Reliability and Validity of EuroQol-5 Dimensions-5 Levels in Patients with Hematologic Malignancies: A Cross-sectional Study

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BACKGROUND & OBJECTIVES

- Hematologic malignancies, including multiple myeloma (MM), leukemia, and lymphoma, represent some of the most aggressive and debilitating cancers, profoundly affecting patients' physical, emotional, and social well-being.
- Measuring health-related quality of life (HRQoL) in these patients is essential to understand the disease burden, evaluating therapeutic outcomes, and informing patient-centered care decisions.
- The EuroQol-5 Dimensions-5 Levels (EQ-5D), a widely adopted generic HRQoL tool valued for its simplicity, adaptability, and utility in economic evaluations, may lack sensitivity to disease-specific complexities.
- This study aimed to assess the reliability and validity of EQ-5D in Chinese patients with MM, acute leukemia (AL), and lymphoma.

METHODS

- **Study Design** A cross-sectional observational study was conducted between January and August 2024, enrolling patients diagnosed with MM, AL, or lymphoma at Xiangya Hospital of Central South University.
- **Data Collection**
  - **HRQoL Assessment**: The validated Chinese version of the EQ-5D questionnaire and the time trade-off (TTO) method were used.
  - **Hospital medical records**: Patient demographics, socioeconomic status, and disease information.
- **Statistical Analysis**
  - Descriptive statistics were employed to summarize the demographic and clinical characteristics along with utility scores derived from the EQ-5D and TTO methods.

Reliability	Cronbach's α analysis
Criterion validity	Spearman's rank correlation
Structural validity	Exploratory factor analysis

  - The Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were performed to determine the adequacy of sampling and the interrelatedness of EQ-5D dimensions.
  - Multivariate linear regression analyses were conducted to further explore the associations between patient characteristics and HRQoL outcomes and confirm the internal validity of EQ-5D.

RESULTS

- This study included 158 patients with hematologic malignancies, comprising 50 cases of MM, 63 AL, and 45 lymphoma (Table 1).

Table 1. Clinical and Demographic Characteristics of Patients with Hematologic Malignancies

Variable	Multiple myeloma		Acute leukemia		Lymphoma	
	N	n (%) or Mean±SD, Median	N	n (%) or Mean±SD, Median	N	n (%) or Mean±SD, Median
Demographics						
Age (years)	50	58.7±7.5, 59.0	45	48.9±14.4, 50.0	63	42.8±14.5, 43.0
Male proportion	50	35 (70.0%)	45	25 (55.6%)	63	36 (57.1%)
Health insurance						
Medical insurance for urban residents	50	25 (50.0%)	45	25 (55.6%)	63	47 (74.6%)
Medical insurance for urban employees	50	19 (38.0%)	45	18 (40.0%)	63	15 (23.8%)
Residence						
Provincial capitals/Municipalities	50	8 (16.0%)	45	6 (13.3%)	63	3 (4.8%)
Disease type						
Acute leukemia						
Acute myeloid leukemia, non-M3	/	/	/	/	63	48 (76.2%)
Lymphoma						
Diffuse large B-cell lymphoma	/	/	45	17 (37.8%)	/	/
Hodgkin lymphoma	/	/	45	6 (13.3%)	/	/
Primary central nervous system lymphoma	/	/	45	5 (11.1%)	/	/
Follicular lymphoma	/	/	45	5 (11.1%)	/	/
Treatment stage						
Newly diagnosed	50	34 (68.0%)	45	37 (82.2%)	63	58 (92.1%)
Extramedullary involvement	50	4 (8.0%)	/	/	/	/
CNS involvement	/	/	45	6 (13.3%)	63	2 (3.2%)
Extranodal involvement	/	/	45	35 (77.8%)	/	/
ECOG ≥2	50	21 (42.0%)	45	13 (28.9%)	63	33 (52.4%)
Previous treatment history						
Anti-tumor therapy	50	47 (94.0%)	45	31 (68.9%)	63	49 (77.8%)
Chemotherapy	50	47 (94.0%)	45	31 (68.9%)	63	49 (77.8%)
Radiotherapy	50	1 (2.0%)	45	2 (4.4%)	63	0 (0.0%)
Hematopoietic stem cell transplantation	50	16 (32.0%)	45	0 (0.0%)	63	2 (3.2%)
Comorbidity						
Hyperlipidemia	50	17 (34.0%)	45	21 (46.7%)	63	16 (25.4%)
Hypertension	50	15 (30.0%)	45	7 (15.6%)	63	9 (14.3%)

CNS: Central Nervous System; ECOG: Eastern Cooperative Oncology Group.

➢ HRQoL Outcomes

- HRQoL outcomes varied significantly among the three groups (Figure 1).
- Across all groups, EQ-5D utility values were consistently higher than TTO-elicited utility.

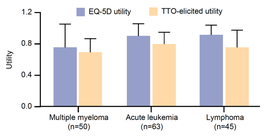

Figure 1. The measured HRQoL utility by EQ-5D and TTO for MM, AL, and lymphoma

- The distributions of rated scores for different EQ-5D dimensions across the three groups are shown in Figure 2.

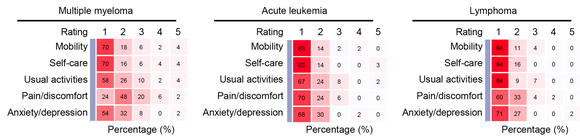

Figure 2. The proportion of different rated scores in various dimensions

➢ Reliability of EQ-5D

- The MM group showed the highest reliability (Cronbach's α=0.899).
- Anxiety/depression consistently negatively impacted overall reliability.
- In AL and lymphoma patients, the mobility dimension contributed most to overall reliability, whereas usual activities was the most critical dimension for MM patients (Figure 3).

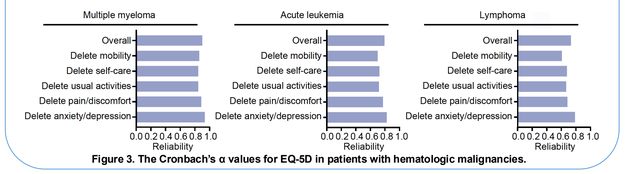

Figure 3. The Cronbach's α values for EQ-5D in patients with hematologic malignancies.

➢ Criterion Validity of EQ-5D

- EQ-5D utility scores showed strong correlation with TTO-elicited utility in MM patients, moderate correlation in AL patients, and no significant correlation in lymphoma patients (Figure 4).

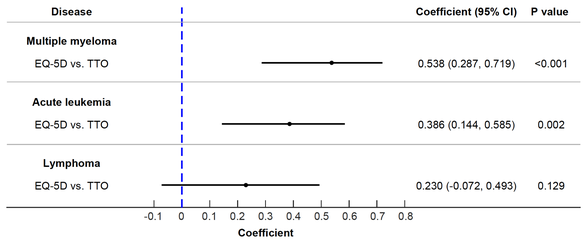

Figure 4. Criterion-related validity of EQ-5D utility scores in patients with hematologic malignancies

➢ Structural Validity of EQ-5D

- MM patients had the highest KMO value (0.829), indicating excellent sampling adequacy, followed by AL (0.786) and lymphoma (0.553) patients. Bartlett's test results were significant for all groups, confirming the appropriateness of factor analysis (Table 2).

Table 2. Kaiser-Meyer-Olkin measure and Bartlett's test of sphericity for EQ-5D utility scores in patients with hematologic malignancies

	Multiple myeloma	Acute leukemia	Lymphoma
KMO value	0.829	0.786	0.553
Bartlett's test of sphericity			
Chi-square value	195.494	108.308	95.121
P value	**<0.001**	**<0.001**	**<0.001**

- Factor analysis identified two key factors across the three groups. Factor 1 primarily captured physical functioning domains (e.g., mobility, self-care, and usual activities) (Table 3 and 4).

Table 3. Eigenvalues and explained variance of factors in the EQ-5D scale

Disease	Factor	Eigenvalue	Variance Explained (%)	Cumulative Variance Explained (%)
Multiple myeloma (N=50)	1	3.416	52.0%	52.0%
	2	0.215	24.3%	76.3%
	3	0.123	23.5%	99.8%
	4	0.007	0.2%	100.0%
	5	0.000	0.0%	100.0%
Acute leukemia (N=63)	1	2.473	43.5%	43.5%
	2	0.164	35.6%	79.2%
	3	0.096	20.2%	99.4%
	4	0.010	0.6%	100.0%
	5	0.000	0.0%	100.0%
Lymphoma (N=45)	1	2.488	44.3%	44.3%
	2	0.640	31.1%	75.4%
	3	0.407	22.9%	98.3%
	4	0.044	1.7%	100.0%
	5	0.000	0.0%	100.0%

Table 4. Rotated factor loadings for EQ-5D dimensions in patients with hematologic malignancies

Disease	Dimensions	Rotated factor loadings	
		Factor 1	Factor 2
Multiple myeloma (N=50)	Mobility	0.931	0.363
	Self-care	0.664	0.655
	Usual activities	0.701	0.631
	Pain/discomfort	0.430	0.637
	Anxiety/depression	0.184	0.478
Acute leukemia (N=63)	Mobility	0.727	0.498
	Self-care	0.658	0.358
	Usual activities	0.370	0.927
	Pain/discomfort	0.585	0.190
	Anxiety/depression	0.250	0.204
Lymphoma (N=45)	Mobility	0.998	0.234
	Self-care	0.231	0.972
	Usual activities	0.719	0.202
	Pain/discomfort	0.453	0.397
	Anxiety/depression	0.114	0.376

➢ Consistency of Associations Between Patient Characteristics and Health Utility

- Results showed consistent patterns for MM patients, with most variables showing no significant associations with EQ-5D utility scores or TTO-elicited utility.
- For AL patients, gender, medical insurance type, and comorbidities with second malignancies showed inconsistent associations with EQ-5D and TTO utility scores.
- For lymphoma patients, variables with inconsistent associations included residence, relapsed or refractory disease, extranodal involvement, central nervous system (CNS) involvement, and comorbidities with pulmonary diseases.

➢ Factors influencing the discrepancy between EQ-5D and TTO-derived utility values

- In patients with AL and lymphoma, multivariable linear regression analysis was performed to investigate patient characteristics influencing the discrepancy between TTO and EQ-5D-derived utility values (Figure 5). Chronic kidney failure was a significant predictor of this discrepancy in AL patients (coefficient=0.213, p=0.035).

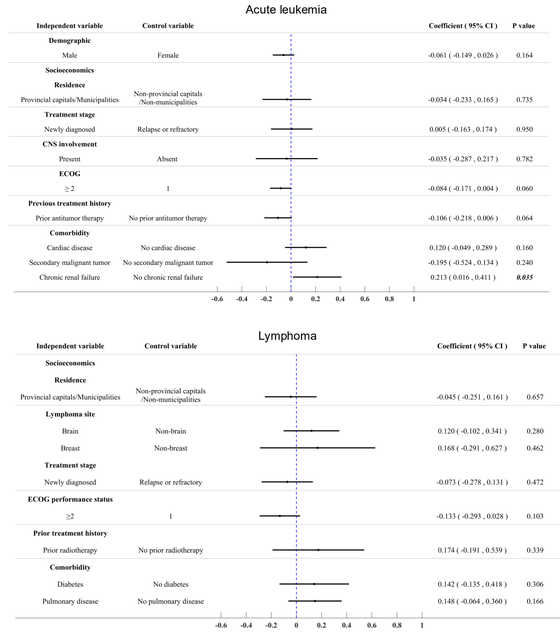

Figure 5. Multivariable linear regression analysis of the discrepancy between TTO and EQ-5D

CONCLUSIONS

- The EQ-5D is a validated instrument for measuring health utility in Chinese MM patients, demonstrating strong internal consistency, significant correlations with TTO-based utilities, and robust structural validity in most dimensions. However, performance was less robust in AL and lymphoma patients, indicating limitations in capturing disease-specific and psychological health states in these populations.