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A generic and dynamic measure of health-related quality of life across a variety of health and disease conditions: insights from healthy individuals and patients with a variety of diagnoses

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Abstract

Objectives Health-Significant Quality of Life Measure (Health-SigQOLM) provides a generic and dynamic assessment of Health-related quality of life (HRQOL). This study aims to assess the HRQOL among healthy and non-healthy participants with varying chronic diseases.

Results Comparisons between healthy and non-healthy participants revealed statistically significant differences ($p < 0.001$) in the mean overall HRQOL score as well as across all its nine domains. Therefore, the Health-SigQOLM, along with its nine domains, is demonstrated to have adequate sensitivity in distinguishing between healthy and non-healthy study participants. This had supported the evidence that the Health-SigQOLM is a reliable and valid scale for measuring both generic and dynamic HRQOL.

Keywords Health-related quality of life, Healthy, Patients

Introduction

Many studies have emphasized the high significance of standardized and validated outcome measures for monitoring disease progression and evaluating intervention outcomes [1–4]. Apart from the conventional biochemical or clinical tests designed for performing an objective diagnosis, patient-reported outcomes also play an equally crucial role in assessing pain and overall quality of life [5–7]. This emphasizes the utilization of health-related quality of life (HRQOL) as an outcome measure for chronic medical conditions and their treatment effects on daily functioning.

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Various types of HRQOL scales exist, including disease-specific and generic ones, that are designed to measure HRQOL over different time frames, such as within 24 h or two to three weeks [8–10]. However, the majority of these HRQOL scales were developed more than 20 years ago. Health Significant Quality of Life Measure (Health-SigQOLM) is representing one of the dimensions in Significant Quality of Life Measure (SigQOLM) [11], i.e. the 'health' dimension of SigQOLM. The Health-SigQOLM comprises 33 items across nine domains such as pain, physical energy, emotional symptoms, independence, mobility, sleep quality, eating regime, body image, and perception of future health. In addition to the content validity along with its statistical evidence, the Health-SigQOLM also demonstrates clinical utility, making it effective in measuring a dynamic and generic health-related quality of life (HRQOL) [12].

With its nine domains, the Health-SigQOLM provides a more comprehensive assessment of patients' health-related outcomes compared to previous HRQoL scales. For example, the Health-SigQOLM evaluates factors such as sleep quality, eating habits, body image, and health perception, which are not addressed in the Medical Outcome Survey Short Form 36 (MOS SF36) [8, 12]. However, although the WHOQOL-BREF also includes measures of sleep and body image, each of these aspects is represented by only a single item [10].

This study is designed to assess and compare HRQOL between healthy participants and those presenting with diverse chronic diseases, such as end-stage renal disease (ESRD), cancer, depressive disorders, and heart disease, by using the Health-SigQOLM. This aims to ascertain the sensitivity of the Health-SigQOLM in their ability to detect a difference in HRQOL between healthy and non-healthy participants and, subsequently, to establish the scale's ability as a generic and dynamic HRQOL. The Health-SigQOLM was chosen because it measures a more holistic measure of patients' outcome related to health as compared to previous scales [12].

Methods

Study design

This cross-sectional study aimed to use the Health-SigQOLM scale for assessing HRQOL among both healthy and non-healthy participants. The Health-SigQOLM scale consists of 33 items with nine domains.

Study subjects

For the healthy participant group, the study sample comprised healthcare workers recruited from two tertiary hospitals, both of which are governmental healthcare facilities. Selection criteria for the control group included: (i) current employment in a healthcare setting, (ii) age 18 and above, (iii) absence of chronic diseases and not currently taking medications (based on self-reported responses), and (iv) willingness to participate in the study. The chronic patients were selected from four specialist clinics: nephrology (end-stage renal disease, ESRD), oncology (various cancers), psychiatry (depressive disorders), and cardiology (coronary heart disease). The selection criteria for this group were: (i) attending current follow-up at the specialist clinics mentioned above, (ii) age 18 and above, and (iii) willing to participate in the study. However, individuals who were unconscious, severely ill, comatose, or experiencing unstable mental conditions during the recruitment period would be excluded from the study.

Data collection process

Data collection took place between May 2022 and May 2023 using a self-administered survey approach with both online forms and paper-based questionnaires. The Health-SigQOLM questionnaire is located in the supplementary file of a prior study [12]. The online survey targeted healthcare workers, whereas patients completed the paper-based version during their follow-up visits at respective specialist clinics. All patients were in a stable condition at the time of filling in the questionnaire.

Ethical and regulatory considerations

Only participants who provided informed consent would be included in the study. The research adhered to all relevant guidelines and regulations stipulated by the Medical Research and Ethics Committee (MREC) of the National Institutes of Health, Ministry of Health, Malaysia. The Medical Research and Ethics Committee (MREC) had granted formal ethics approval for this study under NMRR ID-21-01979-XDL (IIR).

Sample size planning

The sample size determination for this study followed a guideline introduced in a previous study [13]. Given that this study aims to use the Health-SigQOLM to measure HRQOL across various groups of study participants, the objective of this study necessitates a multivariate analysis, such as Analysis of Covariance (ANCOVA), to adjust for any covariates or potential confounders in the statistical analysis. To determine the minimum sample size requirement, an approach based on a rule of thumb for sample size determination of the General Linear Model ANCOVA was employed. According to this recommendation, a minimum sample size of 300 participants is considered sufficient for obtaining accurate estimates by performing ANCOVA in the target population [14]. By incorporating an additional allowance of 10.0% to cater for the possibility of non-response rates, the sample size for this study is calculated to require a minimum of 334 participants.

Statistical analysis

In the dataset, there are three missing values in the variable 'Gender,' which have been imputed to be 'female' based on the job position 'Nurse.' There are also three missing values in the age group variable, which have been imputed to belong to the '18 to 35 years' age group based on job duration. Additionally, one missing value in the 'Ethnic' variable has been imputed to be 'Others,' as the authors were unable to determine the specific ethnicity. The scoring mechanism for the Health-SigQOLM followed the method proposed by a previous study [12].

Descriptive analysis was utilized to delineate the profile and compare HRQOL among five different groups of study participants. HRQOL was categorized into four distinct groups based on the following cut-off scores: poor (<50.0%), moderate (50–69.9%), good (70.0–79.9%), and excellent (≥80.0%). Univariate analysis was conducted by employing a One-way Analysis of Variance (ANOVA) to examine differences between groups. Subsequently, multivariate analysis utilizing the General Linear Model ANCOVA was conducted to compare HRQOL among different groups, after making adjustments for gender, age, and ethnicity. Post-hoc analysis using the Bonferroni test was employed for performing multiple comparisons of population means. All the analyses were performed using SPSS (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.).

Table 1 Basic demographic profile and clinical characteristics of participants

Demographic profile	Category	*n*	%
Gender	Male	122	27.0
	Female	330	73.0
Age group	18–35	225	49.8
	36–40	82	18.1
	41–50	78	17.3
	51–60	46	10.2
	More than 60	21	4.6
Ethnicity	Malay	165	36.5
	Chinese	89	19.7
	Iban	85	18.8
	Bidayuh	80	17.7
	Melanau	11	2.4
	Others	22	4.9
Groups with differing health conditions	Healthy	284	62.8
	ESRD	41	9.1
	Cancer	48	10.6
	Depressive disorder	40	8.8
	Coronary heart disease	39	8.6

Results

The study population comprised 452 participants, with 284 (62.8%) classified as healthy participants, 41 (9.1%) diagnosed with end-stage renal disease (ESRD), 48 (10.6%) with cancer, 40 (8.8%) with depressive disorder, and the remaining with coronary heart disease (8.6%). The majority of participants were female (73.0%), aged between 18 and 35 years (49.8%), and of Malay ethnicity (36.5%) (refer to Table 1).

Status of HRQOL among healthy and non-healthy participants

Among the healthy participants ($n=284$), 45.8% (130/284) reported experiencing excellent HRQOL, 28.9% (82/284) reported good HRQOL, 22.2% reported moderate HRQOL, and the remaining 3.2% (9/284) reported poor HRQOL. When comparing HRQOL between different participant groups with various types of health conditions, all the dimensions of overall HRQOL, as well as its individual domains, were found to be statistically significant ($p<0.001$). Specifically, patients with end-stage renal disease (ESRD) reported the poorest HRQOL in terms of physical energy (58.5%) and eating regime (78.0%). Patients with depressive disorder reported the poorest HRQOL in terms of pain (61.5%), emotional symptoms (72.5%), independence (25.0%), sleep quality (70.0%), body image (57.5%), and perception of future health (47.5%) (refer to Tables 2 and 3).

Results based on a post hoc comparison test by domains

The mean (and standard deviation) of the overall Health-Related Quality of Life (HRQOL) score among healthy participants, those with end-stage renal disease (ESRD), cancer, depressive disorder, and coronary heart disease were 77.8% (+/- 13.4), 59.9% (+/- 16.6), 66.4% (+/- 15.0%), 49.0% (+/- 16.4), and 65.7% (+/- 14.3), respectively. When comparing HRQOL between healthy and non-healthy participants, all the mean differences in overall HRQOL, as well as in its individual domains, were found to be statistically significant ($p<0.001$). Healthy participants reported higher HRQOL scores in almost all the domains of Health-SigQOLM. The results of post-hoc comparisons are presented in Tables 4 and 5. All the post-hoc comparisons conducted between the two groups in terms of overall HRQOL and each of its domains were found to be statistically significant ($p<0.05$).

Discussion

This study successfully demonstrated the criterion validity of the Health-Related Quality of Life (HRQOL) measure through performing a known-groups comparison, specifically to determine the ability of the overall and domain scores to discriminate between healthy and ill respondents. This study is able to so by encompassing

Table 2 Significant association ($p < 0.001$) between group and status of HRQOL in various domains

		Poor			Moderate			Good			Excellent		
Domains	**Group**	***n***	**within group**	**within HRQOL**	***n***	**within group**	**within HRQOL**	***n***	**within group**	**within HRQOL**	***n***	**within group**	**within HRQOL**
Pain	a	10	3.5%	12.8%	71	25.0%	57.7%	65	22.9%	78.3%	138	48.6%	89.6%
	b	19	46.3%	24.4%	15	36.6%	12.2%	4	9.8%	4.8%	3	7.3%	1.9%
	c	11	31.4%	14.1%	14	40.0%	11.4%	5	14.3%	6.0%	5	14.3%	3.2%
	d	24	61.5%	30.8%	9	23.1%	7.3%	3	7.7%	3.6%	3	7.7%	1.9%
	e	14	35.9%	17.9%	14	35.9%	11.4%	6	15.4%	7.2%	5	12.8%	3.2%
Physical	a	25	8.8%	24.3%	89	31.3%	62.2%	43	15.1%	82.7%	127	44.7%	85.8%
energy	b	24	58.5%	23.3%	8	19.5%	5.6%	2	4.9%	3.8%	7	17.1%	4.7%
	c	22	52.4%	21.4%	15	35.7%	10.5%	0	0.0%	0.0%	5	11.9%	3.4%
	d	22	55.0%	21.4%	12	30.0%	8.4%	2	5.0%	3.8%	4	10.0%	2.7%
	e	10	25.6%	9.7%	19	48.7%	13.3%	5	12.8%	9.6%	5	12.8%	3.4%
Emotional	a	13	4.6%	25.5%	76	26.8%	63.9%	46	16.2%	71.9%	149	52.5%	71.6%
symptoms	b	5	12.2%	9.8%	13	31.7%	10.9%	5	12.2%	7.8%	18	43.9%	8.7%
	c	3	7.9%	5.9%	10	26.3%	8.4%	4	10.5%	6.3%	21	55.3%	10.1%
	d	29	72.5%	56.9%	10	25.0%	8.4%	0	0.0%	0.0%	1	2.5%	0.5%
	e	1	2.6%	2.0%	10	25.6%	8.4%	9	23.1%	14.1%	19	48.7%	9.1%
Independent	a	3	1.1%	13.6%	12	4.2%	36.4%	11	3.9%	35.5%	258	90.8%	72.1%
	b	5	12.2%	22.7%	6	14.6%	18.2%	4	9.8%	12.9%	26	63.4%	7.3%
	c	2	5.0%	9.1%	4	10.0%	12.1%	4	10.0%	12.9%	30	75.0%	8.4%
	d	10	25.0%	45.5%	5	12.5%	15.2%	6	15.0%	19.4%	19	47.5%	5.3%
	e	2	5.1%	9.1%	6	15.4%	18.2%	6	15.4%	19.4%	25	64.1%	7.0%
Mobility	a	1	0.4%	9.1%	4	1.4%	11.4%	9	3.2%	36.0%	270	95.1%	72.6%
	b	2	4.9%	18.2%	12	29.3%	34.3%	3	7.3%	12.0%	24	58.5%	6.5%
	c	3	7.5%	27.3%	5	12.5%	14.3%	5	12.5%	20.0%	27	67.5%	7.3%
	d	1	2.6%	9.1%	6	15.4%	17.1%	3	7.7%	12.0%	29	74.4%	7.8%
	e	4	10.3%	36.4%	8	20.5%	22.9%	5	12.8%	20.0%	22	56.4%	5.9%

Note: Group: a=Healthy, b=ESRD, c=Cancer, d=Depressive disorder, e=Coronary heart disease

both healthy participants and individuals diagnosed with four primary chronic diseases: end-stage renal disease (ESRD), cancer, depressive disorders, and coronary heart disease within the study population. This is important because criterion validity is considered one of the most important characteristics of HRQOL tools [7–10].

The Health-SigQOLM is designed to accurately assess the generic and dynamic status of HRQOL. Thus, the scale is suitable for routine clinical practice, clinical research, and evaluating the clinical effectiveness of interventions [12]. As a generic HRQOL scale, it is applicable to both healthy and non-healthy participants. Additionally, the scale is able to elicit a patient's HRQOL outcome measure over a two-week period, acknowledging the dynamic and fluctuating nature of HRQOL depending on the clinical presentations of specific disease conditions. This duration aligns with that of WHOQOL-BREF [10].

The development of the Health-SigQOLM is grounded on the premise that an overall score should be able to universally represent the overall HRQOL, complemented by nine specific domains derived from existing literature on HRQOL. These domains are designed to supplement the overall HRQOL by collectively providing a comprehensive measurement of HRQOL, as well as enhancing its validity within clinical and research contexts. The findings suggest that the Health-SigQOLM has immense potential for development as a tool to measure HRQOL among healthy individuals and patients with specific chronic conditions included in this study. Further research is needed to validate its use across diverse populations.

Future research endeavours should focus on expanding its applicability across various medical conditions, aiming to enhance its clinical utility as a generic instrument for individuals regardless of their health status or number of present illness(es). In addition, future studies should aim to compare the performance of these instruments across different settings and types of studies. Investigating the responsiveness of the Health-SigQOLM in a much larger sample of study participants who are presenting with diverse medical conditions will further inform its psychometric properties and support its future use across various medical disciplines.

Post-hoc comparisons tests

The existing literature contains numerous studies which aim to measure HRQOL among patients with various diagnoses [15–22]. However, there is a dearth of research comparing HRQOL between patients presenting with different clinical diagnoses. In this study, HRQOL was being compared between healthy individuals and those with various diagnoses, highlighting the necessity of such comparisons to gauge the extent to which patients with specific current diagnoses are able to recover from their ailments and to lead healthy lives that are comparable to the general population. For those patients who are not amenable to a full recovery, it is crucial that their treatment necessary rendered must be able to adequately sustain their HRQOL to a satisfactory level.

The findings of this study revealed significant differences in almost all the HRQOL domains between healthy participants and those with chronic diseases who are currently in a stable condition after receiving treatment being rendered to them. This underscores the sensitivity of the Health-SigQOLM in discriminating the HRQOL status between healthy and non-healthy participants. For example, a comparison between healthy participants and patients with heart problems revealed no significant differences in certain domains, such as psychological symptoms and sleep quality. This may be attributed to the fact that when patients with heart problems are in a stable condition, their HRQOL in some aspects still resembles those of healthy individuals. With the advent of modern advancements in medical treatment, many patients with coronary heart disease can also lead their lives similar to those of healthy individuals [23–25]. This emphasizes the importance of advanced and effective treatment in supporting patients' survival and sustaining their daily HRQOL outcomes.

Health-SigQOLM cut-off scores

Based on a Likert scale of 5, where higher scores shall indicate a greater magnitude of experiencing a poorer quality of life (e.g., more pain, weaker physical energy), which would mean that those respondents who rate Health-SigQOLM items as "Never" or "Seldom" are more likely to experience better HRQOL. The classification of HRQOL into different categories based on Health-SigQOLM scores is presented in Tables 4 and 5. Hence, the recommended cut-off scores for Health-SigQOLM are as follows: HRQOL scores equal to or greater than 80.0% are considered 'excellent', HRQOL scores between 70.0% to less than 80.0% are considered 'good', HRQOL scores between 50.0% and less than 70.0% are considered 'moderate', and HQROL scores less than 50.0% are considered 'poor'.

Therefore, in order to be classified as 'excellent' by Health-SigQOLM, the respondent must report "Never" or "Seldom" in most items, indicating good to excellent HRQOL since the higher frequency responses ("Always", "Normally", "Sometimes") shall indicate a poorer HRQOL. The aim of developing these cut-off scores for Health-SigQOLM is to facilitate the interpretation of scores obtained from different studies. This is necessary because the investigators of some of these studies may wish to compare between different categories of health status rather than simply reporting the mean scores of HRQoL [26, 27]. Additionally, some researchers may

Table 3 Significant association ($p < 0.001$) between group and status of HRQOL in various domains (continue)

		Poor			Moderate			Good			Excellent		
Domains	**Group**	***n***	**within group**	**within HRQOL**	***n***	**within group**	**within HRQOL**	***n***	**within group**	**within HRQOL**	***n***	**within group**	**within HRQOL**
Sleep	a	44	15.5%	45.4%	96	33.8%	60.4%	38	13.4%	73.1%	106	37.3%	77.4%
quality	b	15	36.6%	15.5%	10	24.4%	6.3%	3	7.3%	5.8%	13	31.7%	9.5%
	c	7	17.1%	7.2%	22	53.7%	13.8%	2	4.9%	3.8%	10	24.4%	7.3%
	d	28	70.0%	28.9%	10	25.0%	6.3%	2	5.0%	3.8%	0	0.0%	0.0%
	e	3	7.7%	3.1%	21	53.8%	13.2%	7	17.9%	13.5%	8	20.5%	5.8%
Eating	a	61	21.5%	42.7%	91	32.0%	66.9%	51	18.0%	79.7%	81	28.5%	81.8%
regime	b	32	78.0%	22.4%	3	7.3%	2.2%	3	7.3%	4.7%	3	7.3%	3.0%
	c	22	55.0%	15.4%	12	30.0%	8.8%	1	2.5%	1.6%	5	12.5%	5.1%
	d	13	32.5%	9.1%	17	42.5%	12.5%	3	7.5%	4.7%	7	17.5%	7.1%
	e	15	40.5%	10.5%	13	35.1%	9.6%	6	16.2%	9.4%	3	8.1%	3.0%
Body	a	62	21.8%	60.8%	77	27.1%	64.2%	23	8.1%	57.5%	122	43.0%	67.8%
image	b	6	14.6%	5.9%	13	31.7%	10.8%	7	17.1%	17.5%	15	36.6%	8.3%
	c	5	12.5%	4.9%	10	25.0%	8.3%	2	5.0%	5.0%	23	57.5%	12.8%
	d	23	57.5%	22.5%	9	22.5%	7.5%	2	5.0%	5.0%	6	15.0%	3.3%
	e	6	16.2%	5.9%	11	29.7%	9.2%	6	16.2%	15.0%	14	37.8%	7.8%
Perception	a	21	7.4%	29.2%	84	29.6%	58.3%	37	13.0%	72.5%	142	50.0%	81.1%
of future	b	17	41.5%	23.6%	12	29.3%	8.3%	3	7.3%	5.9%	9	22.0%	5.1%
health	c	10	25.0%	13.9%	15	37.5%	10.4%	2	5.0%	3.9%	13	32.5%	7.4%
	d	19	47.5%	26.4%	16	40.0%	11.1%	1	2.5%	2.0%	4	10.0%	2.3%
	e	5	13.5%	6.9%	17	45.9%	11.8%	8	21.6%	15.7%	7	18.9%	4.0%
Overall	a	9	3.2%	20.5%	63	22.2%	47.7%	82	28.9%	73.9%	130	45.8%	90.9%
HRQOL	b	12	29.3%	27.3%	16	39.0%	12.1%	9	22.0%	8.1%	4	9.8%	2.8%
	c	2	6.5%	4.5%	18	58.1%	13.6%	6	19.4%	5.4%	5	16.1%	3.5%
	d	19	50.0%	43.2%	17	44.7%	12.9%	1	2.6%	0.9%	1	2.6%	0.7%
	e	2	5.6%	4.5%	18	50.0%	13.6%	13	36.1%	11.7%	3	8.3%	2.1%

Table 4 A multivariate analysis: the impact of different group of participants towards HRQOL

Domain	Group	Mean	SD	Mean	95%CI		Post-hoc comparisons
Pain	a	77.2	17.2	78.5	74.2	82.8	b, c,d, & e
	b	50.2	18.3	51.3	44.8	57.8	a
	c	55.3	21.0	56.9	50.4	63.5	a & d
	d	41.9	24.1	43.2	35.9	50.5	a & c
	e	53.2	22.4	53.1	46.7	59.5	a
Physical energy	a	74.6	21.3	72.4	67.2	77.6	b, c,d, & e
	b	43.8	29.7	40.5	32.6	48.5	a & e
	c	45.4	22.1	45.3	37.8	52.8	a
	d	40.9	28.6	38.2	29.3	47.1	a & e
	e	56.1	22.5	55.0	47.2	62.9	a, b, & d
Psychological symptoms	a	79.5	19.8	83.7	78.9	88.4	d
	b	72.6	25.5	75.1	67.9	82.3	d
	c	78.7	23.8	79.6	72.5	86.6	d
	d	33.1	23.1	38.1	30.1	46.2	a, b,c, & e
	e	79.3	18.9	79.0	71.9	86.2	d
Independent	a	94.9	12.7	94.2	90.2	98.1	b, d, & e
	b	80.5	25.1	79.3	73.3	85.2	a
	c	89.4	16.8	88.4	82.7	94.2	d
	d	70.6	29.2	70.3	63.6	77.0	a, c, & e
	e	84.0	20.0	83.4	77.5	89.3	a & d
Mobility	a	96.3	8.5	92.4	89.1	95.8	b, c,d, & e
	b	78.4	23.2	76.1	71.0	81.1	a
	c	81.7	19.9	81.8	76.9	86.6	a
	d	87.5	20.8	82.8	77.0	88.5	a
	e	78.2	22.6	78.8	73.8	83.7	a

Note: Group: a=Healthy, b=ESRD, c=Cancer, d=Depressive disorder, e=Coronary heart disease

prefer reporting the HRQOL outcome measures as categorical or binary variables, which enable us to make comparisons between different categories of current health status (e.g., "excellent", "good", "moderate", "poor") by using statistical tests like Pearson's Chi-square and logistic regression, which require fewer underlying statistical assumptions to be fulfilled [28, 29].

Overall, this study was accorded a sufficiently large sample size. This is essential for yielding estimates that are able to accurately represent parameters in the population [30, 31]. Notably, our research not only yielded significant results but also demonstrated significant differences in the HRQoL scores across various domains and different diseases. This study has therefore made a major contribution which adds to the growing body of evidence supporting the clinical utility of Health-SigQOLM as a reliable and valid scale for measuring generic and dynamic Health-Related Quality of Life (HRQOL).

The successful validation of the Health-SigQOLM based on the accrual of its clinical evidence highlights its reliability and validity in measuring Health-Related Quality of Life (HRQOL) for both healthy and non-healthy individuals. The sensitivity of both the overall scores and the nine domains in discriminating the HQROL score between healthy and non-healthy individuals across various aspects of basic functions of daily living further underscores the utility of the Health-SigQOLM as a robust assessment tool for HRQOL. Moving forward, the Health-SigQOLM holds vast promise for use in various research settings and for differing research purposes. Interventional studies, such as clinical trials, could mobilize the utility of Health-SigQOLM by employing this scale to assess the impact of interventions on HRQOL outcomes. Likewise, observational studies, including short-term and long-term cohort studies, could also deploy the Health-SigQOLM as a means to measure patient outcomes and assess the effectiveness of different treatment modalities over time. By continually deploying the wide applications of Health-SigQOLM in future research, researchers can then gain valuable insights into the HRQOL of individuals across a wide range of diverse populations and disease states, ultimately contributing to improved patient care and well-being.

Limitations

On another note, it is nonetheless also important to acknowledge the limitations of this study. The fact that this study had recruited all patients were in a stable condition may limit the generalizability of the findings to those who are in less stable conditions or whose health is rapidly deteriorating. Additionally, the reluctance of

Table 5 A multivariate analysis: the impact of different group of participants towards HRQOL (continue)

Domain	Group	Mean	SD	Mean	95%CI		Post-hoc comparisons
Sleep	a	69.2	22.8	71.7	66.5	77.0	b & c
	b	59.9	29.1	59.9	51.9	67.9	a & d
	c	62.8	21.6	61.4	53.8	69.0	d
	d	32.0	24.2	35.3	26.3	44.2	a, b,c & e
	e	65.2	18.8	62.9	55.0	70.8	d
Eating regime	a	63.8	26.9	60.7	54.5	66.9	b, c, & e
	b	27.7	29.1	28.1	18.7	37.6	a, d, & e
	c	38.4	30.8	39.3	30.3	48.3	a
	d	56.3	23.7	52.0	41.5	62.6	b
	e	47.0	27.4	48.1	38.6	57.6	b
Body image	a	67.5	28.5	72.5	66.0	79.0	d
	b	70.4	25.5	73.1	63.2	82.9	d
	c	75.3	27.3	74.4	64.9	83.8	d
	d	40.2	32.6	46.1	35.1	57.1	a, b, & c
	e	68.9	28.9	66.5	56.6	76.4	-
Perception of future health	a	75.4	23.6	76.4	70.6	82.2	b, c,d, & e
	b	50.2	33.1	48.4	39.5	57.2	a
	c	60.8	30.3	58.5	50.1	67.0	a
	d	43.9	27.3	43.9	34.0	53.8	a
	e	62.2	22.0	58.2	49.3	67.1	a
Overall HRQOL	a	77.8	13.4	78.7	75.4	82.0	b, c,d, & e
	b	59.9	16.6	60.1	55.1	65.0	a & d
	c	66.4	15.0	65.9	60.6	71.1	a & d
	d	49.0	16.4	49.8	44.1	55.5	a, b,c, & e
	e	65.7	14.3	64.7	59.6	69.7	a & d

Note: Group: a=Healthy, b=ESRD, c=Cancer, d=Depressive disorder, e=Coronary heart disease

certain groups of eligible patients to participate due to the inconvenience of data collection is another possible limitation of this study. All these limitations should be duly considered when interpreting the results of the study, and may also inform avenues for possible future research efforts to address these challenges by improving the robustness and generalizability of findings in broadly similar populations.

Abbreviations

ANOVA	Analysis of Variances
ANCOVA	Analysis of Covariances
ESRD	End stage renal disease
HRQOL	Health-related quality of life
LSD	Least Significant Difference
MREC	Medical Research and Ethics Committee
WHOQOL-BREF	World Health Organization Quality of Life BREF

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Author contributions
"M.A.B. initiate the study. M.A.B., Y.K.H., W.H.L., C.H.C., and X.T.T. conduct literature review. M.A.B., W.H.L., X.T.T., E.P.P.Y., Y.Y.H.J., N.F.D.A., M.H., C.H.H.T., K.S.Y., F.J., A.Y.Y.F., C.H.C., and A.R.J.K. conducted research design. E.P.P.Y., Y.Y.H.J., N.F.D.A., C.H.H.T., K.S.Y., F.J., and A.R.J.K. performed data collection. M.A.B. and M.H. conduct statistical analyses and interpretation. M.A.B. drafted the article. All authors reviewed and approved the final article."

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Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
All respondents have provided written informed consent to participate in this study. Ethical approval for this study was granted by the Medical Research and Ethics Committee (MREC), Malaysia. The ethical approval number for this study is NMRR ID-21-01979-XDL (IIR). The study adhered to the Declaration of Helsinki. Confidentiality was ensured and maintained throughout the process.

Consent for publication
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The authors declare no competing interests.

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References

1. Knäuper B, Turner PA. Measuring health: improving the validity of health assessments. Qual Life Res. 2003;12(SUPPL1):81–9.
2. Bujang MA, Adnan TH, Mohd-Hatta NKB, et al. A revised version of diabetes quality of life instrument maintaining domains for satisfaction, impact, and worry. J Diabetes Res. 2018;2018:5804687.
3. Lewis E, Merghani K, Robertson I, et al. The effectiveness of leucocyte-poor platelet-rich plasma injections on symptomatic early

osteoarthritis of the knee: the PEAK randomized controlled trial. Bone Joint J. 2022;104–B(6):663–71.
4. Kotheeranurak V, Tangdamrongtham T, Lin GX, et al. Comparison of full-endoscopic and tubular-based microscopic decompression in patients with lumbar spinal stenosis: a randomized controlled trial. Eur Spine J. 2023;32(8):2736–47.
5. Mokkink LB, Terwee CB, Patrick DL, et al. The COSMIN checklist for assessing the methodological quality of studies on measurement properties of health status measurement instruments: an international Delphi study. Qual Life Res. 2010;19(4):539–49.
6. Badalamente M, Coffelt L, Elfar J, et al. Measurement scales in clinical research of the upper extremity, part 1: General principles, measures of general health, pain, and patient satisfaction. J Hand Surg. 2013;38(2):401–06.
7. Bujang MA, Lai WH, Ratnasingam S, et al. Development of a quality-of-life instrument to measure current health outcomes: Health-Related Quality of Life with six domains (HRQ-6D). J Clin Med. 2023;12(8):2816.
8. Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (Sf-36): I. conceptual framework and item selection. Med Care. 1992;30(6):473–83.
9. EuroQoL Group. EuroQol Eq. 5D User Guide. Rotterdam Centre for Health Policy and Law, Erasmus University; 1996.
10. WHOQOL Group. WHO Quality of Life Scale (WHOQOL). Psychol Med. 1998;28(3):551–8.
11. Bujang MA, Lai WH, Ratnasingam S, et al. Measuring population health and quality of life: developing and testing of the significant quality of life measure. Heliyon. 2023;9(12):e22668.
12. Bujang MA, Lai WH, Ratnasingam S, et al. Health-SigQOLM is a versatile scale for measuring various aspects of health-related quality of life. BMC Res Notes. 2024;17:162.
13. Bujang MA. A step-by-step process on sample size determination for medical research. Malays J Med Sci. 2021;28(2):15–27.
14. Bujang MA, Sa'at N, Sidik TMITAB. Determination of minimum sample size requirement for multiple linear regression and analysis of covariance based on experimental and non-experimental studies. Epidemiol Biostat Public Health. 2017;14(3):e12117-1-9.
15. Vlake JH, Wesselius S, van Genderen ME, et al. Psychological distress and health-related quality of life in patients after hospitalization during the COVID-19 pandemic: a single-center, observational study. PLoS ONE. 2021;16(8):e0255774.
16. Alharbi M, Alharbi F, AlTuwayjiri A, et al. Assessment of health-related quality of life in patients with heart failure: a cross-sectional study in Saudi Arabia. Health Qual Life Outcomes. 2022;20(1):128.
17. Gebremariam GT, Biratu S, Alemayehu M, et al. Health-related quality of life of patients with type 2 diabetes mellitus at a tertiary care hospital in Ethiopia. PLoS ONE. 2022;17(2):e0264199.
18. Wu YH, Hsu YJ, Tzeng WC. Physical activity and health-related quality of life of patients on hemodialysis with comorbidities: a cross-sectional study. Int J Environ Res Public Health. 2022;19(2):811.
19. Emamikia S, Oon S, Gomez A, et al. Impact of remission and low disease activity on health-related quality of life in patients with systemic lupus erythematosus. Rheumatology. 2022;61(12):4752–62.
20. Ragborg LC, Dragsted C, Ohrt-Nissen S, Andersen T, Gehrchen M, Dahl B. Health-related quality of life in patients 40 years after diagnosis of an idiopathic scoliosis. Bone Joint J. 2023;105(2):166–71.
21. Liu WJ, Musa R, Chew TF, et al. Quality of life in dialysis: a Malaysian perspective. Hemodial Int. 2014;18(2):495–506.
22. Bujang MA, Musa R, Liu WJ, et al. Depressive disorders, anxiety and stress among patients with dialysis and the association with quality of life. Asian J Psychiatr. 2015;18:49–52.
23. Azzopardi S, Lee G. Health-related quality of life 2 years after coronary artery bypass graft surgery. J Cardiovasc Nurs. 2009;24:232–40.
24. Herlitz J, Brandrup-Wognsen G, Evander MH, et al. Quality of life 15 years after coronary artery bypass grafting. Coron Artery Dis. 2009;20:363–9.
25. Rose EA, Gelijns AC, Moscowitz AJ, et al. Long term use of a left ventricular assist device for end-stage heart failure. New Engl J Med. 2001;345:1435–43.
26. Kim S, Nigatu Y, Araya T, et al. Health related quality of life (HRQOL) of patients with end stage kidney disease (ESKD) on hemodialysis in Addis Ababa, Ethiopia: a cross-sectional study. BMC Nephrol. 2021;22:280.
27. Suhail M, Saeed H, Saleem Z, et al. Association of health literacy and medication adherence with health-related quality of life (HRQoL) in patients with ischemic heart disease. Health Qual Life Outcomes. 2021;19:118.
28. Liu C, Luo Q, Luo D, et al. Quality of life profiles and its association with predictors amongst Chinese older adults in nursing homes: a latent profile analysis. BMC Geriatr. 2023;23:740.
29. Nguyen GT, Tran TB, Le DD, et al. Determining the factors impacting the quality of life among the general population in coastal communities in central Vietnam. Sci Rep. 2024;14:6986.
30. Bujang MA, Ghani PA, Zolkepali NA, et al. A comparison between convenience sampling versus systematic sampling in getting the true parameter in a population: explore from a clinical database: the audit Diabetes Control Management (ADCM) registry in 2009. Langkawi, Malaysia: Int Conf Stat Sci Bus Eng; 2012. pp. 1–5.
31. Bujang MA, Sa'at N, Joys AR et al. An audit of the statistics and the comparison with the parameter in the population. AIP Conference Proceedings. 2015:050019.

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