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Preference-Based Assessments

Predicting SF-6D from the European Organization for Treatment and Research of Cancer Quality of Life Questionnaire Scores in Patients with Colorectal Cancer

Carlos King Ho Wong, PhD, MPhil, BSc[1,*], *Cindy L.K. Lam, MBBS, MD, FRCGP, FHKAM (Family Medicine)*[1], *Y.F. Wan, MSc, BSc*[1], *Donna Rowen, PhD*[2]

[1]*Department of Family Medicine and Primary Care, The University of Hong Kong, Hong Kong;* [2]*Health Economics and Decision Science, School of Health and Related Research (ScHARR), University of Sheffield, Sheffield, UK*

ABSTRACT

Objectives: To develop a mapping model for estimating six-dimensional health state short form (SF-6D) utility scores from the European Organization for Research and Treatment of Cancer Quality of Life Questionnaires (QLQ-C30 and QLQ-CR29) scores in patients with colorectal cancer (CRC), with and without adjustment for clinical and demographic characteristics. **Methods:** Ordinary least squares regression models were applied to a cross-sectional data set of 216 patients with CRC collected from a regional hospital in Hong Kong. Item responses or scale scores of cancer-specific (QLQ-C30) and colorectal-specific health-related quality-of-life (QLQ-CR38/CR29) data and selected demographic and clinical characteristics of patients were used to predict the SF-6D scores. Model goodness of fit was examined by using exploratory power (R^2 and adjusted R^2), Akaike information criterion, and Bayesian information criterion, and predictive performance was evaluated by using root mean square error, mean absolute error, and Spearman's correlation coefficients between predicted and observed SF-6D scores. Models were validated by using an independent data set of 56 patients with CRC. **Results:** Both scale and item response models explained more than 67% of the variation in SF-6D scores. The best-performing model based on goodness of fit (R^2 = 75.02%), predictive ability in the estimation (root mean square error = 0.080, mean absolute error = 0.065), and validation data set prediction (root mean square error = 0.103, mean absolute error = 0.081) included variables of main and interaction effects of the QLQ-C30 supplemented by QLQ-CR29 subset scale responses and a demographic (sex) variable. **Conclusions:** SF-6D scores can be predicted from QLQ-C30 and QLQ-CR38/CR29 scores with satisfactory precision in patients with CRC. The mapping model can be applied to QLQ-C30 and QLQ-CR38/CR29 data sets to produce utility scores for the appraisal of clinical interventions targeting patients with CRC using economic evaluation.

Keywords: colorectal cancer, EORTC QLQ-C30, mapping, preference-based scores, quality of life, SF-6D.

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Introduction

Under the constraints of resource limitations, health policy makers usually allocate available resources among health interventions on the basis of their clinical performances. This does not, however, take cost and comparable benefit into account, meaning that the allocation of resources may be suboptimal. Colorectal cancer (CRC) impacts a heavy economic burden of disease in the world because of its relatively high incidence rates and treatment costs [1]. Cost-utility analysis is conducted by using the cost per quality-adjusted life-year (QALY) gained to critically appraise the emerging alternatives of costly therapies and interventions for CRC. The QALYs for each CRC health state can be calculated by using direct elicitation methods involving the use of standard gamble or time trade-off techniques [2–5] or preference-based measures such as the EuroQol five-dimensional (EQ-5D) questionnaire [6], six-dimensional health state short form (derived from short-form 36 health survey) (SF-6D) [7], health utilities index [8], and European Organization for Research and Treatment of Cancer (EORTC)-8D [9]. UK national guidelines regarding health technology appraisal [10] recommend the use of generic preference-based measures, and further states a preference for the EQ-5D questionnaire. When the EQ-5D questionnaire is unavailable, it is recommended that the EQ-5D questionnaire data be estimated by using "mapping."

According to a recent literature review [11], there is a growing body of literature on mapping functions of "source" health-related quality-of-life (HRQOL) measures onto "target" preference-based measures based on regression models. Two core modules of cancer-specific HRQOL measures are often used to measure overall

* *Address correspondence to:* Carlos King Ho Wong, Department of Family Medicine and Primary Care, The University of Hong Kong, 3/F, Ap Lei Chau Clinic, 161 Ap Lei Chau Main Street, Ap Lei Chau, Hong Kong.

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and multidimensions of HRQOL in the oncology field: the Functional Assessment of Cancer Therapy-General (27 items) [12] and the EORTC Core Quality of Life Questionnaire (QLQ-C30, 30 items) [13]. In addition to cancer-specific HRQOL measures, the Functional Assessment of Cancer Therapy-Colorectal [14] and EORTC Colorectal Cancer-specific Quality of Life Questionnaire (QLQ-CR38, 38 items) [15] are widely used colorectal-specific HRQOL measures. The Chinese versions of all aforementioned questionnaires have been validated in Hong Kong Chinese patients [16,17]. The QLQ-CR38 was superseded by the QLQ-CR29, which was an updated and improved version of the colorectal-specific measure [18].

The majority of mapping functions available used the EQ-5D questionnaire as their target measure [11], probably due to the preference for the use of the EQ-5D questionnaire in technology appraisals submitted to the National Institute for Health and Clinical Excellence [10]. Eight studies [19–26] used QLQ-C30 data to predict EQ-5D questionnaire utility scores but only one study mapped the EORTC QLQ-C30 to SF-6D utility score derived by using the UK value set [25]. No mapping function for the EORTC QLQ-C30 has ever been done in Chinese populations. Health preference varies systematically across countries because of cultural differences, and therefore preference weighting of preference-based measures is preferably based on local population valuations. The SF-6D is the only multiattribute classification system that has a preference weighting algorithm specific to the Chinese population [27], which makes mapping functions targeting to SF-6D more applicable and valid in our setting.

Despite the evidence that the development of mapping functions was frequently built on patients with cancer condition [28], none of them was specific to patients with CRC. Although numerous studies have developed mapping functions that predicted utility scores by using QLQ-C30 data across a range of different cancer patients groups [19–26,29], no study has mapped from the EORTC CRC-specific module (QLQ-CR38 and QLQ-CR29) to any preference-based measure. Since then, the primary aim of this study was to map from the EORTC cancer-specific and CRC-specific scale scores or item responses to SF-6D preference-based utility scores in patients with different stages of CRC, adjusting for demographic factors. This mapping function enabled researchers to conduct health economic appraisals of population-based screening and treatment modalities for CRC where data have been collected only by using non–preference-based cancer-specific measures.

Methods

Subjects

This study was a secondary analysis of data obtained from a health survey to examine the HRQOL profile and preference-based scores of patients with colorectal neoplasms in a Chinese population [16,30–32]. Study data were obtained from a cross-sectional survey of 587 adult patients attending the colorectal specialist outpatient clinic of an academic teaching hospital in Hong Kong between October 2009 and July 2010. Data of 272 patients with known staged CRC (using the American Joint Committee on Cancer classification) who had completed the cancer-specific QLQ-C30, CRC-specific QLQ-CR38, and generic SF-6D instruments were separated into two samples, one (self-administration = 216, 79.4%) for model development and the other (interviewer-administration = 56, 20.6%) for model validation.

HRQOL Measures

EORTC Measure

The Traditional Chinese version 3 of the QLQ-C30 is a cancer-specific HRQOL instrument [13,17] that has a global health status and quality-of-life scale (QL), five functional scales (physical functioning, PF; role functioning, RF; emotional functioning, EF; cognitive functioning, CF; and social functioning, SF), and nine symptom scales/items (fatigue, FA; nausea and vomiting, NV; pain, PA; dyspnea, DY; insomnia, SL; appetite loss, AP; constipation, CO; diarrhea, DI; and financial difficulties, FI) specific to cancer. The QL scale of the QLQ-C30 consists of two items measuring the degree to which the overall quality of life was subjectively perceived by patients, using a seven-point Likert scale ranging from 1 = "Very poor" to 7 = "Excellent." All items in other scales are scored by using a four-point Likert scale (1 = "Not at all," 2 = "A little," 3 = "Quite a bit," and 4 = "Very much"). To facilitate mapping from the existing data set containing QLQ-C30 only, mapping functions were estimated by using 30 items of the QLQ-C30 as explanatory variables. Moreover, the CRC-specific QLQ-CR38 encompasses four functional scales and seven symptom scales or items [15]. Both colorectal-specific QLQ-CR38 and QLQ-CR29 are additional questionnaire modules that require supplemental use in conjunction with the QLQ-C30. In an attempt to make the mapping functions applicable to utilization in data sets containing either QLQ-CR38 or QLQ-CR29, mapping functions were estimated by using 30 items of the QLQ-C30 plus only the 10 items of the QLQ-CR38 as explanatory variables. Those items have the same wording or phrase as the corresponding QLQ-CR29 items [18] labeled as QLQ-CR29$_{subset}$, representing two functional scales (body image, BI; anxiety, ANX) and five symptom scales/items (urinary frequency, UF; dysuria, DYSU; abdominal pain, APAIN; bloating, BF; and dry mouth, DM). Their content validity was supported by a study on patients with CRC who rated these items relevant and acceptable [33].

The raw score of each scale is summed and rescaled to range from 0 to 100, according to the standardized EORTC scoring guidelines [34]. Higher scores in global and functional scales but lower scores in symptom scales indicate better HRQOL.

SF-6D

The SF-6D is a widely used preference-based generic HRQOL measure with a multiattribute classification system consisting of six dimensions: physical functioning, role functioning, social functioning, pain, mental health, and vitality. Each dimension is composed of three to five levels. The health status described by the combination of six dimensional attributes was converted into an SF-6D value by applying preference weights derived from the general population. Population-specific SF-6D preference weights had been elicited in the United Kingdom [7], our local Hong Kong Chinese population [27,35], and other populations [36,37]. The Hong Kong weights were used in the current study. The Hong Kong population SF-6D values range from 0.315 to 1, with higher scores indicating better HRQOL anchoring on the 0 (dead) to 1 (full health) scale.

Statistical Analysis

Model Development and Specifications

Therefore, 12 model specifications were estimated, where SF-6D was regressed on S1) QLQ-C30 scale scores, S2) as per S1 plus squared and pair-wise interaction terms, S3) as per S2 plus demographic and clinical variables, S4) QLQ-C30 and QLQ-CR29$_{subset}$ scale scores, S5) as per S4 plus squared and pair-wise interaction terms, S6) as per S5 plus demographic and clinical variables, R1) QLQ-C30 raw responses, R2) as per R1 plus squared and pair-wise interaction terms, R3) as per R2 plus demographic and clinical variables, R4) QLQ-C30 and QLQ-CR29$_{subset}$ raw responses, R5) as per R4 plus squared and pair-wise interaction terms, and R6) as per R5 plus demographic and clinical variables. To ensure direct comparability of different models, only cases (n = 216) with complete data of all variables involved in the modeling process were used throughout the analysis.

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