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Using the Multiple Sclerosis Impact Scale to Estimate Health State Utility Values: Mapping from the MSIS-29, Version 2, to the EQ-5D and the SF-6D

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ABSTRACT

Objectives: The 29-item Multiple Sclerosis Impact Scale (MSIS-29) is a psychometrically validated patient-reported outcome measure increasingly used in trials of treatments for multiple sclerosis. However, it is non–preference-based and not amenable for use across policy decision-making contexts. Our objective was to statistically map from the MSIS-29, version 2, to the EuroQol five-dimension (EQ-5D) and the six-dimension health state short form (derived from short form 36 health survey) (SF-6D) to estimate algorithms for use in cost-effectiveness analyses. **Methods:** The relationships between MSIS-29, version 2, and EQ-5D and SF-6D scores were estimated by using data from a cohort of people with multiple sclerosis in South West England (n = 672). Six ordinary least squares (OLS), Tobit, and censored least adjusted deviation (CLAD) regression analyses were conducted on estimation samples, including the use of subscale and item scores, squared and interaction terms, and demographics. Algorithms from models with the smallest estimation errors (mean absolute error [MAE], root mean square error [RMSE], normalized RMSE) were then assessed by using separate validation samples. **Results:** Tobit and CLAD. For the EQ-5D, the OLS models including subscale squared terms, and item scores and demographics performed comparably (MAE 0.147, RMSE 0.202 and MAE 0.147, RMSE 0.203, respectively), and estimated scores well up to 3 years post-baseline. Estimation errors for the SF-6D were smaller (OLS model including squared terms: MAE 0.058, RMSE 0.073; OLS model using item scores and demographics: MAE 0.059, RMSE 0.08), and the errors for poorer health states found with the EQ-5D were less pronounced. **Conclusions:** We have provided algorithms for the estimation of health state utility values, both the EQ-5D and SF-6D, from scores on the MSIS-29, version 2. Further research is now needed to determine how these algorithms perform in practical decision-making contexts, when compared with observed EQ-5D and SF-6D values.

Keywords: cost-effectiveness, decision making, multiple sclerosis, Quality of life.

Introduction

The use of clinical tools, such as the Expanded Disability Status Scale (EDSS) [1], for the assessment of the impact of multiple sclerosis (MS) can describe symptoms, functional disability, and disease progression, but such measures are not able to capture the full impact of MS on people's lives, particularly in terms of their health-related quality of life (HRQOL) [2]. Over recent years, internationally [3], across disease groups [4], and specifically in the field of MS [2,5], there has been a move toward the use of patient-reported outcome measures, which aim to encapsulate these broader effects.

The 29-item Multiple Sclerosis Impact Scale (MSIS-29) [6,7] was specifically constructed to assess the impact of MS on people's HRQOL in terms of their physical and psychological well-being. The measure is founded on qualitative interviews with people with MS and has been developed by using both traditional [8] and contemporary [7,9] psychometric techniques. Its flexibility for use in different settings (e.g., hospital and community) has been demonstrated [10], it can be completed by proxies [11], it has been shown to be responsive over time [2,12,13], and a minimally important difference has been suggested for its physical subscale [12]. The MSIS-29 is now in its second version [7] and given its strong foundations as a suitable outcome measure for clinical trials of the effectiveness of treatments for MS, it is being increasingly used.

However, health policy decision makers also increasingly need information on the comparative effectiveness and cost-effectiveness of treatments across different disease groups. In its current form, the MSIS-29 is not amenable for use in this way,

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because it is not a preference-based measure [14]. Preference-based measures use preference data, often elicited from general populations, to assign relative values to health state descriptions. Preference-based measures have two components: 1) a means of describing health status and 2) a mechanism for assigning health state utility values to each of the possible health states [15]. The health state utility values can be derived by a variety of methods and give values on a scale where 1 is equivalent to full health and 0 is equivalent to death. Data from preference-based measures are more amenable for use in health policy decision making, because preferences for the health states or outcomes associated with interventions can be compared across different conditions. Preference-based responses are also used to estimate quality-adjusted life-years (QALYs).

QALYs combine quantity and quality of life in a single measure of health outcome, by adjusting life-years survived using a quality-of-life weight, with the weight usually being health state utility values derived from preference data [15]. For example, a year in full health would equate to 1 QALY, and 2 years in "half health" (0.5 health state value) would also equate to 1 QALY. QALYs are the outcome of choice in a growing number of health policy settings [16–18].

When an outcome measure, such as the MSIS-29, is not preference based, one solution to enable it to be used in comparative effectiveness and cost-effectiveness analyses is to statistically "map" it to a commonly used preference-based measure [19] such as the EuroQol five-dimension (EQ-5D) [20,21] or the six-dimension health state short form (derived from the short form 36 health survey [SF-36] and the short form 12 health survey [SF-12]) (SF-6D) [22,23]. In mapping studies, statistical regression analyses are used to map from a "starting" measure (e.g., the MSIS-29) to a "target" measure (e.g., the EQ-5D). The relationship between the measures is estimated, and algorithms of this relationship are derived. These algorithms can then be used with other data to convert non–preference-based measure scores (e.g., the MSIS-29) to preference-based measure scores (e.g., the EQ-5D).

"Mapping" has become a fairly common approach and has been conducted in a wide range of disease areas, for example, in osteoarthritis [24], cancer [25], Crohn's disease [26], and oral health [27]. Yet, the approach has been less used with neurological conditions.

Over the last decade, a number of new medicines have been licensed for the treatment of MS, but the evaluation of these medicines has been hampered by an absence of good quality data on the costs and, particularly, the benefits of these treatments [28]. This article estimates and tests mapping algorithms to convert MSIS-29, version 2 (v2), scores to EQ-5D and SF-6D health state utility values for use in assessing the comparative effectiveness and cost-effectiveness of treatments for people with MS.

Methods

The Data

Data from the UK South West Impact of Multiple Sclerosis (SWIMS) cohort were used for analysis. SWIMS is a longitudinal, prospective, cohort study of people with MS in Devon and Cornwall (South West England), with individuals followed-up every 6 months [29]. Data are collected on demographics and clinical features and across a range of patient-reported outcomes, including the MSIS-29 v2, the EQ-5D, and the SF-36. SWIMS commenced recruitment in August 2004, and all participants who had completed baseline questionnaires including complete MSIS-29 v2, the EQ-5D, the SF-36, and demographic (age and gender) data by February 2010 were included in this analysis.

The SWIMS study was approved in the United Kingdom by the Cornwall and Plymouth and South Devon Research Ethics Committees, and written informed consent was obtained from all participants.

Measures

MSIS-29 v2 [6,7]

The MSIS-29 is a 29 item, condition-specific, self-report questionnaire for measuring the impact of MS on people's lives. It has two subscales: a 20-item physical impact scale and a 9-item psychological impact scale (and no total score). It is currently in its second version, which has four-point response categories for each item: "not at all," "a little," "moderately," and "extremely." Scores on the physical impact scale can range from 20 to 80 and on the psychological impact scale from 9 to 36, with lower scores indicating little impact of MS and higher scores indicating greater impact.

The EQ-5D [20]

The EQ-5D is a generic health status measure comprising five subscales (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression), with each subscale having three response levels (1, "no problems"; 2, "moderate problems"; 3, "severe problems"). This classification of health status results in 243 possible health state descriptions.

Participant responses to the EQ-5D can be converted to the EQ-5D derived single index, a generic preference-based measure, using preference weights for the health states. For example, in the United Kingdom, values that have been derived from the preferences of a general population sample for each of the 243 possible health states are commonly used [21]. This gives values for each of the EQ-5D health states on an index ranging from 1.00 for the best health state to −0.594 for the worst health state. The EQ-5D is frequently used in clinical studies and cost-effectiveness analyses, and it is currently the measure preferred by the UK National Institute of Health and Clinical Excellence in its health technology appraisals process [16].

SF-36/SF-6D [22,23]

The SF-36, currently in its second version, includes 36 self-report questions regarding functional health and well-being. Participant responses can be converted to a single index by using preference weights elicited against SF-36–derived health states. For example, scores are commonly converted to SF-6D health state utility values by using valuations elicited from a representative sample of the UK general population [23]. Scores on the SF-6D can range from 0.3 to 1.0, where 0.3 indicates the worst health state and 1.0 the best health state.

Data Analyses

The rigor of the mapping approach rests on there being a considerable overlap between the descriptive systems of the "starting" measure and the "target" measure [19]. The overlap between the MSIS-29 and the EQ-5D and between the MSIS-29 and the SF-6D would be expected to be substantial as each of the measures assesses HRQOL. A diagrammatic representation of the areas of joint coverage is given in Fig. 1.

Statistical conventions in the mapping literature [19] were followed to examine the relationships between the MSIS-29 and the EQ-5D index and between the MSIS-29 and the SF-6D. For the EQ-5D, baseline data from SWIMS were used as the estimation sample to develop the most appropriate statistical models and to test within-sample predictive performance. The predictive accuracy of the best performing subscale scores and item scores models was then assessed by using longitudinal data from