declaration

The authors declare that they have no competing interests.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.clnu.2018.07.024.

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Appendix A. Supplementary data

The following is the supplementary data related to this article:

Multimedia Component 1

Multimedia component 1

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