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## Using a Discrete Choice Experiment Involving Cost to Value a Classification System Measuring the Quality-of-Life Impact of Self-Management for Diabetes

Donna Rowen, PhD<sup>1,\*</sup>, Katherine Stevens, PhD<sup>1</sup>, Alexander Labeit, PhD<sup>1</sup>, Jackie Elliott, PhD<sup>2</sup>,  
Brendan Mulhern, MSc<sup>3</sup>, Jill Carlton, PhD<sup>1</sup>, Hasan Basarir, PhD<sup>4</sup>, Julie Ratcliffe, PhD<sup>5</sup>, John Brazier, PhD<sup>1</sup>

<sup>1</sup>Health Economics and Decision Science, School of Health and Related Research, University of Sheffield, Sheffield, UK; <sup>2</sup>Academic Unit of Diabetes, Endocrinology and Metabolism, Department of Oncology and Metabolism, University of Sheffield, Sheffield, UK; <sup>3</sup>Centre for Health Economics Research and Evaluation, University of Technology Sydney, Sydney, New South Wales, Australia; <sup>4</sup>Health Economics Unit, University of Birmingham, Birmingham, UK; <sup>5</sup>Institute for Choice, Business School, University of South Australia, Adelaide, Australia

### ABSTRACT

**Objectives:** To describe the use of a novel approach in health valuation of a discrete choice experiment (DCE) including a cost attribute to value a recently developed classification system for measuring the quality-of-life impact (both health and treatment experience) of self-management for diabetes. **Methods:** A large online survey was conducted using DCE with cost on UK respondents from the general population ( $n = 1497$ ) and individuals with diabetes ( $n = 405$ ). The data were modeled using a conditional logit model with robust standard errors. The marginal rate of substitution was used to generate willingness-to-pay (WTP) estimates for every state defined by the classification system. Robustness of results was assessed by including interaction effects for household income. **Results:** There were some logical inconsistencies and insignificant coefficients for the milder levels of some attributes. There were some differences in the rank ordering of different attributes for the general population and diabetic patients. The WTP to avoid the most severe

state was £1118.53 per month for the general population and £2356.02 per month for the diabetic patient population. The results were largely robust. **Conclusions:** Health and self-management can be valued in a single classification system using DCE with cost. The marginal rate of substitution for key attributes can be used to inform cost-benefit analysis of self-management interventions in diabetes using results from clinical studies in which this new classification system has been applied. The method shows promise, but found large WTP estimates exceeding the cost levels used in the survey.

**Keywords:** cost, diabetes, discrete choice experiment, preference-based measures.

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### Introduction

Discrete choice experiment (DCE) methods are increasingly being applied as a means to value the benefits of health care interventions. DCEs have usually been used to value the process of health care (either in isolation of or in combination with health outcomes) using bespoke or study-specific attributes developed for individual studies [1]. Recent DCE applications in diabetes include, for example, an investigation of patient preferences for insulin therapy and clinical outcomes in type 2 diabetes [2]. Recent work has extended the use of DCE to valuing classification systems for measuring health-related quality of life (HRQOL) such as the five-level EuroQol five-dimensional questionnaire (EQ-5D-5L) [3] and the six-dimensional health state short form (SF-6D) [4,5] on the 0 to 1 quality-adjusted life-year (QALY) scale

by adding an additional attribute for duration. This approach has been referred to as the DCE<sub>TTO</sub> (TTO, time trade-off) approach in the literature [6–11]. These health state utility values can then be used to estimate QALYs for use in cost-utility analysis and for submission to regulatory agencies such as the National Institute of Health and Care Excellence in the United Kingdom [12] or the Pharmaceutical Benefits Advisory Committee in Australia [13].

An alternative to cost-utility analysis is cost-benefit analysis (CBA), in which the benefits of interventions are represented by monetary values. This approach has been used to capture the benefits of interventions beyond the health outcomes achieved including benefits gained from the process of care delivery. Monetary values of the benefits of interventions are often measured directly by asking respondents how much they would be willing to pay for one intervention over another (e.g., [14]). DCE

\*Address correspondence to: Donna Rowen, School of Health and Related Research, University of Sheffield, Regent Court, 30 Regent Street, Sheffield S1 4DA, UK.

E-mail: [d.rowen@sheffield.ac.uk](mailto:d.rowen@sheffield.ac.uk)

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<http://dx.doi.org/10.1016/j.jval.2017.06.016>

methods may also be applied to obtain willingness-to-pay (WTP) estimates indirectly [15–17] by including cost as an additional attribute in the DCE. As mentioned previously, this approach has been applied recently in diabetes (e.g., in the study by Feher et al. [2]). Nevertheless, to our knowledge, to date this methodology has not been used to value a pre-existing classification system. Application of a DCE approach in this context provides an analogous way of valuing health to DCE<sub>TTO</sub> used with the EQ-5D and the SF-6D, but provides monetary estimates of the WTP to avoid a health state that can potentially be used to inform CBA.

Diabetes costs across the globe are rising because of the increased prevalence of the disease and the increased complexity of its treatment. For example, in the United Kingdom, £936.7 million was spent on prescriptions for diabetes in 2015 [18], and the total cost of diabetes in the United Kingdom is estimated to be £23.7 billion [19]. Structured education in diabetes is one of nine key care process checks recommended by the National Institute of Health and Care Excellence [20]. It benefits patients by giving them the confidence and skills to self-manage their condition, but of those newly diagnosed, less than 6% have been recorded as attending such a course. Evaluating the true monetary value of interventions designed to improve self-management is urgently needed. Self-management of diabetes varies from one individual to another, and similarly the impact of self-management upon an individual is also very personal.

Currently, quality of life is linked to QALYs on the basis of questionnaires that are not diabetes-specific (e.g., the EQ-5D or the SF-12), and so the intended improvement in self-management skills of an intervention cannot be evaluated in economic terms. Likewise, measures that are diabetes-specific (e.g., Problem Areas in Diabetes [21]) are not linked to QALYs. The classification system used in this study was developed to provide a formal and consistent way to take account of self-management across different interventions, because existing measures do not consider the direct impact of different self-management regimes on patients' quality of life from their own perspective [22]. Without the use of a single widely applicable classification system, the change in processes is often measured using study-specific descriptions or vignettes, rather than assessing the impact on quality of life through the use of patient-completed questionnaires in clinical studies.

This article describes the use of DCE including a cost attribute to value a classification system measuring the quality-of-life impact of self-management for diabetes. The article presents a DCE survey with a cost attribute conducted in general population and diabetic patient samples as well as the results of regression analyses to model the DCE data to provide monetary values of the WTP to avoid each state defined by the classification system for both general population and diabetic patient samples. We then discuss the results in terms of the implications for valuing this and other classification systems using this method.

## Methods

### Classification System

The Health and Self-Management in Diabetes classification system was developed to capture the impact of self-management on quality of life in diabetes (see Fig. 1). Four of the dimensions (mood, hypoglycemic attacks, vitality, and social limitations) represent HRQOL and the remaining four dimensions (control, hassle, stress, and support) represent self-management. The dimensions of HRQOL are taken from the Diabetes Health Profile-Five Dimension [23], a diabetes preference-based measure developed from the Diabetes Health Profile [24,25] and the short form 36 health survey (the vitality item) [26]. The development of

the classification system is reported in detail elsewhere [22] and research is ongoing to determine the psychometric properties of the measure and its performance relative to the EQ-5D-5L.

### Valuation Technique

DCE tasks present two or more profiles, in which each profile consists of attribute levels selected from a classification system and respondents are asked to indicate their preferred profile. DCE was selected in this study because it enables WTP values to be generated for every state defined by the classification system through the inclusion of a cost attribute, and the technique is amenable to online data collection [1].

### Selecting the Levels of the Cost Attribute

Limited guidance is provided in the DCE literature about how to choose levels for a cost attribute, and many published studies are either extremely brief in their details of how they determined the levels for the cost attribute or do not report details at all. Nevertheless, the levels should accurately capture the range of preferences for most of the respondents; otherwise, their inclusion will not add any useful information. It is important to ensure the levels are not too high or too low for the treatment or condition being valued, because otherwise cost would be either prohibitive or irrelevant [15]. It has been argued that the range for the cost attribute levels should incorporate values that are higher than the market price, because this may not be the maximum amount that people are willing to pay [16]. Typically, cost levels used in the literature reflect a range around mean cost that includes either a low cost or zero cost. In terms of wording the cost attribute, previous DCE experiments with a cost attribute in diabetes have used “personal cost to you each month” [27], “payment per month out of pocket,” [2] and “cost of diabetes medicines each month” [28].

To empirically inform the selection of the levels of the cost attribute, an online binary choice survey of 400 members of the general population was conducted to assess people's WTP for hypothetical self-management and HRQOL states (recruitment followed the same process for the main general population survey reported later). Respondents completed experimental binary choice questions, where each question was a choice between a poor state with zero cost or a good state with nonzero cost that was randomly varied across different questions using various levels (across different survey versions the levels used were £10, £25, £50, £75, £100, £150, £200, £300, £400, and £600). The proportions of respondents choosing the better state with nonzero cost were compared to determine how the different costs impacted on choice.

Four levels of the cost attribute were selected, in common with the four severity levels of all other attributes. In the literature of DCE involving a cost attribute to determine WTP, the severity levels are not usually equal but increase exponentially (e.g., 2, 4, 8, 16), and this approach was used here to inform the selection of levels. The lowest level of £10 was selected because about a quarter of the respondents being asked the question were not willing to pay £10 to improve their health. The highest level of £600 was selected as the upper end because about one-third of the respondents were willing to pay £600 to improve their health. Levels of £75 and £200 were selected to represent the intermediate cost levels to ensure good coverage.

### Selecting Profiles

Eight attributes from the classification system plus four cost levels resulted in 262,144 profiles, and many millions of possible pairs. Therefore, a subset of profiles was selected using D-optimal methods in Ngene software, distributed by ChoiceMetrics [29] to

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