Estimating Quality-Adjusted Life Years from Patient-Reported Visual Functioning

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There is increasing recognition of the desirability of cost-utility analysis to inform decision making for new drugs and technologies. Cost-utility analyses used to assess the value of new interventions need to incorporate health outcomes through the measurement of utilities, which can be measured through various methods including the Time Trade-off (TTO), the Standard Gamble (SG), or through multi-attribute questionnaires such as the EQ-5D. In the UK, the NICE reference case recommends the use of the EQ-5D within clinical studies for collection of clinical data. However, in clinical trials, health-related quality of life (HRQoL) data is often not collected using generic preference-based measures, but instead is collected using a disease-specific measure that is not designed to generate utilities. The most recent NICE guidelines specify that when EQ-5D data is not available, mapping from a disease specific measure to the EQ-5D is an acceptable way to obtain utility data.[1]

Mapping is an approach that involves estimating the relationship between a non-preference-based measure and a generic preference-based measure using a statistical association. This method requires the two measures to have been administered to the same population, and a statistical model can then be used to estimate health state utilities, which can in turn be used to calculate quality-adjusted life years (QALYs) for cost-per-QALY analysis within economic evaluations.

Vision is a disease area where EQ-5D data are often not readily available. However, the impact of glaucoma on vision has been shown to have implications for patients' health related quality of life.[2,3] The primary aim of this study was to estimate a mapping algorithm to predict EQ-5D and SF-6D utility values based on the 25-item Visual Functioning Questionnaire (VFQ-25), as well as clinical measures of visual function, including integrated visual field (IVF), visual acuity (VA), and contrast sensitivity (CS). Mapping relationships were estimated using a range of techniques and statistical specifications. The mapping functions are compared across the EQ-5D and SF-6D.

Data was collected over 12 months on 132 patients with primary open-angle glaucoma. Fourteen mapping functions were estimated to predict the EQ-5D and SF-6D from a combination of the VFQ-25 overall score, the VFQ-25 dimensions, tests of visual function, and demographics. Mapping requires regression techniques to be used on the estimation data to estimate a statistical relationship between measures. In order to minimize modeling uncertainty within this study, three different models for prediction were used, including ordinary least squares (OLS), Tobit models, and censored least absolute deviations (CLAD). The model performance was then assessed by looking at the root mean square error (RMSE), the R-squared, and the mean absolute error (MAE).

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When estimating the EQ-5D, the lowest errors were found in the mapping function containing the VFQ-25 dimension, visual function, and demographics. However, when estimating the SF-6D, the best performing mapping function only used the overall VFQ-25 score. In both models, the OLS regression was found to be the best performing model of the three, as this produced the lowest errors and the best R-squared, showing how well the observed outcomes were replicated by the model.

There has been limited research into the field of HRQoL and glaucoma, and there is an ongoing debate as to how to best measure utilities in glaucoma patients. The EQ-5D does not have a vision dimension and has been found to be insensitive to HRQoL in this population. Studies using this measure found mean scores that did not differ substantially from their respective population norms,[4,5] meaning that important HRQoL impacts would be undervalued in an economic evaluation. In fact, this study found almost 27% of the patients recorded the maximum EQ-5D score of 1 in the original data, indicating a significant ceiling effect within this measure. It is, therefore, important to have accurate models of measurement of the relationship between disease and HRQoL as this allows clinicians to potentially benchmark their interventions against the potential loss or improvement of HRQoL to the patient. The study has provided models for the initial algorithm to convert the VFQ-25 to the EQ-5D and SF-6D when they would not have originally been used. However, further analysis is needed to validate the models and algorithms.

This study aimed to provide an estimation of mapping algorithms, which could be used in future studies using the VFQ-25 when no HRQoL measure is used. The patients in this study had relatively mild glaucoma, and therefore, there were minimal effects on their HRQoL. Further work needs to be done with a larger sample of patients with a much broader spectrum of the disease to establish the exact pattern of the relationship between decline in HRQoL as the disease progresses. Accurate models of measurement of the relationship between disease and HRQoL will allow clinicians to potentially benchmark their medical or surgical intervention against the potential loss or improvement of HRQoL to the patient.

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