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Estimating a Preference-Based Index for an Eight-Dimensional Health State Classification System for Multiple Sclerosis

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ABSTRACT

Background: Condition-specific measures are frequently used to assess the health-related quality of life of people with multiple sclerosis (MS). Such measures are unsuitable for use in economic evaluations that require estimates of cost per quality-adjusted life-year because they are not based on preferences. **Objectives:** To report the estimation of a preference-based single index for an eight-dimensional instrument for MS, the Multiple Sclerosis Impact Scale – Eight Dimensions (MSIS-8D), derived from an MS-specific measure of health-related quality of life, the 29-item Multiple Sclerosis Impact Scale (MSIS-29). **Methods:** We elicited preferences for a sample of MSIS-8D states ($n = 169$) from a sample ($n = 1702$) of the UK general population. Preferences were elicited using the time trade-off technique via an Internet-based survey. We fitted regression models to these data to estimate values for all health states described by the MSIS-8D. Estimated values were assessed against MSIS-29 scores and values derived from generic preference-based measures in a large, representative sample of people with MS. **Results:** Participants

reported that the time trade-off questions were easy to understand. Observed health state values ranged from 0.08 to 0.89. The best-performing model was a main effects, random effects model (mean absolute error = 0.04). Validation analyses support the performance of the MSIS-8D index: it correlated more strongly than did generic measures with MSIS-29 scores, and it discriminated effectively between subgroups of people with MS. **Conclusions:** The MSIS-8D enables health state values to be estimated from the MSIS-29, adding to the methods available to assess health outcomes and to estimate quality-adjusted life-years for MS for use in health technology assessment and decision-making contexts.

Keywords: multiple sclerosis, preference-based measures, quality-adjusted life-years.

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Introduction

The cost-effectiveness of health care interventions is often assessed using cost-utility analysis, in which health outcomes are measured using quality-adjusted life-years (QALYs). The QALY incorporates the effects of treatment on longevity and quality of life by weighting each life-year according to its quality, on a scale from 1 (full health) to 0 (equivalent to being dead). A common method of obtaining QALY weights is to use an existing preference-based measure (PBM) of health-related quality of life (HRQoL), which provides a tariff of QALY weights for a large number of health states. The most frequently used PBMs are generic; that is, they are considered applicable for all health conditions [1]. These include the EuroQol five-dimensional questionnaire (EQ-5D) [2], the six-dimensional health state short form (derived from short form 36 health survey) (SF-6D) [3], or the Health Utilities Index (HUI) [4]. The appropriateness of these measures has been questioned for some health conditions, including multiple sclerosis (MS) [5].

MS is a progressive neurological condition that affects the central nervous system, causing a wide range of symptoms, which vary between individuals and within the same individual over time [6]. The disease may initially follow a relapsing-remitting pattern, eventually becoming progressive, or may be progressive from onset. Levels of disability increase as the disease progresses [7]. The empirical evidence on the suitability of generic PBMs (GPBMs) for use in MS is equivocal. A number of studies have raised concerns about the content validity [6,8–10] or the sensitivity [6,11–13] of GPBMs in the context of MS. A recent systematic review [5] reports an assessment of the psychometric properties of six GPBMs (EQ-5D, HUI2, HUI3, SF-6D, the Assessment of Quality of Life instrument, and the Quality of Well Being Scale) when applied to MS, finding that each measure has particular strengths and weaknesses. The HUI3 performed best in terms of its psychometric properties, but it is regarded as a measure of impairment rather than HRQoL. The content validity of the EQ-5D and the SF-6D was considered to be compromised because of the omission of domains of HRQoL that are important

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Table 1 – The MSIS-8D classification system.

Physical subscale (includes all physical and social dimensions)					
Dimension	MSIS-29 item	Response levels			
Physical	In the past two weeks, how much has your MS limited your ability to do physically demanding tasks?	1	2	3	4
	<i>In the past two weeks, how much have you been bothered by:</i>				
Social	Limitations in your social and leisure activities at home?	1	2	3	4
Mobility	Being stuck at home more than you would like to be?	1	2	3	4
Daily activities	Having to cut down the amount of time you spent on work or other daily activities?	1	2	3	4
Psychological subscale (includes all psychological and other nonphysical dimensions)					
Dimension	MSIS-29 item	Response levels			
	<i>In the past two weeks, how much have you been bothered by:</i>				
Fatigue	Feeling mentally fatigued?	1	2	3	4
Emotion	Feeling irritable, impatient, or short-tempered?	1	2	3	4
Cognition	Problems concentrating?	1	2	3	4
Depression	Feeling depressed?	1	2	3	4
Note. Response levels: 1 = not at all; 2 = a little; 3 = moderately; 4 = extremely.					
MSIS-8D, Multiple Sclerosis Impact Scale – Eight Dimensions; MSIS-29, 29-item Multiple Sclerosis Impact Scale.					

in MS, specifically fatigue (EQ-5D), mobility (SF-6D), and cognition (both measures). The discriminative validity of the EQ-5D and the SF-6D was assessed as limited across the full range of condition severity for MS, and both measures exhibited floor and ceiling effects. Assessment of the other instruments was limited because of a lack of data. The review concludes that the development of an MS-specific PBM is a possible area for future research. Such a PBM could be used in the absence of GPBM data, or as a supplement to GPBM data to provide more detailed information about the effect of treatments on the HRQoL of people with MS.

A range of condition-specific instruments are available to measure the health status of people with MS, and they are regarded as more appropriate than generic measures for MS because of their focus on the most relevant aspects of HRQoL [11]. Such measures are not preference-based and do not provide the quality weights required for the calculation of QALYs. They can, however, be used as the basis of a condition-specific preference-based measure (CSPBM), and this has become a common approach over recent years, across a range of conditions [14–25].

There are two stages in constructing a CSPBM: developing a classification system to provide standardized descriptions of health states and generating a preference-based single index of health state utility values (HSUVs) (QALY weights) for all health states described by the classification system [1]. We derived a classification system named the Multiple Sclerosis Impact Scale – Eight Dimensions (MSIS-8D) [26] from the 29-item Multiple Sclerosis Impact Scale (MSIS-29) [27,28]. Here, we report the estimation of a preference-based index for the MSIS-8D. This involved a valuation survey to elicit preferences for a sample of MSIS-8D health states from a representative sample of the UK general population, regression modeling to predict values for all MSIS-8D health states, and validation of the resulting algorithm in a large, representative data set of people with MS.

The MSIS-8D Classification System

The MSIS-29 is a validated and frequently used patient-reported measure of HRQoL in MS. It consists of a physical subscale of 20 items and a psychological subscale of 9 items, each with four response levels [28]. This range of items and levels would place an unreasonable cognitive demand on respondents to the preference elicitation exercise required to estimate HSUVs. Therefore, best practice methods were adopted to reduce the size of the

instrument while minimizing the loss of descriptive information [1]. This involved mapping the items of the MSIS-29 to important dimensions of HRQoL in MS, and undertaking Rasch and psychometric analyses to select one item to represent each dimension, using data from the South West Impact of Multiple Sclerosis (SWIMS) longitudinal cohort study of people with MS [29]. The resulting classification system, the MSIS-8D, is presented in Table 1. It comprises four items from the physical subscale of the MSIS-29, which describe physical and social effects of MS, and four items from the psychological subscale, which describe emotional and other nonphysical effects, using the original wording from the MSIS-29. The development of the MSIS-8D has been reported elsewhere [26].

Methods

Valuation

Here, we discuss our approach to some key aspects of valuation survey design, including which health states to value, how to elicit preferences, and whose values to elicit [30].

Health states

It is not possible to value all 65,536 MSIS-8D health states directly; therefore, a sample was selected for the survey. Health state samples are frequently selected using statistically efficient designs. For classification systems constructed from unidimensional scales, the increased likelihood of preference interactions between attributes may result in the inclusion of implausible health states [1], causing confusion for respondents and increasing measurement error [31]. This can be addressed by basing the selection of health states on the combination of item levels that is most likely to occur at each level of condition severity. This method, known as the Rasch vignette approach, is undertaken by examining the Rasch threshold map [24]. The threshold between adjacent item-response levels is defined as the point on the Rasch logit scale at which either response is equally probable. Figure 1 shows the threshold map for the physical subscale of the MSIS-8D, generated from the data set used to develop the MSIS-8D classification system. The x-axis shows the Rasch logit scale, which represents increasing condition severity from left to right. The threshold map shows the response level of each item

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