



## The relationship between patient-reported health-related quality of life and malnutrition risk in cirrhosis: an observational cohort study

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### Abstract

Patients with cirrhosis experience worse health-related quality of life (HRQoL), and attempts are warranted further exploration of modifiable factors to improve HRQoL. Data on the impact of malnutrition risk on HRQoL among cirrhosis are limited; thus, we aimed to strengthen understanding by clarifying the relationship between nutritional status and low HRQoL in patients with decompensated cirrhosis. Consecutive inpatients with cirrhosis attending our department within a tertiary hospital were studied. Generic health profiles and malnutrition risk were evaluated by the EuroQol-5D (EQ-5D) and Royal Free Hospital-Nutritional Prioritizing Tool (RFH-NPT) score, respectively. Multiple linear regression analysis was used to determine association of malnutrition risk with low HRQoL. In this cohort of 364 patients with median age of 64 years and 49.5% male, 55.5% of the study population reported impairment pertinent to HRQoL in at least one dimension in terms of the EQ-5D. Moreover, malnutrition risk (RFH-NPT score:  $\beta$  coefficient =  $-0.114$ ,  $P=0.038$ ) was proved to be independently associated with poor HRQoL in multiple analysis, after adjustment for significant variables like age, BMI and markers of decompensation. Notably, we found that health dimensions representing physical function (i.e. mobility, self-care and usual activities) are substantially affected, while malnourished patients reported less frequencies of complaints in other domain such as anxiety/depression. In conclusion, the risk of malnutrition assessed by the RFH-NPT score is independently associated with low HRQoL. It is operational to improve HRQoL by identifying patients at high malnutrition risk and providing timely nutrition treatment.

**Key words:** Liver cirrhosis; Malnutrition; Health-related quality of life; EuroQol-5D; Physical function

It has been suggested that patient-reported outcomes indicate an umbrella term to measure any facet of a patient's health status directly resulting from the patient without interpretation by anyone else<sup>(1)</sup>. Patient-reported outcomes may encompass symptom duration, frequency, severity pertinent to daily living activities or more complex issues surrounding health-related quality of life (HRQoL). More recently, HRQoL has attracted increasing interest as a major patient-reported outcome measure that is referred to the patient's subjective perception of the impact of diseases and along with its treatment on individual daily life, including physical, emotional, social function and well-being<sup>(2,3)</sup>. In this regard, authorised bodies such as the

European Medicines Agency and US Food and Drug Administration have provided standards to guide clinical trials or researches in relation to potential therapeutic avenue, securing supportive information of intervention impact on the patient's perspective<sup>(4)</sup>. Accordingly, a generic-based construct designated as the EuroQol-5D (EQ-5D) has routinely been carried out in our department to decipher any HRQoL perturbation among hospitalised patients with cirrhosis<sup>(5)</sup>. The EQ-5D questionnaire includes a wide spectrum of health profiles, including mobility, self-care, usual activities, pain and anxiety/depression; its validity and reproducibility have also been verified in the realm of hepatology<sup>(6–8)</sup>. On the other hand, the practitioners

**Abbreviations:** EQ-5D, EuroQol-5D; HE, hepatic encephalopathy; HRQoL, health-related quality of life; MELD, model for end-stage liver disease; RFH-NPT, Royal Free Hospital-Nutritional Prioritizing Tool.

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can obtain a utility index on the basis of EQ-5D scale to perform comparisons between the respondents and population norms if available<sup>(9)</sup>.

Malnutrition occurs in ~70% of adult patients with chronic liver diseases due to multifactorial aetiologies on account of poor intake, increased resting energy expenditure and impaired nutrient absorption/utilisation<sup>(10)</sup>. The presence of malnutrition has been linked to varying dismal outcomes such as morbidity/mortality, development of complications and other related health deficits<sup>(11,12)</sup>. Several international societies highlight the importance and necessity to screen for malnutrition risk and consider the Royal Free Hospital-Nutritional Prioritizing Tool (RFH-NPT) as a sensitive, consistent and simplified tool<sup>(13–15)</sup>. After reviewing the existing literature, one concern is that previous studies looking into the nutritional stats of cirrhotic patients have, to some extent, applied inappropriate measure not specific to advanced chronic liver diseases (e.g. subjective global assessment)<sup>(16,17)</sup>. Furthermore, there remains a lack of clarity around the relationship between HRQoL and risk of malnutrition, and to which degree varying health dimensions are affected. Taken together, in a well-built cohort of inpatients with decompensated cirrhosis we aimed to (i) investigate whether risk of malnutrition assessed by the RFH-NPT score is an independent predictor of low HRQoL in terms of EQ-5D utility index and (ii) identify the variation across categories of malnutrition risk and which health domains within EQ-5D instrument are substantially affected.

## Subjects and methods

### Study population

The current study belonged to a prospective observational cohort study; all assessments were carried out within 48 h of the hospitalisation. The study population comprised inpatients with cirrhosis referred to Department of Gastroenterology and Hepatology, Tianjin Medical University General Hospital (TJMUGH). To meet the inclusion criteria, participants had to be aged  $\geq 18$  years, able to give informed consent and had a cirrhosis diagnosis conforming to liver biopsy, radiological data, medical history and/or laboratory evaluation. All patients were present with signs of decompensation. Patients were excluded if they had concurrent hepatocellular carcinoma or other extrahepatic malignancy, acute-on-chronic liver failure, severe hepatic encephalopathy (HE) interrupting completeness of the questionnaire and refused to scheduled follow-up. The study period was from 2019 to 2021. The study was employed in accordance with the Declaration of Helsinki and approved by Ethnic Committee of TJMUGH.

### Sample size

The calculation of sample size was carried out by using <http://powerandsamplesize.com/> for testing OR between two groups with an  $\alpha$  error = 0.01, a power ( $1 - \beta$  error) = 0.99, group 'A' proportion = 0.70, group 'B' proportion = 0.30 and sampling ratio = 1, obtaining that a total of eighty individuals is required. Given there is no reference to both proportions in relation to high/low malnutrition risk, the data extracted from the current study were used. In particular, group 'A' was indicative of

malnourished subjects (253/364) in relative to group 'B' as nourished subjects (111/364).

### Expose and outcome

Data on patient's demographic feature, cirrhosis aetiology, laboratory values, clinical manifestations and conventional scores (i.e., Child–Turcotte–Pugh categorisation and model for end-stage liver disease (MELD) score) were collected in order to decipher the cohort.

The EQ-5D indicates a well-built quality-of-life instrument that is preference and generic based<sup>(18)</sup>. The questionnaire comprises a descriptive construct with five different dimensions (mobility, self-care, usual activities, pain and anxiety/depression). By using the three levels of each domain (EQ-5D-3L), the practitioner can obtain a total number of  $3^5$  (243) possibly disparate health conditions. The questionnaire is on a scale from 1 to 3: 1 is no problems, 2 some problems and 3 extreme problems. By modelling HRQoL as the primary outcome, it is pivotal to calculate a single value for each of these disparate health conditions. Accordingly, the EQ-5D utility index arises from a country-specific value setting, exhibiting the preference of a particular country in terms of trade-off method. Since a validated Chinese value setting is unavailable, the calculated utility index from the Japanese population is of choice, taking consideration of the comparability between these two East Asia countries<sup>(19)</sup>. Of note, a negative utility index value implicates the condition that respondents might judge their health status worse than death. Moreover, a higher utility index value reflects a better HRQoL wherein the '1' value is equal to the best health status.

On the other hand, the RFH-NPT score is implemented in our previous work along with detailed processes<sup>(20)</sup>. Briefly, the risk of malnutrition is categorised into low (0 points), moderate (1 point) and high (2–7 points) according to the RFH-NPT score. First, the acute alcoholic hepatitis or tube feeding is inquired, as these medical issues may identify respondents as high risk. Next, we discriminate between the categories of patients with and without oedema/ascites. At last, the respondents are assigned to the corresponding risk groups on the basis of score summed.

### Statistical analysis

Baseline characteristics were compared by using the Pearson  $\chi^2$  test or Fisher's exact test for categorical variables and Mann–Whitney test for continuous data. The cohort was illustrated by their complaints in any EQ-5D domain. Multiple linear regression analysis was used to determine the independent association between risk of malnutrition assessed by the RFH-NPT score and HRQoL, with the EQ-5D utility index as the dependent variable. The variables age, BMI, ascites, HE, platelet-to-lymphocyte ratio and Na along with the RFH-NPT score entered into final model on account of their clinical/statistical significance. Entry criteria were  $P < 0.05$  in the simple regression analysis. The spearman's rank correlation analysis ( $r_s$ ) was calculated between the EQ-5D utility index/single dimension of the EQ-5D and the RFH-NPT score. The threshold for statistical significance was referred to  $P < 0.05$ . All statistical analyses were performed by using SPSS 21.0 (IBM) and GraphPad Prism 8.0.1.



**Table 1.** Patients' baseline characteristics (*n* 364) (Numbers and percentages)

	Total ( <i>n</i> 364)		No problems ( <i>n</i> 162)		Some/extreme problems ( <i>n</i> 202)		<i>P</i>
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Age (years)	64		63		64		0.01
IQR	57, 69		57, 68		57, 71		
Sex							0.03
Male	180	49.5	91	56.2	89	44.1	
Female	184	50.5	71	43.8	113	55.9	
BMI (kg/m <sup>2</sup> )	23.7		24.5		23.1		0.01
IQR	20.6, 26.7		21.7, 27.1		20.0, 26.5		
Aetiology							0.16
Viral infection	90	24.7	45	27.8	45	22.3	
Alcohol	82	22.5	39	24.1	43	21.3	
Cholestatic/AILD	107	29.4	49	30.2	58	28.7	
Cryptogenic/NAFLD	85	23.4	29	17.9	56	27.7	
Gastric varices	251	68.9	117	72.2	134	66.3	0.26
Ascites	204	56.0	84	51.9	120	59.4	0.17
HE	25	6.9	8	4.9	17	8.4	0.22
CTP score	7		7		7		0.39
IQR	6, 9		6, 9		6, 9		
CTP categorisation							0.91
A	123	33.8	54	33.3	69	34.2	
B/C	241	66.2	108	66.7	133	65.8	
RFH-NPT score	2		1		3		0.02
IQR	0, 5		0, 5		0, 6		
MELD score	8.5		8.5		8.4		0.83
IQR	4.9, 11.4		5.0, 11.3		4.7, 11.6		
Na (mmol/l)	140		140		140		0.97
IQR	138, 142		138, 142		137, 142		

IQR, interquartile range; AILD, autoimmune liver disease; NAFLD, non-alcoholic fatty liver disease; HE, hepatic encephalopathy; CTP, Child–Turcotte–Pugh; RFH-NPT, Royal Free Hospital–Nutritional Prioritizing Tool; MELD, model for end-stage liver disease.

## Results

### Patients and depressive data

As shown in Table 1, 364 inpatients with decompensated cirrhosis were consecutively included during the study period. The median age was 64 years (interquartile range: 57, 69) and 50.5% (184) were female. The main aetiologies for cirrhosis were chronic viral infection and cholestatic/autoimmune liver disease, experienced in 24.7% (90) and 29.4% (107), respectively. The median MELD score for the cohort was 8.5 (interquartile range: 4.9, 11.4), and 66.2% (241) had Child–Turcotte–Pugh B/C categorisation. The distribution of holistic EQ-5D-3L profile is shown in Fig. 1. Notably, 44.5% (162) of the respondents reported no complaint in any health domain, 20.1% (73) had no complaints in four domains, 15.4% (56) had no complaints in three domains, 14.0% (51) had no complaints in two domains and in single domain, while 6.0% (22) reported complaints across all health domains. Furthermore, patients without any HRQoL deficit were prone to be younger, male sex, had lower BMI and RFH-NPT score.

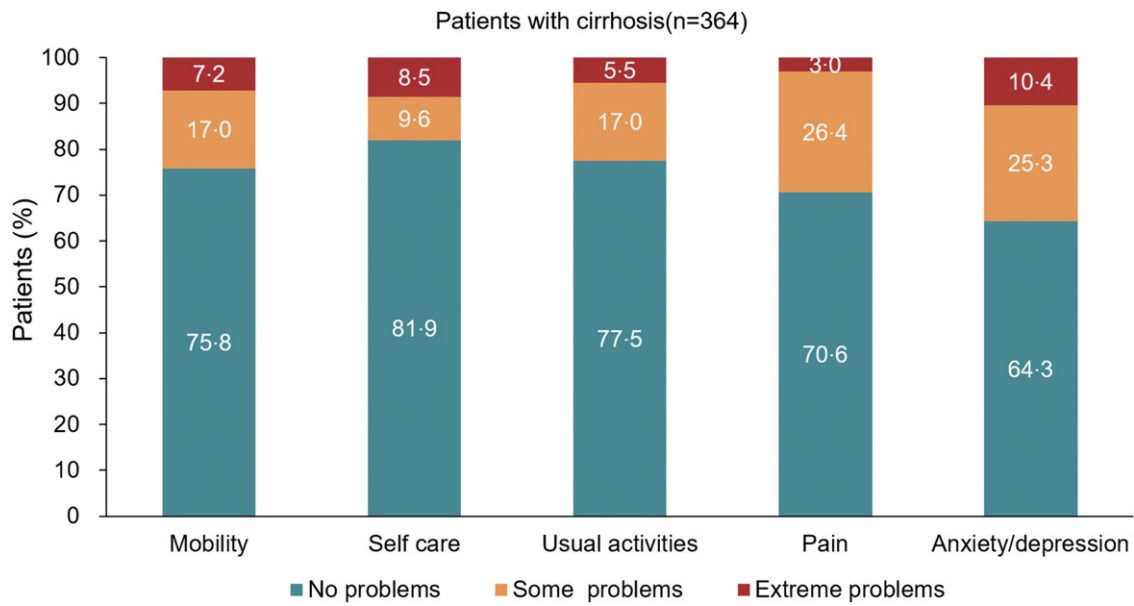
### Risk of malnutrition assessed by the Royal Free Hospital–Nutritional Prioritizing Tool score was an independent predictor of low health-related quality of life

Table 2 shows the results of a linear regression analysis for the risk of malnutrition in relation to HRQoL by using EQ-5D

utility index. Our simple regression analysis found that age ( $\beta$ -coefficient =  $-0.139$ ,  $P = 0.008$ ), BMI ( $\beta$ -coefficient =  $0.220$ ,  $P < 0.001$ ), ascites ( $\beta$ -coefficient =  $-0.134$ ,  $P = 0.012$ ), HE ( $\beta$ -coefficient =  $-0.176$ ,  $P = 0.001$ ), platelet-to-lymphocyte ratio ( $\beta$ -coefficient =  $-0.158$ ,  $P = 0.003$ ) and Na ( $\beta$ -coefficient =  $0.202$ ,  $P < 0.001$ ) along with RFH-NPT score ( $\beta$ -coefficient =  $-0.180$ ,  $P = 0.001$ ) are predictors in relation to EQ-5D utility index with  $P < 0.05$ . Further multiple linear regression indicated that age ( $\beta$ -coefficient =  $-0.150$ ,  $P = 0.004$ ), HE ( $\beta$ -coefficient =  $-0.127$ ,  $P = 0.016$ ), platelet-to-lymphocyte ratio ( $\beta$ -coefficient =  $-0.151$ ,  $P = 0.004$ ) along with the RFH-NPT score ( $\beta$ -coefficient =  $-0.114$ ,  $P = 0.038$ ) are independently related to low EQ-5D utility index (low HRQoL), while BMI ( $\beta$ -coefficient =  $0.201$ ,  $P < 0.001$ ) and Na ( $\beta$ -coefficient =  $0.105$ ,  $P = 0.049$ ) to high EQ-5D utility index.

### Correlation analysis between the EuroQoL-5D and risk of malnutrition

The correlation analysis between the global EQ-5D utility index and the RFH-NPT score led to a significantly inverse correlation ( $r_s = -0.171$ ,  $P = 0.001$ ). The correlations were also observed for mobility ( $r_s = 0.218$ ,  $P < 0.001$ ), self-care ( $r_s = 0.205$ ,  $P < 0.001$ ), usual activities ( $r_s = 0.232$ ,  $P < 0.001$ ) and pain ( $r_s = 0.118$ ,  $P = 0.024$ ) in contrast to anxiety/depression ( $r_s = -0.018$ ,  $P = 0.732$ ) by looking into each dimension within EQ-5D instrument (Fig. 2).



**Fig. 1.** Distribution of holistic EQ-5D profile among patients with decompensated cirrhosis (*n* 364). The EQ-5D questionnaire comprises five health dimensions: mobility, self-care, usual activities, pain and anxiety/depression. Each of these dimensions consists of three levels: no, some or extreme problems. The distribution of the profiles of patients with decompensated cirrhosis in terms of each health domain is shown. EQ-5D, EuroQol-5D.

**Table 2.** A multiple linear regression analysis to assess associations between the following variables and the EQ-5D utility index as dependent variable\* ( $\beta$ -coefficients and 95 % confidence intervals)

Variable	Simple regression analysis			Multiple regression analysis		
	Standardised $\beta$	95 % CI	<i>P</i>	Standardised $\beta$	95 % CI	<i>P</i>
Age (years)	-0.139	-0.240, -0.036	0.008	-0.150	-0.234, -0.045	0.004
Sex (male v. female)	0.071	-0.032, 0.174	0.175			
BMI (kg/m <sup>2</sup> )	0.220	0.111, 0.302	< 0.001	0.201	0.092, 0.286	< 0.001
RFH-NPT score	-0.180	-0.282, -0.078	0.001	-0.114	-0.206, 0.006	0.038
Ascites (yes v. no)	-0.134	-0.237, -0.029	0.012	-0.062	-0.157, 0.041	0.252
Hepatic encephalopathy (yes v. no)	-0.176	-0.279, -0.071	0.001	-0.127	-0.219, -0.023	0.016
CTP score	-0.014	-0.121, 0.092	0.792			
PLR	-0.158	-0.261, -0.053	0.003	-0.151	-0.232, 0.044	0.004
Albumin (g/l)	0.097	-0.009, 0.201	0.072			
ALT (U/l)	0.047	-0.059, 0.152	0.387			
TBIL ( $\mu$ mol/l)	-0.025	-0.130, 0.081	0.647			
MELD score	-0.036	-0.142, 0.071	0.513			
Na (mmol/l)	0.202	0.096, 0.301	< 0.001	0.105	0.000, 0.204	0.049

RFH-NPT, Royal Free Hospital-Nutritional Prioritizing Tool; CTP, Child-Turcotte-Pugh; PLR, platelet-to-lymphocyte ratio; ALT, alanine aminotransferase; TBIL, total bilirubin; MELD, model for end-stage liver disease.

\* Results describe the standardised correlation parameter ( $\beta$ ), its 95 % CI and the associated *P* value.

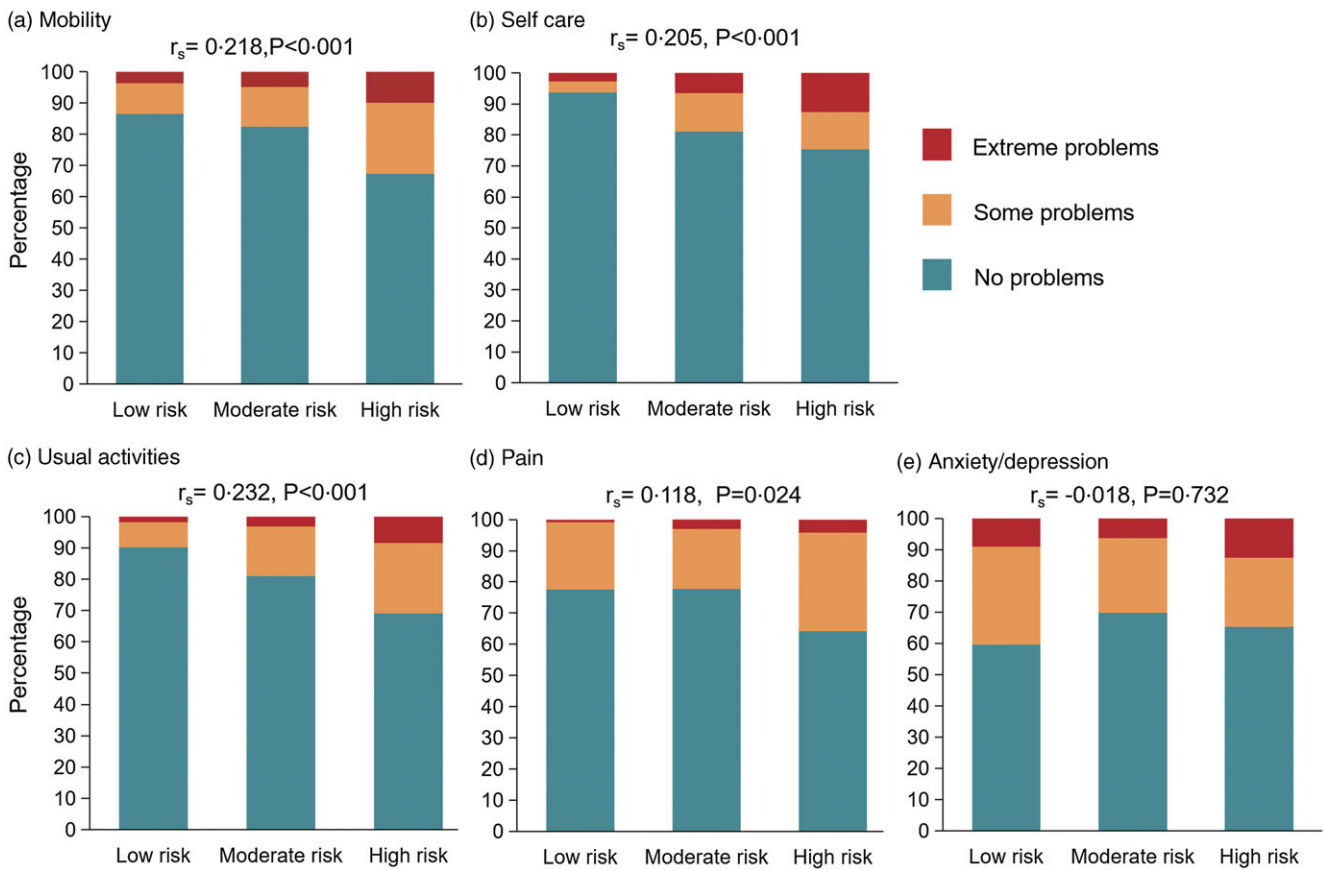
**Comparison of EuroQol-5D profiles in accordance with the categories of malnutrition risk**

Next, we aimed to identify which HRQoL domains are substantially affected in terms of the categories of malnutrition risk. When stratified by the RFH-NPT, the most substantially impaired dimensions in the cohort were mobility, self-care and usual activities (all *P* < 0.001). Notably, 32.6 % (62) of the respondents with high risk of malnutrition reported some or extreme problems in mobility, followed by moderate risk of malnutrition in 17.5 % (11) and low risk of malnutrition in 13.5 % (15). Although the proportions of respondents with some or extreme problems were comparable between low and moderate risk of malnutrition groups, patients with cirrhosis and concomitant high risk

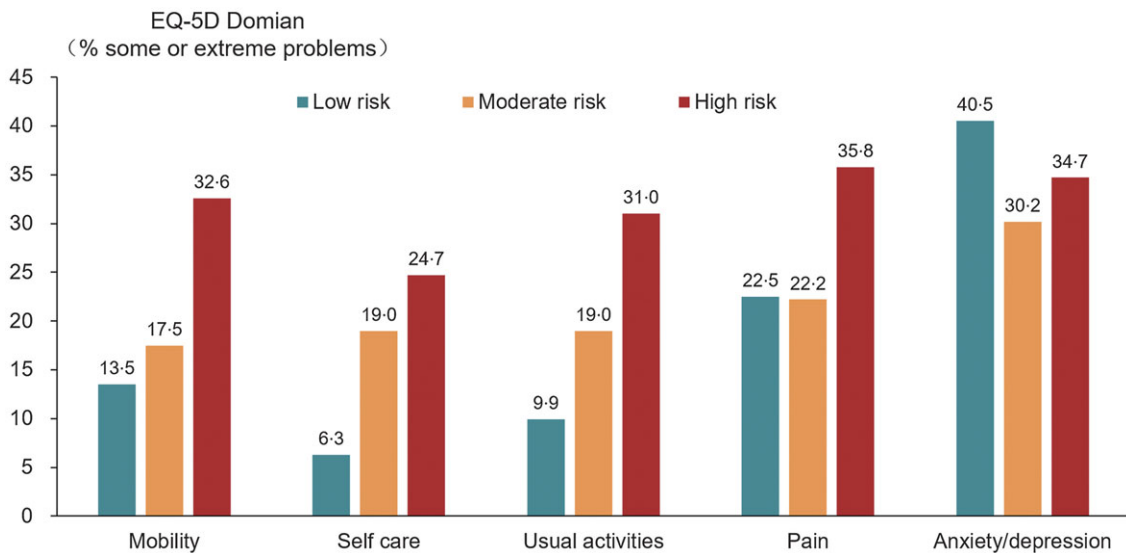
of malnutrition still experienced a considerable health burden on pain (22.5 % v. 22.2 % v. 35.8 %, *P* = 0.020). The EQ-5D utility index was also significantly higher in low risk of malnutrition group in comparison with high risk of malnutrition group (*P* = 0.002) (Fig. 3 and online Supplementary Table S1).

**Discussion**

In this observational investigation of 364 patients, impairment in any or several EQ-5D dimensions was observed in 55.5 % (202) of the cohort, suggesting low HRQoL as a common dismal event among the patients with decompensated cirrhosis. After adjustment for significant variables like age, BMI and markers of



**Fig. 2.** Correlation analyses between each domain of the EQ-5D and RFH-NPT score. Correlation analyses between the following domains: mobility (a), self-care (b), usual activities (c), pain (d) and anxiety/depression (e). EQ-5D, EuroQol-5D; RFH-NPT, Royal Free Hospital-Nutritional Prioritizing Tool.



**Fig. 3.** EQ-5D domains stratified by risk of malnutrition according to the RFH-NPT (low risk: 0 points; moderate risk: 1 points; high risk: 2–7 points). EQ-5D, EuroQol-5D; RFH-NPT, Royal Free Hospital-Nutritional Prioritizing Tool.

decompensation, multiple analysis still denoted that risk of malnutrition is independently associated with low HRQoL. Notably, we found that health dimensions representing physical function (i.e., mobility, self-care and usual activities) are substantially

affected, whereas malnourished patients reported less frequencies of complaints in other domain such as anxiety/depression. It is operational to improve HRQoL by identifying patients at high malnutrition risk and providing timely nutrition treatment.



Cirrhosis is broadly prevalent around the world and associated with high morbidity and mortality<sup>(21)</sup>. Decompensated cirrhosis occurs irreversibly and accompanies with various complications leading to frequent and recurrent hospitalisation, patient decease in the absence of liver transplantation and impaired HRQoL among patient as well as caregivers<sup>(22,23)</sup>. Therefore, it is pivotal to identify modifiable factors with the purpose of improving HRQoL and directing patient-centred care in the context of cirrhosis<sup>(24)</sup>. For instance, Wu *et al.* showed that the proportions of compensated HBV cirrhosis reporting no problems in all EQ-5D dimensions significantly increase from 57.8 to 72.0% along with increased utility index after 5 years of entecavir treatment<sup>(7)</sup>. Notably, malnutrition is present in more than half patients with decompensated cirrhosis and renders subjects susceptible to sarcopenia and physical frailty. Taking consideration of its high prevalence, weight on prognosis and management following prompt recognition, we believe it is of utmost importance to investigate the relationship between malnutrition and HRQoL.

Although the literature surrounding the relationship between the risk of malnutrition and low HRQoL is scattered, findings from our study corroborate with previous works. Rojas *et al.* assessed the nutritional status and HRQoL in separation by using a general tool subjective global assessment and disease-specific measure as the Chronic Liver Disease Questionnaire<sup>(16)</sup>. In that study, malnutrition was in relation to decreased HRQoL independent of disease severity or complications, while malnourished subjects exhibited mostly impaired aspects pertinent to body pain, daily activities, physical activities and weakness. Another study among a pre-transplant cirrhotic population of eighty-one participants revealed that general health, vitality and social functioning (constituents of Short-Form 36) are significantly lower in subjective global assessment-defined malnourished patients after fully adjustment for age, sex or disease severity, but no association was observed between worsen subjective global assessment and bodily pain<sup>(17)</sup>. In the current study, our findings are somewhat a confluence of aforesaid reports: as risk of malnutrition advanced, patients with some or extreme problems in mobility, self-care, usual activities and pain were proportionately increased. Additionally, the RFH-NPT score remained an independent predictor of EQ-5D utility index controlling for baseline characteristics, cirrhosis-related complications and major laboratory indices.

Furthermore, our findings uncovered that health dimensions pertinent to physical function are substantially affected. One explanation might be that malnutrition servers as a contributor to sarcopenia and frailty. Moreover, frailty and sarcopenia can interconnect with each other; muscle contractile function impairment can promote loss of muscle mass and vice versa. The interdependence of malnutrition, frailty and sarcopenia in patients with cirrhosis accounts for dys-regulated physical activities<sup>(15)</sup>. On the other hand, the proportion of cirrhosis with high risk of malnutrition alongside a health burden on pain was 35.8%. Actually, pain represents a common and debilitating symptom among cirrhosis. The pain symptom can occur outside of underpinning liver disease or be disease-specific such as ascites-associated abdominal pain<sup>(25)</sup>. Given the altered bioavailability and metabolism of pain medications in the context of cirrhosis, it

is often difficult to treat<sup>(26)</sup>. Our results adding the knowledge that it may be practical to mitigate pain problem as a HRQoL deficit via nutritional support. Conversely, our findings showed that malnourished patients report less frequencies of anxiety/depression. In fact, the presence of anxiety or depression exhibits neuropsychological indicators of HE in the context of decompensated cirrhosis; thus, these symptoms may be masked by HE of varying severity grades<sup>(27)</sup>. Moreover, several studies demonstrated that the impairment pertinent to anxiety/depression is in alignment with deteriorated liver function among cirrhosis. Xiao *et al.* showed that the anxiety score and depression score are significantly elevated in patients with minimal HE along with highest levels among Child–Turcotte–Pugh C sub-settings<sup>(28)</sup>. Another report implicated that patients with MELD-Na score 20–29 exhibit significantly higher levels of anxiety and depression in comparison to those with MELD-Na < 10<sup>(29)</sup>. Accordingly, the exclusion of patients with severe HE having difficulties to complete the EQ-5D questionnaire of the current study may give rise to selection bias. Taken together, further prospective clinical trials are warranted to validate our preliminary findings.

Another issue surrounding the clinical implementation of this study is to arouse prompt and intensive care of patients with cirrhosis. Actually, the improvement in nursing care in the field of liver diseases has not been accompanied with the management of patients with other chronic conditions, such as lung diseases, heart failure, arterial hypertension and diabetes<sup>(30)</sup>. From clinical perspective of view, nurses are able to facilitate patient education, in consequence of obtaining self-care to prevent complications and improving their well-being and responsibility for their own care<sup>(31,32)</sup>. In the case of decompensated disease, regular assessment of HRQoL and frailty are proposed procedures. Accordingly, the RFH-NPT and EQ-5D questionnaire are measures of choice to evaluate malnutrition risk and impairment in HRQoL in our department as daily practice settings (taken 3–5 min). These are deliberate options in terms of their easy-to-measure, effective point-of-care and cirrhosis-specific characteristics. This is particularly relevant in the clinic with a dramatic work load on patients with decompensated cirrhosis. As a matter of fact, it has been demonstrated that 91% of cirrhosis providers note competing demands for time as an obvious barrier to engaging in palliative care<sup>(33)</sup>. Taken together, we believe that specific education of these tools, for the ease of use, can engage more nurses in the care of patients with cirrhosis with the purpose of bridging the gap between clinicians and families.

The results of current study should be interpreted in light of its limitations. First, the RFH-NPT score and EQ-5D were only assessed at baseline in our cohort. Actually, it might be of interest to consider a dynamic evaluation of malnutrition risk and HRQoL and to investigate whether alteration in the RFH-NPT score over a period might correspond to ever-changing HRQoL. Second, although the study population was sizeable, there were no conventional scores (i.e. Child–Turcotte–Pugh categorisation or MELD score) that emerge as independent contributors of HRQoL. Notably, the predictive ability of disease severity indices appears to be heterogeneous, since the disparities are partially attributed to different methods and measurements used for evaluating HRQoL<sup>(34)</sup>. Last, this was a population derived from



a single centre among Chinese, and hence, results might not be readily generalisable to all populations with cirrhosis.

In conclusion, worse HRQoL is generally prevalent among patients with decompensated cirrhosis. In addition, risk of malnutrition assessed by the RFH-NPT score is independently associated with low HRQoL. It is operational to improve HRQoL by identifying patients at high malnutrition risk and providing timely nutrition treatment.

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There are no conflicts of interest.

### Supplementary material

For supplementary material referred to in this article, please visit <https://doi.org/10.1017/S0007114522003841>

### References

- McSweeney L, Breckons M, Fattakhova G, *et al.* (2020) Health-related quality of life and patient-reported outcome measures in NASH-related cirrhosis. *JHEP Rep: Innovation Hepatol* **2**, 100099.
- Gutteling JJ, de Man RA, Busschbach JJ, *et al.* (2007) Overview of research on health-related quality of life in patients with chronic liver disease. *Neth J Med* **65**, 227–234.
- Afendy A, Kallman JB, Stepanova M, *et al.* (2009) Predictors of health-related quality of life in patients with chronic liver disease. *Aliment Pharmacol Ther* **30**, 469–476.
- McKenna SP (2011) Measuring patient-reported outcomes: moving beyond misplaced common sense to hard science. *BMC Med* **9**, 86.
- Hui Y, Li N, Yu Z, *et al.* (2022) Health-related quality of life and its contributors according to a preference-based generic instrument in cirrhosis. *Hepatol Comm* **6**, 610–620.
- Zhang H, Ren R, Liu J, *et al.* (2020) Health-related quality of life among patients with hepatitis C virus infection: a cross-sectional study in Jianping County of Liaoning Province, China. *Gastroenterol Res Pract* **2020**, 6716103.
- Wu X, Hong J, Zhou J, *et al.* (2021) Health-related quality of life improves after entecavir treatment in patients with compensated HBV cirrhosis. *Hepatol Int* **15**, 1318–1327.
- Chugh Y, Katoch S, Sharma D, *et al.* (2022) Health-related quality of life among liver disorder patients in Northern India. *Indian J Community Med: Offic Publ Indian Assoc Prev Soc Med* **47**, 76–81.
- Zoe T, Jane C, Rebecca H, *et al.* (2020) Health related quality of life in individuals at high risk of chronic liver disease: impact of a community diagnostic pathway. *Public Health Pract* **1**, 100033.
- Ooi PH, Gilmour SM, Yap J, *et al.* (2018) Effects of branched chain amino acid supplementation on patient care outcomes in adults and children with liver cirrhosis: a systematic review. *Clin Nutr ESPEN* **28**, 41–51.
- Maharshi S, Sharma BC & Srivastava S (2015) Malnutrition in cirrhosis increases morbidity and mortality. *J Gastroenterol Hepatol* **30**, 1507–1513.
- Hui Y, Wang X, Yu Z, *et al.* (2021) Relationship between sleep-wake disturbance and risk of malnutrition in hospitalized patients with cirrhosis. *Front Nutr* **8**, 719176.
- European Association for the Study of the Liver, Electronic address EEE & European Association for the Study of the L (2019) EASL Clinical Practice Guidelines on nutrition in chronic liver disease. *J Hepatol* **70**, 172–193.
- Bischoff SC, Bernal W, Dasarathy S, *et al.* (2020) ESPEN practical guideline: clinical nutrition in liver disease. *Clin Nutr* **39**, 3533–3562.
- Lai JC, Tandon P, Bernal W, *et al.* (2021) Malnutrition, frailty, and sarcopenia in patients with cirrhosis: 2021 practice guidance by the American association for the study of liver diseases. *Hepatol* **74**, 1611–1644.
- Rojas-Loureiro G, Servin-Caamano A, Perez-Reyes E, *et al.* (2017) Malnutrition negatively impacts the quality of life of patients with cirrhosis: an observational study. *World J Hepatol* **9**, 263–269.
- Chiu E, Marr K, Taylor L, *et al.* (2020) Malnutrition impacts health-related quality of life in cirrhosis: a cross-sectional study. *Nutr Clin Pract: Offic Publ Am Soc Parenter Enter Nutr* **35**, 119–125.
- EuroQol G (1990) EuroQol – a new facility for the measurement of health-related quality of life. *Health Policy* **16**, 199–208.
- Tsuchiya A, Ikeda S, Ikegami N, *et al.* (2002) Estimating an EQ-5D population value set: the case of Japan. *Health Econ* **11**, 341–353.
- Wang X, Feng H, Hui Y, *et al.* (2022) Neutrophil-to-lymphocyte ratio is associated with malnutrition risk estimated by the Royal Free Hospital-Nutritional Prioritizing Tool in hospitalized cirrhosis. *JPEN/J Parenter Enter Nutr* **46**, 123–129.
- Gines P, Krag A, Abraldes JG, *et al.* (2021) Liver cirrhosis. *Lancet* **398**, 1359–1376.
- Allen AM, Kim WR, Moriarty JP, *et al.* (2016) Time trends in the health care burden and mortality of acute on chronic liver failure in the United States. *Hepatology* **64**, 2165–2172.
- Fabrellas N, Moreira R, Carol M, *et al.* (2020) Psychological burden of hepatic encephalopathy on patients and caregivers. *Clin Transl Gastroenterol* **11**, e00159.
- Labenz C, Toenges G, Schattenberg JM, *et al.* (2019) Health-related quality of life in patients with compensated and decompensated liver cirrhosis. *Eur J Intern Med* **70**, 54–59.
- Waterman BL, Ramsey SU, Whitsett MP, *et al.* (2021) Top ten tips palliative care clinicians should know about end-stage liver disease. *J Palliat Med* **24**, 924–931.
- Kaplan A & Rosenblatt R (2022) Symptom management in patients with cirrhosis: a practical guide. *Curr Treatment Options Gastroenterol* **20**, 144–159.
- Dellatore P, Cheung M, Mahpour NY, *et al.* (2020) Clinical manifestations of hepatic encephalopathy. *Clinics Liver Dis* **24**, 189–196.
- Xiao G, Ye Q, Han T, *et al.* (2018) Study of the sleep quality and psychological state of patients with hepatitis B liver cirrhosis. *Hepatol Research: Offic J Jpn Soc Hepatol* **48**, E275–E282.
- Stine JG, Stukenborg GJ, Wang J, *et al.* (2020) Liver transplant candidates have impaired quality of life across health domains as assessed by computerized testing. *Ann Hepatol* **19**, 62–68.



30. Fabrellas N, Carol M, Torradabella F, *et al.* (2018) Nursing care of patients with chronic liver diseases: time for action. *J Adv Nurs* **74**, 498–500.
31. Williams R, Ashton K, Aspinall R, *et al.* (2015) Implementation of the Lancet standing commission on liver disease in the UK. *Lancet* **386**, 2098–2111.
32. Fabrellas N, Carol M, Palacio E, *et al.* (2020) Nursing care of patients with cirrhosis: the LiverHope nursing project. *Hepatology* **71**, 1106–1116.
33. Ufere NN, Donlan J, Waldman L, *et al.* (2019) Barriers to use of palliative care and advance care planning discussions for patients with end-stage liver disease. *Clin Gastroenterol Hepatol: Offic Clin Pract J Am Gastroenterol Assoc* **17**, 2592–2599.
34. Rabiee A, Ximenes RO, Nikayin S, *et al.* (2021) Factors associated with health-related quality of life in patients with cirrhosis: a systematic review. *Liver Int: Offic J Int Assoc Study Liver* **41**, 6–15.