What can local authorities do to improve the social care-related quality of life of older adults living at home? Evidence from the Adult Social Care Survey

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Research highlights

- Social Care-Related Quality Of Life of frail older adults is associated with 3 local policy targets

- Access to information, design of home and access to local area explain variance in SCRQoL

- They are equally strongly associated with SCRQoL as health indicators

- The associations are stronger for older adults with higher needs and less assistance

Abstract

Local authorities spend considerable resources on social care at home for older adults. Given the expected growth in the population of older adults and budget cuts on local government, it is important to find efficient ways of maintaining and improving the quality of life of older adults. The ageing in place literature suggests that policies in other functions of local authorities may have a significant role to play. This study aims to examine the associations between social care-related quality of life (SCRQoL) in older adults and three potential policy targets for local authorities: (i) accessibility of information and advice, (ii) design of the home and (iii) accessibility of the local area. We used cross-sectional data from the English national Adult Social Care Survey (ASCS) 2010/2011 on service users aged 65 years and older and living at home (n=29,935). To examine the association between SCRQoL, as measured by the ASCOT, and three single-item questions about accessibility of information, design of the home and accessibility of the local area, we estimate linear and quantile regression models. After adjusting for physical and mental health factors and other confounders our findings indicate that SCRQoL is significantly lower for older adults who find it more difficult to find information and advice, for those who report that their home design is inappropriate for their needs and for those who find it more difficult to get around their local area. In addition, these three variables are as strongly associated with SCRQoL as physical and mental health factors. We conclude that in seeking to find ways to maintain and improve the quality of life of social care users living at home, local authorities could look more broadly across their responsibilities. Further research is required to explore the cost-effectiveness of these options compared to standard social care services.

Introduction

The term 'Ageing in Place' is used to refer to the ability of older persons to keep on living in one's own home safely, independently, and comfortably (Centers for Disease Control and Prevention, 2013). Staying at home for as long as possible is favoured by many older adults as they prefer to grow old in a familiar place, and by policy makers as its avoids the costly option of institutional care (Gitlin, 2003; Wiles, Leibing, Guberman, Reeve, & Allen, 2012; WHO, 2007b; WHO Europe, 2008). It follows that the home is increasingly becoming the place where long-term care is provided (Gitlin, 2003).

In many countries long-term care is split between health (usually nursing care) and social care components. Social care is traditionally seen as important for improving or maintaining the quality of life of older adults and in many European countries, local government takes responsibility for providing social care at home (WHO Europe, 2008).This is the case in England, where publicly-funded social care is available through local authorities on a means-tested basis; by contrast nursing care is provided without charge by the National Health Service. Local authorities have responsibility for setting and assessing need and eligibility for social care within national guidelines, and developing local markets through their role as commissioners of care. As a result eligibility for care and the range of services available varies by local area. However, all areas fund (either through block grants, personal budgets or individual care packages) services such as home care, day centres, equipment and adaptations. In addition the prevention agenda has meant that authorities across England have invested in services such as re-ablement and telecare, as well as low-level advice, information and befriending services that aim to improve quality of life and prevent the need for more intensive packages of care (Secretary of State for Health, 2012; Social Care Policy, 2010).

As a result of the austerity programme, retrenchment within local government has seriously eroded the level of public support available to older people, particularly in the area of support to live at home. Despite increased demand for care due to population ageing, 35% fewer older people received publicly-funded home- or community-based care in 2012/13 compared to 2005/6 (Fernandez, Snell, & Wistow, 2013). These statistics paint a stark picture, and one that is likely to get worse as the austerity programme continues to bear down on local government funding. If local government is to continue to enable Ageing in Place it will need to continue to find efficiencies and as Fernandez et al.(2013) hint at when they suggest that "some of the reductions in service provision could be linked to the successful implementation of prevention and reablement schemes"

(p6), with this level of reduction in provision there is little room for further efficiencies within social care departments.

Local government faces a difficult task. However, rather than taking a silo-based approach and focussing solely on finding efficiencies within social care services departments, authorities could look more widely across their functions. In England, local authorities bear other responsibilities that enable Ageing in Place, such as housing, public transport and city planning, within various operationally separate departments. It may be that changes to policy in these areas of responsibility could produce quality of life improvements for older people that reduce their need for social care, and lead to savings for local government. A first step in establishing areas for local government to focus on is to identify areas which contribute most to the quality of life of older adults living at home.

Quality of life is a broad concept and encompasses many domains that are important to older adults (Brown, Bowling, & Flynn, 2004). A process that is increasingly acknowledged as important for the quality of life of older adults is the interaction between older adults and the home and communities they live in (Andrews, Evans, & Wiles, 2012; Wiles et al., 2012; Peace, Holland, & Kellaher, 2011; Rowles & Bernard, 2013). Characteristics of the immediate environment have a growing impact on older people's lives as more time is spent in a reduced range of places in the home and neighbourhood (Oswald & Wahl, 2005; Rowles & Bernard, 2013). As people age, many experience a decline in functional capacities or other 'reductions in competence', which increase the need for familiar and supportive environments (Peace et al., 2011; Oswald & Wahl, 2005; Lawton & Nahemow, 1973; Rowles & Bernard, 2013). Familiar and personalized places provide a sense of identity, privacy, attachment, comfort, security and safety, and supportive environments enable older persons to remain mobile, independent and in control of everyday routines (Peace & Holland, 2001; Peace et al., 2011; Oswald & Wahl, 2005; Rowles & Bernard, 2013; Iwarsson, Stahl, & Lofqvist, 2013). Ageing in Place policies could influence a range of these quality of life domains.

Quality of life measures that reflect this breadth of potential effects should be used to identify features of the local environment that contribute most to the needs reduction of older adults. The Adult Social Care Outcomes Toolkit (ASCOT) was developed to measure social care-related quality of life (SCRQoL), but covers domains which are in general relevant for older adults and the Ageing in Place policy agenda, such as 'personal safety', 'accommodation cleanliness and comfort' and 'control over daily life' (Netten et al., 2012). The Adult Social Care Survey (ASCS), an English annual national survey, includes the ASCOT as well as

information about three of eight domains that were recently identified by the WHO as characteristics of 'Age-Friendly environments' (WHO, 2007b). The three factors - accessibility of information and advice, design of the home and accessibility of the local area- lie within the responsibility of local authorities and literature suggests that these factors have an important impact on older adults' lives.

Accessibility of information and advice about support, services and benefits

The number of organisations involved in home based care, and the widespread and growing use of market mechanisms means that information and advice are important in helping older adults and their informal caregivers to find and apply for services from appropriate providers (WHO Europe, 2008; Leichsenring, 2003; Baxter & Glendinning, 2011). Social care users find information that is physically easy to access and not presented in a cognitively demanding way valuable to build up a picture of the available options and compare the advantages and disadvantages of each (Baxter & Glendinning, 2011). However, it is found that especially for social care, older adults are not aware of all the services they could access (Baxter & Glendinning, 2011) and that there is a shortfall in the number of older people getting the information that enables access to the practical support they need to maintain independence and manage more easily at home (Barrett, 2005).

Perceived design of the home

Older adults with functional disabilities could be confronted with numerous difficulties when carrying out daily activities and navigating at home. The layout of the person's home can greatly influence the type and amount of help needed and cross-sectional evidence suggests that improving home environments is related to functional ability outcomes (Wahl, Fange, Oswald, Gitlin, & Iwarsson, 2009). Not much is known yet about the relationship between design of a home and quality of life, although this relationship has been studied in residential care settings and found to be important (Barnes, 2002; Parker et al., 2004).

Accessibility of the local area

The type and amount of help an older person needs to get to the places they want in the local area depends on the interaction between personal characteristics and characteristics of the external environment. Older adults

with declining health and functional status can be particularly limited in their mobility by barriers in their local area (Burton, Mitchell, & Stride, 2011). Previous studies have shown that the physical environment can have an impact on the independence and quality of life of older people living in the community (Burton et al., 2011; Lui, Everingham, Warburton, Cuthill, & Bartlett, 2009; Gilroy, 2008).

Aim of this study

Yet, it is uncertain to what extent these three factors are associated with quality of life of older adults living at home and receiving social care services. Because it is already known that physical and mental health factors are important predictors of quality of life in old age (Blane, Netuveli, & Montgomery, 2008; Borglin, Jakobsson, Edberg, & Hallberg, 2005; Kim, Lee, & Kim, 2012; Stenzelius, Westergren, Thorneman, & Hallberg, 2005; Webb, Blane, McMunn, & Netuveli, 2011), we aimed to evaluate what the association is between social-care related quality of life and 'accessibility of information and advice', 'design of the home' and 'accessibility of the local area', and whether these factors have any influence over and above the well-established effect of physical and mental health factors.

Methods

Study design and participants

The data we used for this study are from the English cross-sectional 2011 national Adult Social Care Survey (ASCS). The ASCS is designed to capture information on social care outcomes for publicly-funded social care service users. The information from the survey feeds into the government's Adult Social Care Outcomes Framework, which is used to monitor services, inform national and local policymaking and provide accountability to the public for the use of public money (Department of Health, 2011). The ASCS includes the items that comprise a preference-weighted measure of social care-related quality of life (SCRQoL): the Adult Social Care Outcomes Toolkit (ASCOT) (Netten et al., 2012). Apart from the ASCOT, the ASCS includes questions about socio-demographics; satisfaction with social care services; physical and mental health status; and contextual information such as accessibility of information and advice about support, services and benefits; perceived home design; and accessibility of local area.

Each Council with Adult Social Service Responsibilities (CASSR) in England collected data following centrally-set guidance (The NHS IC Social Care Team, 2010). Of the 153 CASSRs in England, 149 participated in the 2011 ASCS. The CASSRs were asked to send postal questionnaires to a random sample of service users who were receiving services funded wholly or partly by CASSRs. A total of 150,676 questionnaires were sent out and 61,105 were returned completed or partially completed (41% overall response rate). The survey was approved by the Social Care Research Ethics Committee.

For our analyses, only adults aged 65 years and older and living at home were included. Respondents living in residential care or in a nursing home were excluded. Older adults that received social care services primarily because of mental health problems, learning disabilities or substance abuse problems were also excluded (n=1984).

Measures

Dependent variable

The dependent variable in this study is the total SCRQoL index score generated from the ASCOT (Malley et al., 2012; Netten et al., 2011; Netten et al., 2012). The ASCOT measure is relevant for community-dwelling older adults with long-term care needs, as its domains are developed to be sensitive to the outcomes of help from

social services. Eight domains of SCRQoL are included in the ASCOT: personal cleanliness and comfort, accommodation cleanliness and comfort, food and drink, safety, social participation and involvement, occupation, control over daily life and dignity. Each domain has four response options, which aim to reflect the following situations as closely as possible:

- *Ideal* The preferred situation, where needs are met to the desired level

- *No needs* Where needs are met, but not to the desired level

- *Some needs* Where there are needs, but these do not have an immediate or longer-term health implication

- *High needs* Where there are needs that have an immediate or longer-term health implication

We used the preference weights that have been elicited with a combined best-worst scaling (BWS) and time-trade off (TTO) approach in a sample of the general population (Netten et al., 2012). These preferences give information about the relative desirability of possible SCRQoL states and can be used to calculate a total SCRQoL index score. The index can take values from -0.17 to 1, with a score of '0' being equivalent to 'being dead' and '1' being the 'ideal' SCRQoL state (Netten et al., 2012). Scores lower than 0 indicate that this specific state is rated as being worse than dead.

Main independent variables

Three questions (about 'accessibility of information and advice', 'perceived design of the home' and 'accessibility of local area') that were included in the ASCS for context and to enable interpretation of the survey outcome questions were used as the principal independent variables in this study, as these factors are potentially amenable to local authorities. The variables were administered as single item questions in the 2011 ASCS. No problems with understanding or answering these questions were found in studies where the ASCS was developed and tested (Malley et al., 2010; Malley, Sandhu, & Netten, 2006).

'Accessibility of information and advice' was assessed with the question 'In the past year, have you found it easy or difficult to find information and advice about support, services or benefits?', that had 4 response options: 'very difficult to find', 'fairly difficult to find', 'fairly easy to find' and 'very easy to find'. Furthermore, there was a possibility to choose the 'not applicable' option: 'I've never tried to find information or advice'.

'Perceived design of the home' was assessed with the question 'How well do you think your home is designed to meet your needs?', with 4 response options: 'my home is totally inappropriate for my needs', 'my home meets some of my needs', 'my home meets most of my needs' and 'my home meets my needs very well'.

'Accessibility of local area' was assessed with the question 'Thinking about getting around outside of your home, which of the following statements best describes your present situation?', with again four response options: 'I do not leave my home', 'I am unable to get to all the places in my local area that I want', 'at times I find it difficult to get to all the places in my local area that I want' and 'I can get to all the places in my local area that I want'.

In this paper we will use the terms 'information', 'design of home' and 'getting around' respectively to refer to these independent variables.

Physical and mental health indicators

We used the following variables from the ASCS to adjust for physical and mental health: 'self-perceived health' (1-5 'very bad' – 'very good'), EQ-5D 'pain/discomfort' (1-3 'I have no pain or discomfort'- 'I have extreme pain or discomfort'), EQ-5D 'depression/anxiety' (1-3 'I am not anxious or depressed' – 'I am extremely anxious or depressed') and number of 'ADL difficulties' (0-8 ability to get around indoors, to get in and out of bed, to feed yourself, to deal with finances and paperwork, to wash all over, to get dressed and undressed, to use the WC/toilet, to wash your face and hands). The remaining EQ-5D domains were not included in the ASCS.

Other covariates

We adjusted for the following other possible confounders for the association between SCRQoL and the main independent variables: demographic characteristics (gender, age group, ethnicity group), receipt of informal care and service packages (receipt of practical help from someone living in household of someone living in another household, receipt of homecare, direct payments or equipment), assistance with the survey (proxy 'someone answered for me without asking me the questions', or assistance 'reading or translating questions', 'writing down answers' or 'talking through the questions' from a care worker or someone living in household or another household) and local authority level indicators (deprivation index, median wages, expenditures and population density). The LA-level indicators were obtained from governmental web sources (McLennan et al., 2011; Office for National Statistics, 2011; Office for National Statistics, 2001; The Information Centre for Health

and Social Care, 2012). The deprivation index is based on 7 domains of deprivation experienced by individuals living in an area: income deprivation; employment deprivation; health deprivation and disability; education skills and training deprivation; barriers to housing and services; living environment deprivation; and crime (McLennan et al., 2011). Expenditures is the money spent on social care for older adults by CASSRs (The Information Centre for Health and Social Care, 2012).

Statistical methods

We used linear ordinary least-squares regression (OLS) to model the association of the main independent variables with SCRQoL as the response variable, adjusted by physical and mental health indicators, demographic characteristics, receipt of informal care and service packages, assistance with the survey and local authority level indicators.

In the first model the crude association between the main independent variables and SCRQoL was estimated. Subsequently, these associations were adjusted for physical and mental health indicators in model 2, and the other covariates were added in model 3. We have estimated a multilevel model with a random intercept as well to adjust for variance in SCRQoL between CASSRs. However, the estimated coefficients did not change and the random CASSR variance (0.010) and the ICC (the proportion of the total variance due to the variance between CASSRs) of 0.5% were small. This shows that the variance between the CASSRs is small compared to the variance between respondents, justifying the use of regular OLS models instead of multilevel models. Therefore, the OLS models are presented in this paper.

In models 1-3, the main independent variables were treated as interval variables and 'not-applicable' and missing responses were omitted from analysis. As 23.3% of the participants chose the 'not-applicable' response regarding the question about 'information', these complete case analyses resulted in quite a large reduction of the sample size. Therefore we estimated another model (model 4) to see whether results changed after including these 'not applicable' respondents in the analysis. Instead of treating 'information' as an interval variable the responses for this variable were added to model 4 as a set of four dummy variables.

After including the 'not-applicable' responses for the 'information' variable, 15.5% of the 26,096 respondents for whom a SCRQoL score could be calculated had a missing response on at least one of the independent variables. Missing responses to the questionnaire items were likely to be due to the respondents

experiencing a difficulty with the question which means that he/she did not feel able to answer it. Therefore, the missing data are most likely not missing completely at random (MCAR). In addition to the four models with complete data, we repeated the estimation of model 4 with imputed data. Twenty imputed datasets were created using multiple imputation by chained equations (MICE) (White, Royston, & Wood, 2011; van Buuren & Oudshoorn, 1999). Multiple imputation using the chained equations method assumes the data are missing at random (MAR), which is more tenable for these data. All variables in the dataset were used for the imputation, complemented with authority-level data. Results from the separate imputations were combined using Rubin's rules (Rubin, 1987).

The distribution of the SCRQoL data was typical for indirect utility scores: a negatively skewed distribution bounded at the upper end of the SCRQoL index scale, with most of the values lying at the higher end of the measurement scale and only some observations displaying very low values (Pullenayegum, Wong, & Childs, 2012; Basu & Manca, 2012; Austin, 2002; Grootendorst, 2000). Accordingly there was indication of heteroscedasticity and non-normality of the error terms using OLS estimation. To account for non-normality of the error terms and heteroscedasticity in the models the Huber-White sandwich estimator was used to adjust standard errors (Huber, 1967; White, 1980).

Finally, to examine the robustness of the results based on the OLS technique, we also employed a quantile regression model, which was introduced by Koenker and Basset (Koenker & Bassett, Jr., 1978). Quantile regression is robust to heteroscedasticity and recommended for analysing associations with bounded data from multi-attribute utility scales (Austin, 2002; Grootendorst, 2000). The effect of the independent variables may be higher at the lowest percentile of SCRQoL compared with the highest percentile, resulting in unequal variance for the independent variables across the data distribution. Quantile regression estimates separate slopes across different levels of SCRQoL (Stoltzfus, Nishijima, & Melnikow, 2012). By estimating a family of conditional quantile functions a more complete picture of covariate effects can be provided without making distributional assumptions about the error term in the model. We estimated regression models for the 5th, 25th, 50th, 75th and 95th quantiles, corresponding to SCRQoL values of .43 .68 .82 .93 and 1 respectively. The slopes for the three main independent variables across the different levels of SCRQoL were compared in a figure and model 5 reports the results of the median regression model (the coefficients estimated for the 50th quantile). Median regression is the most common form of quantile regression. It estimates the median of the dependent variable, conditional on the independent variables.

Furthermore, we explored interactions between the main independent variables and physical and mental health indicators, gender, age group, receipt of informal care and service packages, assistance with filling in the questionnaire and local authority level indicators on SCRQoL score. Interactions were considered significant at α=0.05.

All statistical analyses were conducted using Stata version 12.

Results

Sample

A total of 31,919 of the 73,350 older adults living at home who were sampled from social services records completed the Adult Social Care Survey (43.5%). We found only marginal differences between participants and non-responders (Malley & Fernandez, 2012). We excluded 1,984 respondents from our analysis, as they received services primarily because of mental health problems, learning disabilities or substance abuse problems, resulting in a final number of 29,935 participants.

For 3,839 participants (12.8%) a preference weighted SCRQoL score could not be calculated due to missingness on one or more ASCOT items. The mean SCRQoL score for the remaining 26,096 participants was 0.78 (SD 0.18), the median score 0.82. Table 2 shows the distribution of answers per ASCOT domain. Of the participants with complete outcome information, 4,047 (15.5%) had a missing response on at least one of the independent variables. Missing responses to independent variables varied between 1.3% and 11%, with the multi-item variable 'number of ADL difficulties' having the most missing responses.

Models 1-4: Linear regression models

Table 3 presents the regression coefficients from the five regression models as described in the methods section. The crude regression estimates in model 1 show significant positive associations between SCRQoL and 'information', 'design of home' and 'getting around' (p<0.01). This means that respondents who found it easier to find information and advice, who thought their home met their needs better and who were better able to get to the places they want had a higher SCRQoL score. The significant F-ratio shows that model 1 had significantly more predictive ability than a model with a constant only.

In the next step (model 2), physical and mental health indicators were added to the model to adjust for potential confounding. Although this step reduced the regression coefficients of the three main independent variables, the significant positive associations with SCRQoL remained. The fraction of variance explained (R^2) improved from 0.32 to 0.43.

In model 3 the regression coefficients of 'information', 'design of home' and 'getting around' were adjusted for both the physical and mental health indicators and the other covariates. This model shows that after adjusting for physical and mental health indicators (as shown in model 2), adjustment by the other

covariates does not result in a further change in the regression coefficients for 'information', 'design of home' and 'getting around'. The estimated coefficients are based on different scales and therefore not directly comparable. To compare the relative strength of the various independent variables we looked at the standardized regression coefficients for this model as well. These were 0.22, 0.22, 0.11, 0.18, 0.00, -0.19 and -0.12 for 'information', 'design of home' and 'getting around' and the physical and mental health indicators 'self-perceived health', 'EQ-5D pain/discomfort', 'EQ-5D anxiety/depression', and 'number of ADL difficulties' respectively. This means, for example, that one standard deviation difference in 'information' is associated with a 0.22 standard deviation difference in SCRQoL score. Thus, the strongest associations in the full model, with standardized regression coefficient of about 0.20, were found between SCRQoL and 'information', 'design of home', 'self-perceived health' and 'anxiety/depression' The standardized regression coefficients for all other covariates were smaller than 0.06.

Model 4 is similar to model 2; although instead of treating 'information' as an interval variable, it was added to the regression model as a set of dummy variables. In this model, the participants who chose the answer option 'I've never tried to find information or advice' were also included in the model, resulting in a larger sample size. The regression coefficients for the set of dummy variables show a linear pattern. Compared to participants who found it very difficult to find information and advice, participants who never tried to find information or advice had on average a 0.10 higher SCRQoL score.

We compared all participants that were included in model 4 (N=22,049) with participants that were not included due to missing answers on the independent variables (N=4,047). Only small differences were observed. The combined regression coefficients that were estimated with the imputed datasets were the same as those in model 4 (results not shown).

Model 5: quantile regression model

In the estimated quantile models the associations of the independent variables with SCRQoL were in general weaker though still significant in higher quantiles of SCRQoL (Figure 1). In the lower part of the distribution stronger associations were observed, and the coefficients for the median model were similar to those for the mean model (model 2). Model 5 in Table 3 shows the regression coefficients for the independent variables in the 50th quantile (median regression model). The regression coefficient for 'perceived design of the home' is

0.01 point higher compared to the OLS model, whereas the coefficient for 'accessibility of local area' is 0.01 lower.

Interactions

Table 4 presents significant interactions between the covariates and SCRQoL score, showing that the positive associations we found were stronger for participants with more ADL difficulties and more feelings of depression/anxiety. The associations were weaker for participants with practical help from someone inside or outside the household.

Discussion

The objective of this study was to examine the associations between social care-related quality of life in older adults and 'accessibility of information and advice', 'design of the home' and 'accessibility of the local area'.

Our findings show that these factors significantly explain variance in SCRQoL. Furthermore, we found that accessibility of information, design of the home and accessibility of the local area is particularly important for older people with higher needs and less assistance from informal carers, and that the associations of the three factors with SCRQoL are strongest among people with lower SCRQoL scores. This is consistent with the environmental docility hypothesis which supposes that the less competent the persons, the more dependent they are on environmental circumstances (Lawton & Nahemow, 1973; Peace et al., 2011).

The estimated coefficients in the adjusted regression models show that a 1 level increase in ease of getting around is associated with an increase of about 1.5% in SCRQoL score, and a 1 level increase in ease of finding information/advice and in perceived design of the home with an increase of about 4.5% in SCRQoL score. The strength of these associations is similar to other factors that are associated with quality of life of older adults. First, our own results show that the strength of the association between SCRQoL and 'information' and 'design of home' is similar to the association between SCRQoL and 'self-perceived health' and 'anxiety/depression'. Second, the effect sizes are comparable to previously reported effect sizes of social, physical and mental problems, and larger than reported effect sizes of (socio)demographic factors (Ratcliffe, Lester, Couzner, & Crotty, 2013; Kim et al., 2012; Kim et al., 2012; Hawton et al., 2011; Makai, Koopmanschap, Brouwer, & Nieboer, 2013). Thus, this study suggests that the home environment and information provision may be just as important for the quality of life of older adults as physical and mental health factors. To our knowledge, it has not been found before that quality of life is equally strongly associated with the home environment and information provision as with physical and mental health factors. Qualitative research provides indications for the enabling role of the home environment: during the aging process the home becomes an increasingly important source of support and independence, compensating for declines in functional capacity (Haak, Fänge, Iwarsson, & Ivanoff, 2007; Fänge & Ivanoff, 2009).

The size and national coverage of the sample, and therefore the high generalisability of the results in England is a major strength of this study. A random sampling approach in all local councils was used with the objective of getting a representative local and national sample. The 41% response rate of the sample is high for

a postal questionnaire and non-responders differed only slightly from the participants (Malley & Fernandez, 2012).

Nonetheless, some limitations apply to this study. First, the statistical modelling of the associations was complicated by the nature of the SCRQoL data. Due to the negatively skewed and bounded distribution of SCRQoL, the assumptions of homoscedasticity and normally distributed error terms necessary to use ordinary least squares estimation were violated. We addressed this by using Huber-White standard errors for the OLS models and by estimating quantile regression models. The robustness of the results to the different models give us confidence in the results.

Second, the Ramsey reset test for omitted variables (Ramsey, 1969) and Pregibon's link test (Pregibon, 1980) indicate problems with specification. The specification of our model was limited to the variables available in the Adult Social Care Survey dataset, which were all used in our analysis, and the LA-level variables. For some variables we were restricted to the use of simple indicators rather than extensive measures. For example, a couple of single-item self-reported questions were used to adjust for the influence of physical and mental health factors. If more extensive or objective measures of health would be available, including for example information about multimorbidity and cognitive limitations, relatively smaller effect sizes for our main independent variables may be found. Yet, we expect that most of the influence of these other health factors is taken into account by older adults when answering questions about self-perceived health and ADL limitations.

Another factor not captured by questions in the ASCS survey was the type and intensity of service packages received. By having this variable omitted in our models, the effect sizes of design of the home, access to the local area and of physical and mental health factors are likely to be underestimated. The health of older adults and the accessibility of their home and local area are evaluated during the needs assessment that determines the type and intensity of a service package. A more intensive package is appointed to older adults with higher needs. We expect that the service package in its turn positively influences SCRQoL. As we were not able to include service receipt in our model, the effects of this loop are to some extent captured by the regression coefficients of the design of the home, access to the local area and of physical and mental health factors.

Finally, the models are based on cross-sectional observational data, which implies that the associations cannot be interpreted as causal relationships. Therefore, it cannot yet be concluded that investing in accessibility of information and advice, design of the home and accessibility of the local area will lead to

improvements in the quality of life of older adults. However, our findings suggest that the effects of these factors are worth a further exploration. As the number of care-dependent older adults living at home is expected to rise (Wittenberg et al., 2011) and considerable resources are spent on providing care at home (European Economy, 2006), it is important for local authorities to search for efficient options across their functions which support the goals of social care. Prospective studies and cost-effectiveness research should be performed to investigate whether investments in accessibility of information and advice, design of the home and accessibility of the local area will indeed lead to improvements in the quality of life of older adults. Investment in environmental features may postpone or avoid the point where declining individual competences demand actions such as relocation or intensification of formal care (Peace et al., 2011). Our results indicate that these factors have the largest influence on older adults with higher needs, less assistance and lower quality of life, further research should therefore focus on interventions targeted at older adults that are most vulnerable. Qualitative research could provide insight in how the environmental factors relate to specific quality of life domains.

If evidence is forthcoming about causality and efficiency of these factors, the Ageing in Place literature contains a number of suggestions about ways to improve each of these three aspects. For example, the provision of easily to find, personalised, up-to-date and high quality information could assist older adults and their informal caregivers to find, compare and apply for services from appropriate providers (Baxter, Glendinning, & Clarke, 2008; WHO, 2007a). Adapted toilets, showers, and lifting equipment have been suggested as home modifications which improve the independence and quality of life of older adults (McCullagh, 2006). Finally, it has been found that 'going outdoors' by older adults is supported by neighbourhood and public transportation attributes such as bus stop locations, transport fares and scheduling, adequate handicap parking, pedestrian infrastructure, proximity to shops and services and feelings of familiarity and safety (McCluskey, Thurtell, Clemson, & Kendig, 2011; Shigematsu et al., 2009; Van Cauwenberg et al., 2012; King et al., 2011). Characteristics of places are not only physical, they have social and emotional meaning (Wiles, 2005), and for older people it seems important to have choices about where and how they age in place (Wiles et al., 2012).

We conclude that in seeking to find ways to maintain and improve the quality of life of social care users living at home, local authorities could look more broadly across their responsibilities. Further research is required to establish causal relationships and explore the cost-effectiveness of investing in the accessibility of

information and advice, the design of the home and the accessibility of local area compared to standard social care services.

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Tables.

Table 1. *Characteristics (N=29935)*

Characteristic	
Gender	
Male	29.8%
Age group	
65-75	19.7%
75-84	38.4%
>85	41.9%
Ethnic group	
White	92.0%
Mixed	0.2%
Asian	3.4%
Black	2.5%
Other	0.7%
Missing	*1.3%*
Ease of finding information/advice	
Very difficult	5.2%
Fairly difficult	12.2%
Fairly easy	37.1%
Very easy	16.5%
Never tried	23.3%
Missing	*5.7%*
Design of home	
Totally inappropriate	1.9%
Meets some of needs	11.7%
Meets most of needs	36.9%
Meets needs very well	44.6%
Missing	*4.9%*
Ease of getting around	
Don't leave home	23.3%
Unable to get to all places	24.9%
Difficult to get to all places	25.3%
Can get to all places	20.5%
Missing	*5.9%*
Self-perceived health (1-5)	
Mean (sd)	3.02(0.86)
Missing	*3.5%*
Number of ADL difficulties (0-8)	
Mean (sd)	3.55 (2.64)
Missing	*11%*
EQ-5D: pain/discomfort	
No pain/discomfort	16.1%
Moderate pain/discomfort	60.8%
Extreme pain/discomfort	18.7%
Missing	*4.4%*
EQ-5D: anxiety/depression	
Not anxious/depressed	47.2%
Moderately anxious/depressed	41.8%
Extremely anxious/depressed	4.8%
Missing	*6.1%*
Receipt of services/support	
Practical help: in household	32.4%
Practical help: outside household	53.9%
Home Care	51.8%
Direct payments	6.5%
Equipment	32.5%
Survey help	
Proxy	5.2%
Assistance from care worker	4.7%

Assistance from someone inside the home	14.9%
Assistance from someone outside the home	28.9%
No assistance/proxy	39.1%
Missing	*5.9%*

Table 2. *Distribution ASCOT items (N=29935)*

	Control over daily life	Personal care	Food and drink	Accomo- dation	Personal safety	Social participation	Occupation	Dignity
Level of need								
No needs, ideal state	26.6%	50.9%	62.8%	60.3%	55.1%	37.0%	20.9%	50.5%
No needs, mustn't grumble	43.5%	42.5%	29.8%	32.8%	35.4%	37.3%	33.0%	32.5%
Low-level needs	23.0%	3.7%	3.7%	3.5%	5.0%	18.5%	34.0%	8.9%
High-level needs	4.1%	0.5%	0.5%	0.3%	1.7%	4.4%	8.2%	0.9%
Missing	*2.8%*	*2.4%*	*3.1%*	*3.2%*	*2.9%*	*2.8%*	*3.8%*	*7.2%*

Table 3. *Multivariate regression models for SCRQoL*

Model	Linear regression models				Quantile regression model
	1. Crude model	2. Adjusted by physical and mental health indicators	3. Adjusted by all covariates	4. With 'finding information' as nominal level variable	5. Median regression
	b (robust se)	*b* (robust se)	*b* (robust se)	*b* (robust se)	*b* (bootst se)
Finding information *[as nominal level variable]*					
Fairly difficult (vs. very difficult)				0.05(0.006) *	
Fairly easy (vs. very difficult)				0.12(0.006) *	
Very easy (vs. very difficult)				0.15(0.006) *	
Never tried (vs. very difficult)				0.10(0.006) *	
Finding information	0.07(0.002) *	0.05(0.002) *	0.05(0.002) *		0.05(0.002) *
Design of home	0.08(0.001) *	0.05(0.002) *	0.05(0.002) *	0.05(0.002) *	0.06(0.002) *
Getting around	0.03(0.001) *	0.02(0.001) *	0.02(0.001) *	0.02(0.001) *	0.01(0.001) *
Physical and mental health indicators					
Self-perceived health		0.04(0.002) *	0.04(0.002) *	0.04(0.001) *	0.04(0.002) *
EQ-5D pain/discomfort		0.00(0.002)	0.00(0.002)	0.00(0.002)	0.00(0.002)
EQ-5D anxiety/depression		-0.06(0.002) *	-0.06(0.002) *	-0.06(0.002) *	-0.06(0.003) *
Number of ADL difficulties		-0.01(0.000) *	-0.01(0.001) *	-0.01(0.000) *	-0.01(0.001) *
Sociodemographic characteristics					
Gender: male (vs. female)			-0.01(0.003) *		
Age group: 75-84 (vs. 65-74)			0.00(0.003)		
Age group: 85 and over (vs. 65-74)			0.01(0.003) *		
Ethnic group: mixed (vs. white)			-0.05(0.024)		
Ethnic group: Asian (vs. white)			-0.02(0.007) *		
Ethnic group: black (vs. white)			0.00(0.009)		
Ethnic group: other (vs. white)			0.01(0.017)		
Receipt of informal care and service packages					
Practical help from inside household			0.02(0.003) *		
Practical help from outside household			0.01(0.003) *		
Services: Home Care			0.01(0.003)		
Services: Direct payment			0.02(0.005) *		
Services: Equipment			0.00(0.003)		
Local authority level indicators					
Local deprivation indicator			0.00(0.000)		
Local median wage			0.00(0.000)		
Local population density			0.00(0.000)		
Local expenditure per head of population			0.01(0.024)		
Local authority type: two-tier (vs. one tier)			0.00(0.003)		
Assistance with the survey					
Survey help: proxy			-0.04(0.007) *		
Survey help: assistance from careworker			0.04(0.005) *		

Survey help: assistance from inside household				0.00(0.004)	
Survey help: assistance from outside household				-0.01(0.003) *	
N	18431	16738	14756	22049	16738
R^2	0.32	0.43	0.45	0.42	
F-test	2313 *	1340 *	327 **	1282 *	
AIC	-17105	-18456	-16467	-24155	
Pregibon link test (p)	p <.001	p <.001	p <.001	p <.001	p <.001
Ramsey omitted variable test (p)	p <.001	p <.001	p <.001	p <.001	N.A.

* p<.01

Table 4. *Interactions for 'accessibility of information and advice' and SCRQoL; 'design of home' and SCRQoL and 'accessibility of local area' and SCRQoL*

The positive association between **' finding information'** and SCRQoL is
stronger
- For those with more ADL difficulties (b=0.003)

and **weaker**
- For those with better perceived home design (b =-0.006)
- For those with more accessibility of local area in the area (b =-0.007)
- For questionnaires filled in with help from a care worker (b =-0.011) or someone outside the home (b =-0.009)
- For those with practical help from someone inside (b =-0.022) or outside (b =-0.012) household

The positive association between '**home design'** and SCRQoL is
stronger
- For those who are more depressed/anxious (b =0.011)

and **weaker**
- For those who find it easier to get information/advice (b =-0.007)
- For those with better perceived health (b =-0.009)
- For those with practical help from someone inside household (b =-0.013)

The positive association between '**getting around'** and SCRQoL is
stronger
- For those who are more depressed/anxious (b =0.009)
- For those with more ADL difficulties (b =0.002)

and **weaker**
- For those who find it easier to get information/advice (b =-0.007)
- For those with practical help from someone inside household(b =-0.005)
- For those who receive homecare (b =-0.004)

Note: *b* shows the regression coefficient for the interaction term
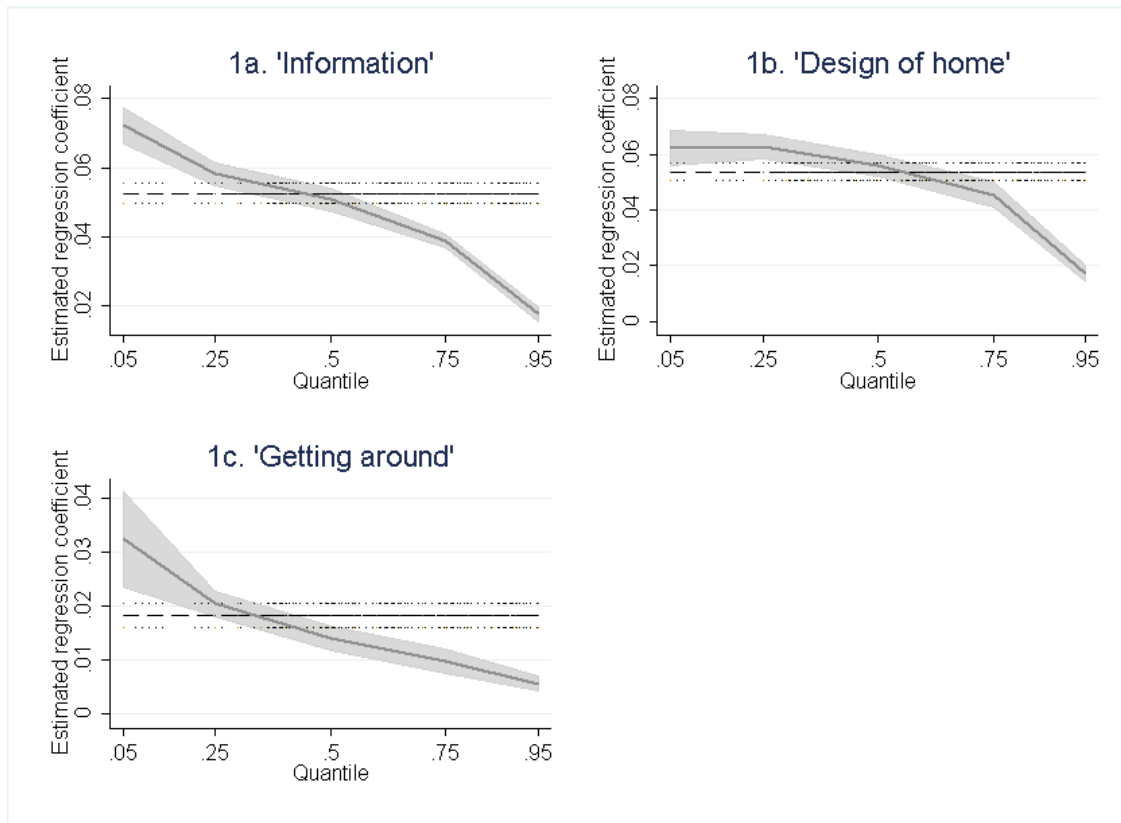
Figure 1. Estimated quantile regression coefficients.
Estimates and 95% confidence bands (thick lines with grey areas) for the adjusted regression coefficients associated with the main independent variables, by quantiles of SCRQoL. The thin straight lines show regression coefficients and 95% confidence bands estimated with the OLS technique.