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## Patient-Reported Outcomes

# Can Social Care Needs and Well-Being Be Explained by the EQ-5D? Analysis of the Health Survey for England



Jeshika Singh, MSc<sup>1,2,\*</sup>, Subhash Pokhrel, PhD<sup>2</sup>, Louise Longworth, PhD<sup>1</sup>

<sup>1</sup>PHMR Ltd.—Health Economics, Pricing and Reimbursement, London, UK; <sup>2</sup>Health Economics Research Group, Department of Clinical Sciences, Brunel University London, London, UK

### ABSTRACT

**Background:** The recent shift to an integrated approach to health and social care aims to provide cohesive support to those who are in need of care, but raises a challenge for resource allocation decision making, in particular for comparison of diverse benefits from different types of care across the two sectors. **Objective:** To investigate the relationship of social care needs and well-being with a generic health status measure using multivariate regression. **Methods:** We empirically compared responses to health and well-being measures and social care needs from a cross-sectional data set of the general population (the Health Survey for England). Multivariate regression analyses were conducted to examine whether social care needs measured by the Barthel index can be explained by health status as captured by the EuroQol five-dimensional questionnaire (EQ-5D) and two well-being measures—the Warwick Edinburgh Mental Wellbeing Scale (WEMWBS) and the General Health Questionnaire (GHQ-12). **Results:** Our study found that poor overall scores for EuroQol visual analogue

scale, EQ-5D index, GHQ-12, and WEMWBS indicated a need for social care. Investigation of the dimensions found that the EQ-5D dimensions self-care and pain/discomfort were statistically significantly associated with the need for social care. Two dimensions of the WEMWBS (“been feeling useful” and “had energy to spare”) were statistically significantly associated with the Barthel index, but none of the GHQ-12 dimensions were. **Conclusions:** The results show that the need for social care, which is dependent on the ability to perform personal day-to-day activities, is more closely related to the EQ-5D dimensions than the well-being measures WEMWBS and GHQ-12.

**Keywords:** health status, HSE, social care, well-being.

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## Introduction

Health care systems are under more pressure than ever before, with people living longer and often with several comorbidities or chronic conditions that require care. In the United Kingdom, there is a shift toward an integrated approach to health and social care [1,2]. In 2013, the National Institute for Health and Care Excellence (NICE) was given a new responsibility for providing guidance and quality standards for social care services. This was in addition to its established remit of providing guidance on health technologies, clinical practice, and public health [3]. The move to an integrated approach aims to provide a cohesive and consolidated support to those who are in need of care. It, however, raises the challenge of capturing the benefits from different types of care to inform resource allocation decisions across health and social care interventions.

The NICE manual on developing guidelines states that the health effect of health technologies, public health, and social care

interventions should be expressed in terms of quality-adjusted life-years (QALYs), with the EuroQol five-dimensional questionnaire (EQ-5D) as the preferred measure of health status [4]. The EQ-5D describes an individual's health status across five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. It is the most widely used instrument for estimating the health-related quality of life (HRQOL) component of the QALY and has preference-based value sets obtained from general population samples in several countries [5,6].

The NICE manual for developing guidelines recognizes that use of the EQ-5D as the measure of outcomes for the evaluation of public health and social care interventions may be inappropriate in some situations. In addition to health effects, public health and social care interventions may result in non-health-related benefits that might not be captured by the EQ-5D. In public health, non-health-related benefits are included on a case-by-case basis, and in social care, “capability” measures are recommended by NICE to capture improvements in terms of an

\*Address correspondence to: Jeshika Singh, PHMR Ltd.—Health Economics, Pricing and Reimbursement, Berkley Grove, London NW1 8XY, UK.

E-mail: [jeshikasingh@phmr.com](mailto:jeshikasingh@phmr.com)

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individual's ability to “do” and “be” the things that are important in life and health/social care outcomes [4]. A systematic review conducted by Makai et al. [7] that aimed at identifying quality-of-life instruments for economic evaluations in health and social care for older people found 487 articles using 34 generic instruments, 23 of which were well-being measures and 11 HRQOL instruments. It was noted that HRQOL instruments include physical, social, and psychological dimensions, whereas well-being instruments include additional dimensions such as purpose in life and achievement, security, and freedom [7]. This study suggested the use of the Adult Social Care Outcome Tool (ASCOT) and the ICEpop CAPability measure for Older people (ICECAP-O), but noted that these measures may capture health dimensions only partially and that the instruments require further validation [7]. Another report [8] noted that the six most commonly used measures of health and well-being in the United Kingdom are the General Health Questionnaire (GHQ-12); the Warwick Edinburgh Mental Wellbeing Scale (WEMWBS); the Office of National Statistics well-being measure that includes four subjective well-being questions (ONS-4); ICECAP-A measure, which is a capability measure for adults; ASCOT, which was designed in 2012 to measure the aspects of an individual's quality of life that can be affected by social care; and the EQ-5D, which is an HRQOL measure.

The use of multiple outcome measures such as these presents decision makers with several issues. Which measures are most appropriate for capturing social care outcomes? How should measures be used to make comparisons? How should information from multiple measures be combined? Given these questions, it is important to gain a better understanding of how the measures used in health and social care are related to each other; one way to do so is to compare the responses with the instruments used in the same population.

There is currently little clarity about how health and well-being measures are associated with outcomes specifically associated with social care. The Health Survey for England (HSE) series obtain data using health and well-being instruments such as the three-level EQ-5D (EQ-5D-3L), GHQ-12, and WEMWBS to capture changes in the health and lifestyles of people in England. In 2011, the HSE included a core module on social care with the objective of delivering robust data on the need for and receipt of social care services. A major study was undertaken to identify the questions to be used in the social care module in 2009. This included review of relevant economic evaluations and a review of existing questions to identify data gaps, followed by qualitative research with stakeholders, service providers, and service users. This research informed the initial design of the questions, which were then subject to expert evaluation and two rounds of cognitive question testing. More detailed information about the development of the questions is available in chapter 5 of the HSE 2011 report and in the NatGen report [9,10]. The HSE measured the need for and receipt of social care using a number of activities of daily living (ADL) and instrumental ADL and summarized it using the Barthel index (BI) [9,11]. The social care module focused only on population aged 65 years and older, because the proportion of people who have difficulties with ADL increases with age. The percentage of people with at least one difficulty at age 65 years is 21.2% and the proportion increases to more than 50% after the age of 85 years [12].

This study will use this cross-sectional data set of the general population to investigate the relationship of social care needs with health and well-being using regression analysis of responses to BI, EQ-5D, GHQ-12, and WEMWBS. As the measure selected to represent social care needs in the HSE, the BI is used as a proxy of social care needs in this study. In addition, the relationship of the EQ-5D with well-being measures will be examined using regression techniques to augment understanding of the primary analysis.

## Methods

### HSE Data Set

The HSE is an annual survey administered since 1991 to monitor trends in national health and to estimate the prevalence of specific health conditions and risk factors. A number of core questions on sociodemographic characteristics, employment, health conditions and risk factors, and some clinical measurements (such as blood pressure, anthropometric measurements, and analysis of blood and saliva samples) are included in every survey. Each survey also has a particular focus on a disease, condition, or population group (such as older people or minority ethnic groups) that varies from year to year. General health status has been measured using the EQ-5D in the years 1996, 2003 to 2006, 2008, 2011, and 2012. This study uses the 2011 and 2012 data sets, which are the only two data sets including information on the EQ-5D, social care needs, general health, and well-being [9,11].

In HSE 2011 and 2012, a total of 8992 and 9024 addresses were randomly selected from a postcode address file, using a multi-stage sample design with appropriate stratification, and surveyed over 12 months from January to December 2011 and from January to December 2012, respectively. Data collection involved a face-to-face computer-assisted interview with some questions asked by the interviewer and others provided in a booklet for self-completion, followed by a visit from a specially trained nurse if the participant agreed. The nurse visit included measurements and collection of blood and saliva or urine samples, as well as additional questions. Household response rates of 66% and 64% were achieved in 2011 and 2012, respectively. The HSE surveys are designed to yield a representative sample of the general population living in private households in England. Those living in care institutions were not included in the survey.

### Instruments Used in the HSE

HSE 2011 and 2012 measured self-reported health status using the EQ-5D-3L, which contains five dimensions assessed across three levels each, and the EuroQol visual analogue scale (EQ-VAS), which measures self-assessed health on a scale of 0 to 100, where 0 represents “worst imaginable health” and 100 represents “best imaginable health.” Mental health was assessed using the GHQ-12. In the GHQ-12, each item is rated on a four-point response scale to indicate whether 12 symptoms of mental ill health are “not at all present,” present “no more than usual,” present “rather more than usual,” or present “much more than usual.” Subjective well-being was measured using the WEMWBS, which includes hedonic and eudemonic perspectives and covers many attributes of mental well-being. A summary of the components of the different instruments used in the HSE and the modes of administration is presented in Table 1. Questions on the EQ-5D, GHQ-12, and WEMWBS were self-completed by the respondents, whereas social care questions were asked by the interviewer. The GHQ-12 was not included in the 2012 survey. In 2011, the WEMWBS was administered during the main interview, but in 2012 it was administered during the nurse visit.

### Social Care Needs

Social care describes a range of care activities, such as providing help with personal hygiene, dressing, and feeding as well as help with shopping, getting out and about, socializing, and keeping the home tidy and clean. Netten et al. [13] state that outcomes relevant to social care interventions are associated with rehabilitation or “maintenance” outcomes, “process” outcomes, which

**Table 1 – Summary of instruments used in HSE 2011 and 2012.**

Measure	Dimensions	Levels	Mode of administration	
			HSE 2011	HSE 2012
EQ-5D-3L	Mobility; self-care; usual activity; pain/discomfort; anxiety/depression	No problems; moderate problems; extreme problems	Self-completion during interviewer visit	
GHQ-12	Able to concentrate; lost sleep over worry; felt that you were playing a useful part in things; felt capable for making decisions; felt constantly under strain; felt couldn't overcome difficulties; able to enjoy day-to-day activities; been able to face problems; been feeling unhappy and depressed; been losing confidence in self; been thinking of self as worthless; been feeling reasonably happy	Based on severity of a mental problem over the past few weeks and assessed using a four-point Likert-type scale (such as not at all, no more than usual, rather more than usual, and much more than usual); high scores indicate worse health	Not included	Self-completion during interviewer visit
WEMWBS	Been feeling optimistic about the future; been feeling useful; been feeling relaxed; been feeling interested in other people; had energy to spare; been dealing with problems well; been thinking clearly; been feeling good about myself; been feeling close to other people; been feeling confident; been able to make up my own mind about things; been feeling loved; been interested in new things; been feeling cheerful	None of the time, rarely, some of the time, often or all of the time; high score indicates good well-being	Self-completion during interviewer visit	Self-completion during nurse visit
Barthel index	Bowel and bladder incontinence; grooming; toilet use; feeding; transfer; mobility; dressing; stairs; bathing	Continent/incontinent; ADL levels were independent, manage on their own with difficulty and dependent; high overall score indicates minimum disability	Social care questions were asked by the interviewer during the main visit	

ADL, activities of daily living; EQ-5D-3L, three-level EuroQol five-dimensional questionnaire; GHQ-12, General Health Questionnaire; HSE, Health Survey for England; WEMWBS, Warwick Edinburgh Mental Wellbeing Scale.

are related to how services are delivered, and “prevention.” They further add that these outcomes are relevant to a broader quality of life, which goes beyond health or well-being.

For the purpose of this study, the HSE definition of social care, which is “help with personal care and domestic tasks to enable people to live as independently as possible,” is adopted. The surveys focused only on social care needs of those aged 65 years and older, and the sample differed from the younger population in terms of marital status, home tenure, household income, and index of multiple deprivation [9,11].

The need for and receipt of social care was measured using a number of ADL, which are basic self-care tasks and include ADL essential for an individual's self-care (e.g., dressing and feeding oneself). Respondents were presented with a list of ADL and asked whether they could carry out the activity on their own, manage on their own with difficulty, only do the activity with help, or could not do it at all. The responses were used to estimate the BI.

The original BI was developed by Mahoney and Barthel [14] in 1965 to measure functional change in an orthopedic inpatient rehabilitation setting, and has since been revised. The version used in the HSE comprises 10 items—assessment of ability to perform eight ADL and a question each on bladder and bowel incontinence—and is exact to the revised BI by

Collin et al. [15], which is a widely used measure of the ability to live at home with a degree of independence. The overall index score ranges between 0 (maximum disability) and 20 (minimum disability). It is also used to assess rehabilitation after stroke [16–18].

### Statistical Analysis

Initial analysis focused on understanding the distributions of key variables using descriptive statistics: the EQ-5D dimensions, index, and VAS; the WEMWBS summary score and dimensions; the GHQ-12 score and dimensions; the BI summary score and dimensions; and sociodemographic variables. Distributions of responses were cross-tabulated to check whether they met expected associations; for example, positive association was expected between age and need for social care. The Wilcoxon-Mann-Whitney test was used to test whether samples differed across sociodemographic factors when missing and/or inconsistent responses were obtained in key variables. Bivariate analyses were carried out to examine the strength of association between variables.

To facilitate interpretation of results, all the variables related to the EQ-5D, GHQ-12, WEMWBS, BI, and background characteristics were recoded in the same direction so that a higher score is

better on all items and the lowest score is assigned to the worst level. The EQ-5D index values were applied using the algorithm developed by Dolan et al. [19].

Multivariate analysis was carried out to examine whether social care needs measured by the BI can be explained by 1) EQ-5D, 2) WEMWBS, and 3) GHQ-12 as follows:

$$\text{Social care} = f(\text{EQ-5D, control variables}), \quad (1)$$

$$\text{Social care} = f(\text{WEMWBS, control variables}), \quad (2)$$

$$\text{Social care} = f(\text{GHQ-12, control variables}). \quad (3)$$

Exploratory analyses also examined the relationship of health status with mental health and well-being.

$$\text{Well-being} = f(\text{EQ-5D, control variables}), \quad (4)$$

$$\text{Mental health} = f(\text{EQ-5D, control variables}). \quad (5)$$

In Equations 1 to 5, social care need is represented by the overall BI, well-being is represented by the WEMWBS score, and mental health is represented by the GHQ-12. It was assumed that better health and well-being outcomes would be associated with reduced social care needs, and better health will be associated with better well-being and mental health.

Control variables were selected on the basis of interaction with dependent variables for each equation. The variable “long-standing illness” had the highest association at 0.5 with all the outcome variables. The control variables included in the final analyses were age, sex, employment, education, index of multiple deprivation quintile, marital status, alcohol consumption, smoking, body mass index (BMI), and long-standing illness. Variables with very weak association were excluded from the analysis.

The outcome variables were not normally distributed and the regression analysis was conducted using probability models. The overall BI was restricted to a binary or dichotomous outcome where the response was restricted to any or no disability, that is, BI less than 20 and BI equal to 20, respectively, to split the distribution evenly. The binary model used logistic distribution [20]. In addition, the dependent variable was estimated as an ordered outcome variable (levels 0–20) to take into account the granularity of the outcome variable, and probit distribution was adopted [20].

### Explanatory Variables

The EQ-5D was the key outcome variable in this study. All socioeconomic and demographic characteristics of the survey were assessed by testing Spearman rank correlation coefficient with the outcome variables examined. In addition, the year of the survey was included as a control variable because the data for 2011 and 2012 were pooled. Three different combinations of variable sets including the EQ-5D were examined—EQ-5D dimensions and control variables, EQ-VAS and control variables, and finally EQ-5D index and control variables. For the WEMWBS and GHQ-12, background variables with dimensions were used first and later replaced with summary scores. The relationship of the EQ-5D with mental health and well-being was estimated by using EQ-5D dimensions and background variables as regressors.

### Model Specification and Fit

Model specification, in particular omitted variable, was assessed for each model using the regression error specification test [20]. Ordered logit models also require that the model fulfilled proportional odds assumption [21]. It was not possible to estimate ordered logit models for most combinations because of concavity or violation of the assumption of proportional odds.

Final analyses focused on binary logit and ordered probit models only. On estimation of these models, the significance of each independent variable in the model was reported by checking whether the z ratio was statistically significant at a conventional 5% level of significance. The fit of the predictions by the model to the observed data was measured using overall  $\chi^2$  (usually reported as “pseudo  $R^2$ ”) [21]. Goodness of fit of the binary logistic models was also assessed using the Hosmer-Lemeshow test [22].

## Results

### Sample Characteristics

The HSE 2011 and 2012 data sets were downloaded from the UK Data Archive in August 2015 and pooled. People 65 years and older were included in the analyses ( $N = 3354$ ). The total percentage of missing responses for key summary variables EQ-5D index, EQ-VAS, GHQ-12 score, and WEMWBS score were 3.8%, 9.7%, 50.5%, and 24%, respectively. The proportions of missing data were statistically significantly greater for older people, those with lower educational qualifications, and those who were not married or living with a partner. The GHQ-12 was administered only in year 2011, and relatively more data were missing for the WEMWBS and the EQ-5D in 2012 compared with 2011. Table 2 presents the EQ-5D responses obtained from participants 65 years and older in HSE 2011 and 2012. Nevertheless, the pooled data set was used to improve sample size, and a complete case analysis was conducted.

Most respondents reporting no problems to EQ-5D questions also indicated minimum disability with BI scores more than 13. A graphical illustration of distribution of overall scores of the measures for all BI scores is provided in Figure 1. The figure demonstrates that an increase in the overall score is positively correlated with increase in health and well-being summary score. Respondents indicating the greatest need for social care with BI scores of less than 5 reported high levels of health status (EQ-5D) and well-being (WEMWBS and GHQ-12). Further analysis of this apparent inconsistency included investigating whether this group of respondents reported having their social needs met; nevertheless, most of them reported that they had not had their needs met (88%). People with maximum disability (BI score of 0–4) were better educated than those with higher scores. We note that only a small number of people reported such disability ( $n = 26$ ).

The results of regression models using binary logit and ordered probit models are described hereafter and corresponding tables display unadjusted coefficients. Note that the reference category used for explanatory dummy variables was always the worst level (e.g., extremely anxious or depressed was the omitted category in the anxiety dimension of the EQ-5D), unless otherwise specified. Because the binary model in this study assumed standard logistic function, log-odds can be computed from the coefficients. The coefficients of the explanatory variables in the ordered probit model are more difficult to interpret. The quantitative predictions have to be made on the basis of marginal and average effects, which depend on the values of the explanatory variables or they are different for different types of individuals. All the interpretations of coefficients are treated as qualitative. A positive coefficient means that the individual is more likely to report no needs in social care compared with the reference category. A negative coefficient indicates they are more likely to report disability and need for social care.

### Explaining Social Care Needs Using the EQ-5D

The final models using the EQ-5D dimensions, EQ-VAS, and EQ-5D index values to explain social care needs are presented in Table 3.

**Table 2 – EQ-5D responses of participants 65 y and older from HSE 2011 and 2012.**

EQ-5D dimensions and levels	HSE 2011 (n = 1612) (%)	HSE 2012 (n = 1742) (%)
Mobility		
No problem in walking about	57.20	63.95
Some problem in walking about	40.57	34.50
Confined to bed	0.25	0.06
Missing	1.99	1.49
Self-care		
No problems with self-care	88.28	87.49
Some problems washing or dressing	9.00	9.30
Unable to wash or dress myself	0.81	0.46
Missing	1.92	2.76
Pain/discomfort		
No pain or discomfort	40.88	47.53
Moderate pain or discomfort	49.19	44.03
Extreme pain or discomfort	8.19	6.66
Missing	1.74	1.78
Usual activities		
No problems performing usual activities	64.83	71.81
Some problems performing usual activities	29.59	22.79
Unable to perform usual activities	3.60	2.93
Missing	1.99	2.47
Anxiety/depression		
Not anxious or depressed	71.96	77.90
Moderately anxious or depressed	24.81	18.20
Extremely anxious or depressed	1.61	1.49
Missing	1.61	2.41

EQ-5D, EuroQol five-dimensional questionnaire; HSE, Health Survey for England.

The binary models using the EQ-5D summary score and control variables indicated that higher EQ-5D index and VAS scores are associated with an increase in odds ratio of requiring no social care. The ordered probit model reinforced the result that lower EQ-5D index and VAS values indicate greater need for social care and vice versa. The self-care and pain/discomfort dimensions of the EQ-5D were significantly associated with the need for social care. In addition, individuals with extreme anxiety/depression were more likely to have social care needs than those who reported not being anxious/depressed. Nevertheless, the dimensions that were statistically significant differed between the dichotomous and full BI model—mobility was significant in the binary model, and ability to perform usual activities was significant in the ordered model. The full regression models with social care as the dependent variable and control variables as explanatory variables, alongside EQ-5D dimensions, EQ-VAS and EQ-5D index score separately are provided in [Supplementary tables 1-3](#).

Background characteristics, such as older age, having a degree (compared with those with no degree), and limiting long-standing illness (compared with no long-standing illness), had negative coefficients and were predictors of social care needs across all six models. In addition, the ordered model with EQ-VAS and control variables as independent variables found that those who are underweight or overweight are more likely to indicate social care needs than those who have an ideal BMI.

### Explaining Social Care Needs Using the WEMWBS and the GHQ-12

The overall summary scores for the WEMWBS and the GHQ-12 were significantly associated with the BI. Among the control variables, age, long-standing illness, and BMI were statistically significant. In addition, the binary model with WEMWBS scores and control variables found that female respondents were less likely to report no disability, hence requiring social care. The full

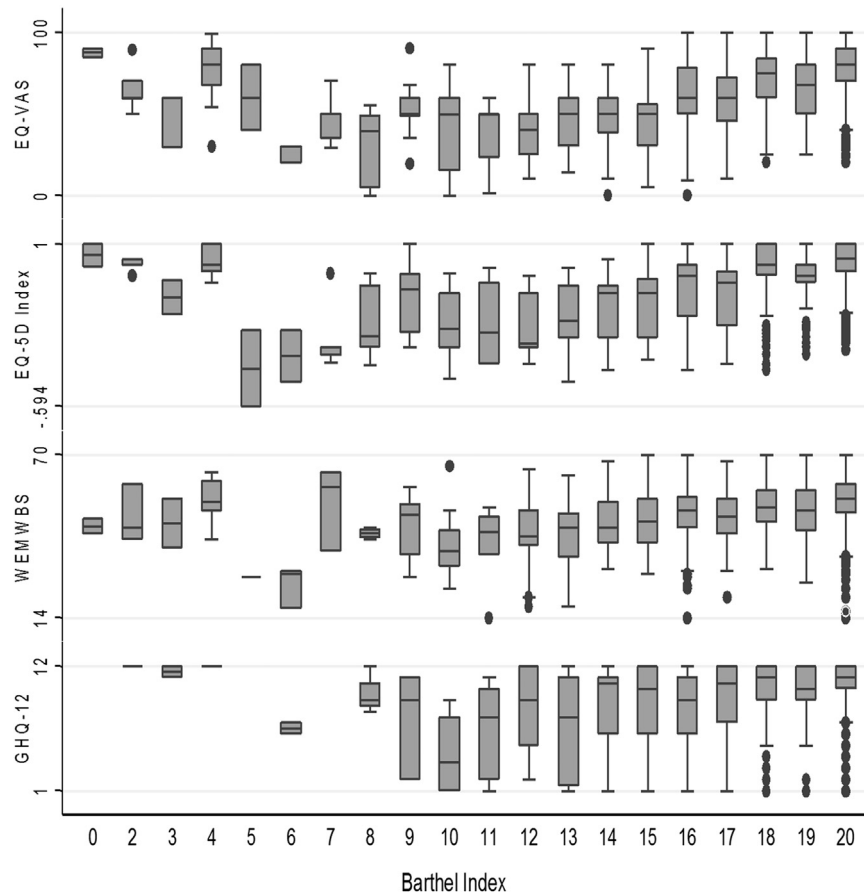
models using WEMWBS score and GHQ-12 scores with control variables to explain social care is provided in [Supplementary Table 4 and 5](#).

None of the GHQ-12 dimensions were significant in explaining the probability of social care needs. Two dimensions from the WEMWBS, “been feeling useful” and “had energy to spare,” were significantly associated with BI. The models found that older respondents, those who were underweight/overweight (compared with individuals with ideal BMI), and those with limiting long-standing illness (compared with those without long-standing illness) were more likely to indicate social care needs. The full regression models using WEMWBS dimensions and GHQ-12 dimensions separately with control variables to explain social care is provided in [Supplementary Tables 6 and 7](#).

### Further Analyses

#### Explaining well-being and mental health

An ordered probit model examining the relationship of the WEMWBS and GHQ-12 with the EQ-5D is presented in [Table 4](#). The full regression models with EQ-5D dimensions and control variables as explanatory and wellbeing score as dependent variable (measured using WEMWBS and GHQ-12) is presented in [Supplementary Table 8](#). Respondents who were able to perform usual activities were likely to have better well-being than those who were unable to. Similarly, those who were less anxious had higher well-being scores than those who were extremely anxious or depressed. Respondents reported better well-being scores in 2012 than in 2011. The reason could be that the WEMWBS questionnaire was administered during interviewer visits in 2011 but during nurse visits in 2012. The models suggest that respondents without any qualifications had a better GHQ-12 score than those with a degree. This finding contradicts that of bivariate analysis in which, taken in isolation, the GHQ-12 score and dimensions are positively correlated with education.



**Fig. 1 – Distribution of EQ-VAS, EQ-5D index, WEMWBS, and GHQ-12 scores by the Barthel index response. Note. A higher score is better on all measures and the lowest score is assigned to the worst level. A Barthel index less than 5 would indicate maximum disability. EQ-5D, EuroQol five-dimensional questionnaire; EQ-VAS, EuroQol visual analogue scale; GHQ-12, General Health Questionnaire; WEMWBS, Warwick Edinburgh Mental Wellbeing Scale.**

Stepwise regression was adopted to examine whether the finding was a result of overfitting the model, but this was not the case.

## Discussion

The probability models found that, holding everything else constant, higher EQ-5D index, VAS, GHQ-12, and WEMWBS points are associated with an increased probability of no social care needs. The self-care and pain/discomfort dimensions of the EQ-5D explained the need for social care and were statistically significant. In addition, individuals with extreme anxiety/depression (compared with not anxious/depressed) and unable to perform usual activities (compared with no problem in performing usual activities) were more likely to report need for social care. None of the GHQ-12 dimensions were statistically significantly associated with the BI and only two dimensions from the WEMWBS (“been feeling useful” and “had energy to spare”) were significantly associated with BI. The results show that the need for social care, which is dependent on the ability to perform personal day-to-day activities, is more closely related to the EQ-5D dimensions that assess physical and mental health than to the well-being measures WEMWBS and GHQ-12.

Statistical tests used to examine the difference between those with BI score less than 5 and those scoring more than 4 found that a higher proportion of respondents with social care needs were better educated. Those with social care needs also reported better mental health scores than the rest of the sample. One possibility

is that the respondents had an incentive to demonstrate need for social care and were responding strategically. A more plausible explanation, however, is the different modes of administration: the BI questions were asked by an interviewer, and the remaining questions were self-completed by the respondents. Nevertheless, it is a small number of respondents with inconsistent responses and it is unlikely to affect overall analysis.

Respondents who were able to perform usual activities were likely to have better well-being than those who were unable to; similarly, those who were less anxious had higher well-being scores than those who were extremely anxious or depressed. It was not surprising that the EQ-5D dimension for anxiety/depression was statistically significantly associated with the GHQ-12; pain (no pain vs. extreme pain) and mobility (no problem vs. confined to bed) were also statistically significantly associated. Having a limiting long-standing illness was a significant predictor of well-being in both the instruments. The WEMWBS scores differed by year of survey, which may be because it was administered during the main interview visit in HSE 2011 but during the nurse visit in 2012. Although both WEMWBS and GHQ-12 are well-being measures with emphasis on mental health, a number of other subjective well-being measures are available and have been examined using different data sets [23–25].

Mukuria and Brazier [23] compared EQ-5D-3L and six-dimensional health state short form (SF-6D) health states with self-reported happiness on a frequency scale. They found mental health, vitality, and social functioning significantly associated

**Table 3 – Summary of models using the EQ-5D to explain social care need.**

Independent variable	Dependent variable—Barthel index					
	Binary logit models			Ordered probit models		
	Dimension	VAS	Index	Dimension	VAS	Index
<b>EQ-5D</b>						
<b>Mobility</b>						
Confined to bed (reference)	(empty)			(omitted)		
Some problems in walking	(omitted)			0.919		
No problems in walking	<b>0.408</b>			1.17		
<b>Self-care</b>						
Unable to wash or dress	(empty)			(omitted)		
Some problems washing or dressing myself	(omitted)			<b>0.784</b>		
No problems with self-care	<b>2.167</b>			<b>1.823</b>		
<b>Usual activities</b>						
Unable to perform usual activities	(omitted)			(omitted)		
Some problems performing my usual activities	0.396			0.272		
No problems performing my usual activities	0.807			<b>0.495</b>		
<b>Pain/discomfort</b>						
Extreme pain or discomfort	(omitted)					
Moderate pain or discomfort	<b>0.787</b>			<b>0.397</b>		
No pain or discomfort	<b>1.008</b>			<b>0.506</b>		
<b>Anxiety/depression</b>						
Extremely anxious or depressed	(omitted)					
Moderately anxious or depressed	0.671			0.29		
Not anxious or depressed	<b>1.433</b>			<b>0.717</b>		
<b>EQ-5D index</b>			<b>3.522</b>			<b>1.955</b>
<b>EQ-VAS</b>		<b>0.031</b>			<b>0.02</b>	
<b>Sex</b>						
Male	(omitted)					
Female	−0.146	−0.228	−0.134	−0.08	−0.105	−0.068
<b>Age</b>	−0.03	−0.032	−0.033	−0.018	−0.019	−0.021
<b>Education</b>						
No qualification	(omitted)					
Less than a degree	−0.128	−0.017	−0.094	−0.113	−0.024	−0.084
Degree or higher	−0.453	−0.336	−0.437	−0.275	−0.206	−0.26
<b>Long-standing illness</b>						
Limiting long-standing illness	(omitted)					
Nonlimiting long-standing illness	0.192	<b>0.652</b>	<b>0.356</b>	0.073	<b>0.359</b>	<b>0.189</b>
No long-standing illness	<b>0.545</b>	<b>0.902</b>	<b>0.678</b>	<b>0.332</b>	<b>0.537</b>	<b>0.421</b>
<b>BMI</b>						
Overweight or underweight	(omitted)					
Healthy weight	0.192	0.091	0.182	0.081	0.055	0.086
Ideal weight	0.237	0.268	0.238	0.127	<b>0.173</b>	0.143
<b>Constant</b>	−0.004	0.461	−0.353			
<b>Number of observations</b>	2401	2251	2408	2408	2251	2408
<b>Probability &gt; <math>\chi^2</math></b>	0	0	0	0	0	0
<b>Pseudo R<sup>2</sup></b>	0.167	0.116	0.146	0.109	0.07	0.089
<b>Likelihood ratio <math>\chi^2</math></b>	581.8	386.3	505.3	755.0	477.3	618.
<b>Log-likelihood of model</b>	−1265	−1270	−1310	−2625	−2580	−2693
<b>Degrees of freedom</b>	30	22	23	32	23	23
<b>RESET</b>	Passed	Passed	Passed	Passed	Passed	Passed

**Note.** Coefficients in boldface are statistically significant at 5%; cell is described as empty when the number of cases is insufficient.

BMI, body mass index; EQ-5D, EuroQol five-dimensional questionnaire; EQ-VAS, EuroQol visual analogue scale; RESET, regression error specification test.

with patients' own happiness assessment, pain was less so, and physical health had no association. They found that problems associated with mental health domains and vitality of the EQ-5D and SF-6D have a relatively larger association with subjective well-being. In a study by Richardson et al. [25] the relationship between six different multi-attribute utility instruments (five-level EQ-5D, SF-6D, Health Utilities Index Mark 3 (HUI-3),

15 Dimension (15D), Assessment of Quality of Life (AQoL)-8D (AQoL-8D), and Quality of Well-being scale (QWB)) and subjective well-being measures (4 Office for National Statistics personal well-being questions (ONS-4), Satisfaction with Life Survey (SWLS), and Personal Wellbeing Index (PWI)) was examined using correlation analysis and regression models. Survey data of healthy public and patients in seven disease areas were used.

**Table 4 – Summary of models using EQ-5D dimensions and control variables to explain well-being.**

Independent variable	Dependent variable	
	WEMWBS coefficient	GHQ-12 coefficient
Mobility		
Confined to bed (reference)	(omitted)	
Some problems in walking	1.851	1.999
No problems in walking	1.942	2.371
Self-care		
Unable to wash or dress	(omitted)	
Some problems washing or dressing myself	0.201	−0.35
No problems with self-care	0.447	0.048
Usual activities		
Unable to perform usual activities	(omitted)	
Some problems performing my usual activities	0.471	0.13
No problems performing my usual activities	0.679	0.309
Pain/discomfort		
Extreme pain or discomfort	(omitted)	
Moderate pain or discomfort	−0.089	0.196
No pain or discomfort	0.039	0.371
Anxiety/depression		
Extremely anxious or depressed	(omitted)	
Moderately anxious or depressed	0.805	1.037
Not anxious or depressed	1.579	2.24
Education		
No qualification	(omitted)	
Less than a degree	0.044	−0.107
Degree or higher	−0.016	−0.374
Marital status		
Not married or not living with husband/wife	(omitted)	
Married and living with husband/wife	0.112	−0.063
Long-standing illness		
Limiting long-standing illness	(omitted)	
Nonlimiting long-standing illness	0.181	0.347
No long-standing illness	0.233	0.32
Year of survey		
2011	(omitted)	
2012	0.175	NA
Number of observations	1836	1259
Probability > $\chi^2$	0	0
Pseudo R <sup>2</sup>	0.023	0.142
Likelihood ratio $\chi^2$	454.545	529.059
Log-likelihood of model	−6174.06	−1295.06
Degrees of freedom	32	31
RESET	Passed	Passed

Note. Coefficients in boldface are statistically significant at 5%; cell is described as empty when the number of cases is insufficient. EQ-5D, EuroQol five-dimensional questionnaire; GHQ-12, General Health Questionnaire; RESET, regression error specification test; WEMWBS, Warwick Edinburgh Mental Wellbeing Scale.

They concluded that utility explains variation in subjective well-being measures to a large extent. Another study examined the relationship between health and subjective well-being in patients with Parkinson disease, using well-being questions from the Integrated Household Survey [24]. They found that only the dimensions of pain/discomfort (level 3) and anxiety/depression (levels 2 and 3) were statistically significant across models, in addition to the dimension of usual activities (level 3) when using an ordered probit model. The results are similar to findings in this study. Respondents who were less anxious and who were able to perform usual activities had higher well-being scores than those who were extremely anxious or depressed and who were unable to perform usual activities. Pain, however, was not statistically significant and this could be because the study focused on patients with rheumatoid, whereas this study used a sample of older general population.

This study is one of the first attempts to compare social care needs with health and well-being outcomes; nevertheless, social care includes a range of interventions that support or substitute care for individuals with impairments and applies to individuals across all ages. The study included only individuals living in private households and not those living in care institutions. Those residing in care home settings or who are hospitalized are likely to be less healthy and independent than the individuals included in this study. One might therefore expect the relationship to be even stronger in this population group; it is, however, also possible that social care may be substituted by medical and other types of care.

The variables used in the regression models were constrained by data available in the HSE. Another limitation of this study is that the study used pooled cross-sectional data and the instruments examined here provided a snapshot of the association between health, well-being, and social care needs of the general population but does not measure change over time. Perhaps therein lies the real challenge of implementing the EQ-5D in such evaluations; that is, “Will it be able to measure impact of social care interventions over time effectively compared with other instruments?”

Recent reviews identifying instruments that can be used in evaluation of social care intervention in older patients have recommended use of the EQ-5D in combination with measures that have a broader focus such as ASCOT or ICECAP-O [7,26]. The EQ-5D can be a potential tool for determining need for social care and evaluation of social care interventions with a focus on maintaining or improving mental or physical impairment; further research is, however, needed. Policymakers and researchers may wish to consider including instruments specifically developed to measure the outcomes associated with social care in future studies.

Although we have demonstrated that the EQ-5D can explain some of the variance in social care needs, the EQ-5D was not developed for use in social care and may not capture the full range of social care outcomes [27]. It is possible that a possible revision of the existing descriptive system or the use of “bolt on” to the EQ-5D, such as one representing dignity, will allow social care outcomes to be captured more fully [28]. The concept is similar in construct to ASCOT, which was specifically designed to measure social care-related quality of life and comprises eight attributes; seven attributes focus on quality of life and one attribute (dignity) focuses on the “impact of care process on how people feel about themselves” [27].

## Conclusions

The results show that the need for social care, which depends largely on one's ability to perform personal day-to-day activities,



is closely related to those EQ-5D dimensions that capture physical and mental health. Nevertheless, further empirical research is required to be able to determine the ability of the EQ-5D to capture the benefits of social care interventions and whether measures specifically designed to measure outcomes of social care would perform better.

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## Supplemental Materials

Supplementary data associated with this article can be found in the online version at <https://doi.org/10.1016/j.jval.2018.01.002>.

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