Beyond the Mean: Do distribution-based metrics offer greater insight into predictors of societal health preferences? A secondary analysis of 42 EQ-5D-5L value sets

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INTRODUCTION & AIM

- Health preference data are widely used in economic evaluations and increasingly applied in clinical settings to track patient progress and support quality monitoring.
- The EQ-5D-5L, developed by the EuroQol Research Foundation, is among the most widely used tools in this field.
- Summarising preference-based data using only central tendency measures can obscure the underlying distribution of societal preferences, which often show left-skew due to clustering at high utility values.
- This study assessed whether distribution-based indicators offer additional explanatory power in predicting value set variability.

METHODS

- This secondary analysis forms part of a broader examination of valuation studies using widely applied multi-attribute utility instruments.
- A total of 42 general population EQ-5D-5L valuation studies conducted with the standardised EuroQol Valuation Technology (EQ-VT) protocol were identified and analysed.
- Each value set was summarised using seven dependent indicators: mean, median, skewness, interquartile range (IQR), 75th percentile (P75), 25th percentile (P25), and the value for the 'pits' state (55555).
- Independent variables were publication year, mean age, gender ratio, sample size, CREATE score, WHO region, EQ-VT version (1, 2, or other), and valuation technique (composite time trade-off (cTTO) or hybrid).
- Univariate and multivariable linear regression models were applied to identify predictors of each summary indicator.
- A p-value of <0.05 was considered significant.
- Model performance was evaluated using R^2, root mean square error (RMSE) and mean absolute error (MAE).

RESULTS

- These studies (2016-2025) were conducted in Europe (38%), Asia/Western Pacific (29%), Africa/Middle East (19%), and the region of the Americas (14%).
- EQ-VT version 2 and the hybrid approach were most frequently used (67%).
- Region and EQ-VT version were consistent predictors across indicators.
  - Compared to Europe, value sets from Asia/Western Pacific reported significantly lower mean (β = -0.102, 95%CI [-0.199, -0.004]), median (β = -0.110, 95%CI [-0.207,-0.013]), and P75 (β = -0.089, 95%CI [-0.167,-0.010]) utilities.
  - Older EQ-VT (v1) value sets tend to have higher central values and more skewed distributions, but narrower spreads, relative to v2.
- IQR demonstrated the strongest overall performance (R^2 = 48.8%, RMSE = 0.069, MAE = 0.050), with EQ-VT version 1 being the sole predictor (β = -0.114, 95%CI [-0.187,-0.042]).

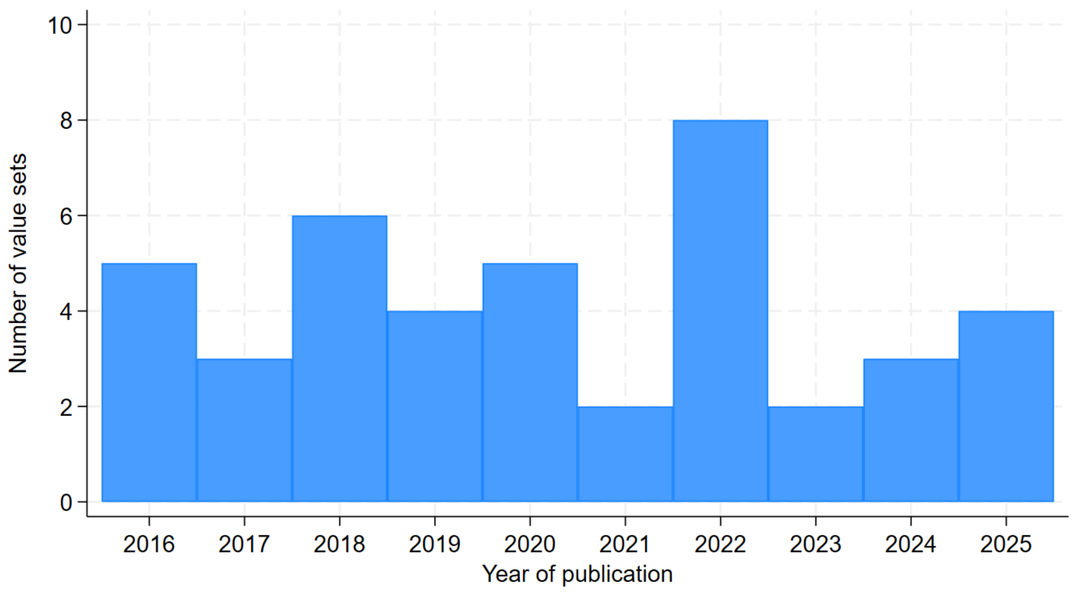

Figure 1. Publication year of EQ-VT Based EQ-5D-5L value sets

Table 1. Characteristics of included EQ-VT based studies (N=42)

	N (%)
Grand Mean Age (SE)	47.57 (1.1)
Grand Mean Male Proportion (SE)	0.9 (0.0)
Grand Mean Sample Size (SE)	1024.5 (55.4)
Mean CREATE score (SE)	89.7 (1.8)
WHO region	
Europe	16 (38.1)
Asia and Western Pacific	12 (28.6)
African/ Middle-East	8 (19.1)
Americas	6 (14.3)
EQ-VT version	
1	9 (21.4)
2	28 (66.7)
Other (EQ-PVT, EQ-VT lite)	5 (4.8)
Valuation technique	
cTTO	14 (33.3)
Hybrid	28 (66.7)

Note: cTTO- composite time trade-off

Table 2. Multivariable predictors of various summary scores for EQ-VT-based value sets (N=42)

	Central measure of tendency		Distribution-based indicators				
	Mean	**Median**	**Skewness**	**IQR**	**P25**	**P75**	**Pits**
	β (95% CI)						
Year	0.006 (-0.015, 0.027)		-0.001 (-0.020, 0.018)	-0.002 (-0.014, 0.010)	0.010 (-0.016, 0.036)		0.015 (-0.027, 0.056)
Sample size	0.000 (-0.000, 0.000)	0.000 (-0.000, 0.000)					
WHO region (ref= Europe)							
Africa/Middle-East	-0.066 (-0.197, 0.064)	-0.052 (-0.172, 0.068)	0.036 (-0.082, 0.153)	0.025 (-0.048, 0.099)	-0.098 (-0.259, 0.062)	-0.052 (-0.148, 0.045)	-0.205 (-0.462, 0.052)
Americas	0.008 (-0.116, 0.131)	0.000 (-0.123, 0.124)	0.033 (-0.078, 0.143)	-0.044 (-0.113, 0.025)	0.026 (-0.125, 0.176)	-0.020 (-0.119, 0.080)	0.035 (-0.206, 0.276)
Asia/ Western Pacific	**-0.102 (-0.199, -0.004)***	**-0.110 (-0.207, -0.013)***	**0.128 (0.040, 0.216)****	-0.030 (-0.086, 0.025)	-0.054 (-0.174, 0.066)	**-0.089 (-0.167, -0.010)***	-0.011 (-0.203, 0.181)
EQ-VT (ref=v2)							
v1	**0.155 (0.026, 0.284)***	**0.123 (0.024, 0.222)***	**0.117 (0.001, 0.233)***	**-0.114 (-0.187, -0.042)****	**0.196 (0.038, 0.354)***	0.049 (-0.031, 0.129)	**0.445 (0.192, 0.698)****
others	-0.126 (-0.263, 0.01)	-0.128 (-0.264, 0.009)	0.070 (-0.049, 0.190)	0.058 (-0.017, 0.133)	**-0.192 (-0.354, -0.029)***	**-0.136 (-0.242, -0.029)***	-0.230 (-0.490, 0.030)
Performance indicators							
R2	0.428	0.405	0.382	0.488	0.403	0.342	0.505
RMSE	0.122	0.122	0.111	0.069	0.151	0.099	0.242
MAE	0.093	0.096	0.079	0.050	0.116	0.075	0.176

*Note: * P<0.05; ** P<0.01; *** P<0.001;* EQVT EuroQol Valuation Technology protocol; IQR interquartile range; MAE mean square error; P25 25th percentile; P75 75th percentile; Pits value of '55555' health state; R2 coefficient of determination; RMSE root mean square error; SE standard error

CONCLUSIONS

- Summary metric choice influences observed predictors, highlighting the limitations of relying solely on central tendency in EQ-5D-5L analyses.
- The relatively high R^2 for interquartile range and pits state value shows that distributional metrics capture meaningful variation that mean values alone might miss.
- Protocol version and regional context significantly shape the distribution of EQ-VT-based value sets, beyond central tendency measures.

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