Using a discrete choice experiment involving cost to value a classification system measuring the quality of life impact of self-management for diabetes

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Abstract

Objective: This paper describes 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=1,497) and individuals with diabetes (n=405). The data was modelled using a conditional logit model with robust standard errors. The marginal rate of substitution (MRS) was used to generate willingness to pay 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 diabetes patients. The willingness to pay to avoid the most severe state was £1,118.53 per month for the general population and £2,356.02 per month for the diabetes patient population. The results were largely robust.

Conclusion: Health and self-management can be valued in a single classification system using DCE with cost. The MRS for key attributes can be used to inform cost-benefit analysis of self-management interventions in diabetes using results from clinical studies where this new classification system has been applied. The method shows promise, but found large willingness to pay estimates exceeding the cost levels used in the survey.
1.0 Introduction

Discrete choice experiment (DCE) methods are increasingly being applied as a means to value the benefits of health care interventions. Usually DCEs have 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 e.g. 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 EQ-5D-5L (3) and SF-6D (4, 5) on the 0-1 QALY scale by adding an additional attribute for duration. This approach has been referred to as the DCE_TTO approach in the literature (6-11). These health state utility values can then be used to estimate QALYs for use in cost-utility analysis, for submission to regulatory agencies such as NICE the National Institute of Health and Care Excellence in the UK (12), or the Pharmaceutical Benefits Advisory Committee in Australia (13).

An alternative to cost-utility analysis is cost-benefit analysis (CBA), where the benefit of interventions is represented by a monetary value. 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 (for example (14)). DCE 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 (for example (2)). However, 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_TTO used with EQ-5D and SF-6D, but provides monetary estimates of the willingness to pay to avoid a health state that can potentially be used to inform CBA.

Diabetes costs across the globe are rising due to the increased prevalence of the disease and the increased complexity of its treatment. For example, in the UK £936 million was spent on prescriptions for diabetes in 2015 (18), and the total cost of diabetes in the UK is estimated to be £23.7 billion (19).
Structured education in diabetes is one of 9 key care process checks recommended by NICE (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 based on questionnaires which are not diabetes specific, e.g., EQ-5D or SF-12, and so the intended improvement in self-management skills of an intervention cannot be evaluated in economic terms. Likewise measures which are diabetes-specific, e.g., PAID, 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, as existing measures do not consider the direct impact of different self-management regimes on patient’s 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 paper 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 paper presents a DCE survey with a cost attribute conducted in general population and diabetes patient samples, and the results of regression analyses to model the DCE data to provide monetary values of the willingness to pay to avoid each state defined by the classification system for both general population and diabetes patient samples. We then discuss the results in terms of the implications for valuing this and other classification systems using this method.

2.0 Methods

Classification system

The Health and Self-Management in Diabetes (HASMID) classification system was developed to capture the impact of self-management on quality of life in diabetes (see Figure 1). Four of the
dimensions represent HRQoL (mood, hypoglycaemic attacks, vitality and social limitations) and the remaining four dimensions represent self-management (control, hassle, stress, support). The dimensions of HRQoL are taken from the DHP-5D (23), a diabetes preference-based measure developed from the Diabetes Health Profile (DHP) (24, 25) and the SF-36 (the vitality item) (26). The development of the classification system is reported in detail elsewhere (22).

Valuation technique

DCE tasks present two or more profiles, where 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 as 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. However, the levels should accurately capture the range of preferences for the majority of 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, as 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, as this may not be the maximum amount people are willing to pay (16). Typically, cost levels used in the literature reflect a range around mean cost that includes either a low 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 willingness to pay for hypothetical self-management and HRQoL states. 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 willingness to pay 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 as around one quarter of 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 as around one third of 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 (29) to produce a design that enables estimation of the parameters in a pre-specified
regression model with precision. The design selected 120 choice sets across 10 survey versions (12
per survey) and was piloted (50 respondents) to generate priors for each attribute level of each
dimension. These priors were then used to generate the design (i.e. select 120 choice sets) for the
main study. The rationale for this was to improve the efficiency of the design with information
regarding the magnitude of the parameter values.

Respondents
Presently, there is no consensus in the literature about whether values should be obtained from
general population or patient samples (30). This paper does not propose to review this debate, but
given the diversity of viewpoints values have been collected from both general population and
individuals with diabetes.

1) General population sample
Respondents were recruited in the same way as reported above for survey 1.

2) Patient sample
Diabetes patients were recruited in a variety of ways in order to ensure a good coverage across
different groups in terms of severity, background and setting:
• Posters in clinics and invitations letters posted with the usual clinic appointment letter to patients at Sheffield Teaching Hospitals
• Invitation letters posted to members of the Sheffield Diabetes Research Database who have previously been consented to receive information about diabetes research projects
• Diabetes UK and DAFNE Online advertised a link to the online survey
• Twitter and Facebook posts to diabetes charities, organisations, University of Sheffield staff and students and using a social media marketing company

All patient respondents were offered optional entry into a prize draw for £50 shopping vouchers per 50 respondents.

The DCE survey
Respondents were presented with the project information sheet and consented. They then completed sociodemographic and health questions including gender, age, education level, annual household income and whether they have diabetes. Following this respondents were provided with information about what it is like to live with diabetes and were asked to complete the HASMID classification system for themselves if they have diabetes or imagining someone with diabetes in order to familiarise themselves with the classification system. Respondents then answered 1 practice DCE plus 12 DCE questions, an example question is shown in Figure 2. Finally, patients were also asked about their own self-management of diabetes.

Piloting
The draft survey instrument was shown to a general patient and public involvement (PPI) panel for comments and piloted with 50 members of the general population to inform the final survey design.

Analysis
Socio-demographic and self-reported health characteristics were analysed and categorised. T-tests were used to assess the significance of differences in respondent characteristics across the different populations.

The DCE data was modelled using the following model specification:
\[ \mu_{ij} = \alpha_1 + \beta_1 c_{ij} + \beta'_2 x_{ij} + \epsilon_{ij} \]  

where \( c_{ij} \) represents cost, \( \beta_1 \) is the coefficient for costs and \( \beta'_2 \) the coefficients for the 24 non-reference attribute levels of the classification system. This model produces unanchored values for scenarios or combinations of attribute levels. The monetary value of each level of each attribute is estimated by dividing the coefficient attached to the relevant attribute level by the coefficient attached to the cost attribute (after prior checking for the linearity of the cost attribute) to generate the marginal rate of substitution, \( \frac{\beta'_2}{\beta_1} \). This enables the monetary value of self-management alone, or the combined monetary value of HRQOL and self-management, to be estimated. Models were estimated separately for the general population and diabetes patient samples. Models were estimated using the conditional logit model with robust standard errors, and confidence intervals and standard errors of the WTP estimates were determined using the Delta method. Model performance was examined using sign, significance and logical consistency of coefficients, log likelihood and pseudo R-squared. The models assumed that cost was linear and a continuous variable. This was examined by modelling cost as a categorical variable and plotting the cost coefficients (31).

Robustness

Regressions were re-estimated excluding all responses to the DCE questions that were achieved within an implausibly short time period as it is likely that such quick responses indicate that these respondents are less likely to have read, understood and considered the profiles. Regression models were also estimated to determine whether sociodemographics impacted on the results, including main effects plus interaction effects (one at a time) for the sociodemographic characteristics of age, sex, low income, high income, EQ-5D score, and whether the respondent has diabetes.

3.0 Results

3.1 The sample

The characteristics of the general population and diabetes patient samples compared to the UK general population are shown in Table 1. The general population sample has a similar proportion of males and similar employment status to the UK general population, but has a lower proportion of
respondents aged over 65. The diabetes patient samples are significantly different at the 1% level for age (a larger proportion over 65), employment status (fewer in employment), EQ-5D-5L score (a lower score) (scored using the cross-walk from EQ-5D-5L to EQ-5D (32) and a lower proportion in the highest income category, and at the 5% level for gender (a lower proportion of males) and having a degree qualification (fewer).

3.2 Regression analysis

Regression results for the conditional logit model with robust standard errors and the anchored coefficients using the marginal rate of substitution are reported in Table 2. The specified model is acceptable for both the general population and patient population using log likelihood and pseudo R-squared. The anchored coefficients are monetary values reflecting the amount that respondents would be willing to pay each month in pounds sterling (£) to avoid the decrement in the health or self-management attributes.

The cost coefficient has the expected negative coefficient, showing that individuals are willing to pay to avoid decrements in health or self-management outcomes. Prior analyses (not reported) indicated it was appropriate to assume cost was linear and continuous, using a plot for each sample of the cost levels and coefficients estimated using a model where cost was included as a categorical variable.

The estimated coefficients of the health and self-management attributes are all logically consistent, with the exception of level 2 coefficients for mood, vitality and support though only the vitality level 2 coefficient is approaching significance (at the 10% level). Out of a possible 25 coefficients, 21 and 17 are statistically significant in the models in the general population and diabetes populations, respectively. All level 3 and level 4 coefficients are negative and significant with the exception of the level 3 coefficient for vitality in the model estimated for the diabetes patient population.

Table 3 shows the rank ordering of the level 4 coefficients for the general population and diabetes patient samples, which indicate the ordering of which attributes have the largest impact on willingness to pay at the most severe level. There are noticeable differences, particularly for vitality and mood.
Figure 3 shows the relative size of the anchored coefficients for the general population and diabetes patient samples and shows the relative importance of each of the attributes. The size of the anchored coefficients are similar in size for the HRQoL attributes and the self-management attributes, implying that self-management and HRQoL are equally important. In general, the patient coefficients tend to be larger than those of the general population sample for more severe levels of each attribute, but smaller for the least severe level of each attribute. This suggests that patients are willing to pay less to avoid mild health states but are willing to pay more to avoid severe health states in comparison to the general population. For example, the willingness to pay to avoid the mild state of state 22222222 is £121.99 per month for the general population and £64.02 per month for the diabetes patient population. In contrast, the willingness to pay to avoid the most severe state 44444444 is £1,118.53 per month for the general population and £2,356.02 per month for the diabetes patient population.

3.3 Robustness

Robustness analyses excluded responses under 5 (19% and 5% of responses for general population and patients respectively) and 10 seconds (40% and 16% of responses for general population and patients respectively), resulting in larger absolute anchored coefficients at levels 3 and 4. This suggests that the exclusion of responses from respondents who may not have understood or engaged with the task will increase the size of the willingness to pay estimates. Regression models including main effects plus interaction effects (one at a time) for the sociodemographic characteristics of age, sex, low income, high income, EQ-5D score, and whether the respondent has diabetes found no distinguishable pattern in terms of which coefficients were significant. This was surprising for the income variables, given that it was anticipated that willingness to pay may increase as annual household income increases.

4.0 Discussion

This paper describes the use of DCE including a cost attribute to value a classification system describing the impact of health and self-management of diabetes on quality of life. The classification system is distinct in that it provides a formal and consistent way to take account of self-management across different interventions and one that is not intervention specific. However, in order to use this information to inform health technology assessment, a means of weighting the severity levels of each
attribute to produce a single score is required. This paper describes a novel application of the technique of DCE involving a cost attribute to enable the valuation of a standardised classification system to provide willingness to pay values for every state defined by the classification system. The paper also provides a comparison of general population and diabetes population willingness to pay values.

In the regression analysis, the anchored coefficients for the HRQoL and self-management attributes are of similar magnitude, suggesting that HRQoL and self-management have a similar relative impact in terms of their utility decrement or amount respondents are willing to pay to avoid more severe levels of the attribute. This has important implications for policy, since it suggests that the impact of changes in self-management on the lives of people with diabetes can be as important as any HRQoL improvement resulting from the change.

The largest difference in the rank ordering of the level 4 coefficients between the general population and patient samples is the ranking of the vitality attribute, which is ranked most important for the general population, whereas it is ranked least important for the patient population. This is interesting given that it is the attribute in the classification system derived from the generic SF-36, whereas the other items were all derived either from a diabetes-specific measure or from interviews with people with diabetes. Whilst this suggests that the general population may place a higher relative value on reductions in vitality than the general population, the absolute value is similar for both samples. In addition the mood attribute is ranked second most important for the diabetes population but second least important for the general population. However the hypoglycaemic attack attribute is ranked least important for the general population and second least important for the diabetes population.

The willingness to pay per month to avoid state 4444444444 is £1,118.53 for the general population and £2,356.02 for the diabetes patient population. This is significantly larger than the largest cost level included in the survey of £600 per month. An indication of how large these values are relative to annual household income can be calculated. Approximately 23.9% of the general population sample has annual household income below £20,800, and for these respondents this would represent at least 64.5% of their income (£13,422.36). Obviously this is a somewhat unrealistic example as it includes
the most severe state experienced by respondents with the lowest income, but indicates that the results should be interpreted with caution, since they may only indicate relative values rather than absolute values.

One limitation of the study is that the patient sample is relatively small given the survey design included 12 blocks of 10 DCE questions, meaning approximately 29-34 respondents answered each block of 10 questions. This may have impacted on the significance of coefficients for the regression models estimated on the patient samples.

The regression models had some insignificant and some inconsistent results. However, it is important to note that it is not uncommon for valuation surveys of classification systems to find this, for example the UK valuation of the SF-6D using standard gamble had both inconsistent and insignificant coefficients (4, 5).

The use of existing general population online panels can be criticised for not being representative of the UK population. Members of online panels may differ from the general population in that they exclude the computer illiterate and those without access to the internet. In addition respondents have signed up to be a member of a panel with a market research agency and stated they are willing to answer surveys in return for points that can be exchanged for goods, and therefore their motivation for undertaking the survey may have an impact on their responses, potentially making their responses unrepresentative. However in terms of sociodemographic characteristics measured, they were found to be similar to the UK general population except there being fewer over 65s and in contrast a larger proportion of retired respondents, although they may differ in terms of other unmeasured characteristics. The patient sample was different in ways that would be expected for those with diabetes.

The major limitation of this study is concerned with the accuracy of the elicitation of preferences for the cost attribute. The UK healthcare system is publically funded, meaning that the general population receives free health care at the point of use with the exception of small charges such as prescription charges. This means that respondents are not used to paying for healthcare, or paying to improve
their health state. This may have impacted on the results as it may mean that responses are not fully considered or fully informed due to inexperience in paying for healthcare or health improvement. It is possible that the selection of four levels rather than a higher number for the cost attribute may have impacted on the results.

The wording of the cost attribute may have impacted on the results. In the profiles the wording was “The monthly cost of treatment to you”. It is possible that respondents may not have correctly interpreted the cost as being applicable every month, and may have instead interpreted it as a one-off payment. The frequency of payment as monthly rather than annually may have impacted on results as, for example, altering the wording to annual rather than monthly may not have multiplied the size of the willingness to pay estimates by twelve times.

This paper contributes to the methodological literature on the valuation of standardised patient reported outcome measures using WTP for potential application in cost-benefit analysis. This approach could potentially add to the use of willingness to pay in economic evaluation. The levels of the cost attribute used in the DCE survey were derived empirically, adding strength to the approach. The project also compared general population and diabetes patient values. Overall this approach shows promise, but there are some concerns with some inconsistencies in results, insignificant coefficients and large willingness to pay estimates observed that extend beyond the cost levels used in the survey. The novel application of DCE with a cost attribute to value a classification system provides an alternative approach to DCE with duration, an approach that has been previously used to value classification systems. Further research applying DCE with a cost attribute to value a classification system and to compare this method with DCE with duration is ongoing.
References

### Table 1: Samples of respondents to the DCE survey

<table>
<thead>
<tr>
<th></th>
<th>General population (n=1,497)</th>
<th>Diabetes population (n=405)</th>
<th>UK general population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>48.6%</td>
<td>41.5%</td>
<td>49.1%</td>
</tr>
<tr>
<td>Age 18-44</td>
<td>47.0%</td>
<td>40.0%</td>
<td>46.6%</td>
</tr>
<tr>
<td>45-64</td>
<td>39.7%</td>
<td>35.3%</td>
<td>32.5%</td>
</tr>
<tr>
<td>65+</td>
<td>13.3%</td>
<td>24.7%</td>
<td>20.9%</td>
</tr>
<tr>
<td>Degree</td>
<td>52.9%</td>
<td>45.9%</td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>60.5%</td>
<td>45.4%</td>
<td>61.7%</td>
</tr>
<tr>
<td>Retired</td>
<td>18.0%</td>
<td>29.9%</td>
<td>13.9%</td>
</tr>
<tr>
<td>Housework</td>
<td>6.7%</td>
<td>5.7%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Student</td>
<td>4.5%</td>
<td>3.7%</td>
<td>9.3%</td>
</tr>
<tr>
<td>Seeking work</td>
<td>1.3%</td>
<td>1.5%</td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>3.1%</td>
<td>3.0%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Long term sick</td>
<td>4.8%</td>
<td>9.4%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Other</td>
<td>1.1%</td>
<td>1.5%</td>
<td>2.2%</td>
</tr>
<tr>
<td>EQ-5D-5L Mean (s.d.)</td>
<td>0.79 (0.25)</td>
<td>0.70 (0.27)</td>
<td></td>
</tr>
<tr>
<td>Have diabetes</td>
<td>13.2%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Type 1</td>
<td>2.5%</td>
<td>47.7%</td>
<td></td>
</tr>
<tr>
<td>Type 2</td>
<td>10.6%</td>
<td>52.3%</td>
<td></td>
</tr>
<tr>
<td>Annual household income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to £5,199</td>
<td>2.8%</td>
<td>4.7%</td>
<td></td>
</tr>
<tr>
<td>£5,200-10,399</td>
<td>6.1%</td>
<td>6.4%</td>
<td></td>
</tr>
<tr>
<td>£15,400-15,599</td>
<td>8.6%</td>
<td>10.9%</td>
<td></td>
</tr>
<tr>
<td>£15,600-20,799</td>
<td>8.5%</td>
<td>11.4%</td>
<td></td>
</tr>
<tr>
<td>£20,800-25,599</td>
<td>10.6%</td>
<td>11.4%</td>
<td></td>
</tr>
<tr>
<td>£26,000-31,199</td>
<td>10.2%</td>
<td>8.1%</td>
<td></td>
</tr>
<tr>
<td>£31,200-36,399</td>
<td>9.6%</td>
<td>5.9%</td>
<td></td>
</tr>
<tr>
<td>£36,400-51,999</td>
<td>15.5%</td>
<td>13.6%</td>
<td></td>
</tr>
<tr>
<td>£52,000 +</td>
<td>18.5%</td>
<td>11.1%</td>
<td></td>
</tr>
<tr>
<td>Prefer not to say</td>
<td>9.6%</td>
<td>16.5%</td>
<td></td>
</tr>
</tbody>
</table>

Note: Statistics for England in the Census 2011. The census includes persons aged 16 and above whereas this study only surveys persons aged 18 and above. Age distribution is here reported as the percentage of all adults aged 18 and over.
### Table 2: Regression analysis of DCE survey responses by population

<table>
<thead>
<tr>
<th>Variable</th>
<th>General population unanchored estimates</th>
<th>Diabetes population unanchored estimates</th>
<th>General population anchored estimates</th>
<th>Diabetes population anchored estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mood L2</td>
<td>0.0414</td>
<td>0.0033</td>
<td>16.52</td>
<td>2.79</td>
</tr>
<tr>
<td>Mood L3</td>
<td>-0.1226***</td>
<td>-0.1094*</td>
<td>-48.91***</td>
<td>-93.31*</td>
</tr>
<tr>
<td>Mood L4</td>
<td>-0.2713***</td>
<td>-0.3847***</td>
<td>-108.25***</td>
<td>-328.29***</td>
</tr>
<tr>
<td>Hypoglycaemia L2</td>
<td>-0.0413</td>
<td>-0.0605</td>
<td>-16.49</td>
<td>-51.60</td>
</tr>
<tr>
<td>Hypoglycaemia L3</td>
<td>-0.1814***</td>
<td>-0.1426**</td>
<td>-72.37***</td>
<td>-121.71**</td>
</tr>
<tr>
<td>Hypoglycaemia L4</td>
<td>-0.2415***</td>
<td>-0.2807***</td>
<td>-96.38***</td>
<td>-239.53***</td>
</tr>
<tr>
<td>Vitality L2</td>
<td>0.0581*</td>
<td>0.1075*</td>
<td>23.18*</td>
<td>91.71*</td>
</tr>
<tr>
<td>Vitality L3</td>
<td>-0.3036***</td>
<td>-0.1016</td>
<td>-121.14***</td>
<td>-86.68</td>
</tr>
<tr>
<td>Vitality L4</td>
<td>-0.5918***</td>
<td>-0.2770***</td>
<td>-236.17***</td>
<td>-236.37***</td>
</tr>
<tr>
<td>Social limitations L2</td>
<td>-0.0205</td>
<td>-0.0153</td>
<td>-8.17</td>
<td>-13.06</td>
</tr>
<tr>
<td>Social limitations L3</td>
<td>-0.0977***</td>
<td>-0.1586***</td>
<td>-38.97***</td>
<td>-135.23***</td>
</tr>
<tr>
<td>Social limitations L4</td>
<td>-0.1707***</td>
<td>-0.2612***</td>
<td>-68.12***</td>
<td>-222.91***</td>
</tr>
<tr>
<td>Control L2</td>
<td>-0.1427***</td>
<td>-0.0236</td>
<td>-56.94***</td>
<td>-20.10</td>
</tr>
<tr>
<td>Control L3</td>
<td>-0.3010***</td>
<td>-0.3372***</td>
<td>-120.12***</td>
<td>-287.72***</td>
</tr>
<tr>
<td>Control L4</td>
<td>-0.4441***</td>
<td>-0.5343***</td>
<td>-177.22***</td>
<td>-455.88***</td>
</tr>
<tr>
<td>Hassle L2</td>
<td>-0.0971***</td>
<td>-0.0649</td>
<td>-38.73***</td>
<td>-55.35</td>
</tr>
<tr>
<td>Hassle L3</td>
<td>-0.2328***</td>
<td>-0.2138***</td>
<td>-92.89***</td>
<td>-182.46***</td>
</tr>
<tr>
<td>Hassle L4</td>
<td>-0.4134***</td>
<td>-0.3563***</td>
<td>-164.95***</td>
<td>-304.05***</td>
</tr>
<tr>
<td>Stress L2</td>
<td>-0.1543***</td>
<td>-0.0601</td>
<td>-61.56***</td>
<td>-51.29</td>
</tr>
<tr>
<td>Stress L3</td>
<td>-0.2188***</td>
<td>-0.1465***</td>
<td>-87.30***</td>
<td>-125.03***</td>
</tr>
<tr>
<td>Stress L4</td>
<td>-0.3715***</td>
<td>-0.3230***</td>
<td>-148.25***</td>
<td>-275.61***</td>
</tr>
<tr>
<td>Support L2</td>
<td>0.0506</td>
<td>0.0385</td>
<td>20.20</td>
<td>32.88</td>
</tr>
<tr>
<td>Support L3</td>
<td>-0.1266***</td>
<td>-0.1859***</td>
<td>-50.50***</td>
<td>-158.61***</td>
</tr>
<tr>
<td>Support L4</td>
<td>-0.2987***</td>
<td>-0.3438***</td>
<td>-119.19***</td>
<td>-293.38***</td>
</tr>
<tr>
<td>Cost</td>
<td>-0.0025***</td>
<td>-0.0012***</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

**LLN** -10458.4 -3027.3
**Pseudo-R^2** 0.160 0.101
**Number of respondents** 1,497 405
**Number of responses** 35,928 9,720
**Statistically significant (out of 25)** 21 17
**Incorrect sign** 3 3
**Inconsistencies** 3 3

Note: *** p<0.01, ** p<0.05, * p<0.1
### Table 3: Ranking of level 4 anchored coefficients by population

<table>
<thead>
<tr>
<th>General population</th>
<th>Diabetes population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitality L4</td>
<td>-236.17</td>
</tr>
<tr>
<td>Control L4</td>
<td>-177.22</td>
</tr>
<tr>
<td>Hassle L4</td>
<td>-164.95</td>
</tr>
<tr>
<td>Stress L4</td>
<td>-148.25</td>
</tr>
<tr>
<td>Support L4</td>
<td>-119.19</td>
</tr>
<tr>
<td>Mood L4</td>
<td>-108.25</td>
</tr>
<tr>
<td>Hypo L4</td>
<td>-96.38</td>
</tr>
</tbody>
</table>
Figure 1: Health and self-management in diabetes (HASMID) classification system

Mood
You never find yourself losing your temper over small things
You sometimes find yourself losing your temper over small things
You usually find yourself losing your temper over small things
You always find yourself losing your temper over small things

Hypoglycaemic attacks
You never worry about going hypo
You sometimes worry about going hypo
You usually worry about going hypo
You always worry about going hypo

Vitality
You are never tired
You are sometimes tired
You are usually tired
You are always tired

Social Limitations
Your days are never tied to meal times
Your days are sometimes tied to meal times
Your days are usually tied to meal times
Your days are always tied to meal times

Control
You feel you have a lot of control of your diabetes
You feel you have some control of your diabetes
You feel you have little control of your diabetes
You feel you have no control of your diabetes

Hassle
You find your life with diabetes is never a hassle
You find your life with diabetes is sometimes a hassle
You find your life with diabetes is often a hassle
You find your life with diabetes is always a hassle

Stress
You find your life with diabetes is never stressful
You find your life with diabetes is sometimes stressful
You find your life with diabetes is often stressful
You find your life with diabetes is always stressful

Support (All support you have; from family, friends and health care professionals)
You feel totally supported with your diabetes
You feel you have a lot of support with your diabetes
You feel you have a little support with your diabetes
You feel you have no support with your diabetes
**Figure 2:** Example DCE question

<table>
<thead>
<tr>
<th>Health description A</th>
<th>Health description B</th>
</tr>
</thead>
<tbody>
<tr>
<td>You <em>always</em> find yourself losing your temper over small things</td>
<td>You <em>never</em> find yourself losing your temper over small things</td>
</tr>
<tr>
<td>You <em>sometimes</em> worry about going hypo</td>
<td>You <em>never</em> worry about going hypo</td>
</tr>
<tr>
<td>You are <em>never</em> tired</td>
<td>You are <em>always</em> tired</td>
</tr>
<tr>
<td>Your days are <em>never</em> tied to meal times</td>
<td>Your days are usually tied to meal times</td>
</tr>
<tr>
<td>You feel you have <em>some</em> control of your diabetes</td>
<td>You feel you have <em>no</em> control of your diabetes</td>
</tr>
<tr>
<td>You find your life with diabetes is <em>never</em> a hassle</td>
<td>You find your life with diabetes is <em>always</em> a hassle</td>
</tr>
<tr>
<td>You find your life with diabetes is <em>never</em> stressful</td>
<td>You find your life with diabetes is <em>always</em> stressful</td>
</tr>
<tr>
<td>You feel <em>totally</em> supported with your diabetes</td>
<td>You feel you have <em>a little</em> support with your diabetes</td>
</tr>
<tr>
<td><strong>Which do you prefer?</strong></td>
<td><strong>The monthly cost of treatment to you is</strong></td>
</tr>
<tr>
<td><strong>£10</strong></td>
<td><strong>£75</strong></td>
</tr>
</tbody>
</table>
Figure 3: Anchored coefficients for the general population and diabetes patients