



Development of an online database of published usable mapping algorithms used to estimate EQ-5D utilities.



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INTRODUCTION

A systematic literature review (SLR) was conducted of published mapping algorithms across multiple disease areas used to predict EQ-5D (5L or 3L) utilities. A classification system was created that categorized the performance of mapping algorithms as either 'Poor', 'Useful' or 'Ready to Use' based on standard measures of performance. A database of the classification (freely available) is available at www.r-s-s.com.

OBJECTIVES

- To identify all published mapping algorithms.
- To classify the usefulness of mapping algorithms.
- To provide a freely available database of the classification system.

METHODS

We searched the available databases (including PubMed, Cochrane). We identified common performance metrics of mapping algorithms (e.g., R² and Root Mean Squared Error (RMSE)). We classify these using monte-carlo simulation methods and advocate a new classification system using the population distribution of the performance metrics of the form:

$$\Pr[(\Omega_j \geq 0) | \Lambda, A_j] \geq \Delta, \text{ for } \Lambda \in \{\text{measures such as } R^2\}$$

$$\Pr[(\Omega_j < 0) | \Lambda, A_j] \geq \Delta, \text{ for } \Lambda \in \{\text{measures such as RMSE, MAE}\}$$

Where, $\Omega_j = (\theta_j^* - \hat{\mu})$, θ_j^* is an overall average performance metric and $\hat{\mu}$ is an overall performance measure across algorithms and A_j is each algorithm. Based on this, algorithms are classified as 'Poor', 'Useful/Use with Caution' or 'Ready to Use'.

RESULTS

Table 1: Identified Mapping Algorithms & Performance Metrics

Disease Area	Identified Algorithms N = 186	Mean R ² Value (SD)	Mean RMSE Value (SD)
Oncology	41 (22.04%)	0.645 (0.127)	0.108 (0.050)
Mixed Disease Types ^a	32 (17.20%)	0.739 (0.255)	0.032 (0.059)
Musculoskeletal	23 (12.37%)	0.537 (0.212)	0.116 (0.118)
Mental Health	21 (11.29%)	0.351 (0.136)	0.123 (0.061)
Neurology	17 (9.14%)	0.473 (0.183)	0.145 (0.088)
Chronic Disease	10 (5.38%)	0.518 (0.111)	0.112 (0.061)
Central Nervous System	8 (4.30%)	0.468 (0.091)	0.137 (0.046)
Rheumatology	8 (4.30%)	0.571 (0.089)	0.152 (0.044)
Cardiovascular	6 (3.23%)	0.519 (0.124)	0.123 (0.069)
Stomach & Bowel	4 (2.15%)	0.289 (0.165)	0.160 (0.122)
Endocrine Disorder	4 (2.15%)	0.440 (0.156)	0.169 (0.050)
Respiratory	3 (1.61%)	0.395 (0.069)	0.188 (0.037)
Urogenital	3 (1.61%)	0.483 (0.361)	0.143 (0.052)
Dermatology	2 (1.08%)	0.275 (0.063)	0.166 (0.046)
Other ^b	4 (2.15%)	0.425 (0.114)	0.083 (0.097)

RMSE: Root Mean Square Error; SD: Standard Deviation; ^aMixed Disease Types include different populations with diseases such as chronic pain, injuries, cancer, or no disease; ^bincluding Hematology, Autoimmune, Sleep Disorder, Ophthalmology.

REFERENCES

Dakin H, Abel L, Burns R, Yang Y. Review and critical appraisal of studies mapping from quality of life or clinical measures to EQ-5D: an online database and application of the MAPS statement. Health Qual Life Outcomes. 2018 Feb 12;16(1):31. doi: 10.1186/s12955-018-0857-3. PMID: 29433510; PMCID: PMC5810002. Walloo, A., Hernandez Alava, M., Pudney, S. NICE DSU Technical Support Document 22 Mapping to estimate health state utilities. 2023 [Available from <http://www.nicedsu.org.uk>]. Algorithm I: Kay, S., Tolley, K., Colayco, D., Khalaf, K., Anderson, P., & Globe, D. (2013). Mapping EQ-5D utility scores from the Incontinence Quality of Life Questionnaire among patients with neurogenic and idiopathic overactive bladder. Value in Health : the Journal of the International Society for Pharmacoeconomics and Outcomes Research, 16(2), 394–402. <https://doi.org/10.1016/j.jval.2012.12.005>. Algorithm II: Ruiz, M. A., Gutiérrez, L. L., Monroy, M., & Rejas, J. (2016). Mapping of the OAB-SF Questionnaire onto EQ-5D in Spanish Patients with Overactive Bladder. Clinical drug investigation, 36(4), 267–279. <https://doi.org/10.1007/s40261-016-0377-z>. Algorithm III: C. Coon, A. Bushmakina, S. Tatlock, N. Williamson, M. Moffatt, R. Arbuckle & L. Abraham (2018) Evaluation of a crosswalk between the European Quality of Life Five Dimension Five Level and the Menopause-Specific Quality of Life questionnaire, Climacteric, 21:6, 566–573, DOI: 10.1080/13697137.2018.1481381

From a total of 556 identified published mapping algorithms, 186 publications reported both R² and RMSE values. The most common disease area was Oncology (22.04%) and Musculoskeletal (12.37%). 35% of identified algorithms were classified as red ('Poor'), 38% were classified as amber ('Use with Caution') and 27% were classified as green ('Ready to Use'). The 'usable' algorithms were considered as performing at either above or below average (the expected mean estimate of the metric of interest.)

Figure 1: Classification tree for mapping algorithms identified from 186 publications.

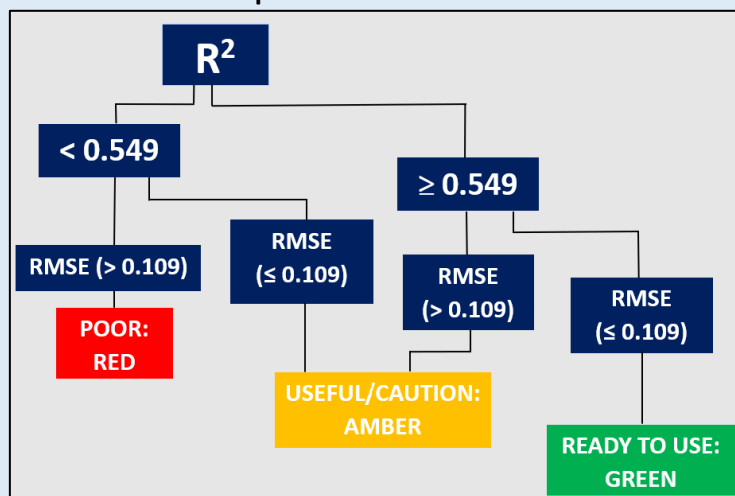


Table 2: Example of Urogenital Mapping Algorithm Classification (using 3 algorithms)

Algorithms (Disease Area: Urogenital)	Simulated R ² Value (Mean)	Simulated RMSE Value (Mean)	% of times simulated R ² ≥ mean estimate	% of times simulated RMSE ≤ mean estimate	Classification
Algorithm I	0.271	0.148	7%	32%	Poor
Algorithm II	0.784	0.199	92%	13%	Useful/Caution
Algorithm III	0.371	0.111	18%	53%	Poor

Publication details for Algorithms I, II, III reported in References.

Following the classification tree (Figure 1) and Table 2, 2 out of 3 mapping algorithms identified in the Urogenital disease area were classified as 'Poor' and 1 out of 3 algorithms which reported both R² and RMSE values was classified as 'Useful/Caution'. R² and RMSE values were simulated at least 5000 times for each algorithm reported in Table 2.

CONCLUSIONS

Classification of mapping algorithms is feasible. A database of the classification is provided at www.r-s-s.com which offers a rich source of structured information on the use of mapping algorithms consistent with the guidance provided in NICE DSU TSD 22 (June 2023). This will be a valuable resource updated regularly and freely available to academics and pharmaceutical companies for economic evaluation.