Modelling Health System Capacity and Measurement Dispersion to Explain Cross-National Variation in EQ-VT Utility Values

MSR178

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BACKGROUND & AIMS

- Country-specific EQ-5D-5L value sets are cornerstones of health-economic evaluation, yet mean EQ-VT utility scores vary widely across populations.
- The sources of this variation, including population preferences, socio-economic context, healthcare system capacity, or measurement-level factors remain poorly understood.
- Most cross-country comparisons focus on mean utility and overlook dispersion (within-study variability), which may itself reflect genuine preference heterogeneity and protocol performance [2].
- This study aimed to identify country-level predictors of mean EQ-VT utility, and test whether modelling measurement dispersion changes the inferences drawn.

METHODS

- **Design:** Secondary analysis of 42 EQ-5D-5L valuation studies conducted under the standardised EQ-VT protocol (2012–2024).
- **Outcome:** Study-specific mean EQ-VT utility, computed across all 3,125 defined health states.
- **Predictors:** 17 country-level indicators grouped into (i) study-level factors, (ii) demography, (iii) health outcomes, (iv) economy, (v) healthcare financing, and (vi) healthcare resources, sourced from World Bank, WHO, and GBD 2019.
- **Modelling:** Univariable OLS, LASSO penalised regression, and forward selection; model performance compared via adjusted R^2, RMSE, AIC, and BIC.
- **Sensitivity analysis:** Re-estimated all multivariable models including the within-study SD of EQ-VT utility as a covariate, to account for measurement dispersion.

RESULTS

- Across the 42 studies, the strongest univariable predictor of mean EQ-VT utility was hospital bed density (β = 0.020 per additional bed per 1,000 population; 95% CI 0.005-0.036).
- Physicians per 1,000 population was the second strongest predictor (β = 0.034; 95% CI 0.004-0.065).
- LASSO retained EQ-VT version, hospital beds, and physician density; in post-LASSO OLS, only EQ-VT version remained statistically significant.
- Forward selection retained hospital beds (β = 0.016; 95% CI 0.001–0.032); overall fit was modest (adjusted R^2 = 0.19).
- When the within-study SD of mean EQ-VT utility was included to account for measurement dispersion, none of the country-level capacity indicators remained statistically significant, although model fit improved substantially (adjusted R^2 rose from 0.19 to 0.64).

Table 1. Univariable and multivariable regression models of mean EQ-VT utility, with and without SD adjustment

Predictor	Univariable OLS β (95% CI)	Model 1 Adjusted β (95% CI)	Model 2 Adjusted β (95% CI)
Study-level factors			
EQ-VT version 2/lite (vs v1)	−0.121 (−0.221, −0.021) *	−0.091 (−0.191, 0.009)	0.063 (−0.017, 0.144)
Healthcare resources			
Hospital beds per 1,000	0.020 (0.005, 0.036) *	0.016 (0.001, 0.032) *	0.004 (−0.007, 0.015)
Physicians per 1,000	0.034 (0.004, 0.065) *	—	—
Model fit			
Adjusted R^2	—	0.189	0.643
RMSE	—	0.125	0.083
AIC / BIC	—	−49.99 / −44.92	−81.91 / −75.15

**p < 0.05; β, regression coefficient; CI, confidence interval; RMSE, root mean square error; AIC/BIC, Akaike/Bayesian information criterion. Model 1 is the forward-selection OLS model retaining EQ-VT version and hospital beds per 1,000 population. Model 2 further adjusts for the within-study SD of mean EQ-VT utility*

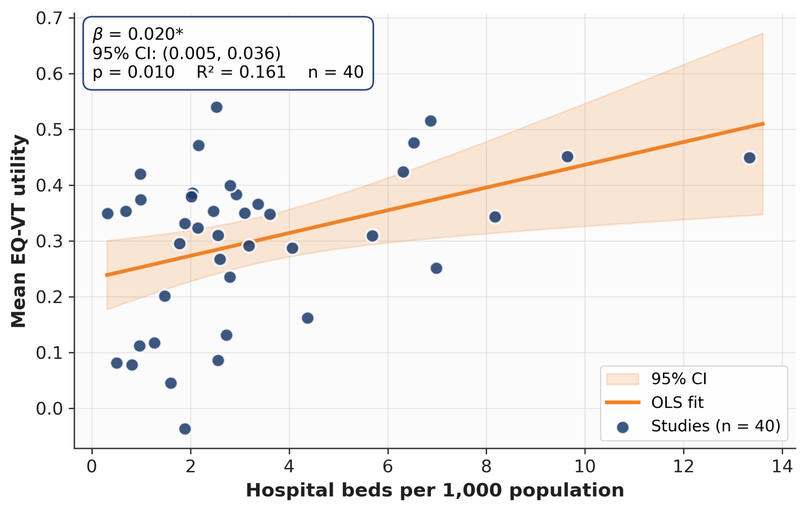

Figure 1. Hospital bed density is positively associated with mean EQ-VT utility (β = 0.020, p = 0.010).

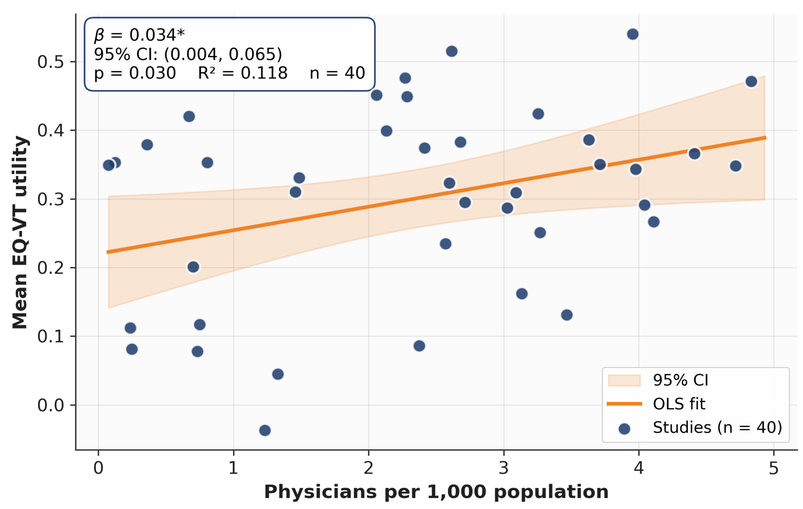

Figure 2. Physician density shows a similar positive, but weaker, association (β = 0.034, p = 0.030).

Table 2. Characteristics of study-level and country-level indicators included in the analysis (N = 42)

	Mean (SD)	Min	Max
Study-level factors			
Data collection year, n (%)			
2012-2016	16 (38.1)		
2017-2021	20 (47.6)		
2022-2024	6 (14.3)		
EQ-VT, n (%)			
Version 1	9 (21.4)		
Version 2/lite	33 (78.6)		
Sample age, years	44.4 (5.510)	32.1	53.5
Sample male, (%)	47.7 (4.440)	34.0	57.7
Preference elicitation method, n (%)			
TTO	13 (31.0)		
Hybrid/DCE	29 (69.0)		
Country-level demographic indicators			
World Bank region, n (%)			
Asia	12 (28.6)		
Europe & Central Asia	16 (38.1)		
Americas	6 (14.3)		
Africa & Middle East	8 (19.1)		
World Bank income, n (%)			
Low/Lower-middle	8 (19.1)		
Upper-middle	8 (19.1)		
High	26 (61.9)		
Male population proportion	0.50 (0.030)	0.46	0.64
Population aged ≥65, (%)	12.14 (6.560)	1.61	24.58
Country-level healthcare resource indicators			
Hospital bed per 1,000 population	3.32 (2.730)	0.32	13.34
Physicians per 1,000 population	2.34 (1.390)	0.08	4.83

Values are mean (SD), range, or n (%), as appropriate. DCE, discrete choice experiment; SD, standard deviation; TTO, time trade-off

DISCUSSION & CONCLUSIONS

- Country-level healthcare capacity indicators, particularly hospital bed density and physician supply, explain a modest but statistically meaningful share of cross-national variation in mean EQ-VT utility under conventional regression.
- Once within-study dispersion (SD of mean EQ-VT) is modelled, these associations are fully attenuated: no country-level predictor remains significant, and the dispersion term alone captures most of the explainable variance.
- This suggests that part of the apparent 'health-system effect' on valuations reflects how preferences are distributed within a population, not only their central tendency. Ignoring dispersion risks overstating the role of macro-level healthcare characteristics.
- Implication for practice: when borrowing or mapping value sets across countries, analysts should consider both mean utility and its within-study variability, rather than mean utility alone.

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