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The impact of social isolation on the health status and health-related quality of life of older people

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Abstract

Purpose: To investigate for socially isolated older people, and older people at risk of social isolation: i) health status and health-related quality of life (HRQL); ii) the relationship between social isolation and health status/HRQL; iii) the relationship between two alternative measures of health status/HRQL.

Methods: 393 older people at risk of social isolation completed the EQ-5D and the SF-12. Multiple regression analyses were performed to examine the relationship between levels of social isolation and health status/HRQL, controlling for demographic/clinical characteristics. The agreement between EQ-5D and SF-6D (SF-12) scores was explored using descriptive psychometric techniques.

Results: Health status and health state values were much lower than UK general population age-matched norms. After controlling for depression, physical co-morbidities, age, gender, living alone status, employment and accommodation, social isolation was a significant, and clinically relevant, predictor of EQ-5D DSI, SF-6D (SF-12) and SF-12 MCS scores. Possible ceiling and floor effects of the EQ-5D and the SF-6D (SF-12), respectively, were identified.

Conclusion: This work clearly highlights the burden that social isolation may have on the health and well-being of older people. The potential HRQL gains from addressing social isolation may be considerable, with those at risk of social isolation also a key target group.

Keywords: aged – frail elderly – social isolation – health status – quality of life

Introduction

Social isolation is a key factor when considering the powerful role of the social environment in influencing health and well-being [1]. It has been well-documented as an extremely complex construct to assess [2], with no single measure having been satisfactorily psychometrically validated. Social isolation has been conceptualised as comprising both *structural* and *functional* elements [3]. *Structural* refers to the more objective aspects of social isolation, in terms of the size of peoples' social networks or their frequency of contact, whilst *functional* relates to peoples' perceptions of the quality of their interactions. Although the construct of social isolation is multifaceted, at its core is a low level of contact with family, friends or the wider community [3]. This operationalisation of the concept was reflected in a recent nationally representative survey of 999 people aged 65 years or over living in the community [4]. In this work, funded as part of the UK Economic and Social Research Council (ESRC) *Growing Older Programme*, social isolation was defined in two ways: i) those with less than weekly direct contact with family, friends or neighbours and; ii) those with less than monthly direct contact with family, friends or neighbours. Similarly, the English Longitudinal Study of Ageing (ELSA) [5] of 9,901 older people measured social exclusion by asking how often respondents met with family members and friends.

The potential impact of social isolation is seen across all age groups [1], but reduced social contact is consistently related to negative effects on the quality of life of older people [4]. There is an increasing awareness of the challenges of an ageing society, and strategies for promoting 'quality of ageing' for older people have been a major component of recent Government policy in the UK [6-8].

The UK's demographic profile is shifting toward increasing numbers of older people. By 2025 the number of people over the age of 80 will increase by almost a half, whilst those over 90 years will double [6]. As the proportion of older people in the population increases, more are living alone. In the UK, Victor *et al* [4] found that between 11% and 17% of those aged 65 years or over were socially isolated (when social isolation was defined as not being in direct contact with family, friends or neighbours on a monthly or weekly basis, respectively). A recent longitudinal study of 4,524 people aged 50 years or over found that those either living alone or not living with a partner were most likely to experience long periods of detachment from society (13% and 18% respectively) [9]. Given the emerging evidence of links between

social isolation and poorer health and well-being [2, 10-12], the effect of social isolation on the health status and health-related quality of life (HRQL) of older people is rapidly becoming one of our most important social, political and health care priorities.

The significant investment in programmes to tackle social isolation in older people [6-8] highlights the need for further research to explore the relationship between social isolation and health and well-being in the context of other demographic and clinical factors. In addition, interventions developed to address social isolation will require evaluation to assess both their effectiveness and cost-effectiveness. The design of appropriate methods for evaluation will be aided by an understanding of how tools to measure health status and HRQL perform in relation to the construct of social isolation. For example, measures will need to be sufficiently discriminative to detect differences in health status and HRQL for varying degrees of severity of social isolation and sufficiently sensitive to respond to changes in social isolation (e.g. before and after an intervention).

In the present study we describe the relationship between social isolation and measures of health status and HRQL for older people in the context of demographic and clinical characteristics, estimating health state values for social isolation. We also conduct a comparative psychometric analysis of how two of the most commonly used measures of health status/HRQL, the EQ-5D and SF-6D (SF-12), operate for socially isolated older people and those at risk of social isolation.

Methods

Participants

During 2007 and 2008, 395 older people were recruited to the Devon Ageing and Quality of Life (DAQoL) study [13], designed to explore the effectiveness and cost-effectiveness of a community mentoring intervention for socially isolated older people. Intervention participants were recruited via community mentoring service providers, while control participants were recruited through screening surveys sent via general practices in geographical areas where the intervention was not available. All participants were aged 50 years or over and were deemed to be at risk of social isolation based on service provider assessment or self-report data, for intervention and control groups respectively.

Procedure

Participants were visited at home by a researcher for a baseline assessment to be undertaken. Informed consent was obtained and participants completed a battery of self-report measures.

Measures

The baseline assessment included information on the following:

Social isolation: Structural social isolation was assessed using data derived using the Rand Social Health Battery [14], and the definitions of social isolation used by Victor *et al* [4]. In assessing social contacts and social resources, the Rand Social Health Battery [14] includes the following item which explicitly assesses structural social isolation, *How many times a year do you get together with friends and relatives e.g. going out together or visiting each other's homes?*. This is rated on a seven point scale from *'every day'* to *'less than 5 times a year'*. Victor *et al* [4] defined social isolation in two ways: i) those with less than weekly direct contact with family, friends or neighbours and; ii) those with less than monthly direct contact with family, friends or neighbours. We used these definitions in the current analyses to represent i) 'social isolation' and ii) 'severe social isolation' respectively. Those who did not reach these criteria were categorised as being 'at risk of social isolation'.

Health status: Participants completed version 2 of the SF-12 [15]. This gives mental health component (MCS) and physical health component (PCS) summary scores. Higher scores indicate better health status, with scores ranging from 0 to 100. Scores are standardised to a mean of 50 and a standard deviation of 10. There is a general consensus that changes of 2-3 points in SF-12 scores are clinically meaningful [15].

Respondents also completed the EQ-5D [15] which comprises five dimensions of health (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) with each dimension having three response levels (1 no problems, 2 moderate problems, 3 severe problems).

Health-related quality of life: Participant responses to the EQ-5D were converted into a weighted health state index (derived single index, DSI) using valuations (tariffs) elicited from a general population sample for the UK [17]. Health state tariff values for the EQ-5D DSI range from 1.00 for the *best health* state to -0.594 for the *worst health* state (where a score of 0 is regarded as equivalent to death, and scores less than 0 are considered worse than death).

Participant responses to the SF-12 were converted to the SF-6D (SF-12), a preference-based measure of health using tariffs elicited from a representative sample of the UK general population. Scores on the SF-6D (SF-12) can range from 0.3 to 1.0, where 0.3 indicates the *worst health* state, and 1.0 the *best health* state [18].

Depression: Depression was assessed using the Geriatric Depression Scale-10 [19, 20] which includes 10 yes/no response items. Scores range from 0 to 10, with higher scores reflecting greater levels of depressive symptoms. A score of four or more has been used as a screening measure to identify individuals with a potential diagnosis of clinical depression [21].

Physical co-morbidities: Participants rated (yes/no) whether they had experienced a list of nine common physical health conditions (angina, arthritis, cancer, diabetes, heart failure, high blood pressure, problems with sight or hearing, stroke, chronic respiratory conditions) over the previous six months [22]. A co-morbidity index was then calculated by summing the number of co-morbid conditions reported [23].

Demographics: Age (years), gender (male/female), living alone status (yes/no), accommodation type (home owner/not home owner) and employment status (employed/not employed) were recorded.

Ethics

Ethics approval for the DAQoL study was granted by Devon & Torbay NHS Research Ethics Committee (REC number 07/Q2102/9), and research governance approval given by the relevant NHS and social care Trusts. All participants gave their informed consent prior to inclusion in the study.

Data analysis

Health status and HRQL were described, and EQ-5D data considered alongside UK age population norms [24, 25]. (UK norms are not currently available for the SF-12 and the SF-6D [SF-12]).

SF-12 (MCS and PCS), EQ-5D DSI and SF-6D (SF-12) scores were compared across the three groups (‘at risk of social isolation’, ‘socially isolated’ and ‘severely socially isolated’) using one way, unrelated ANOVAs. Differences between each of the groups were determined using a priori-specified contrasts and the t statistic.

Forward stepwise regression analyses were conducted to estimate the strength of social isolation as a predictor of health status and HRQL in relation to other demographic and clinical features. SF-12 MCS, SF-12 PCS, EQ-5D DSI and SF-6D (SF-12) scores were the dependent variables in four separate analyses; social isolation, depression, age, gender, living alone status, accommodation type, employment status and number of physical co-morbidities were included as independent variables.

The stepwise regression method used selects the independent variable that has the largest partial correlation with the dependent variable, controlling for variables already in the model. In addition, a variable's partial regression coefficient must be significant at 0.05 and 0.01% of its variance must be independent of other predictor variables (tolerance value) in order to be selected.

The correlations between the independent variables were checked prior to inclusion in the regression analyses, and following the analyses multi-collinearity was determined by variable tolerances. The patterns of residuals were reviewed using normality plots and scatterplots of predicted versus residual values.

The comparative psychometric analysis of how the EQ-5D (and EQ-5D DSI) and SF-6D (SF-12) operate for this population draws on the work of Brazier *et al* [26] and Grieve *et al* [27]. The relationships between dimension scores were assessed using Spearman's rank correlations, and potential ceiling or floor effects were considered by exploring the spread of responses across the measure levels. The agreement between the EQ-5D DSI and SF-6D (SF-12) index scores was assessed using the intra-class correlation coefficient (ICC) [28]. The ICC can fall between -1 and 1, where 1 indicates absolute agreement, 0 no agreement and -1 absolute negative agreement.

All data analysis was conducted using SPSS 15.0.

Results

Ninety-four (24%) participants were classified as 'socially isolated' and 67 (17%) were classified as 'severely socially isolated'. The remaining 232 (59%) were classified as being 'at risk of social isolation'. (Two participants did not report their degree of social isolation, and were excluded from subsequent analyses).

Health status and HRQL of socially isolated older people

Demographic and clinical features of the sample are given in Table 1. The percentages of respondents reporting any problem on each of the EQ-5D dimensions are given in Table 2 by age, alongside age-matched UK population norms [24]. On each of the dimensions, by each of the age categories, the percentage reporting any problem was greater for the three groups ('at risk of social isolation', 'socially isolated', 'severely socially isolated') than for UK population norms. The only exception was the *Pain/discomfort* dimension for those aged 80 or over, where the percentage reporting a problem in the 'at risk' and 'socially isolated' groups was slightly lower than the norms.

Mean (sd) SF-12 MCS, SF-12 PCS, EQ-5D DSI and SF-6D (SF-12) scores are given in Table 3. All the SF-12 scores are below the standardised mean of 50, and those who were 'severely socially isolated' reported more negative physical and mental health status than those in the 'at risk' and 'socially isolated' groups. HRQL was worse for those 'severely socially isolated', as assessed by both the EQ-5D DSI and the SF-6D (SF-12), although the distinction was less marked when HRQL was defined by the SF-6D (SF-12). Statistically significant differences were found between the three social isolation groups on the SF-12 MCS, the EQ-5D DSI and the SF-6FD (SF-12), but not on the SF-12 PCS (see Table 3). The scores of the 'severely socially isolated' group were statistically significantly ($p<0.05$) poorer than those of the 'at risk' group and those of the 'socially isolated' group for each of the health status and HRQL measures. Such differences were not found between the 'at risk' and the 'socially isolated' groups.

Mean (sd) EQ-5D DSI scores were compared with UK population norms [25] (Table 4). For each of the age categories, the scores of the 'severely socially isolated' individuals were lower, indicating poorer HRQL.

Association between social isolation and older people's health status and HRQL, in relation to demographic and clinical features

Table 5 gives the findings of the final steps of the four stepwise regression analyses. Each of the models significantly predicted the dependent variable (all at $p<0.01$), with R^2 adjusted values from 0.34 to 0.41. When the effects of depression, physical co-morbidity, age, gender, living alone, accommodation type and employment status were controlled for, social isolation was still significantly (at $p<0.01$) independently predictive of SF-12 MCS, SF-6D (SF-12), EQ-

5D DSI, but not SF-12 PCS, scores. Social isolation was most strongly predictive of SF-12 MCS scores (β -0.16, p<0.01), followed by the EQ-5D (β -0.11, p<0.01) and the SF-6D (SF-12) (β -0.10, p<0.01).

Of all the demographic/clinical variables, social isolation was the second strongest predictor of SF-12 MCS scores, after depression. Respondents who were 'severely socially isolated' had SF-12 MCS scores an average of 4.73 points lower than respondents who were not 'severely socially isolated'. Given the general consensus that changes of 2-3 points on the SF-12 are clinically relevant [21], this difference in scores between those who were and were not 'severely socially isolated' appears clinically relevant.

Social isolation was the third predictor to be entered into the model of SF-6D (SF-12) scores. Respondents reporting severe social isolation had SF-6D (SF-12) scores an average of 0.04 points lower than those who were not 'severely socially isolated'. A minimal meaningful difference on the SF-6D (SF-12) of 0.041 is suggested [29], implying that the difference found here is clinically important.

'Severely socially isolated' individuals had EQ-5D DSI scores an average of 0.09 points less than those who were not 'severely socially isolated'. Given that the minimally important difference on the EQ-5D DSI is thought to be between 0.03 [31, 32] and 0.075 [29], this difference would be viewed as meaningful and important in the context of the measurable burden of social isolation.

The consistency of the 'social isolation' β weights for predicting EQ-5D DSI (-0.11) and SF-6D (SF-12) (-0.10) scores implies the similarity of these measures in terms of how they relate to the construct of social isolation.

The relationship between the EQ-5D and the SF-6D (SF-12)

The Spearman rank correlation coefficients between scores on the EQ-5D and SF-6D (SF-12) dimensions are given in Table 6. Brazier *et al.* [26] have suggested instances where a high correlation might be expected because the dimensions appear to measure similar constructs. These are indicated in the Table in bold. All correlations were significant at p<0.01. The high correlations between *Pain/Discomfort* and *Pain* (0.71) and *Mobility* and *Physical functioning* (0.63) and *Anxiety/Depression* and *Mental health* (0.62) support the argument that the tools are measuring health status in similar ways with regards to these dimensions.

Respondents were generally more likely to report health status at the poorer levels of the SF-6D (SF-12) than they were when reporting health status against the EQ-5D. For example, 34.9% of respondents rated the worst level of *Physical functioning* (SF-6D [SF-12]), but only 0.3% rated the worst level of *Mobility* (EQ-5D). The clearest example is that of *Role limitation* (SF-6D [SF-12]) where 52.5% of respondents marked the worst level, as compared to 7.9% rating the worst level of *Usual activities* (EQ-5D), implying a floor effect (being unable to distinguish between health states at the lower end of the health state valuation spectrum) of the SF-6D (SF-12). These responses suggest that an extreme problem on the EQ-5D is considered to be worse than an extreme problem on the SF-6D (SF-12).

The EQ-5D had a larger proportion of respondents in the best health status categories for all of the dimensions. This may suggest a ceiling effect, in that the EQ-5D is not able to distinguish between health states close to full health in this population of vulnerable older people.

One person reported full health on the SF-6D (SF-12) and 64 (16%) respondents had full health on the EQ-5D. The distribution of SF-6D (SF-12) scores of those who reported full health on the EQ-5D clearly indicated that those who reported full health on the EQ-5D did not have full health according to the SF-6D (SF-12).

The distribution of responses showed a greater, and more normally distributed, spread of scores on the SF-6D (SF-12) as compared to the EQ-5D DSI. The EQ-5D DSI also showed some evidence of a bi-modal distribution.

The ICC was 0.543 ($p<0.01$), implying that although there is a 'moderate' (and statistically significant) level of agreement between the tools, there are also differences.

Discussion

Despite recognition of the potential impact of social isolation on quality of life, and the drive for interventions to tackle it, the influence of social isolation on health status and HRQL is poorly understood [2]. Previous work has considered these relationships [12], but often descriptively, or in terms of what may affect social isolation, rather than the likely effects of social isolation itself [e.g. 4, 30]. This is the first study that has estimated the health status (SF-12 and EQ-5D) and the health state values associated with HRQL (SF-6D [SF-12] and EQ-5D DSI) for socially isolated older people in the UK.

Main findings

The health status and health state values (HRQL) of those who were socially isolated, and especially those reporting severe social isolation, were lower (worse) than expected in the UK general population for people of the same age. Those 'at risk of social isolation' also had lower scores than reported population norms for this age group.

The SF-12 health status scores were broadly consistent with those found in an Italian study investigating the association between social relationships and health status, in a sample of over 33,000 older people [33]. Those with the lowest reported frequency of seeing/meeting friends and family reported mean (sd) PCS scores of 38.9 (12.0) and 41.7 (11.8) respectively, as compared to 40.0 (13.4) and 35.7 (12.6) for the 'socially isolated' and 'severely socially isolated' in the current study. The same individuals in the de Belvis *et al* [33] study gave mean (sd) MCS scores of 43.4 (12.5) and 45.6 (12.1), as compared to 47.1 (10.4) and 40.0 (11.6) for the 'socially isolated' and 'severely socially isolated' in this sample.

A major finding of the current study is that social isolation was significantly, independently predictive of health status and HRQL, even when depression, physical co-morbidity, age, gender, living alone, employment status and accommodation type were accounted for. The differences in scores, from the regression analyses, between those 'at risk of social isolation' or 'socially isolated' and those who were 'severely socially isolated' were statistically significant and clinically relevant for both health status (SF-12 MCS) and HRQL (EQ-5D DSI and SF-6D [SF-12]).

The comparative psychometric analysis of the relationship between the alternative measures of health status and HRQL, suggested ceiling effects with the EQ-5D and floor effects with the SF-6D (SF-12), and the difference in how the measures assess HRQL was demonstrated by the moderate intra-class correlation of 0.54. These findings are consistent with the results of others who have compared the tools in different settings [25]. Such floor and ceiling effects might have meant that the tools were unable to discriminate between differences in social isolation, particularly in the case of the EQ-5D where the effect was more pronounced (16% of people described themselves as being in full health). However, this was not the case. Both the EQ-5D DSI and the SF-6D (SF-12) discriminated between those who were 'severely socially isolated' and those who were not, and the instruments appeared to relate to the construct of social isolation (and other demographic and clinical variables) in similar ways, as

shown by the comparative beta weights for the two measures in the regression analyses (Table 5).

Limitations and strengths of the study

The regression findings are based on a comparison of those who were 'severely socially isolated' with those who were 'socially isolated' or 'at risk of social isolation' - they were not compared with individuals who were *not* socially isolated. This warrants careful interpretation of the predictive strength of social isolation and implies that the figures reported here may *underestimate* the effect of social isolation on health status and HRQL.

The construct of social isolation lacks theoretically consensus and is notoriously difficult to assess [2]. In the absence of any psychometrically validated instrument to measure social isolation, the approach adopted here follows that of Victor *et al* [4] in their UK nationally representative survey of 999 older people. Social isolation was operationalised as a concrete, structural construct in order to, as far as possible, have an 'objective' measure. However, the fact that social isolation also comprises functional elements i.e. the quality of interactions, is recognised but not explored here.

Correlational analyses do not enable the determination of cause and effect, so the directionality of the relationships between social isolation and health status/HRQL cannot be deduced from the reported analyses. However, the use of regression techniques has demonstrated that health status and HRQL can be predicted from reports of social isolation. Previously, there has been much descriptive and theoretical work regarding social isolation [2, 30] and the effects of particular interventions for social isolation have been considered, but this type of detailed statistical analysis has been used less frequently [4], particularly across a range of health status and HRQL tools.

(We also recognise the more general issues relevant to this work of the use of estimates of clinically meaningful differences and the comparative sensitivity of different HRQL measures).

Implications and conclusions

Further work is now needed to explore whether the current findings hold for larger, nationally representative samples of older people, and to explore the strength of these relationships when individuals who are not socially isolated are included in the analyses. However, this study clearly highlights the potential burden of social isolation on the health and well-being of

older people, and emphasises the possible benefits of reducing social isolation on mental and physical well-being.

Social isolation is independently (negatively) associated with the health status and HRQL of older people. The effect is of a magnitude that is clinically relevant, and it is independent of depression levels, physical co-morbidities, age, gender, living alone status, employment status and accommodation type. This has implications for health and social care policy makers and researchers.

New (and existing) social isolation interventions will require evaluation, and the development of such interventions should be concomitant with the advancement of methodologies to assess their effectiveness and cost-effectiveness. We would suggest the inclusion in such research of a preference-based measure of health status so that health status and HRQL can be assessed pre and post intervention, for both intervention and comparator groups, and to allow consideration of QALYs in any analysis. Our results imply that the use of either the SF-6D (SF-12) or the EQ-5D would be acceptable, as both relate to the construct of social isolation (and other key demographic and clinical variables) in similar ways. Both measures are likely to be sensitive to changes in social isolation, as both tools predicted clinically meaningful differences in HRQL as individuals moved from being 'severely socially isolated' to 'socially isolated'/'at risk of social isolation' and vice versa. The SF-6D (SF-12) may have the slight edge for use with this population, as the distribution of responses was more normal as compared to the EQ-5D DSI, and the floor effect found on this measure is less marked than the ceiling effect found with the EQ-5D DSI. As Brazier *et al*. [34] suggest, the EQ-5D may be preferred in populations with more severe health problems, but the SF-6D may be more sensitive to milder conditions.

The growth in interventions to address social isolation should continue, as the potential health gains from addressing social isolation may be considerable. For example, in the UK population approximately 1.3 million older people are likely to be 'severely socially isolated' [35]. Addressing and reducing social isolation, and preventing its initial advent, may represent a significant and meaningful improvement in health gain, regardless of co-morbid conditions. Our findings also suggest that policy and practice should target individuals 'at risk' and likely to become at risk of social isolation, where the impact of social isolation on health status and HRQL may already be expected to be significant. The comparisons between this group and UK population norms show that those at risk of social isolation represent an important

treatment group, implying that people need to be identified upstream with early interventions before health and quality of life losses can occur. Addressing the impact of social isolation, as part of a broader approach to promoting 'quality of ageing' in older people and in considering the role of the social environment in influencing health and well-being, is a key challenge for health and social care policy makers.

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Table 1: Demographic and clinical features of participants

	'At risk of social isolation' (n=232)	*'Socially isolated' (n=94)*	*'Severely socially isolated' (n=67)*
Demographic / Clinical characteristic			
Age, mean (sd) years	71.5 (11.8)	69.7 (12.0)	69.8 (12.1)
Gender, n (%) male	64 (27.6)	41 (43.6)	33 (49.3)
Lives alone, n (%) yes	115 (49.6)	36 (38.3)	34 (50.7)
Accommodation type, n (%):			
Home owner	175 (75.4)	76 (80.9)	42 (62.7)
Rented/Council	54 (23.3)	17 (18.1)	25 (37.3)
Residential home	3 (1.3)	1 (1.1)	0
Employment status, n (%):			
Employed	30 (12.9)	19 (20.2)	8 (11.9)
Unemployed	4 (1.7)	2 (2.1)	3 (4.5)
Long term sick or disabled	24 (10.3)	10 (10.6)	9 (13.4)
Retired	174 (75.0)	63 (67.0)	47 (70.1)
Physical co-morbidities, n (%):			
Angina	30 (12.9)	12 (12.8)	2 (3.0)
Arthritis	118 (50.9)	30 (31.9)	34 (50.7)
Cancer	12 (5.2)	6 (6.4)	7 (10.4)
Diabetes	24 (10.3)	11 (11.7)	10 (14.9)
Heart failure	14 (6.0)	3 (3.2)	4 (6.0)
High blood pressure	112 (48.5)	36 (38.3)	28 (41.8)
Sight/hearing problems	110 (47.4)	41 (46.3)	35 (52.2)
Stroke	10 (4.3)	2 (2.1)	3 (4.5)
Chronic respiratory conditions	39 (16.8)	14 (14.9)	15 (22.4)
Number of physical co-morbidities, mean (sd)	2.0 (1.3)	1.6 (1.3)	2.1 (1.3)

Table 2: Percentages of individuals reporting any problem on the EQ-5D dimensions by degree of social isolation, as compared to UK population age norms (Kind et al, 1998)

	EQ-5D Dimension	Mobility	Self care	Usual activities	Pain/ discomfort	Anxiety/ depression
Age group (years)	*Social isolation category (%)*					
50-59	Norms	21.9	5.2	21.9	43.7	27.2
	'At risk of social isolation' (n=48)	45.8	18.8	54.2	62.5	54.2
	'Socially isolated' (n=25)	36.0	16.0	56.0	60.0	48.0
	'Severely socially isolated' (n=18)	64.7	17.6	52.9	64.7	64.7
60-69	Norms	29.3	5.7	24.7	46.2	28.0
	'At risk of social isolation' (n=52)	38.5	9.6	46.2	59.6	46.2
	'Socially isolated' (n=21)	33.3	19.0	38.1	52.4	38.1
	'Severely socially isolated' (n=12)	66.7	33.3	66.7	83.3	75.0
70-79	Norms	39.8	7.4	26.3	56.0	25.3
	'At risk of social isolation' (n=66)	77.3	19.7	65.2	72.7	42.4
	'Socially isolated' (n=23)	60.9	26.1	52.2	73.9	52.2
	'Severely socially isolated' (n=24)	83.3	12.5	70.8	75.0	58.3
≥80	Norms	56.7	16.3	44.0	60.3	24.8
	'At risk of social isolation' (n=66)	71.2	21.2	62.1	59.1	45.5
	'Socially isolated' (n=24)	70.8	25.0	52.2	58.3	29.2
	'Severely socially isolated' (n=13)	84.6	46.2	76.9	69.2	84.6

Table 3: Mean (sd) health status and HRQL scores by degree of social isolation

	'At risk' (n=232), mean (sd)	*'Socially isolated' (n=94), mean (sd)*	*'Severely socially isolated' (n=67), mean (sd)*	*Statistical test*
SF-12 MCS	47.9 (10.2)	47.1 (10.4)	40.0 (11.6)	F=15.00, df=2, p<0.01
SF-12 PCS	39.1 (12.4)	40.0 (13.4)	35.7 (12.6)	F=2.47, df=2, p=0.09
EQ-5D DSI	0.65 (0.30)	0.69 (0.27)	0.50 (0.32)	F=8.86, df=2, p<0.01
SF-6D (SF-12)	0.67 (0.14)	0.67 (0.12)	0.59 (0.12)	F=9.91, df=2, p<0.01

Table 4: Mean (sd) EQ-5D DSI scores by degree of social isolation, as compared to UK population norms (Kind et al, 1999)

		EQ-5D DSI
Age group (years)	*Social isolation category, mean (sd)*	
55-64	Norms	0.80 (0.26)
	'At risk of social isolation' (n=54)	0.66 (0.32)
	'Socially isolated' (n=25)	0.68 (0.29)
	'Severely socially isolated' (n=17)	0.65 (0.30)
65-74	Norms	0.78 (0.26)
	'At risk of social isolation' (n=51)	0.67 (0.29)
	'Socially isolated' (n=17)	0.74 (0.23)
	'Severely socially isolated' (n=15)	0.49 (0.31)
75+	Norms	0.73 (0.27)
	'At risk of social isolation' (n=107)	0.66 (0.28)
	'Socially isolated' (n=38)	0.65 (0.30)
	'Severely socially isolated' (n=26)	0.52 (0.31)

Table 5: Final step results of regression analyses of social isolation and demographic/clinical factors on measures of health status and HRQL (N=382)

	SF-12 MCS	*SF-12 PCS*	*EQ-5D DSI*	*SF-6D (SF-12)*
R^2 adjusted	*0.34***	*0.34***	*0.35***	*0.41***
β coefficients:				
Social isolation	-0.16**(b)	-	-0.11**(e)	-0.10**(c)
Depression	-0.50**(a)	-0.27**(b)	-0.38**(a)	-0.48**(a)
Physical co-morbidity	-	-0.35**(a)	-0.29**(b)	-0.25**(b)
Age	0.11*(d)	-	0.13**(d)	0.13**(e)
Gender	0.11*(c)	-0.12* (d)	-	-
Living alone status	-	-	-	-
Accommodation	-	-	-	-
Employment status	-	0.22**(c)	0.17**(c)	0.15**(d)
B coefficients (SE):				
Social isolation	-4.73 (1.25)	-	-0.09 (0.03)	-0.04 (0.02)
Depression	-11.09 (0.96)	-7.13 (1.11)	-0.23 (0.03)	- 0.14 (0.01)
Physical co-morbidity	-	-3.42 (0.43)	-0.07 (0.01)	- 0.03 (0.01)
Age	0.10 (0.04)	-	0.003 (0.001)	0.002 (0.001)
Gender	2.53 (0.97)	-3.16 (1.13)	-	-
Living alone status	-	-	-	-
Accommodation	-	-	-	-
Employment status	-	8.04 (1.59)	0.15 (0.04)	0.06 (0.02)

* p<0.05; ** p<0.01
a to e indicates the ordering of the independent variables into the model; - not entered into model.

Table 6: Spearman rank correlations between EQ-5D and SF-6D (SF-12) dimension scores

	EQ-5D				
	Mobility	*Self-care*	*Usual activities*	*Pain/ discomfort*	*Anxiety/ depression*
SF-6D (SF-12)					
Physical functioning	**0.63**	0.46	**0.64**	0.40	0.22
Role limitation	0.40	0.20	**0.44**	0.42	0.42
Social functioning	0.34	0.29	**0.48**	0.30	0.36
Pain	0.46	0.28	*0.49*	**0.71**	0.31
Mental health	0.19	0.16	0.34	0.24	**0.62**
Vitality	0.47	0.22	0.48	0.26	0.32