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Population norms of health-related quality of life in Iran: findings from a national EQ-5D-5L study

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Abstract

Background Evaluating health-related quality of life (HRQoL) in the general population is essential for establishing benchmarks for health outcome assessments. This study aimed to generate population norms for the EQ-5D-5L dimensions, EQ-VAS (EuroQol-Visual Analogue Scale) scores, and EQ-5D-5L index scores in Iran, stratified by sex and age.

Methods Data for this cross-sectional study were gathered through face-to-face interviews with 3,518 adults from the general population across nine provinces in Iran, employing a multistage sampling approach. Respondents assessed their own health state across the EQ-5D-5L dimensions—mobility, self-care, usual activities, pain/discomfort, and anxiety/depression—along with the EQ-VAS to evaluate their overall health. The EQ-5D-5L score was calculated using the value set derived from the Iranian general population. Dimension scores and index values (EQ-5D-5L index and EQ-VAS score) were analyzed using multiple logistic regression and generalized linear model (GLM), respectively.

Results The estimated mean \pm standard deviation [SD] of EQ-5D-5L index for the general population of Iran was 0.789 ± 0.258 , while the EQ-VAS score was estimated at 74.34 ± 18.67 . Among the study participants, 35.8% reported being in the best health state (11111), while the remaining 64.2% experienced problems in at least one of the five dimensions. The most commonly reported problems were related to anxiety/depression (49.2%), followed by pain/discomfort (45.3%). Regression analyses revealed that females reported significantly more problems across the five dimensions of the EQ-5D-5L and had lower EQ-5D-5L index and EQ-VAS scores compared to males. Anxiety/depression were more prevalent among younger individuals, while problems in other dimensions tended to increase with age.

Conclusions The findings indicate that nearly two-thirds of respondents experienced problems in at least one dimension, with anxiety/depression being the most prevalent, particularly among younger individuals. Females reported lower utility scores and more problems across all dimensions in all age groups. To effectively improve the health status of the Iranian population and ensure optimal resource allocation, it is vital to develop and implement targeted interventions that specifically address the needs highlighted in this study.

Keywords EQ-5D-5L, Population norm, Utility, Health-related quality of life

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Introduction

Health-related quality of life (HRQoL) is a comprehensive and multifaceted measure that reflects an individual's overall health status by integrating physical, mental, and social well-being [1, 2]. Unlike quality of life (QoL), which encompasses a wide range of human experiences, HRQoL specifically focuses on the effects of illness and the impact of treatment on overall quality of life [3]. This concept emphasizes the significance of health and the valuation of various health conditions. Furthermore, HRQoL is widely recognized as a critical metric for assessing the burden of morbidity [4, 5].

There are two primary approaches to measuring HRQoL [6, 7]: generic measures, such as the SF-36 [8] and EQ-5D [9], which provide an overall evaluation applicable across diverse populations, and specific measures like the Asthma Quality of Life Questionnaire (AQLQ) [10] and the Parkinson's Disease Questionnaire (PDQ-39) [11], which target particular diseases or patient groups. Each approach has its advantages; generic measures are useful for broad assessments and cost-effectiveness analyses, while specific measures offer greater sensitivity to minor changes that may be clinically or personally significant. The EQ-5D is a widely used generic and preference-based instrument for assessing HRQoL, offering a descriptive profile across five dimensions: mobility (MO), self-care (SC), usual activities (UA), pain/discomfort (PD), and anxiety/depression (AD). In 2011, the EuroQol Group enhanced this instrument by increasing the severity levels from three to five in the EQ-5D-5L version, allowing for a more nuanced assessment of health states that can be converted into a single index 'utility' score representing HRQoL [12–15]. The EQ-5D-5L has been utilized in previous studies for both the general population and specific groups [16–19].

To enable thorough analysis and comparison of HRQoL measurements across various studies, it is essential to establish reference data in the form of population norms. These norms should encompass HRQoL information for the general population. The increasing accessibility of population norms provides another method for evaluating and tracking population health and health disparities [20]. As population's age and the significance of non-fatal diseases rises, evidence-based public health policies necessitate an understanding of population health concerning both morbidity and mortality [21]. While EQ-5D-5L population norms have been documented for several countries [21–25] and EQ-5D-3 L norms exist for Iran [26], there are currently no EQ-5D-5L population norms available for Iran based on large sample data at the national level and its samples are limited to a single city [27]. The EQ-5D-5L has demonstrated better psychometric properties compared to the EQ-5D-3 L in various studies conducted in Iran, including improvements in

ceiling effect, discriminatory power, convergent validity, and reliability [15, 28]. These advantages make the EQ-5D-5L a more robust instrument for assessing HRQoL and highlight the need for population norms specific to the Iranian context. Therefore, this study aimed to generate population norms for the EQ-5D-5L among adults in Iran using a large sample, and to investigate the heterogeneity of health-related quality of life (HRQoL) across sex and age groups using the EQ-5D-5L index and EQ-VAS score.

Method

Data were collected and analyzed from 3,518 individuals aged 18 and older in 2024–2025 through face-to-face interviews, excluding 192 incomplete questionnaires. Interviewers underwent a structured training program covering instrument explanation (EQ-5D-5L and EQ-VAS), mock interviews, and hands-on practice. Weekly debriefing sessions were held to ensure protocol adherence, and 5% of interviews were randomly reviewed by supervisors to confirm consistency. The study focused on HRQoL and its determinants across nine provinces in various regions of Iran (see Supplementary Fig. 1). To be eligible for the study, participants had to meet the following criteria: be at least 18 years old, have resided in the province of study for more than five years, and be capable of completing the questionnaire. Samples were obtained using a multistage sampling approach. First, Iran was divided into nine regions, and one province was randomly selected from each region. Within each selected province, the capital city was chosen and further divided into four areas based on socioeconomic development. I employed convenience sampling to select 100 participants from each area. In Tehran, the capital of Iran, due to its larger population, I divided the city into five distinct regions and similarly gathered 100 samples from each of these regions.

Data were collected using a self-administered questionnaire divided into two sections. The first section gathered sociodemographic information, including age, sex, marital status, and socioeconomic factors such as monthly household expenses, educational level, and health insurance coverage. It also addressed lifestyle factors like smoking habits, physical activity levels, body mass index (BMI), and the presence of chronic diseases. The second section included a validated Iranian version of the EQ-5D-5L questionnaire developed [29] by the EuroQol Group. This standardized tool assesses HRQoL across five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension offers five response options representing varying severity levels: no problems, slight problems, moderate problems, severe problems, and extreme problems/unable to perform. Additionally, the EQ-5D-5L includes the EQ-VAS,

which allows participants to rate their health status on a scale from 0 (worst imaginable health) to 100 (best imaginable health). To calculate HRQoL scores for participants, I applied the Iranian value set for EQ-5D-5L health states [29], with scores ranging from -1.19 for the worst health state (55555) to 1 for full health (11111).

Statistical analysis

Continuous variables were reported as mean \pm standard deviation (SD), and categorical variables as frequency (percentage). The Kolmogorov-Smirnov test confirmed a positively skewed distribution for both EQ-5D-5L utility and EQ-VAS scores, necessitating non-parametric or distribution-adjusted analyses. As pre-specified in our analytical plan, the frequency of self-reported health states (e.g., 11111, 11121) was analyzed descriptively and reported in the results (Table 1). Utility value and EQ-VAS score were stratified by sociodemographic variables (sex and age groups: 18–24, 25–34, 35–44, 45–54, 55–64, ≥ 65 years) and analyzed using descriptive statistics (mean \pm SD). For dimension-level analysis, probabilities of reporting each EQ-5D-5L dimension level [1–5] were calculated, stratified by sex (male/female) and age groups (18–24, 25–34, 35–44, 45–54, 55–64, ≥ 65 years), followed by computation of an aggregate measure reflecting “any problem” across dimensions. I Finally, I conducted multivariable analysis to examine the associations between sex and age with reported problems in the EQ-5D-5L, EQ-VAS, and EQ index scores. For the reported issues in each dimension, I utilized multiple logistic regression, coding ‘no problems’ as 0 and ‘slight problems,’ ‘moderate problems,’ ‘severe problems,’ or ‘extreme problems/unable’ as 1. To investigate the relationship between sex and age with both EQ-5D-5L utility scores and EQ-VAS scores, I employed a Generalized Linear Model (GLM) with a log link function and gamma distribution. This model demonstrated the lowest AIC (-1.409) and BIC (-25519.43) compared to alternative configurations tested (e.g., Gaussian/inverse Gaussian distributions with identity/logit links). The GLM effectively addresses issues of skewness and heteroscedasticity [30]. Since this

method requires non-negative values, I calculated the disutility value as (disutility = 1 - EQ-5D-5L value) and entered it as a dependent variable; in this model, a higher value indicates lower HRQoL. All regression models were adjusted for sex, age, marital status, education level, place of birth, smoking status, presence of any chronic condition, province, and physical activity. These variables were selected based on a two-step process: first, a univariate analysis was performed between each potential explanatory variable and the outcome variables. Second, all variables with a p -value less than 0.05 in the univariate analyses were then entered into the multivariable regression model.

I entered the data into Excel 2016, and after cleaning the data, it was transferred to Stata/MP 17 (Stata Corporation, USA) for statistical analyses. A p -value of less than 0.05 was considered statistically significant.

Results

A total of 3,815 individuals aged 18 years and older were included in the analysis, with an average age of 38.2 years (SD = 14.6). Among the participants, 51.2% were female. The sample comprised 58.43% married individuals, and nearly half of the respondents held a bachelor's degree. The vast majority of participants were born in urban areas, while 89.85% had basic health insurance coverage. Additionally, 24.9% of participants reported having at least one chronic condition, and nearly 47% of respondents described their health as good. The descriptive characteristics of the study population are detailed in Table 2.

The results presented in Table 1 highlight the most frequently reported EQ-5D-5L health states among participants. The health state “11111” indicating no problems in any dimension, was reported by 1,258 individuals (35.8% of the sample), followed by “11112” with 393 participants (11.2%) and “11122” with 310 individuals (8.8%). Twenty health states had frequencies of 0.5% and above, accounting for 82.7% of respondents. Other notable health states included “11121”, reported by 239 participants (6.8%), and “11113”, with 130 reports (3.7%).

The frequencies of item responses for each EQ-5D-5L dimension in the total sample, organized by age group, are presented in Table 3. A significant portion of respondents (64.2%) reported experiencing problems in at least one of the five dimensions. The most commonly reported problems were related to anxiety/depression (49.2%), followed by pain/discomfort (45.3%). Overall, problems with mobility, usual activities, and pain/discomfort tended to increase with age, while problems related to anxiety/depression were more prevalent among younger individuals and generally decreased as age increased. For instance, among participants aged 18 to 24 years, 50.8% reported no problems in the anxiety/depression

Table 1 Most frequently reported EQ-5D-5L health States

Health state	n	%	Health state	n	%
11,111	1258	35.8	11,222	33	0.9
11,112	393	11.2	11,131	32	0.9
11,122	310	8.8	11,124	30	0.8
11,121	239	6.8	11,114	27	0.8
11,113	130	3.7	21,132	24	0.7
11,123	127	3.6	21,222	22	0.6
21,121	67	1.9	21,123	21	0.6
21,122	59	1.7	11,134	21	0.6
11,133	47	1.3	21,221	18	0.5
11,132	36	1.0	11,223	17	0.5

Table 2 Descriptive characteristics of participants included in the study (n = 3518)

	n	Percent
All	3518	100
Age group		
18–24	791	22.5
25–34	794	22.6
35–44	814	23.1
45–54	570	16.2
55–64	337	9.6
65+	212	6.1
Sex		
Male	1717	48.7
Female	1803	51.3
Marital status		
Single	1293	7.0
Married	2044	58.4
Others	161	4.6
Level of education		
Illiterate	132	3.8
Primary school	320	9.2
Secondary school	718	20.6
Bachelor	1662	47.8
Master and Ph.D.	648	18.6
Place of birth		
Urban	2856	82.0
Rural	627	18.0
Basic health insurance		
Yes	3161	89.8
No	357	10.2
Presence of chronic condition		
Yes	875	25.0
No	2626	75.0
Self-rated health status		
Very poor	35	1.0
Poor	182	5.2
Fair	1015	29.0
Good	1611	46.1
Very good	651	18.6
BMI		
Under weight	131	3.8
Normal	1501	43.7
Overweight	1237	36.0
Obese	567	16.5
Monthly household cost		
Less than 5 million IRR	175	5.04
5 to 10 million IRR	526	15.14
10 to 15 million IRR	812	23.37
15 to 20 million IRR	842	24.24
More than 20 million IRR	1119	32.21

Note: Some variables had missing data, which has resulted in the sum of categories being less than the total sample size of 3,518

dimension, compared to 56.4% in the 55–64 age group and 53.8% for those aged 65 years and older. Additionally, our analyses showed that 62.1% of males and 66.3% of females reported experiencing problems in at least one of the five dimensions. For both sexes, anxiety/depression was more common among younger individuals and tended to decline with age. In contrast, the prevalence of problems related to mobility, self-care, usual activities, and pain/discomfort increased with age. Comparable results for males and females are detailed in Tables 4 and 5, respectively.

Figures 1 and 2, and 3 display the percentages of respondents reporting problems (slight, moderate, severe, or extreme) by dimension and age group for the total sample, as well as for males and females. The figures indicate that the highest percentage of reported problems across the five dimensions was related to anxiety/depression, with 49.2% for the total sample, 45.4% for males, and 52.9% for females. The highest percentage of reported problems varied by age group. For the age groups 18–24, 25–34, and 35–44 years, the most frequently reported problem was anxiety/depression. In contrast, for the age groups 45–54, 55–64, and 65 years and older, pain/discomfort was the most commonly reported problem.

Appendix 2 presents the EQ-5D index and EQ-VAS scores. The study found that females generally reported lower EQ-5D-5L index scores compared to males across all age groups, indicating a slightly reduced HRQoL. The mean EQ-5D index was 0.812 for males and 0.768 for females. However, EQ-VAS scores were relatively similar between sexes, with males scoring 75.38 and females scoring 73.34.

Table 6 presents the odds ratios (OR) for reporting problems across various EQ-5D dimensions, along with the regression coefficients (β) for disutility scores and EQ-VAS. The results indicate that females have significantly higher odds of reporting problems in mobility (OR = 1.7), self-care (OR = 1.3), usual activities (OR = 1.6), pain/discomfort (OR = 1.6), and anxiety/depression (OR = 1.6) compared to males. Furthermore, older age groups show increasingly higher odds ratios for reporting problems, particularly those aged 65 and older, who have the highest ORs of 8.3 for mobility problems and 9.4 for self-care dimensions compared to individuals aged 18–24 years. The disutility score also increases with age; for instance, the β coefficients for disutility scores are 0.3 for those aged 45–54, 0.7 for those aged 55–64, and 1.0 for individuals aged 65 and older, all in comparison to the 18–24 age group.

Discussion

In this study, I present population norms for the EQ-5D-5L in Iran, stratified by sex and age, based on a sample of 3,518 individuals aged 18 years and older from nine

Table 3 Item response frequencies in each dimension of the EQ-5D-5L by age (%)

Dimensions	Age category, years						
	Total n=3518	18–24 n=791	25–34 n=794	35–44 n=814	45–54 n=570	55–64 n=337	65+ n=212
<i>Mobility</i>							
No problems	82.2	93.7	88.6	83.2	80.2	63.8	46.7
Slight	12.7	4.2	10.2	12.5	14.0	23.7	34.0
Moderate	3.3	1.4	1.0	2.5	3.9	8.9	12.2
Severe	1.6	0.6	0.1	1.7	1.9	3.6	5.2
Extreme	0.2	0.0	0.1	0.1	0.0	0.0	1.9
<i>Self-care</i>							
No problems	94.2	97.2	97.0	95.8	96.8	88.7	68.4
Slight	4.1	1.6	2.0	3.1	2.6	8.6	21.2
Moderate	1.0	0.5	0.6	0.5	0.4	2.4	5.2
Severe	0.5	0.2	0.1	0.5	0.2	0.3	5.2
Extreme	0.2	0.4	0.3	0.1	0.0	0.0	0.0
<i>Usual activities</i>							
No problems	87.9	92.7	90.8	89.8	88.9	77.7	65.1
Slight	9.3	5.2	7.4	8.0	8.9	17.2	25.0
Moderate	2.1	1.4	1.5	1.5	1.9	3.9	6.6
Severe	0.5	0.4	0.0	0.6	0.2	0.6	2.8
Extreme	0.3	0.4	0.3	0.1	0.2	0.6	0.5
<i>Pain/discomfort</i>							
No pain	54.7	68.1	62.5	54.0	47.7	39.2	21.7
Slight	31.2	25.8	28.3	32.3	34.0	36.2	42.5
Moderate	10.6	3.9	7.8	10.7	13.9	18.1	24.5
Severe	2.7	1.8	1.0	2.2	3.5	5.0	8.5
Extreme	0.8	0.4	0.4	0.7	0.9	1.5	2.8
<i>Anxiety/depression</i>							
No problems	50.8	51.7	49.2	46.7	53.1	56.4	53.8
Slight	29.3	27.1	29.9	33.1	29.1	24.6	29.7
Moderate	13.7	12.9	14.6	16.2	12.3	11.6	10.9
Severe	4.4	5.7	4.4	2.9	4.7	5.0	2.8
Extreme	1.8	2.6	1.9	1.1	0.7	2.4	2.8

provinces across different regions of Iran. These findings contribute valuable insights to the existing body of research and facilitate comparisons between specific population groups and the general population. By establishing these norms, policymakers can identify disparities in health outcomes among various groups, enabling targeted interventions and more effective resource allocation.

Our study found that 64.2% of respondents reported experiencing problems in at least one of the five dimensions of the EQ-5D-5L, with a higher percentage among females (66.3%) compared to males (62.1%). The most commonly reported problems were related to anxiety/depression, affecting 49.2% of respondents, followed closely by pain/discomfort, reported by 45.3%. These results were consistent across sexes, with females exhibiting higher prevalence rates in both dimensions: 52.9% of females reported problems related to anxiety/depression compared to 45.4% of males, and 48.6% of females experienced pain/discomfort, while only 41.8% of males

reported these problems. In line with our findings, a previous study [31] conducted among the adult population in western Iran using the EQ-5D-3 L also identified that the highest percentage of reported problems was associated with anxiety and depression, followed by pain/discomfort. Additionally, another study conducted in Tehran [29] revealed that respondents reported more problems in the dimensions of anxiety/depression and pain/discomfort compared to those in 'mobility, self-care, and usual activities. The high prevalence of anxiety and depression among younger adults in this study, regardless of sex, underscores a substantial risk of psychological disorders and calls for urgent attention. Social factors, such as societal pressures tied to academic competition, career challenges, and social media influence, likely contribute to elevated stress levels. Economic instability, including unemployment and job insecurity, may further exacerbate these mental health challenges. Additionally, psychological factors, such as limited coping mechanisms

Table 4 Item response frequencies in each dimension of the EQ-5D-5L by age for males (%)

Dimensions	Age category, years						
	Total n = 1715	18–24 n = 336	25–34 n = 400	35–44 n = 378	45–54 n = 293	55–64 n = 191	65+ n = 117
<i>Mobility</i>							
No problems	84.9	93.7	90.7	85.2	85.3	73.8	55.6
Slight	11.0	3.6	7.7	11.9	11.3	17.8	28.2
Moderate	2.9	1.5	1.3	1.9	3.1	5.8	11.1
Severe	1.0	1.2	0.3	1.1	0.3	2.6	3.4
Extreme	0.2	0.0	0.0	0.0	0.0	0.0	1.7
<i>Self-care</i>							
No problems	94.7	96.7	97.5	95.0	97.9	92.2	75.2
Slight	3.5	2.1	1.7	3.4	1.7	5.2	15.4
Moderate	0.8	0.9	0.3	0.3	0.4	2.1	5.1
Severe	0.6	0.3	0.5	1.1	0.0	0.5	4.3
Extreme	0.3	0.0	0.0	0.3	0.0	0.0	0.0
<i>Usual activities</i>							
No problems	89.7	92.0	92.8	90.5	91.5	83.8	75.2
Slight	7.6	5.4	5.7	7.1	6.8	12.1	17.1
Moderate	1.8	2.1	1.0	1.3	1.0	3.1	5.1
Severe	0.5	0.6	0.5	0.8	0.4	0.5	2.6
Extreme	0.4	0.0	0.0	0.3	0.3	0.5	0.0
<i>Pain/discomfort</i>							
No pain	58.2	70.2	67.7	56.9	54.3	44.0	28.2
Slight	29.7	23.8	24.3	29.9	34.1	36.1	43.6
Moderate	9.2	3.3	7.5	10.0	9.2	14.7	19.7
Severe	2.0	2.4	0.2	2.1	1.4	4.2	5.1
Extreme	0.9	0.3	0.2	1.1	1.0	1.0	3.4
<i>Anxiety/depression</i>							
No problems	54.6	56.5	52.2	50.5	58.4	56.5	58.1
Slight	28.3	26.5	28.5	30.9	27.3	27.2	29.1
Moderate	11.7	8.9	14.2	14.3	11.3	9.9	6.8
Severe	3.4	5.4	2.5	2.6	2.7	4.7	2.6
Extreme	1.9	2.7	2.6	1.6	0.3	1.6	3.4

or resilience, could heighten vulnerability to anxiety and depression in this demographic.

The mean EQ-5D-5L index for participants in this study was 0.789, which is lower than the values reported in Norway (0.805) [32], Belgium (0.84) [21], Japan (0.96) [33], China (0.96) [34], and Italy (0.93) [23]. However, this score is comparable to two previous studies that reported a value of 0.79 from an adult sample in Tehran, Iran [27, 35]. This similarity can be attributed to the comparable populations and value sets used in these studies. The lower EQ-5D-5L index in our study compared to some international benchmarks may be attributed to several factors. Firstly, differences in healthcare systems and access to healthcare services can influence HRQoL scores. For instance, countries with more comprehensive public health systems may report higher HRQoL scores due to better healthcare access and outcomes [36]. Secondly, socioeconomic factors such as income level, education, and employment status can also impact HRQoL [37]. Populations with higher socioeconomic status may

report better health outcomes due to better living conditions and access to resources. Lastly, cultural and environmental factors can influence how individuals perceive and report their health status [38]. Different cultural backgrounds may have varying expectations and values regarding health and well-being, which can affect self-reported HRQoL scores.

I also found that the mean EQ-5D-5L index was higher for males (0.812) than for females (0.768). Similarly, the mean EQ-VAS score for males (75.38) exceeded that for females (73.34). Previous studies [21, 27, 32, 39, 40] have consistently shown that males generally have higher EQ-5D-5L index values and EQ-VAS scores compared to females, a trend reflected in our findings. For example, a 2022 study of the general population in Norway [32] found that females had lower EQ-5D-5L index scores than males, which aligns with our results. The multivariate regression analyses indicated that females had a statistically significant higher odds ratio for reporting problems across the dimensions of the EQ-5D-5L.

Table 5 Item response frequencies in each dimension of the EQ-5D-5L by age for females (%)

Dimensions	Age category, years						
	Total n = 1803	18–24 n = 455	25–34 n = 394	35–44 n = 436	45–54 n = 277	55–64 n = 146	65+ n = 95
<i>Mobility</i>							
No problems	79.6	93.6	86.3	81.4	74.7	50.7	35.8
Slight	14.4	4.6	12.7	13.1	17.0	31.5	41.0
Moderate	3.7	1.3	0.8	3.0	4.7	13.0	13.7
Severe	2.1	0.5	0.2	2.3	3.6	4.8	7.4
Extreme	0.2	0.0	0.0	0.2	0.0	0.0	2.1
<i>Self-care</i>							
No problems	93.7	97.6	96.5	96.5	95.7	84.2	60.0
Slight	4.6	1.3	2.3	2.7	3.6	13.1	28.4
Moderate	1.1	0.2	1.3	0.7	0.7	2.7	5.3
Severe	0.5	0.5	0.0	0.0	0.0	0.0	6.3
Extreme	0.1	0.4	0.0	0.0	0.0	0.0	0.0
<i>Usual activities</i>							
No problems	86.2	93.2	88.8	89.2	86.3	69.8	52.6
Slight	10.8	5.0	9.1	8.7	10.8	24.0	34.7
Moderate	2.3	0.9	2.1	1.6	2.9	4.8	8.4
Severe	0.5	0.7	0.0	0.5	0.0	0.7	3.2
Extreme	0.2	0.2	0.0	0.0	0.0	0.7	1.1
<i>Pain/discomfort</i>							
No pain	51.4	66.6	57.1	51.6	40.8	32.9	13.7
Slight	32.6	27.2	32.5	34.4	33.9	36.3	41.1
Moderate	11.9	4.4	8.1	11.2	18.8	22.6	30.5
Severe	3.3	1.3	1.8	2.3	5.8	6.2	12.6
Extreme	0.7	0.5	0.5	0.5	0.7	2.0	2.1
<i>Anxiety/depression</i>							
No problems	47.1	48.1	46.2	43.3	47.6	56.2	48.4
Slight	30.3	27.5	31.2	34.9	31.0	21.2	30.5
Moderate	15.6	15.8	15.0	17.9	3.4	13.7	15.8
Severe	5.3	5.9	6.3	3.2	6.9	5.5	3.2
Extreme	1.7	2.6	1.3	0.7	1.1	3.4	2.1

Additionally, they exhibited a statistically significant lower EQ-5D-5L index and EQ-VAS score. Our analysis also indicated that the likelihood of reporting problems related to mobility, self-care, usual activities, and pain/discomfort increased with age. However, I did not observe a statistically significant relationship between age and the probability of reporting problems related to anxiety/depression. These findings are consistent with those of other studies [21, 27, 35, 40]. Additionally, a study conducted in Iran [27] found that males and younger individuals were more likely to have better EQ-VAS scores and higher utility scores.

The current study has several limitations that should be acknowledged. Firstly, the sample was drawn from nine provinces in Iran, which may not fully capture the diversity of the entire Iranian population. To address this, we employed a multistage sampling approach to ensure geographical representation, but the use of convenience sampling at the final stage may limit the generalizability of our findings. While efforts were made to include

provinces from different regions of Iran to reflect cultural and socio-economic diversity, caution should be exercised when applying these results to broader contexts. Secondly, as a cross-sectional study, this research provides valuable insights into the relationships between utility scores and variables such as age and sex but is inherently limited in its ability to establish causality or determine the direction of these relationships. Cross-sectional designs offer a snapshot of data at a single point in time, which is useful for identifying associations and generating hypotheses but cannot account for temporal changes or causal pathways. For example, it remains unclear whether lower utility scores among older adults are due to aging itself or other unmeasured confounders such as chronic illnesses or socio-economic factors. Similarly, the observed higher prevalence of anxiety and depression among younger adults could reflect contemporary societal pressures or pre-existing vulnerabilities exacerbated by external factors. Secondly, as a cross-sectional study, this research provides valuable insights

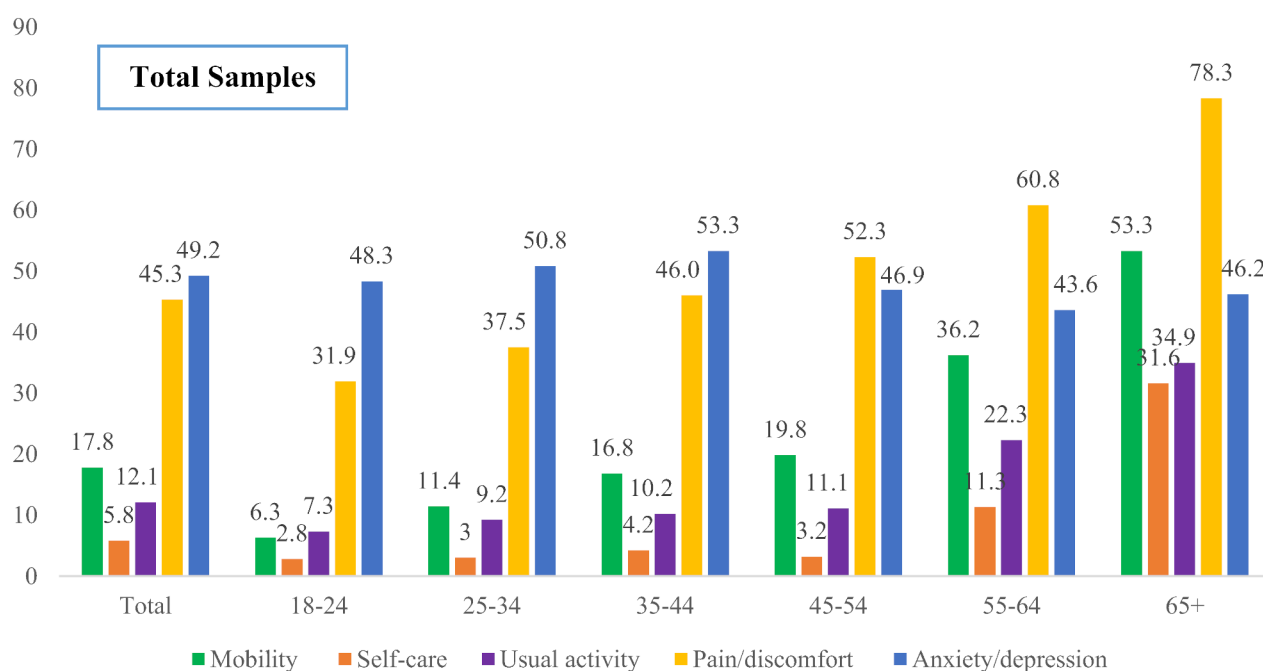


Fig. 1 Percentage of respondents reporting problems (slight, moderate, severe, or extreme) by dimension and age group for the total sample included in the study ($n=3,518$) in 2024

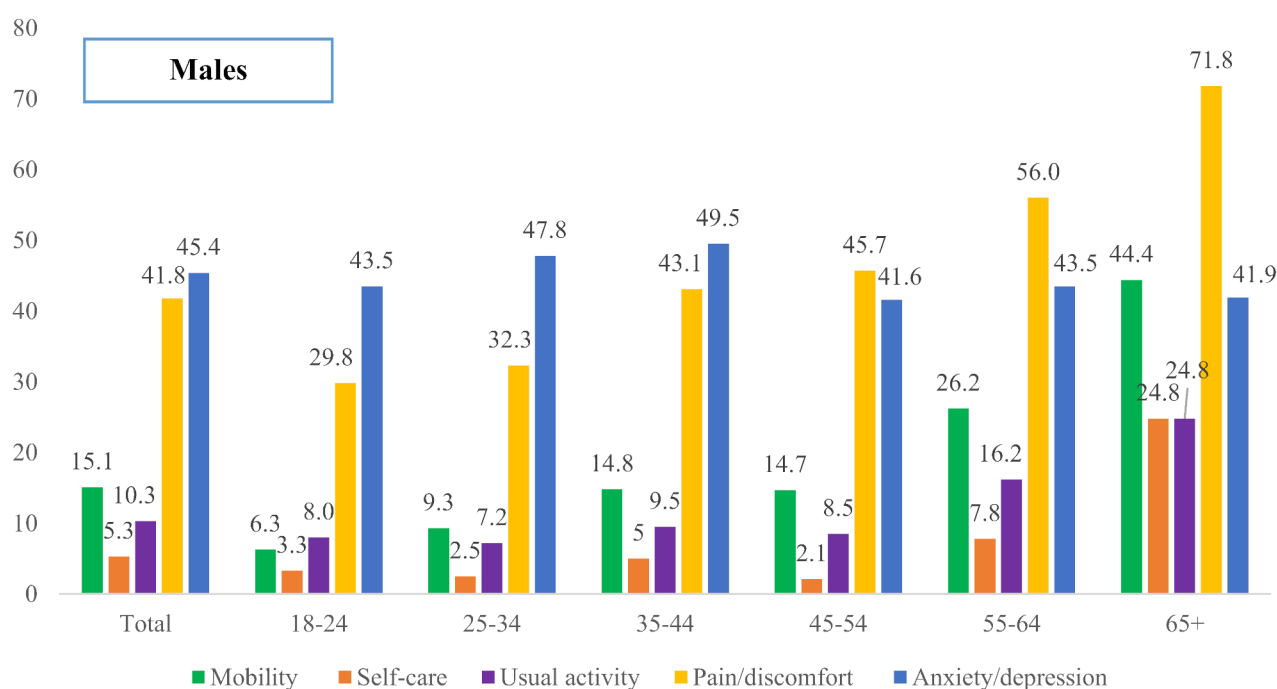


Fig. 2 Percentage of respondents reporting problems (slight, moderate, severe, or extreme) by dimension and age group for males ($n=1,715$) in 2024

into the relationships between utility scores and variables such as age and sex but is inherently limited in its ability to establish causality or determine the direction of these relationships. Cross-sectional designs offer a snapshot of data at a single point in time, which is useful for

identifying associations and generating hypotheses but cannot account for temporal changes or causal pathways. To overcome these limitations, longitudinal studies are needed to track changes over time and establish causal relationships between variables. Such designs would

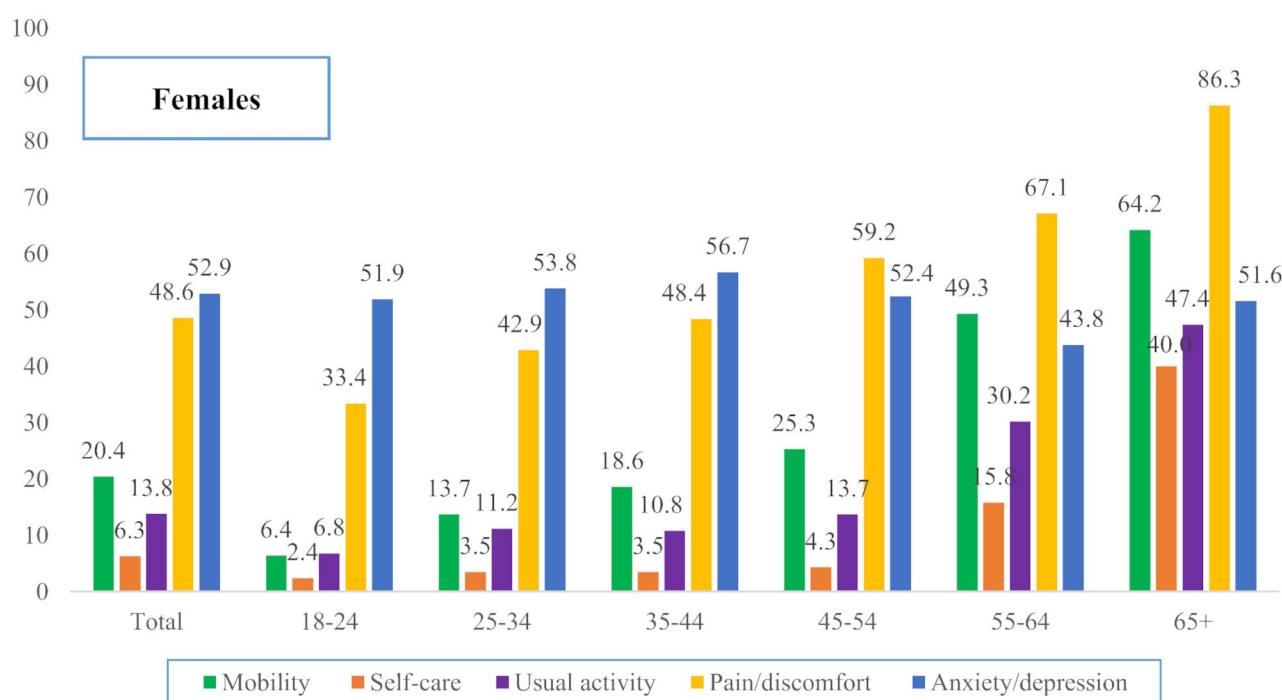


Fig. 3 Percentage of respondents reporting problems (slight, moderate, severe, or extreme) by dimension and age group for females ($n = 1,803$) in 2024

Table 6 Odds ratios (95% confidence interval) for reporting any problem per EQ-5D dimension and regression coefficients (95% confidence interval) for disutility score and EQ-5D VAS

	EQ-5D dimensions ^a					Disutility score ^b	EQ-VAS score ^c
	Mobility	Self-care	Usual activities	Pain/discomfort	Anxiety/depression		
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	β (95% CI)	β (95% CI)
Sex							
Male	-	-	-	-	-	-	-
Female	1.7 (1.4 to 2.1)	1.3 (0.9 to 1.9)	1.6 (1.3 to 2.0)	1.6 (1.3 to 1.8)	1.6 (1.4 to 1.9)	0.3 (0.2 to 0.4)	-0.05 (-0.06 to -0.03)
Age groups							
18-24	-	-	-	-	-	-	-
25-34	1.6 (1.0 to 2.4)	1.2 (0.6 to 2.3)	1.3 (0.8 to 1.9)	1.2 (0.9 to 1.5)	1.2 (0.9 to 1.5)	0.1 (-0.0 to 0.2)	-0.02 (-0.05 to 0.0)
35-44	2.1 (1.4 to 3.2)	1.6 (0.8 to 3.2)	1.3 (0.9 to 2.1)	1.5 (1.2 to 2.0)	1.4 (1.1 to 1.8)	0.3 (0.1 to 0.4)	-0.02 (-0.05 to 0.0)
45-54	2.6 (1.7 to 4.0)	1.2 (0.5 to 2.6)	1.5 (0.9 to 2.5)	2.1 (1.6 to 2.8)	1.1 (0.8 to 1.4)	0.3 (0.1 to 0.4)	-0.01 (-0.04 to 0.02)
55-64	5.3 (3.3 to 8.5)	3.6 (1.7 to 7.7)	3.1 (1.9 to 5.1)	2.8 (1.9 to 4.0)	0.9 (0.6 to 1.3)	0.7 (0.5 to 0.9)	-0.05 (-0.09 to -0.01)
65+	8.3 (4.9 to 14.1)	9.4 (4.2 to 20.7)	4.6 (2.6 to 8.2)	6.5 (4.1 to 10.4)	0.9 (0.6 to 1.4)	1.0 (0.7 to 1.3)	-0.11 (-0.16 to -0.06)
Pseudo R²							
	0.1505	0.2097	0.1124	0.1224	0.1125	AIC= -1.408 BIC= -25519.4	AIC= 10.62 BIC= -27052.2

a: Based on multiple logistic regression, the analysis was adjusted for sex, age, marital status, level of education, place of birth, smoking status, presence of any chronic condition, province, and physical activity. **b:** The analysis using the Generalized Linear Model (GLM) was also adjusted for sex, age, marital status, level of education, place of birth, smoking status, presence of any chronic condition, province, and physical activity. The GLM is designed to address skewness and heteroscedasticity while requiring non-negative values. Consequently, the disutility score (disutility score = 1 - EQ-5D-5L index value) was included in the model. **c:** Analysis based on the Generalized Linear Model (GLM) was conducted with adjustments for sex, age, marital status, level of education, place of birth, smoking status, presence of any chronic condition, province, and physical activity

Significant results at the $p < 0.05$ level are shown in bold

enable researchers to control for unobserved heterogeneity and better understand how factors such as age, sex, and socio-economic conditions dynamically influence HRQoL. For instance, longitudinal data could clarify whether interventions targeting mental health challenges among younger adults lead to sustained improvements in HRQoL or if additional systemic changes are required. Future research incorporating longitudinal approaches would provide deeper insights into these relationships and enhance the robustness of findings.

Conclusion

The current study established general population norms for the EQ-5D-5L and EQ-VAS scores, stratified by age and sex, using a large sample from nine provinces in Iran. These findings are significant and can be utilized by policymakers to design and implement effective health interventions. Our analysis revealed that over 64% of respondents reported experiencing problems in at least one of the five dimensions of the EQ-5D-5L. The most frequently reported problems were related to anxiety and depression, affecting 49.2% of participants, particularly among both sexes in younger age groups. In contrast, pain and discomfort were more prevalent among older individuals. Furthermore, females exhibited lower utility scores and reported more problems across all dimensions of the EQ-5D-5L, regardless of age group. Therefore, to enhance the health status of the Iranian population and optimize resource allocation, it is crucial to pay attention to the findings of this study. Targeted interventions addressing the specific needs highlighted by our research could lead to improved health outcomes for vulnerable groups within the population.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12955-025-02378-8>.

Supplementary Material 1

Supplementary Material 2

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Author contributions

S. R. conceptualized the study, collected and analyzed the data, and drafted the initial report. S. R. critically reviewed the manuscript, providing feedback

on the first draft. S. R. collaborated on revisions and finalizing the manuscript. The author has read and approved the final version of the paper.

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Data availability

The datasets are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

The research protocol was approved by the Research Deputy of Kermanshah University of Medical Sciences, with the approval number IR.KUMS.REC.1403.337. The study adhered to the ethical principles outlined in the Declaration of Helsinki. Before data collection, the researchers provided a verbal explanation of the study's purpose to each potential participant, and informed consent was obtained from all subjects. Participants were also informed of their right to withdraw from the study at any time without facing any consequences.

Competing interests

The authors declare no competing interests.

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