The burden of common chronic disease on health-related quality of life in an elderly community-dwelling population in the UK

Parker, Laura; Turner, Grace; Roberts, Lesley M; McCahon, Deborah; Turner, Grace; Calvert, Melanie

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Quality of life in an ageing population: the burden of chronic disease

Running title: HRQoL and morbidity in the over 65s

Authors:

Laura Parker [1]

Lesley M Roberts [2]

Melanie Calvert [2]

Deborah McCahon [*2]

1. University Hospitals Coventry and Warwickshire, Clifford Bridge Road, Walsgrave, Coventry, CV2 2DX

2. Primary Care Clinical Sciences, School of Health and Population Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT

* Corresponding author

Dr Deborah McCahon, Primary Care Clinical Sciences, School of Health and Population Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, Tel: 0121 414 6784, Email: d.mccahon@bham.ac.uk.

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LR was responsible for obtaining funding for the original study with co-authors and for the design and collection of the original dataset. DM was responsible for preparing the dataset and recoding. LP was responsible for the design, analysis and interpretation of this study with supervision by MC. The first draft was written by LP. All authors have made comment, provided critical revisions and approved the final version for submission. DM is the guarantor and corresponding author for this paper.

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Deborah McCahon, corresponding author (the manuscript's guarantor) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

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Ethical approval was granted for the BETS by the Scottish Multi-Centre Research Ethic Committee and as appropriate by local research ethic committees (reference WH/MREC/01/0/24). Ethical approval for secondary analyses of this data was granted by the University of Birmingham Bachelor of Medical Science Population Sciences and Humanities, Internal Ethics Review Committee on 08/02/2011.

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All authors had full access to all data including statistical reports and tables and can take full responsibility for the integrity of the data and the accuracy of the data analysis. No additional data are available for sharing.

ABSTRACT

Objective: To explore factors associated with health-related quality of life (HRQL) in a community based population aged 65 years of more in the UK.

Design: Multivariable models were used to assess the relationship between characteristics of participants enrolled in a cross-sectional screening study and their HRQL.

Setting: Primary care.

Participants: 5849 patients aged 65 and over.

Main outcome measure: HRQL assessed using the EuroQoL EQ-5D.

Results: The mean EQ-5D index score was 0.78 (SD 0.2), range -0.43 to 1.00. Overall 53% (n=3078) of the cohort reported problems with pain, 39% (n=2273) with mobility and 9% (n=529) with self-care. Multivariate modeling demonstrated that impaired HRQL was significantly associated with: increasing age, smoking, female gender, deprivation and a range of comorbidities, with the most significant reductions observed in those with a history of depression; neurological disease and osteoarthritis.

Conclusions: This study demonstrates the burden of morbidity and further quantifies the negative impact of various chronic conditions and multimorbidity on HRQL in a community dwelling ageing population. Focus of services on areas identified as association with impaired HRQL may improve patient well-being.

Key words; Ageing, Primary Care, co morbidity, Health related quality of life

“What this paper adds”

What is already known on this subject

Population data shows reductions in health related quality of life (HRQL) associated with ageing, gender, smoking status and deprivation. There is limited evidence on the relative impact of comorbidities on HRQL in an ageing population.

What this study adds?

These findings support previous research demonstrating an association between HRQL and age, gender, deprivation and smoking status. The study demonstrates for the first time the relative impact of a range of chronic conditions on HRQL. Depression, neurological disease and osteoarthritis appear to be associated with the most significant reductions in HRQL. The study identifies potential targets for increased intervention and future research.

INTRODUCTION

By 2034 it is estimated that 23% of the UK population will be aged 65 and over. [1] Currently over 50% of individuals aged 65 and older have one or more chronic conditions and as such, are at increased risk of developing additional chronic disease. [2,3] Furthermore, individuals with comorbidity (the occurrence of more than one unrelated chronic condition) or multimorbidity (the co-existence or two or more chronic conditions) have more complex health care needs than those with a single chronic disease and are more likely to have poorer quality of life and greater disability and mortality. [4,5] The prevention and management of chronic disease and reduction of health inequalities in this increasing population poses a continuing challenge to policy makers. [6] In recent years, UK public health service delivery for older people has been reformed to promote active ageing, [7,] to sustain well being and independence and improve health related quality of life (HRQL) in this patient group.[8]

Whilst there is much research evaluating HRQL of patients with a single, chronic condition, either from cohort studies or clinical trials, evidence of the impact of morbidity (including co or multimorbidity) in an ageing community dwelling population is limited. A 1993 survey by Kind *et al*. collected normative EQ5D data from the UK general population aged 18 years and over and demonstrated significant differences in HRQL between subgroups of the population with respect to age, gender, social class, marital and housing status. [9] This study, however, did not explore the impact of morbidity on HRQL in this population. Furthermore, the management of chronic disease in the UK has improved since these data were collected. [10, 11] More recently two studies have demonstrated the impact of morbidity on HRQL. [12, 13] Heyworth et al demonstrated a significant and consistent decline in health status with increasing number of chronic conditions. [10] Similarly, an evaluation of HRQL in a large (n=5000) community based South Asian and African-Caribbean population in the UK demonstrated a significant reduction in HRQL in the presence of a range of medical conditions and as number of co morbidities increased. [13] Although patient HRQL has been shown to deteriorate with increased number of morbidities, research that assesses the impact of multiple chronic diseases on health status in an older sample of the UK general population is limited. [2, 9, 12] The aim of the current study therefore, was to further explore the impact of morbidity on HRQL in a contemporary cohort of elderly community dwelling individuals.

METHODS

Study Population

We used individual patient data collected in the Birmingham Elderly Thyroid Study (BETS). [14] The design and principal results of the BETS have been previously published. [14] Ethical approval was granted for the BETS by the Scottish Multi-Centre Research Ethic Committee and as appropriate by local research ethic committees (reference WH/MREC/01/0/24). Ethical approval for secondary analyses of this data was granted by the University of Birmingham Bachelor of Medical Science Population Sciences and Humanities, Internal Ethics Review Committee on 08/02/2011. In brief, the primary aim of BETS was to estimate the prevalence of subclinical thyroid dysfunction in the over 65s. Twenty primary care practices in the West Midlands, UK, were recruited during 2002. From these, all patients aged over 65 were invited to participate by letter, unless their GP deemed it inappropriate to approach them for reasons such as recent bereavement or reduced capacity due to dementia or if they had previously received anti-thyroid therapy. Overall, 85% of eligible patients responded and 46% of respondents were willing to attend a screening appointment at which they were given questionnaires for self-completion.

HRQL assessment using the EQ-5D

All BETS participants were asked to rate the severity of problems they experienced in 5 areas: mobility, self-care, usual activities, pain, and anxiety or depression using the EQ-5D questionnaire. The participant provided a score (1 no problems, 2 moderate problems, 3 severe problems) for each parameter, which was then translated to an index score. The index score was calculated based on the regression model developed by Dolan et al. [15] The EQ-5D index scores can range from -0.59 to 1.00, encompassing a range of 243 possible health states plus two further additional states (unconscious and dead). An index score of 1.00 is indicative of full health, (i.e. a score of 1 in each of the 5 parameters) and an index score of -0.59 is indicative of very poor health (ie: severe problems in all 5 parameters, scoring 3 in each).

At the initial BETS screening appointment participants also completed the Hospital Anxiety and Depression Scale (HADS); self reported smoking status and presence of all major current medical diagnoses. Routine general practice records were reviewed to verify current diagnoses. Data were stored on the BETS database.

For the purposes of the current study, the following data were extracted from the BETS database; EQ-5D descriptive profile scores and index score, age at the start of BETS, gender, smoking status and socioeconomic status based upon the Index of Multiple Deprivation (IMD) 2004. Presence of a medical history of each of the following conditions was also extracted; cardiac arrhythmia (including atrial fibrillation); cancer; cerebrovascular disease, including stroke and transient ischaemic attack (TIA); dementia; diabetes; heart failure and valvular disease; hypertension; ischeamic coronary heart disease (ICHD), including ischaemic heart disease, coronary heart disease and angina; peripheral vascular disease (PVD) including peripheral venous and arterial disease; pulmonary disease, including chronic obstructive pulmonary disease (COPD) and asthma; renal disease (grade 3 or grade 4 chronic kidney failure); rheumatoid arthritis; osteoarthritis; and neurological disease, for example Parkinson's.

Presence of depression was based on a HADS score of >7, determined at screening upon entry to BETS. The HADS has been frequently used in both the clinical and research setting, and both the questionnaire itself, and the use of 7 as a cut off for depression, has been validated. [16] Those with missing HADS scores were assumed negative for the condition (n=15).

The Index of Multiple Deprivation (IMD) 2004 was used as a proxy measure of socioeconomic deprivation for this population. IMD 2004 is a measure of deprivation at a small area level comprised of seven domains (barriers to housing and services, crime, education skills and training, employment, health deprivation, income and living environment). [17] IMD scores were converted into quintiles with quintile 1 representing the most deprived and quintile 5 the most affluent.

Ethnicity data were not collected during BETs. Geocoding, an indirect method for estimation of ethnicity of the study participants was therefore used. Geocoding has been shown to produce reasonable estimates for ethnicity when direct data on major ethnic group is not available. [18] This technique involved using the participant's postcode to identify the area where they lived and linking

this information to UK census data relating to that geographical area. Ethnicity was then inferred based upon the predominant ethnicity of persons living within that area.

Statistical analyses

Analyses were performed using SAS V9.2 (SAS Institute, Cary NC). Descriptive data were expressed as proportions of the cohort, medians with interquartile ranges, or means with standard deviations. Prior to any multivariable analysis, non-linear functional forms were considered for all continuous variables, including log transformation and restricted cubic splines. More complex forms were only included in the final backwards selection if they improved model fit as judged by Akaike's Information Criterion [19]. The relationship between EQ-5D score and the candidate explanatory variables was assessed using backwards stepwise selection with a 0.05 level of significance for inclusion. The final model included general practice as a random effect to account for clustering at the practice level. [20] Model estimates were used to predict EQ-5D scores for patients with differing demographics and morbidity.

RESULTS

Analysis was performed on data from 5849 subjects, having excluded 32 participants (0.5%) with missing EQ-5D data prior to analysis. The characteristics of participants are shown in Table 1. The mean age of participants was 73.6 years (SD 5.6) and 2879 (49.2%) were male. 2081 (35.7%) participants had one morbidity and 1519 (25.9 %) had 2 or more co-morbidities. The median number of morbidities was 1 (IQR 2). Each socioeconomic group was represented within the study cohort. Geocoding was used to infer ethnic group. Geocoding resulted in 97.9% of the study population being categorized as White, 1.9% Asian and 0.2% Black. The proportion of the study population categorized to each of the major ethnic groups was compared with ethnicity data for England derived from the 2011 census. Results show that a smaller proportion of the population of England are White (92.2%) compared with the study population and a larger proportion of the population of England are Asian (3.9%) or Black (2%) compared with the study population.[21]

The proportions of individuals reporting problems in each EQ-5D dimensions are shown in figure 1. This demonstrates that the most commonly reported problem is pain, with over half of the sample population complaining of "any" problems within this parameter. Over a third of participants reported problems with mobility, whereas just 9% report any problems with self-care. The mean EQ-5D index score for the study population was 0.78 (SD 0.2), range -0.43 to 1.0. Problems with pain were reported by 56.2% of females aged 65-69, 60% of females aged 70-79 and 65.6% of females aged 80 years or more (table 2).

Patient Characteristics associated with QoL

Multivariable regression demonstrated that a higher EQ-5D index (improved HRQL) is significantly associated with male gender and the absence of a medical history of morbidities, whereas a lower EQ-5D index is significantly associated with smoking, an increase in age, increased deprivation and the presence of medical conditions such as hypertension, heart failure, neurological disease or depression (table 3). Candidate variables that were eliminated during backwards stepwise selection (i.e. were not

statistically significant) were: ethnicity, total number of co morbidities and a medical history of arrhythmia or dementia.

The level of variance in EQ5D index score explained by this model was 22%. Increased deprivation was associated with reduced HRQL with an estimated reduction of 0.002 per unit increase in deprivation score ($p<0.001$).

The reduction in EQ-5D index score in patients with a history of depression was estimated at a decrease of 0.27 units ($p <0.001$) on a scale where 0 represents no health (dead) and 1 represents full health and where a minimally clinically important difference has been estimated at 0.07 [22]. 527 (9.0%) of the population under study had a prior history of depression. A medical history of either neurological disease or osteoarthritis was also associated with lower EQ-5D index scores, with an average reduction of 0.17 ($p <0.0001$) and 0.08 (p 0.006) respectively.

Estimated Health Utility

Model estimates were used to predict EQ-5D scores for patients with differing demographics and morbidity. These models suggest that worst HRQL would be noted in an elderly, female, smoker, resident in a deprived area with multi-co morbidity (table 4).

Discussion

Summary of Main Findings

This study demonstrates the burden of chronic disease in terms of HRQL in an ageing UK-based community dwelling population and has been able to quantify the relative impact of various chronic conditions on HRQL. In accordance with previous research this study shows that poorer HRQL is significantly associated with being female, increasing age, increased levels of deprivation and smoking. [9] Additionally, this study suggests that the chronic conditions; depression, neurological disease and osteoarthritis [23] have the greatest negative impact on HRQL after adjustment for age, gender, ethnicity, socioeconomic status and presence of other chronic conditions.

The quantification of the impact of these morbidities is of significant value in informing policy and guideline development. This study further highlights areas where intervention may have the greatest opportunity to demonstrate cost effectiveness through increased HRQL. At the current time the management of osteoarthritis, for example, does not generate additional reward for general practices under the UK Quality Outcomes Framework, a reward and incentive programme with performance indicators against which general practice levels of achievement are assessed. [24,25] Considering the prevalence of osteoarthritis in the UK and the detrimental impact of osteoarthritis on HRQL demonstrated in the current study (reduction of -0.081 , p=0.0006), it may be appropriate to consider the inclusion of a specific management plan for osteoarthritis in Quality of Outcome Framework.

These findings could also form the basis for research concerning prognosis prediction based upon HRQL. This in turn could aid clinical decision making as well as allocation of scarce resource. [26]

Strengths and Limitations

The sample size (n=5849) used was large when compared with other similar studies, and has thus provided more accurate results, reflected in the small confidence intervals for regression model estimates. Furthermore, data reported are consistent with utility scores reported by Kind et al 1998 [9].

This study was a secondary analysis of pre-collected data and has thus been limited by the aims and methods of the previous researchers. The variables used were selected and measured by the original

BETS research team. As a result, methods used may have been open to bias, and there may be important factors for which data have not been collected. The final model explains 22% of the residual variance. Furthermore, data were collected from just one point in time, and thus only association, not causality, can be inferred from the results. Therefore, it is unclear whether significantly associated variables are causing a poorer HRQL, or whether a poor HRQL leads the individual to partake in certain behaviours. Lastly, although the findings suggest that ethnicity is not associated with HRQL, geocoding may have impacted on the model findings. Findings related to ethnicity therefore should be interpreted with caution.

Conclusion

This study demonstrates the burden of morbidity and further quantifies the negative impact of chronic conditions and multimorbidity on HRQL in a community dwelling ageing population. Focus of services upon areas identified to be associated with reduced HRQL may improve patient well-being.

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References

1. ONS Aging. http://www.statistics.gov.uk/hub/population/ageing/older-people.(Last accessed January 2014).
2. Fortin M, Bravo G, Hudon C, Vanasse A, Lapointe L. Prevalence of multi-morbidity among adults seen in family practice. Ann Fam Med 2005; 3(3):223-228
3. Calvert MJ, Freemantle N, Cleland J. The impact of chronic heart failure on health-related quality of life data acquired in the baseline phase of the CARE-HF study. The European Journal of Heart Failure 2005; 7:243-251.
4. Smith SM, Soubhi H, Fortin M, Hudson C, O'Dowd T. Managing patients with multimorbidity: systematic review of interventions in primary care and the community settings. BMJ 2012; 345:e5205
5. Boyde CM, Fortin M. Future of multimorbidity research: How should understanding of multimorbidity inform health system design? Public Health Reviews. 2010;32:451
6. Healthy Lives Healthy People. http://www.official-documents.gov.uk/document/cm79/7985/7985.pdf (Last accessed January 2014)
7. WHO. What is active ageing? http://www.who.int/ageing/active_ageing/en/index.html, (Last Accessed January 2014)
8. Department of Health. National Service Framework for older people. http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4003066; (Last accessed January 2014)
9. Kind P, Dolan P, Gudex C, Williams A. Variations in population health status: results from a United Kingdom national questionnaire survey. BMJ 1998; 316: 736-741.
10. Heyworth I, Hazell M, Linehan M, Frank T. How do common chronic conditions affect health-related quality of life? Br J Gen Practice. 2009; 59(568):353-358.
11. Murray J, Saxena S, Millett C, Curcin V, de Lusignan S, Majeed A. Reductions in risk factors for secondary prevention of coronary heart disease by ethnic group in south-west London: 10-year longitudinal study (1998-2007). Fam Pract. 2010 Aug;27(4):430-8.
12. Calvert M, Shankar A, McManus RJ, Lester H, Freemantle N. Effect of the quality and outcomes framework on diabetes care in the United Kingdom: retrospective cohort study. BMJ. 2009 May 26;338:b1870. doi: 10.1136/bmj.b1870
13. Calvert M, Duffy H, Freemantle N, Davis R, Lip GY, Gill P. Population health status of South Asian and African-Caribbean communities in the United Kingdom. *BMC Health Serv Res.* 2012 Apr 25;12:101.
14. Wilson S, Parle J, Roberts L, Roalfe A, Hobbs R, Clark P, Sheppard M, Gammage M, Pattison H, Franklyn J. Prevalence of Subclinical Thyroid Dysfunction and It's Relation to Socioeconomic Deprivation in the Elderly: A Community-Based Cross-Sectional Survey. The Journal of Clinical Endocrinology & Metabolism 2006; 91(12): 4809-4816.
15. Dolan P. Modelling Valuations for EuroQol Health States. Medical Care 1997; 35(11):1095-1108
16. Bjelland I, Dahl AA, Haug TT, Neckelmann D. The validity of the Hospital Anxiety and Depression Scale: an updated literature review. *J Psychosom Res.* 2002; 52:69-77.
17. Watson V, Sutton M, Dibben C, Ryan M. Deriving Weights for the Index of Multiple Deprivation based on societal preferences: The application of a discrete choice experiment. OPHI working paper 23. 2008 found at http://www3.qeh.ox.ac.uk/pdf/ophiwp/OPHIwp24.pdf (Last accessed January 2014)
18. Fiscella K, Fremont AM. Use of Geocoding and Surname Analysis to Estimate Race and Ethnicity. Health Services Research. 2006; 41:1482-1500.
19. Hamparsum, Bozdogan. Akaike's Information Criterion: Model selection and Akaike's Information Criterion (AIC): The general theory and its analytical extensions. Psychometrika year;52(3):345-370

20. McCulloch CE, Searle SR. Generalized, linear, and mixed models. New York: John Wiley, 2001.
21. Census data; http://www.ons.gov.uk/ons/guide-method/census/2011/census-data/index.html (Last accessed January 2014)
22. Walters SJ, Brazier JE. Comparison of the minimally important difference for two health state utility measures: EQ-5D and SF-6D. Qual Life Res 2005; 14(6):1523-1532.
23. Ko Y, Coons SJ. Self-reported chronic conditions and EQ-5D index scores in the US adult population. Curr Med Res Opin. 2006 Oct;22(10):2065-71.
24. Quality and Outcomes Framework guidance for GMS contract 2009/10. http://www.nhsemployers.org/SiteCollectionDocuments/QOFguidanceGMScontract_2011_12_FL%2013042011.pdf. (Last accessed January 2014)
25. National Institute for Clinical Excellence. About the Quality and Outcomes Framework. http://www.nice.org.uk/aboutnice/qof/qof.jsp (Last accessed January 2014)
26. Persad G, Wertheimer A, Emanuel EJ. Principles for allocation of scarce medical interventions. Lancet. 2009;373:423-31

Figure 1 Percentage of respondents reporting moderate, severe or any problems in each EQ-5D dimension

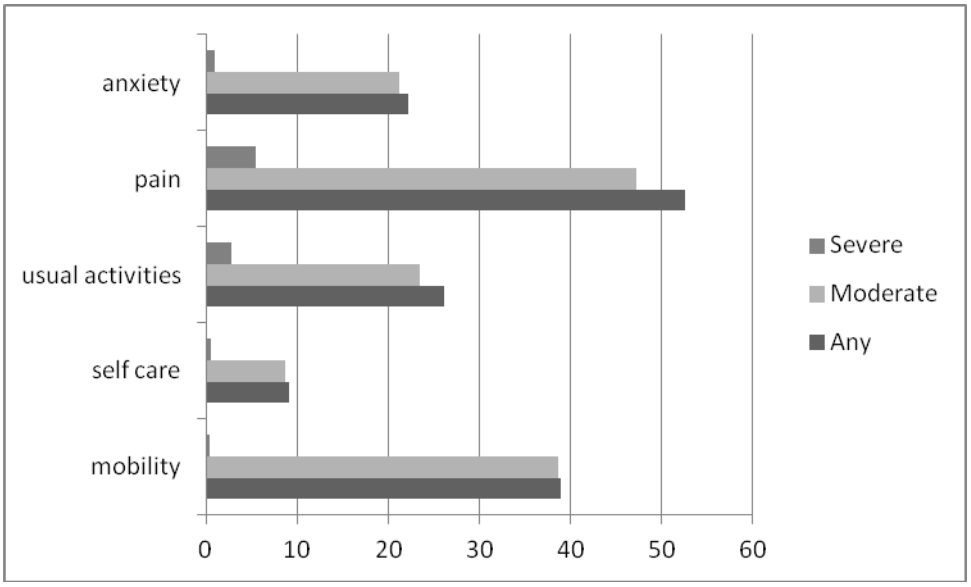

Table 1 Characteristics of the study cohort

Characteristic	n=5849 (%)
Gender	
Male	2879 (49.2)
Female	2970 (50.8)
Age	
60-69	1719 (29.4)
70-79	3125 (53.4)
≥80	1005 (17.2)
Ethnicity (inferred by geocoding)	
White	5727 (97.9)
Asian	110 (1.9)
Black	12 (0.2)
Deprivation Quintile*	
Class I (34.23 to 86.36)	1010 (17.3)
Class II (21.17 to 34.22)	1225 (20.9)
Class III (13.73 to 21.16)	1414 (24.2)
Class IV (8.36 to 13.72)	942 (16.1)
Class V (0.59 to 8.35)	1258 (21.5)
Smoker	
Yes	582 (10.0)
No	5267 (90.0)
Morbidities	
Cancer (any)	310 (5.3)
Cardiovascular	
Arrhythmia (including AF)	344 (5.9)
Stroke or TIA	86 (1.5)
Heart Failure	184 (3.2)
Hypertension	2308 (39.5)
Ischeamic coronary heart disease	457 (7.8)
Perivascular Disease	53 (0.9)
Neurological	
Dementia	18 (0.3)
Neurological disease	83 (1.4)
Musculoskeletal	
Oestoarthritis	84 (1.4)
Rhematoid Arthritis	138 (2.4)
Endocrine	
Diabetes	526 (9.0)
Other	
Depression	527 (9.0)
Renal disease	49 (0.8)
Pulmonary disease	615 (10.5)
Median No. of morbidities	1 (IQR 2) (Range 0- 3)

*West Midland Reference Values for IMD 2004

Table 2 Proportions of Respondents Reporting Any Problems in Each EQ-5D Dimension by Age and Gender

Age Group (years)	65-69 n (%) *	70-79 n (%) *	>80 yrs n (%) *
EQ5D Dimension			
Mobility			
All	520 (30.3)	1194 (38.2)	559 (55.6)
Male	238 (28.3)	548 (34.3)	217 (49.2)
Female	282 (32.8)	646 (42.3)	342 (60.6)
Self-Care			
All	123 (7.2)	263 (8.4)	144 (14.3)
Male	52 (6.28)	116 (7.3)	57 (12.9)
Female	71 (8.1)	147 (9.6)	87 (15.4)
Usual Activities			
All	367 (21.4)	773 (24.7)	389 (38.7)
Male	147 (17.5)	307 (19.2)	139 (31.5)
Female	220 (25.0)	466 (30.5)	250 (44.3)
Pain			
All	847 (49.3)	1637(52.4)	594 (59.1)
Male	353 (42.2)	720 (45.01)	224 (50.8)
Female	494 (56.2)	917 (60.1)	370 (65.6)
Anxiety			
All	369 (21.57)	683 (21.8)	249 (24.8)
Male	135 (16.1)	250 (15.7)	78 (17.7)
Female	234 (26.6)	433 (28.4)	171 (30.3)

Table 3 Results of Regression Analysis Examining the Association between Candidate Variables and EQ-5D Index

	*Estimate**	Lower CI**	Upper CI**	p value
Intercept	2.399	2.082	2.718	<0.0001
Male	0.063	0.052	0.074	<0.0001
Log Age	-0.358	-0.432	-0.284	<0.0001
Smoker	-0.021	-0.040	-0.003	0.0247
IMD Score 2004#	-0.002	-0.002	-0.002	<0.0001
Medical History Of:				
Hypertension	-0.020	-0.031	-0.008 .	0.008
Heart Failure	-0.035	-0.067	-0.004	0.029
Cancer	-0.037	-0.0062	-0.012	0.0032
Stroke or TIA	-0.046	-0.092	-0.001	0.0458
Pulmonary Disease	-0.054	-0.072	-0.036	<0.0001
Rheumatoid arthritis	-0.059	-0.095	-0.023	0.0015
Diabetes	-0.061	-0.080	-0.041	<0.0001
Ischeamic coronary heart disease	-0.061	-0.081	-0.040	<0.0001
Renal Disease	-0.064	-0.124	-0.00	0.038
Perivascular Disease	-0.075	-0.133	-0.017	0.0115
Osteoarthritis	-0.081	-0.128	-0.035	0.0006
Neurological disease	-0.172	-0.218	-0.125	<0.0001
Depression	-0.269	-0.289	-0.250	<0.0001

* Estimate of abolute risk ** 95% confidence intervals #untransformed variable

Table 4 Estimated utility scores for patients of different age and gender accounting for deprivation and co morbidity

Patient	**Gender**	**Age (years)**	**Deprivation index (IMD 2004)***	**Smoker**	**Comorbidities**	**EQ-5D Score#**
1	M	69	11	N	0	0.90
2	F	69	11	N	0	0.84
3	M	78	11	N	0	0.88
4	M	78	31.1	N	0	0.82
5	M	78	31.1	Y	Hypertension, Ischeamic coronary heart disease	0.76
6	F	78	31.1	Y	Hypertension, Rheumatoid arthritis	0.68

* The index of multiple deprivation (IMD) 2004 is a measure of deprivation at a small area level comprised of seven domains (barriers to housing and services, crime, education skills and training, employment, health deprivation, income and living environment). Higher scores reflect higher levels of deprivation.

EQ-5D scores provide a value for health related quality of life (HRQL), with a score of 1.00 indicative of full health and scores less than 1 reflecting impaired HRQL.