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Identifying the impact of adult social care: Interpreting outcome data for use in the Adult Social Care Outcomes Framework

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The Policy Research Unit in Quality and Outcomes of person-centred care (QORU) is a collaboration involving researchers in health and social care from the Universities of Kent, Oxford and the London School of Economics (LSE), funded by the Department of Health.

Our aim is to improve the quality of health and social care of people with long-term conditions through generating high-quality evidence about need, quality and outcomes of person-centred care.

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Executive summary

Introduction

1. In England, the Adult Social Care Outcomes Framework (ASCOF) is an important part of the policy strategy to drive improvements in social care through the measurement of long-term outcomes. The ASCOF places the outcomes of individuals who use social care at the centre of defining the quality and effectiveness of social care services and local or national policy.
2. The ASCOF includes overarching measures of social care-related quality of life (SCRQoL) for users of social care and for (unpaid) carers. These are collected using national surveys of these groups of people (ASCS and SACE).
3. The SCRQoL indicator in ASCOF is intended to capture the effect of social care services on people’s lives. Nonetheless, it is important to acknowledge that many factors affect the SCRQoL in the population, and many of these are outside the direct control of social care services.
4. The aim of this project was to develop outcome indicators that might better reflect the contributions made by adult social care. Specifically, the project sought to identify a way by which data collected from the ASCS and SACE could be used to generate a measure of ‘added value’ reflecting the impact of support provided by local authorities (LAs) on social care-related outcomes.
5. A supplementary aim was to provide initial estimates of the productivity (cost-effectiveness) of (community-based) social care.

Concepts

6. As stated in the 2014 Care Act, a core purpose of the care system is to improve the wellbeing of service users. The ASCOT SCRQoL measure used in the outcomes framework is an appropriate measure, being person-centred and focused on elements of a person’s wellbeing or quality of life that are relevant to the needs and care of people that encounter the care system.
7. In general, where people have needs due to their underlying condition, frailty and impairment, their SCRQoL is reduced. Care services aim to restore SCRQoL. There are also a range of other factors that affect a person’s SCRQoL, including their socio-demographic characteristics, income, expectation, etc.
8. Many of these factors – including the underlying needs of the local population – are beyond the direct control of LAs. Differences between areas in terms of these population characteristics will therefore lead to different SCRQoL scores that are nothing to do with the activities of the care system.
9. In principle we can seek to remove the effects of external factors, subtracting them from population SCRQoL scores, in order to leave an ‘adjusted’ SCRQoL score which better reflects the activities of the care system.

Methods

10. Statistical models can be used to attribute the differences in SCRQoL between individuals to differences in their characteristics and circumstances. In this way we can understand the specific impact that different factors have on people’s SCRQoL. By isolating the impact of factors beyond the control of LAs (i.e. the *external* factors), an adjusted SCRQoL score can be calculated.
11. The project collected a wide range of data from a sample of care recipients and their carers. Specifically, we collected data from 990 people with either physical or sensory impairment (PSI,

546 people), mental health problems (MH, 224 people) or learning disabilities (LD, 220 people). Also, data were collected from 387 carers who helped look after a subset of these care recipients. The data were collected by interview (mainly face-to-face, or by telephone).

12. Conceptually, a person's current SCRQoL is affected by: the care services they use; external factors, mainly reflecting their 'need' (e.g. activities of daily living (ADL) impairment, age, self-rated health, limiting illnesses and environmental indicators) and 'other' factors. Three statistical approaches were used in the study, differing by how they distinguish these factors:
    a. First, a risk adjustment approach which estimated the relationship between sample SCRQoL and the external (risk) factors.
    b. Second, a production of wellbeing approach which also estimates the relationship between sample SCRQoL and the external (risk) factors, but in this case also including the amount of care people received.
    c. Third, an approach that uses the *expected* ASCOT tool which asks people to hypothetically rate their SCRQoL as if they did not receive services. Again, we estimated the relationship between this measure and the external factors.
13. Each of these approaches produces a formula calculating a person's SCRQoL score using their values of all the relevant factors. The net effect of the external factors can then be subtracted from the (unadjusted) SCRQoL score using the values in the formula to give an *adjusted* score.

Data

14. The study aimed to sample the same population of social care service users captured by the ASCS, with the exclusion of clients in residential or nursing care and those in the 'substance misuse' and 'vulnerable people' client groups. In the main, IIASC samples were broadly consistent with ASCS sample. The IIASC PSI and MH samples had a slightly higher proportion of males, younger age groups and those with significant social care needs. The learning disability subgroup has a higher proportion of male respondents and a lower level of social care need than the 2012/13 ASCS sample.
15. We used the utility-weighted score in the study (rather than the equally weighted version in the ASCS) to reflect the different importance people place on the different elements that make up their overall SCRQoL. The scale is anchored, with zero being no better than being dead, and a value of one meaning ideal (social care-related) quality of life.
16. In the IIASC sample, the mean value of current (utility-weighted) SCRQoL was 0.74 for the PSI group, 0.71 for the MH group, and 0.87 for the LD group. The self-reported expected (in the absence of social care support) SCRQoL score (again utility-weighted) was much lower: 0.31 for the PSI group, 0.41 for the MH group and 0.51 for the LD group.
17. In other words, respondents felt that services and support increased their SCRQoL by 0.43 for the PSI group, 0.30 for the MH group and 0.36 for the LD group. The remaining part of the current SCRQoL is affected by other factors, not social care services and support.

Results

18. Separate results were estimated for carers and cared-for people. As regard the latter, after some experimentation we opted for two estimations: one combining the PSI and MH groups and the other for people with LD.

Cared-for people

19. In accordance with our theoretical model, the following groups of variables were used for external factors: the individual's socio-demographic characteristics; health and impairment; and home and local environment. In each statistical analysis we also used interview administration

and help variables as controls. Finally, service mix and intensity variables were used with the production of wellbeing method.

20. In all the estimations the external factors were all highly statistically significant.
21. The adjustment process resulted in some change in the relative score for service users. For the PSI+MH group in the IIASC sample, the degree of correlation between the adjusted and unadjusted scores was between 0.60 and 0.79 (depending on the approach used). A correlation of one would indicate no (ordinal) difference between scores; a correlation of zero would mean that they are completely different (unrelated). For the LD group, the correlation between the adjusted and unadjusted scores was between 0.68 and 0.86. In both cases, the preferred models were those that also produced the lower correlations in these ranges.
22. The adjustments were also applied to the full ASCS sample for the PSI+MH group. Balancing the need to be as inclusive as possible of external factors and minimising misspecification bias, we recommend the following adjustment factor for the **PSI+MH group** (which uses the production of wellbeing approach):

Adjustment factor =		0.5798
Age:- Is the person over ≥ 65 years: if Yes, add:	(+)	0.0473
Self-rated health: if the rating is ‘fair’ then subtract:	(−)	0.0148
Self-rated health: if the rating is ‘bad’ or ‘very bad’ then subtract:	(−)	0.1090
Count of ADLs with difficulty or unable to complete alone without help: subtract:	(−)	0.0202 × count
Design of home: if it ‘meets most needs’, subtract:	(−)	0.0308
Design of home: if it ‘meets some needs or inappropriate’, then subtract:	(−)	0.1250
Access to local environment: if ‘difficult to get to all places’, subtract:	(−)	0.0603
Access to local environment: if ‘unable to get to all places or do not leave home’ subtract	(−)	0.1100

23. The adjusted score is: *Adjusted SCRQoL = Current (utility-weighted) SCRQoL - Adjustment factor.* For example, take Mrs X from Anyshire local authority. She is: over 65; her self-rated health is ‘bad’; she has difficulty with five ADLs; her home design is ‘inappropriate’; and she finds that she is ‘unable to get to all places’ in terms of the access to the local environment.
24. Using adjustment equation (2) above, her adjustment factor = 0.5798 + 0.0473 + 0 – 0.109 – 0.101 + 0 – 0.125 + 0 – 0.11 = 0.182. Mrs X reports in the ASCS survey her current SCRQoL as 0.400. Therefore her adjusted score is 0.218. The mean value across each respondent in the Anyshire survey gives the overall Anyshire adjusted SCRQoL score.
25. In comparing the adjusted score for each LA against the unadjusted score, we found quite a substantial change. The correlation between mean adjusted and unadjusted scores was 0.62.
26. The adjustment therefore leads to a change in the ranking of LAs. When comparing LAs’ quartile ranking, the adjustment of the SCRQoL score would change the quartile position of 56% of LAs. Specifically, 44% of LAs would stay in the same quartile when their score was adjusted; 37% would move one quartile up or down; and the remaining 19% would move more than one quartile.
27. We calculated a similar formula for people with LD. However, due to the more limited availability of data, this adjustment is perhaps less robust than the PSI+MH version.

Carers

28. In the analysis for carers we used the new ASCOT carer measure. It was chosen because it is conceptually more consistent with the service user measure and because it can produce the expected SCRQoL score (i.e. the score in the absence of services).

29. The following groups of variables were used for external factors affecting carer's SCRQoL: the carer's socio-demographic characteristics; carer health; living situation (co-habiting carer); and cared-for person's health and needs. Compared to other carers, people had lower carer SCRQoL where: the cared-for person had higher needs; where the carer co-habited with the cared-for person; and where the carer's health was poor. Other things equal, employed carers and carers of older people had better carer SCRQoL than other carers.
30. As above, using the adjusted against the unadjusted ASCOT score for carers made a significant difference. Within the IIASC carers sample, the correlation between people's adjusted and unadjusted score ranged between 0.68 and 0.87 (the preferred model produced the 0.68 correlation).
31. The adjustment for **carers** is (using the preferred model):

Carers adjustment factor =		14.353
Care recipient: has 'dementia', then subtract:	(−)	1.820
Care recipient: has 'mental health problem', subtract:	(−)	0.703
Care recipient: has 'sensory impairment', subtract:	(−)	1.508
Carer: is 45+, then subtract:	(−)	1.807
Carer: is 'male', then add:	(+)	1.437
Carer: is 'white', then add:	(+)	0.634
Carer: is 'employed full-time', then subtract:	(−)	0.036
Carer: if the 'carer lives with care recipient', then subtract:	(−)	3.339
Carer: if the carer has a 'physical problem', then subtract:	(−)	2.401
Carer: if the carer has a 'mental health problem' then subtract:	(−)	1.419

32. Adjusted carer SCRQoL score = 3.88 + 0.604 × SACE carer SCRQoL score + 0.055 × (SACE carer SCRQoL score)^{2} – carer adjustment factor.

Discussion

33. When we compare unadjusted SCRQoL scores between LAs, a significant part of the difference between LAs is due to characteristics of the local population that are beyond the control of the LA. For example, a LA with a well-performing care system could have a lower score than another LA with a poorer-performing system because the first LA happened to have a less healthy/more impaired population than the other LA. The adjusted SCRQoL score should help to account for these differences, potentially reversing the ranking between the two LAs in this example.
34. The adjusted score seeks to estimate the improvement produced by support in people's SCRQoL. Since there is no benchmark for gauging improvement, the adjusted score on its own has limited meaningfulness. Rather, it should be used for comparison: e.g. comparing between LAs and/or changes over time. The adjusted score removes the effects of the main measurable external factors. It does not remove *all* possible external effects, so again best used in a comparative way.
35. Our immediate conclusions with respect to the ASCOF are that the adjustment for external effects is (a) merited in theory, and (b) feasible and empirically meaningful given the data available. With regard to the latter point, the data currently in the ASCS and SACE national surveys can be used to make adjustments. Further data collection and/or linkage of data sets would bring some improvements in how well we account for external factors (especially in the carers' case).

36. There are a number of issues when using the adjusted score to assess performance. First, there needs to be agreement that the external factors used are really beyond the control of LAs (as we contend). Second, limitations with getting data mean that the PSI+MH adjustment is the most robust. The LD and carers measures are more tentative. Third, we used the utility-weighted versions of the SCRQoL indicators for cared-for people. Currently the equally-weighted versions are used in the ASCOF. Although the differences are small, the former better reflects the value people put on care-related quality of life. Fourth, for carers we used the new ASCOT carer measure to underpin the analysis. The adjusted score, however, can be calculated with the current PSS SACE indicator, as required.
37. We would suggest that the adjusted score is used alongside the current (unadjusted) SCRQoL score in the ASCOF.

1. Introduction

In England, the Adult Social Care Outcomes Framework (ASCOF) is an important part of the policy strategy to drive improvements in social care through the measurement of long-term outcomes. The ASCOF places the outcomes of individuals who use social care at the centre of defining the quality and effectiveness of social care services and local or national policy.

The ASCOF was introduced in 2011 to increase transparency regarding the effectiveness of local authority social care for people with long-term conditions or disabilities and older adults. The ASCOF encompasses a number of centrally-reported outcome measures that enable comparison between local authorities. The principle behind the ASCOF is that this information will empower local communities to hold local authorities to account for public care services, which will drive local innovation in social care policy and the commissioning and delivery of services.

The ASCOF includes two overarching measures of social care-related quality of life (SCRQoL) for users of social care and their informal (unpaid) carers. Although these self-reported quality of life measures are central to the aims of the ASCOF: that is, to capture the effect of social care services on people's lives, it is important to acknowledge potential attribution issues when comparing quality of life between local authorities or over time. Quality of life can be affected by a number of factors, some of which may be outside of the direct control of social care services and may fluctuate by geographic region or over time.

One approach to the attribution problem is the statistical adjustment of self-reported quality of life to remove the effect of non-service-related factors. There are various methodologies that may be applied to adjust indicators of social care-related quality of life in order to improve how well it measures the *impact* of the care system.

Preliminary analysis to compare these different methodologies has been conducted with the data collected in the Adult Social Care Survey (ASCS) (Malley and Fernandez 2014). However, this analysis was limited to the measures available in the ASCS questionnaire and data return completed by local authorities.

1.1 Policy context

Two areas of policy development are relevant to these issues. The first is the concept of using outcomes information to assess performance of the care system. The second is the principle of 'territorial justice', whereby in comparing performance between or allocating funding to local authorities, factors beyond the control of the local authority that affect performance, or the need for funding, should be taken into account.

In England, as well as internationally, there has been a shift since the 1990s from a focus on the outputs of public service delivery to the demonstration of 'good public governance' based on measurable long-term outcomes (Bovaird and Loffler 2003). This development has been characterised by a move from measuring the quality of services using delivery process-level outcomes to measuring the quality of life of those who use public services to drive improvements (Bovaird and Loffler 2003). This shift is founded on the principle that wellbeing or quality of life is the ultimate or final outcome of public services, and that service delivery should be structured around the delivery of this outcome rather than driven by internal process concerns.

The collection of self-reported quality of life through public sector surveys is a relatively new development in England, although earlier national surveys have collected data on service user experience and satisfaction (Health and Social Care Information Centre 2012). Key sources of self-reported outcomes include the Adult Social Care Survey (ASCS) and the Personal Social Services Survey of Adult Carers in England (SACE). ASCS is an annual survey of all publicly-funded social care service users, while the SACE is a biennial survey of informal carers known to local authorities.

The launch of the Adult Social Care Outcomes Framework (ASCOF) in 2011 provided a structure within which data from both the ASCS and SACE surveys could be used to monitor the performance of social care in England (Malley and Fernandez 2014). The ASCOF contains social care outcomes indicators, of which a number are collected in the ASCS and SACE. The Adult Social Care Outcomes Toolkit (ASCOT) provides an indicator of social care-related quality of life (SCRQoL) of service users covering eight domains or aspects of quality of life (Netten et al. 2012). There is a corresponding measure of the SCRQoL of informal carers covering six domains (Fox, Holder, and Netten 2010).

The purpose of the ASCOF is three-fold (Department of Health 2012):

1. Support councils to improve the quality of care and support by providing robust, nationally comparable information on outcomes and experiences of local people. The ASCOF supports meaningful comparisons between councils, helping to identify priorities for local improvement, and stimulating the sharing of learning and best practice.
2. Foster greater transparency in the delivery of adult social care by supporting local people to hold their council to account for the quality of services they provide.
3. Measure the performance of the adult social care system as a whole, and its success in delivering high quality, personalised care and support.

The ASCOF highlights that caution is required when interpreting comparisons since a wide range of factors (such as level of care need) may have an impact on outcomes (Department of Health 2012). Furthermore, while the ASCOF encourages comparisons between local authorities and/or over time, surveys such as ASCS and SACE can only provide an indication of the SCRQoL of service users and carers at any given time point.

The principle of territorial justice in social care has mainly developed in relation to resource allocation between local authorities (Davies 1968; Boyne 1991). The idea is that local authorities should be compensated for expenditure-relevant factors beyond their control. This principle applies readily to performance assessment. In particular, previous research is clear that a whole range of factors (e.g. the local population structure, the level of deprivation, the health status of the local population) – many clearly beyond the control of the local care system – affect SCRQoL in the population (Malley and Fernandez 2014; Rand, Malley, and Netten 2012 ; Forder et al. 2013). These factors could lead to differences in SCRQoL scores between LAs that have nothing to do with the performance of the local care system. Therefore, in making comparisons of performance, local authorities should be 'compensated' for relevant factors beyond their control.

Taken together, these policy principles imply the need to develop a performance measure that both reflects final outcomes and also accounts for factors beyond the control of local authorities. Previous research suggests that risk-adjustment or adjustment of external factors might be appropriate to meet this need (Iezonni 2013; Malley and Fernandez 2014; Darton et al. 2010).

This study – Identifying the Impact of Adult Social Care (IIASC) – was commissioned to provide research evidence to address these requirements.

1.2 Aims

The primary aim of this IIASC study is to develop outcome indicators that better reflect the contributions made by adult social care. Specifically, the IIASC study aims to identify a way by which data collected from the ASCS and SACE could be used to generate a measure of 'added value' reflecting the impact of support provided by LAs on social care-related outcomes.

The IIASC study collected in-depth information from service users and carers across 22 local authorities (LAs) in England. By including a wide range of measures of social care service use and non-service-related factors, the study aims to identify the best adjustment methodology to ensure a fair comparison between organisations and over time, and to provide recommendations for the use of this measure and the supplementary items to be collected in the ASCS and SACE. The study does not aim to address theoretical questions on the use of outcome measures in adult social care.

1.3 Structure of the report

The report is structured as follows. Chapter 2 outlines the theoretical framework within which the adjustment methodologies have been applied. The study methods are described in Chapter 3. Chapter 4 outlines the characteristics of the sample recruited to the study. The risk-adjustment and production function analyses concerning supported people are described in Chapter 5. The equivalent analyses for carers are reported in Chapter 6. Chapter 7 discusses these results to draw together the implications for the ASCOF.

2. Theoretical framework

2.1 What is social care trying to achieve?

Adult social care refers to a range of services or interventions to support an individual suffering impairment to achieve daily activities, such as personal care, feeding, keeping active or socialising (Fernandez, Forder, and Knapp 2011). Although there are intermediate goals, the ultimate objective of the adult social care (ASC) system, as explicitly stated in the 2014 Care Act, is to improve the (care-related) wellbeing of service users. 'Wellbeing', however, is clearly a broad concept, and in general a person's wellbeing is likely to be affected by a great many factors and experiences in their lives.

In using the concept of wellbeing (improvement) in social care, we need to be able to balance the aim of being comprehensive in assessing wellbeing changes against the need to understand how the ASC system has an impact on improving wellbeing.

A number of principles can help resolve this tension and suggest the use of SCRQoL as an appropriate wellbeing measure. First, social care is inherently person-centred, so the concept of wellbeing should be assessed at an individual person level, and not at the organisational or system level.

Second, the care system is concerned with people who have reduced wellbeing as a result of the (long-term) conditions they are suffering. As such, wellbeing concepts in relation to social care should focus on how an individual's quality of life is improved as they are helped to overcome these deficits or needs. In other words, we should narrow our perspective to people's experiences that affect wellbeing, but are also relevant to their needs (being supported).

2.2 Social care outcome indicators

The Adult Social Care Outcomes Framework (Department of Health 2013) uses both the service user and carer indicators of SCRQoL (ASCOF 1A, 1D) available in ASCOT and measured using data from the ASCS and the SACE (Department of Health 2013). The service user SCRQoL measure comprises eight domains. Each domain derives from the score on a single item rated on a four response-level Likert scale. An easy-read version of the instrument was developed for adults with a learning disability (Caiels et al. 2010; Malley et al. 2010). Based on analysis from the pilot ASCS in 2009/10, it was decided that the ASCOF measure would be the combined score from each of the eight domains assuming equal weights (Malley et al. 2010). Subsequently, a set of utility weights has been developed so as to reflect that people might put more or less weight on the different domains.[1]

The ASCOF measure includes only the equally-weighted (EW) measure, since the utility-weighted score was not available at the time. However, since the utility-weighted score provides additional information that should be considered when evaluating the effectiveness of policy and practice, the analysis presented in this report considers the utility-weighted (UW) SCRQoL score unless otherwise stated.

Box 1. ASCOF measures and indicators from the ASCS and SACE

ASCOF Domain 1: Enhancing quality of life for people with care and support needs

- 1A. Service user SCRQoL (ASCS)
- 1B. The Control over daily life domain from the ASCOT measure of SCRQoL (ASCS)
- 1D. Carer SCRQoL (SACE)
- 1I. The Social participation domain from the ASCOT and ASCOT-Carer measure of SCRQoL (ASCS, SACE)

ASCOF Domain 3: Ensuring that people have a positive experience of care and support

- 3A. Overall satisfaction of people who use services with their care and support (ASCS)
- 3B. Overall satisfaction of carers with social services (SACE)
- 3C. The proportion of carers who report that they have been included or consulted in discussions about the person they care for (SACE)
- 3D. The proportion of people who use services and carers who find it easy to find information about support (ASCS, SACE)

ASCOF Domain 4: Safeguarding adults whose circumstances make them vulnerable and protecting from avoidable harm

- 4A. The proportion of people who use services who feel safe (ASCS)
- 4B. The proportion of people who use services who say that those services have made them feel safe and secure (ASCS)

The carer measure of SCRQoL (ASCOF 1D) was developed in parallel with the ASCOT for users of social care services to include domains that are relevant to the concerns of carers (Fox, Holder, and Netten 2010; Holder, Smith, and Netten 2009; Smith, Fox, and Holder 2009). The version included in the SACE comprises six domains. Each domain is rated on a three response-level Likert scale.[2] The measure was originally developed with an seventh domain (*Space and time to be myself*), although

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[1] Utility weights was estimated using a combination of Best-Worst Scaling (BWS) and Time Trade Off (TTO) approaches (Netten 2011; Netten et al. 2012; Potoglou et al. 2011).

[2] See Appendix 1 for further details.

analyses of the pilot SACE indicated that this domain could potentially be omitted due to overlap with other domains (Malley, Fox, and Netten 2010).

For the purposes of this study, further development work has been undertaken to develop a seven-domain, four response-level instrument that mirrors the ASCOT for service users in the ASCS to explore the potential for combining the service user and carer measures (Rand, Malley, and Netten 2012).[3] The data collection for this study included both the six- domain, three-response-level version from the SACE (Carer SCRQoL) and the seven-domain four-response-level versions of the instrument (the ASCOT-Carer INT4). The analyses presented in this report are based on the ASCOT-Carer INT4 instrument unless otherwise specified. As there are currently no available utility weights for either the SACE Carer SCRQoL or ASCOT-Carer INT4 version of the instrument, the reported SCRQoL scores for informal carers are all equally-weighted (EW).

2.3 Why adjust social care outcome indicators?

As outlined above, a key challenge in using wellbeing measures like SCRQoL (ASCOT) for assessing the progress and impact of the ASC system is that, whilst the current SCRQoL of people in the care system (or average SCRQoL for a population group) will be affected by social care activity, it is also likely to be affected by factors unrelated to social care interventions, service delivery or policy. There is, as a result, a strong argument that we should adjust for these 'external' factors when assessing SCRQoL in a population.

Adjustment has been identified as an essential step when using non-experimental outcomes data, such as those collected from patient surveys or from administrative datasets, to quantify the effectiveness of care interventions or policy, to allow fair comparison between organisations that manage or provide care, and to evaluate changes over time (Iezonni 2013).

Adjustment methodologies generally involve developing a formula that uses external data to manipulate the baseline indicator (in this case SCRQoL) to give an adjusted indicator. They are normally in the form of simple linear equations: adjusted indicator = baseline indicator plus or minus a set of parameter-weighted factors.

Adjustment methodologies require (a) a *theoretical understanding* of the way in which various factors might impact on SCRQoL; and (b) *appropriate data* to be used in actually making adjustments.

There is some argument about how precise the theoretical understanding needs to be, but at the very least we require a way to identify likely external factors. Although a range of theories can be used, there is no definitive choice and therefore we use a more general framework in this study.[4] Choosing a more specific theoretical framework might improve the precision of the adjustment rules, but would come with an increased risk that an inappropriate theory had been selected.

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[3] See Appendix 2 for details about how this measure was developed.

[4] See Appendix 3.

2.4 A framework for adjusting social care outcomes

The production of welfare framework (Davies 1985; Davies and Knapp 1981; Knapp 1984), with developments from Sen's capability theory and hedonic psychology (see Forder and Caiels 2011), lead to the following propositions which define our adjustment model:

- Quality of life, and in particular SCRQoL, is quantifiable and can be measured at any given time on a scale of essentially bad to good. Positive experiences improve people's quality of life at any given time and negative experiences worsen it (Netten et al. 2012; Forder and Caiels 2011).
- Care services/support 'produce' improvements in SCRQoL. The size of the improvement (the difference between SCRQoL 'with support' and SCRQoL 'without support') is the measurable impact of those services or support (Forder et al. 2013).
- The extent of this improvement is determined by (a) the intensity of support; (b) the effectiveness (or quality) of this support; and (c) the needs-related characteristics of recipients (Darton et al. 2010; Davies, Fernández, and Nomer 2000; Forder et al. 2013; Fernandez and Forder 2008).
- Perceived (subjective) improvement in SCRQoL will also depend on the degree to which people upwardly revise their expectations about what constitutes good quality of life when receiving high(er) levels of support.
- Quality of life is also determined by a range of other (non-care-related) experiences that people have in their lives and also by the expectations they hold about what these experiences mean. At least some of these external influences will be picked up by a SCRQoL measure such as ASCOT.
- The amount of public care services provided in an area is determined by eligibility criteria concerning people's needs-related characteristics and their financial situation (Department of Health 2003, 2010).
- Self-reported data on quality of life will potentially be influenced by the framing of questions, the mode of administration, and the amount and type of help people received in answering the questions.

By understanding how people's current SCRQoL is determined, we have a basis for isolating those factors which are beyond the control of the care systems and therefore serve as a basis for adjustment. For each person, their SCRQoL is a function of the following (Forder and Caiels 2011):

SCRQoL (y) = f^y(formal care, need, other experiences (m), expectations (b), other impacts (e^y))

Need is the negative effect on quality of life of experiences such as being in pain, insecure, lonely, depressed, etc. The effect of need will vary according to:

Need = f^n(underlying conditions (z^0); personal characteristics (z^1); environmental characteristics (z^2))

In other words, the effect of need on SCRQoL will vary with the personal and environment characteristics of the person (as indicated by age, gender, wealth, education and so on) and with the nature of the person's underlying conditions (e.g. as indicated by the prevalence of chronic illnesses or indicators of health status or disability).

The effect of (formal) care on SCRQoL – such as of services, support, etc. provided by the care system – will also vary according to a range of factors:

> Formal care = f^x(effectiveness of support (q), the amount/intensity of services (x), other impacts (e^x), underlying conditions (z^0); personal characteristics (z^1); environmental characteristics (z^2))

Other experiences will generally be unknown in the analysis but are likely to be correlated with personal and environment characteristics, as above. Similarly, expectations are hard to observe directly but should vary with these characteristics.

If we substitute for some of these functions into the SCRQoL function we are left with:

> SCRQoL (y) = f(effectiveness of support (q), the amount/intensity of support (x), underlying conditions (z^0); personal characteristics (z^1); environmental characteristics (z^2), other impacts (e))

Or in shorthand[5]:

$$y = f(q, x, z^0, z^1, z^2, e) \tag{1}$$

Following the fundamental premise outlined above, we consider that the adult social care system will not be able to (directly) affect: underlying conditions (z^0), personal characteristics (z^1), environmental characteristics (z^2), other impacts (e). All of these factors are therefore potential adjustors. In particular, if remove all these factors from the above equation, we are left only with the impact on SCRQoL due to the effectiveness of support (q) and the amount/intensity of support (x). This is exactly how we would want to compare LAs.

2.5 Utility weighting

Social care-related quality of life (SCRQoL) is measured using the Adult Social Care Outcomes Toolkit (ASCOT) indicator. The indicator combines people's rating in eight aspects of their life, ranging from their experience of basic functioning such as feeding and dressing, to higher order domains such as social contact and occupation. Because people place different degrees of importance on these domains and between levels within the domains, the ASCOT tool uses a set of 'utility weights' which are multiplier numbers that apply to each possible rating (Netten et al. 2012).

The ASCOT measure used in the ASCOF currently is equally weighted i.e. it does not give greater weight to some domains than others. This option is more straightforward, but since the research to derive the utility weights clearly showed that people place more weight on some outcomes than others, we argue that the utility weighted version should be used. For this reason, the main analysis below uses the weighted SCRQoL score.

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[5] It is important to note that the impact of support will also be independently affected by these characteristics. In particular, both the effectiveness of support (q) and the amount/intensity of support (x) are influenced by people characteristics and conditions in terms of (a) the amount of support they are assessed as needing and (b) because care systems are inherently personal and so their effectiveness is dictated by the characteristics of the recipient.

3. Methods

3.1 Statistical analysis

A statistical analysis is used to establish an estimated relationship between determinant factors and SCRQoL.[6] [7] A statistical model counterpart to the above theoretical model – equation (1) – is[8]:

$$y_i = \beta_0 + f^x(x_i, q_i, z_i; \beta_1) + \beta_2 z_i^0 + \beta_3 z_i^1 + \beta_3 z_i^2 + e_i \qquad (2)$$

where:

y_i is SCRQoL
x_i is the amount/intensity of support
q_i is the effectiveness of support
z_i^0 is underlying conditions
z_i^1 is personal characteristics
z_i^2 is environmental characteristics (including survey administration indicators)
e_i is other factors (the independently-distributed error term)

The subscripts i denote each individual in the sample. The βs are the estimated regression coefficients.

With regard to the above model (2), we can differentiate three groups of factors:

- Risk adjustors: underlying conditions; personal characteristics; and environmental characteristics (including survey administration indicators) – the z terms in (2)
- The impact of care services/support: the function of amount/intensity of support and effectiveness of support – the $f^x(x_i, q_i; \beta_1)$ function in (2)
- The independently-distributed error term – the e_i in (2)

3.1.1 The risk-adjustment approach (RA)

This approach estimates a model of current SCRQoL using just the risk adjustors. As such, the residual of this model – which we label the RA error – is the adjusted SCRQoL score, with the effects of external risk factors being removed. This error captures the impact of care services/support and the effect of other factors (the independently distributed error, e_i).[9] The mean value of the RA error can be calculated for each local authority (LA). Differences between LAs in this mean value therefore give an indication of the differences in how much improvement in SCRQoL is generated for the local population in each LA.[10]

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[6] Appendix 5 describes the statistical methods in detail.

[7] Analyses were conducted in Stata version 13 (Statacorp 2013).

[8] We have implicitly assumed that the function f^{y2} in (1) is a linear (additively separate) function over needs-related and other characteristics, and with a function f^x representing the impact of services. An independent distributed error is assumed to capture any remaining differences.

[9] Strictly, it captures the total impact of services standardised for the whole-sample average impact of needs on the effects of services – see Appendix 5.

[10] This assumes that the effect of other (independently distributed) factors is not related to the local authority so that the mean value of the independently distributed error is zero for each LA subsample.

3.1.2 The production function approach (PF)

This approach estimates the full SCRQoL model, including the impact of service intensity directly. In this case, the error term – which we label the PF error – gives an adjusted SCRQoL score that incorporates the *effectiveness* of care service/support plus other factors. One option is to compare the mean values of the PF error for each LA, which gives an indication of the relative effectiveness of local services in producing improvement in SCRQoL for the local population. Another option, more comparable to the risk-adjustment approach, is to leave the intensity of service out of the adjustment[11] so that comparisons of adjusted SCRQoL in this case give an indication of the differences in how much improvement in SCRQoL is generated for the local population in each LA.[12]

3.1.3 The expected quality of life approach (EQ)

In this method, we estimate a model of 'expected SCRQoL' using the risk adjustors. The expected SCRQoL is what respondents in the survey expect their quality of life to be in the absence of services: i.e. it is directly measured. In theory, this direct measure should summarise the net effect of the risk adjustors on quality of life. We can then subtract this value from the current SCRQoL score to generate a residual akin to the RA error. In the same way as the above methods, the average value of this residual at the LA level should be a good indicator of how much improvement in SCRQoL is generated for the local population in each LA.

3.2 Study design and data collection

The statistical analysis required the collection of bespoke data. As a result we conducted a survey of social care service users across 22 local authorities in England. [13] Each LA was asked to identify a sample of service users in receipt of community-based support from their social care records. Clients who consented to take part in the research were then interviewed using a structured questionnaire approach to gather data.

Prior to the data collection, a favourable ethical opinion was obtained from the Social Care Research Ethics Committee (SCREC). The research was authorised by the research governance process for each local authority that had agreed to participate in the study.

A project advisory group was set up comprising the research team and key stakeholders, including representatives from the Health and Social Care Information Centre (HSCIC), local authorities, the Department of Health and two public representatives, who were experts by their experience of social care as a user or informal carer. The group met four times throughout the project, to discuss the design and initial phase of the project, and proposed changes to the methodology during the fieldwork. The advisory group was also supported by three public involvement (service user/carer) representatives from the QORU Research Advisor panel, who were consulted at key stages of the project for their views on the feasibility and acceptability of the research design, the study documentation and lay summary reports.

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[11] Effectively putting this effect in the residual.

[12] This approach will give a different result from the basic risk-adjustment approach because it removes the correlation between need and service intensity. It does not impose the standardisation (for the whole-sample average impact of needs on the effects of services) inherent in the risk-adjustment approach – see footnote 9.

[13] Appendix 4 gives full details of the study design and data collection.

As is common in primary data collection studies, there were instances of missing data in the sample. We used two main approaches.[14] First, casewise deletion: i.e. only using respondents with a full set of non-missing data as required for the particular analysis. Second, missing data were 'imputed' to generate a full dataset.

4. Data

The main source of data for the study was the IIASC sample. We also drew on the corresponding ASCS surveys.

4.1 IIASC sample characteristics

4.1.1 Service users

The study aimed to sample the same population of social care service users captured by the ASCS[15] with the exclusion of clients in residential or nursing care and those in the 'substance misuse' and 'vulnerable people' client groups. The ASCS captures a diverse population of users of publicly-funded social care services/support with a variety of social care needs and circumstances.

Although the population of eligible community-based service users in England is predominantly those with physical disabilities or sensory impairment (PDSI) (67.6%), with a much smaller proportion of clients with mental health (MH) conditions (16.8%) and learning disabilities (LD) (12.8%),[16] the study set out to sample three subgroups of equal size to allow separate analyses to be conducted with sufficient sample size per subgroup. However, due to the smaller population size and relative difficulty of recruiting clients from the learning disability and mental health groups, the study sample of these two subgroups is smaller (MH, n=224; LD, n=220) than for the PDSI subgroup (n=546) and for the original target sample of 500 service users per subgroup. Due to the limited sample size, the separate analyses in this report for the LD and MH subgroups are exploratory.

The sample was drawn either from a non-stratified random sample of the eligible clients in each local authority's social care database or from those respondents from the 2012/13 ASCS who indicated that they would like to receive information about follow-up research. A small number of clients (PDSI, n=1; MH n=2; LD, n=16) were recruited separately via local providers of home care. In total 14,021 letters were sent out by the councils (13,654) and home care providers (367). A total of 1,730 return slips were received (12.3% response rate). Of these, 1,441 indicated an interest in participating in the study and met the study inclusion criteria. A total of 990 valid interviews were in the final dataset: 546 adults with physical disability or sensory impairment, 224 adults with mental health conditions and 220 adults with learning disability. The outcomes of the remaining contacts are summarised in Table 1.

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[14] See Appendix 5 for details.

[15] The ASCS data collections are conducted based on guidance published by the Health and Social Care Information Centre (see http://www.hscic.gov.uk/socialcare/usersurvey). The sample is selected from those who were in receipt of public-funded services (i.e. not self- or full-payers), as defined by those included in Referrals, Assessments and Packages of care (RAP) P forms, on a specified date between 30th September and 31st December of the year before the survey.

[16] Based on local authority data returns to the Health and Social Care Information Centre (HSCIC) for the 2011/12 ASCS.

Table 1. Fieldwork outcomes

Outcome	Frequency
Number of letters sent out by councils and home care providers	14,021
Number of positive return slips (i.e. met inclusion criteria and interested in study)	1,441
Number of valid interviews with users of social care services	990
Fieldwork agency unable to contact the service user during fieldwork period	238
Service user declined to participate when contacted by fieldworker	124
Out of scope (lacked mental capacity to participate or in nursing/residential care)	76
Deceased	6
Not available during fieldwork period	3
Retrospective request to remove data from the study after interview completed	4

The characteristics of the sample of service users by subgroup in comparison to the final sample respondents from the 2012/13 ASCS are shown in Figure 2. The IIASC PSI/MH sample was broadly consistent with ASCS sample, but with a higher proportion of males, of younger age groups and of social care needs (as measured by I/ADLs). Similarly, the mental health subgroup had a larger proportion of respondents in the younger age groups and with higher social care needs than the ASCS sample. The learning disability subgroup has a higher proportion of male respondents and a lower level of social care need than the 2012/13 ASCS sample.

Table 2. Characteristics of the study sample compared to the 2012/13 ASCS sample of community-based clients

	PDSI		MH		LD	
	IIASC Frequency % (n=546)	2012/13 ASCS Frequency % (n=37,763)	IIASC Frequency % (n=224)	2012/13 ASCS Frequency % (n=6,060)	IIASC Frequency % (n=220)	2012/13 ASCS Frequency % (n=8,901)
Sex						
Female	325 (59.5%)	25,236 (66.8%)	122 (54.5%)	3,332 (55%)	86 (39.1%)	3,904 (43.9%)
Male	221 (40.5%)	12,476 (33.1%)	102 (45.5%)	2,722 (44.9%)	134 (60.9%)	4,995 (56.1%)
Missing	0 (0.0%)	51 (0.1%)	0 (0.0%)	6 (0.1%)	0 (0.0%)	2 (0.0%)
Age group						
18-64 years	96 (35.9%)	8,608 (22.8%)	155 (69.2%)	3,513 (58.0%)	205 (93.1%)	8,030 (90.2%)
65 or over	340 (62.3%)	29,155 (77.2%)	66 (29.5%)	2,547 (42.0%)	14 (6.4%)	862 (9.7%)
Missing	10 (1.8%)	0 (0.0%)	3 (1.3%)	0 (0.0%)	1 (0.5%)	9 (0.1%)
Self-rated health						
Very good	33 (6.0%)	1,614 (4.3%)	16 (7.1%)	502 (8.3%)	90 (40.9%)	3,280 (36.9%)
Good	123 (22.5%)	7,903 (20.9%)	56 (25.0%)	1,491 (24.6%)	63 (28.6%)	2,726 (30.6%)
Fair	222 (40.7%)	18,028 (47.7%)	89 (39.8%)	2,546 (42.0%)	47 (21.4%)	1,966 (22.1%)
Bad	116 (21.3%)	6,751 (17.9%)	47 (21.0%)	1,017 (16.8%)	13 (5.9%)	662 (7.4%)
Very bad	51 (9.3%)	2,403 (6.4%)	16 (7.1%)	332 (5.5%)	7 (3.2%)	99 (1.1%)
Missing	1 (0.2%)	1,064 (2.8%)	0 (0.0%)	172 (2.8%)	0 (0.0%)	168 (1.9%)
I/ADLs. Find it difficult to….						
Get around indoors	401 (73.4%)	20,616 (54.6%)	73 (32.6%)	1759 (29.0%)	26 (11.8%)	1,327 (14.9%)
Get in/out of bed/chair	346 (63.4%)	19,456 (51.5%)	77 (34.4%)	1,626 (26.8%)	21 (9.6%)	1,256 (14.1%)
Feed self	287 (52.6%)	8,942 (23.7%)	76 (33.9%)	1,166 (19.2%)	20 (9.1%)	1,049 (11.8%)
Finances/paperwork	363 (66.5%)	24,599 (65.1%)	147 (65.6%)	4,014 (66.2%)	197 (89.6%)	7,817 (87.8%)
Wash in bath/shower	429 (78.6%)	26,583 (70.4%)	109 (48.7%)	2,576 (42.5%)	74 (33.6%)	3,963 (44.5%)
Get un/dressed	432 (79.1%)	22,857 (60.5%)	99 (44.2%)	1,976 (32.6%)	39 (17.7%)	2,596 (29.2%)
Use toilet	282 (51.7%)	13,971 (37.0%)	59 (26.3%)	1,130 (18.7%)	31 (14.1%)	1,785 (20.1%)
Wash hands and faces	221 (40.5%)	9.879 (26.2%)	45 (20.1%)	955 (15.8%)	29 (13.2%)	1,918 (21.6%)
I/ADLs. Unable to….						
Get around indoors	168 (30.8%)	6,006 (15.9%)	22 (9.8%)	405 (6.7%)	13 (5.9%)	650 (7.3%)
Get in/out of bed/chair	179 (32.8%)	6,990 (18.5%)	28 (12.5%)	417 (6.9%)	9 (4.1%)	707 (7.9%)
Feed self	177 (32.4%)	2,474 (6.6%)	36 (16.1%)	305 (5.0%)	9 (4.1%)	594 (6.7%)
Finances/paperwork	297 (54.4%)	17,195 (45.5%)	120 (53.6%)	2,538 (41.9%)	156 (70.9%)	7028 (79%)
Wash in bath/shower	342 (62.6%)	16,080 (42.6%)	66 (29.5%)	1,218 (20.1%)	21 (9.6%)	1,662 (18.7%)
Get un/dressed	307 (56.2%)	11,164 (29.6%)	57 (25.5%)	770 (12.7%)	13 (5.9%)	1,106 (12.4%)
Use toilet	149 (27.3%)	6,310 (16.7%)	23 (10.3%)	443 (7.3%)	11 (5%)	892 (10.0%)
Wash hands and faces	122 (22.3%)	3,921 (10.4%)	18 (8.0%)	403 (6.7%)	14 (6.4%)	892 (10.0%)

4.1.2 Carers

The carers were recruited via the service users interviewed for the study. If an interview identified that the respondent received informal, unpaid help from a friend, neighbour or relative, then the interviewer asked the respondent whether they would agree to pass an invitation letter to their primary carer.

The service user interviews identified a total of 739 primary informal carers (PDSI n=449; MH n=170; LD n=120). Of these, 510 respondents agreed to pass on a letter of invitation to participate in the study to their carer (PDSI n=316; MH n=102; LD n=92). A total of 387 informal carers were recruited and completed an interview. In 54% of cases (n=208), the interview took place on the same day as the interview with the service user. The remaining interviews were conducted within 60 days of the interview with the service user (n=386[17]; mean 3.88; SD 7.46; min 0; max 60)

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[17] The number of days between the service user and carer interview was not known (missing) in one case.

Table 3. Characteristics of the carer sample compared to the 2012/13 SACE sample

	IIASC	2012/13 SACE†
	Frequency % (n=387)	**Frequency % (n=53,317)**
Sex		
Female	228 (58.9%)	35,345 (66.3%)
Male	159 (41.1%)	17,548 (32.9%)
Missing	0 (0.0%)	424 (0.1%)
Age group		
18-64 years	221 (57.1%)	25,777 (48.3%)
65 or over	166 (42.9%)	24,923 (46.8%)
Missing	0 (0.0%)	2,617 (4.9%)
Co-residence		
Cared-for person lives elsewhere	90 (23.3%)	12,657 (23.7%)
Live with cared-for person	297 (76.7%)	39,455 (74%)
Missing	0 (0.0%)	1,205 (2.3%)
Duration of caring		
Less than one year	19 (4.9%)	2,430 (4.6%)
Over one year but less than 3 years	45 (11.6%)	8,685 (16.3%)
Over 3 years but less than 5 years	38 (9.8%)	8,891 (16.7%)
Over 5 years from less than 10 years	82 (21.2%)	11,920 (22.3%)
Over 10 years but less than 15 years	55 (14.2%)	6,390 (12.0%)
Over 15 years but less than 20 years	49 (12.7%)	3,777 (7.1%)
20 years or more	99 (25.6%)	9,984 (18.7%)
Missing	0 (0.0%)	1,240 (2.3%)
Hours of care per week		
0-9 hours	56 (14.5%)	2,669 (5.0%)
10-19 hours	47 (12.1%)	3,818 (7.2%)
20-34 hours	51 (13.2%)	3,769 (7.1%)
35-49 hours	65 (16.8%)	4,026 (7.6%)
50-99 hours	83 (21.5%)	9,106 (17.1%)
100 or more hours	84 (21.7%)	18,243 (34.2%)
Varies – less than 20 hours	n/a	1,725 (3.2%)
Varies – 20 hours or more	n/a	3,633 (6.8%)
Missing	1 (0.2%)	6,328 (11.8%)
Care tasks		
Personal care	256 (66.2%)	35,190 (66.0%)
Physical help	249 (64.3%)	30,461 (57.1%)
Help to deal with care services and benefits	330 (85.3%)	45,031 (84.5%)
Help with paperwork or finances	322 (83.2%)	44,754 (83.9%)
Other practical help	378 (97.7%)	49,154 (92.2%)
Keeping company	373 (96.4%)	43,088 (80.8%)
Taking the care recipient out	336 (86.6%)	39,891 (74.8%)
Giving medicines	272 (70.3%)	39,887 (74.8%)
Keeping an eye on care recipient	379 (97.9%)	47,850 (89.8%)
Emotional support	379 (97.9%)	44,219 (82.9%)
Other	192 (49.6%)	10,949 (20.5%)
Health		
No disability, illness or long-term conditions	176 (45.5%)	21,123 (39.6%)
Primary client group of cared-for person		
Physical disability and sensory impairment	242 (62.5%)	34,479 (64.7%)
Mental health	76 (19.7%)	8,236 (15.5%)
Learning disability	69 (17.8%)	6,060 (11.4%)
Other (substance misuse/vulnerable adults)	0 (0.0%)	1,256 (2.3%)
Missing	0 (0.0%)	3,286 (6.1%)

† Excluding carers of those permanently resident in a care home

The characteristics of the sample of carers are shown in Table 3 alongside those of the 2012/13 SACE sample (respondents only). There are some differences in the characteristics of the study sample compared to the SACE sample: for example, there is a higher proportion of males and carers who have looked after the cared-for person in the IIASC study sample compared to the SACE sample. This would be expected given the differences in sampling in SACE, which is based on a random sample of all eligible carers, and the IIASC study, which recruited carers through the cared-for person.

4.2 Social care-related quality of life

4.2.1 Service users

The distributional statistics for the outcome variables and all ASCOT domains are shown in Table 4 (current SCRQoL) and Table 5 (expected SCRQoL). The ASCOT current SCRQoL score is negatively skewed and peaked (leptokurtic) (see Figure 1 for the equally-weighted score for PSI/MH groups, Figure 2 for the utility weighted score, and Figure 3 for the LD group scores). The distributions vary between the client subgroups, with higher average scores for adults with learning disabilities than for people with mental health conditions or physical disabilities. Across all three client groups there is a spike at the upper end of the scale, although this is again more pronounced for the LD group. Whereas only 4.4% (n=24) of the PDSI sample rated their quality of life at the ideal state across all eight ASCOT domains, 6.3% (n=14) of the mental health client sample and 14.6% (n=32) of the LD sample reported an ASCOT score at the maximum of the scale.

Table 4. Distributional statistics for current SCRQoL and ASCOT domains

Variable	Physical disability & sensory Impairment Mean (SD)	Mental health Mean (SD)	Learning disability Mean (SD)
ASCOT: SCRQoL-EW Score	**17.71 (4.08)**	**17.16 (4.32)**	**20.55 (3.13)**
ASCOT: SCRQoL-UW Score	**0.74 (0.21)**	**0.71 (0.21)**	**0.87 (0.14)**
Control over daily life	1.80 (0.95)	1.86 (0.90)	2.25 (0.84)
Personal cleanliness and comfort	2.52 (0.64)	2.35 (0.73)	2.73 (0.55)
Food and drink	2.65 (0.65)	2.55 (0.74)	2.81 (0.42)
Accommodation cleanliness and comfort	2.52 (0.69)	2.40 (0.79)	2.81 (0.42)
Personal safety	2.39 (0.78)	2.17 (0.94)	2.60 (0.72)
Social participation and involvement	1.83 (1.03)	1.71 (1.10)	2.32 (0.88)
Occupation	1.66 (0.97)	1.64 (0.97)	2.34 (0.75)
Dignity	2.34 (0.86)	2.27 (0.92)	2.60 (0.63)

Table 5. Distributional statistics for expected SCRQoL and ASCOT domains

Variable	Physical disability & sensory impairment Mean (SD)	Mental health Mean (SD)	Learning disability Mean (SD)
ASCOT: expected SCRQoL-EW Score	**10.28 (5.60)**	**12.00 (5.83)**	**14.11 (5.31)**
ASCOT: expected SCRQoL-UW Score	**0.31 (0.29)**	**0.41 (0.30)**	**0.51 (0.28)**
Control over daily life	0.67 (0.88)	1.03 (1.09)	1.40 (1.12)
Personal cleanliness and comfort	1.08 (1.11)	1.57 (1.14)	1.93 (1.12)
Food and drink	1.58 (1.28)	1.82 (1.20)	1.88 (1.11)
Accommodation cleanliness and comfort	1.40 (1.22)	1.65 (1.17)	1.89 (1.13)
Personal safety	1.10 (1.12)	1.32 (1.16)	1.39 (1.11)
Social participation and involvement	1.19 (1.13)	1.06 (1.11)	1.68 (1.12)
Occupation	1.06 (1.02)	1.13 (1.03)	1.41 (1.03)
Dignity	N/A	N/A	N/A

Figure 1. Distribution of ASCOT-EW scores for respondents in the physical disability and sensory impairment and mental health client groups

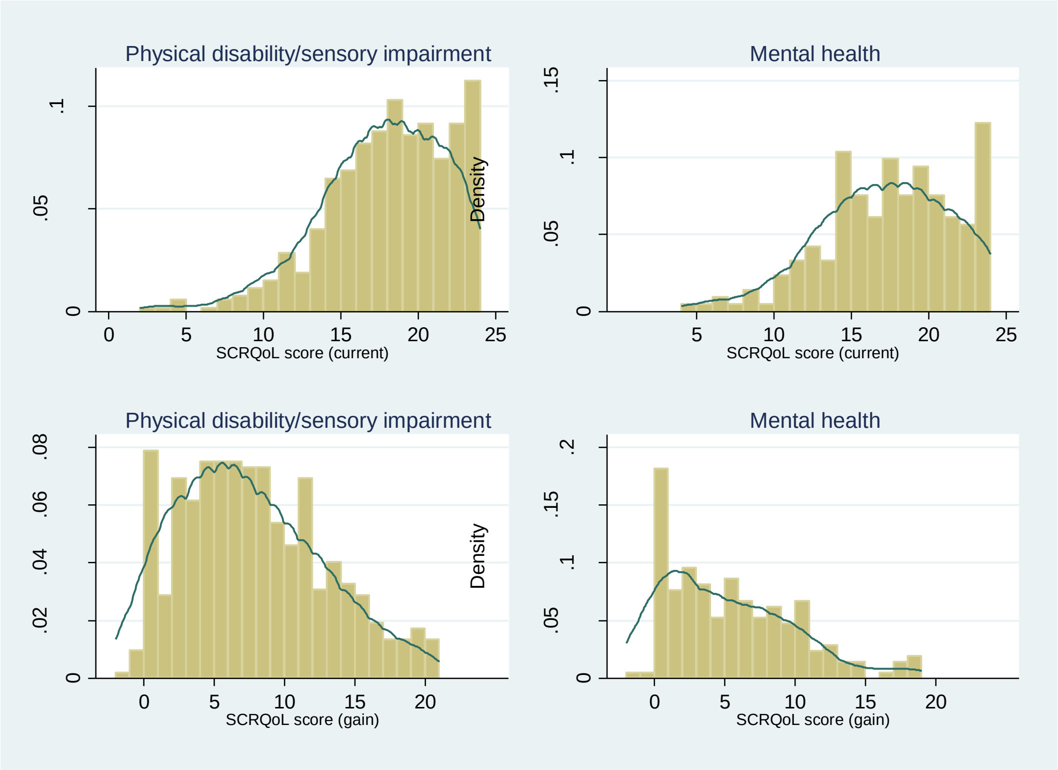


Figure 2. Distribution of ASCOT-UW scores for respondents in the physical disability and sensory impairment and mental health client groups

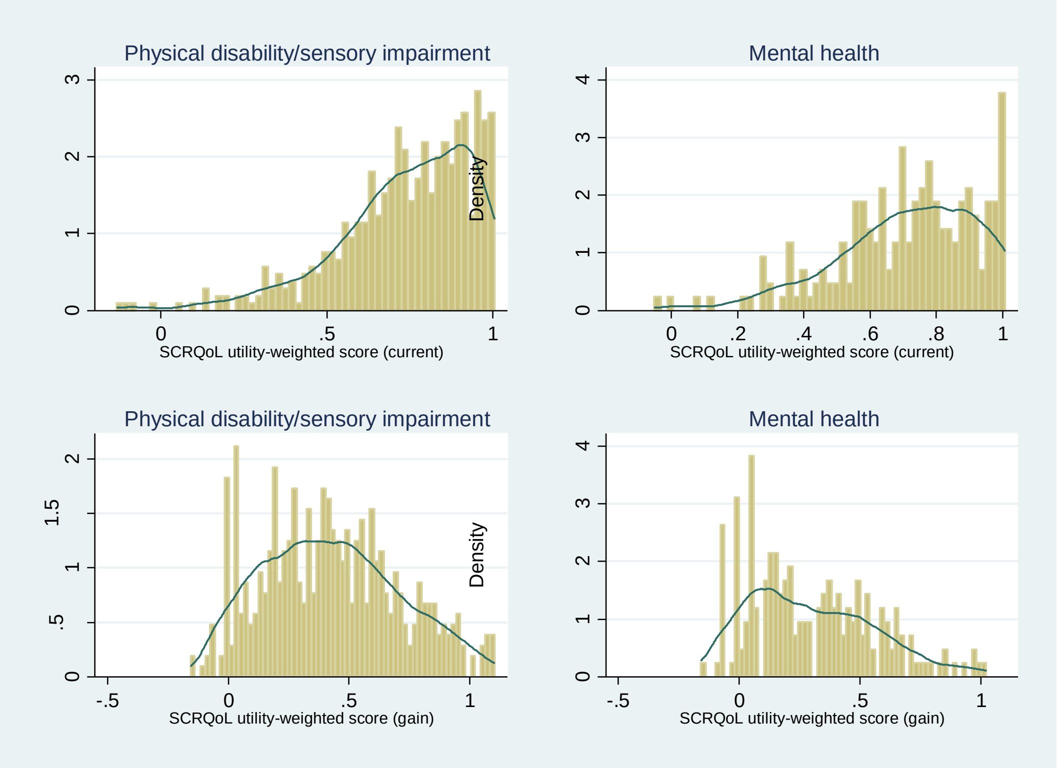
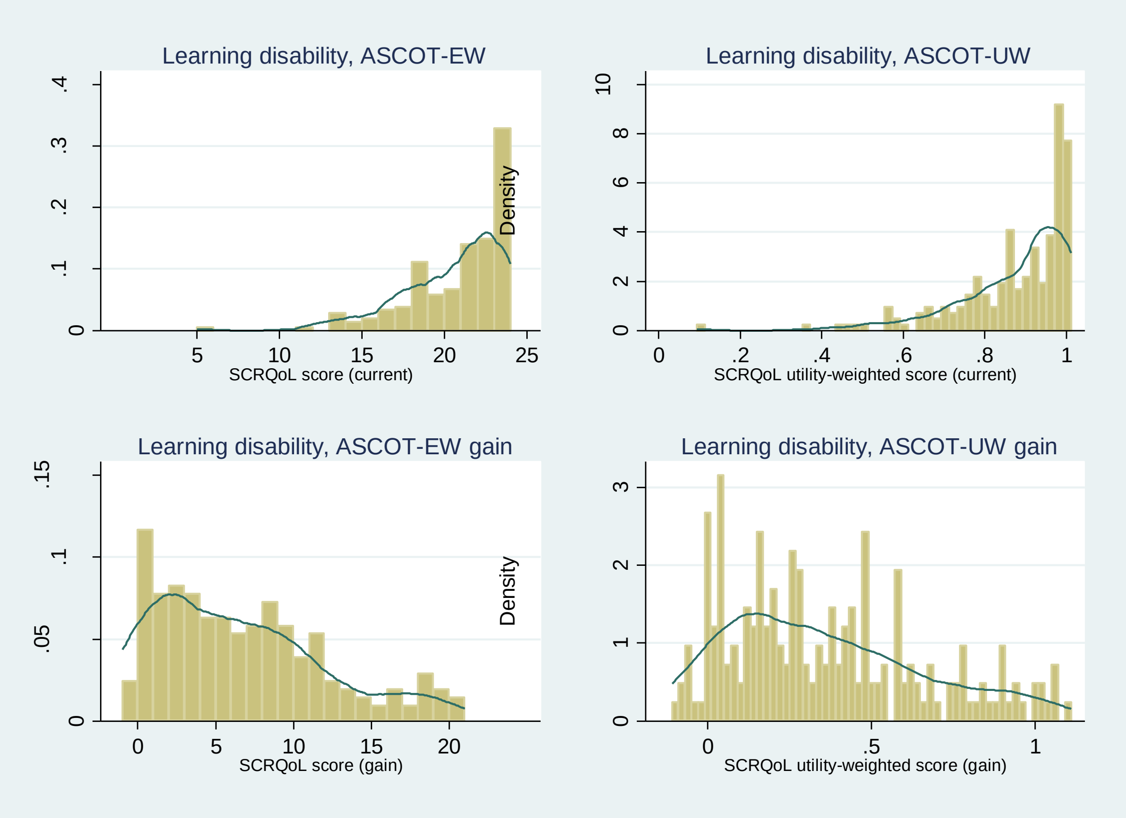


Figure 3. Distribution of ASCOT-EW and UW scores for respondents in the learning disability client group



The shape of the distribution is reversed for ASCOT self-reported ‘gain’ in care-related quality of life due to social care support/services. The distributions are positively skewed with a spike around zero, which represents the respondent rating that social care support had no effect on quality of life across all of the ASCOT domains. There were differences across the client groups, with a higher proportion of mental health clients (n=38, 17.0%) compared to learning disability (n=24, 10.9%) and PDSI clients (n=41, 8.6%) rating that care services/support had no impact on quality of life.

As regards the analysis of (2) in most of the estimations reported in the next section, we used the current utility-weighted ASCOT: SCRQoL-UW score as our measure of social care-related quality of life (y_i).

4.2.2 Carers

The distributional statistics for the two versions of the social care-related quality of life instrument for informal carers are presented in Table 6 (current score) and Table 7 (expected score). There are no preference weights available for either version of the informal carer care-related quality of life measure, so only the equally weighted scale scores are presented here. Nine carers (2.3%) indicated that social care had a negative impact on their quality of life, and a further 84 respondents (21.7%) reported that social care services/support had no effect on the care-related quality of life.

Both the care-related quality of life score from the ASCOT-Carer INT4 instrument, which was developed for this study (Rand, Malley, and Netten 2012), and the Carer SCRQoL score from the instrument included in the SACE (Fox, Holder, and Netten 2010; Malley, Fox, and Netten 2010), are negatively skewed with a spike at the upper end of the scale (see Figure 4). The SACE Carer SCRQoL has a higher proportion of respondents reporting the ideal state across all domains (n=66, 17.1%) than for the ASCOT-Carer INT4 instrument (n=26, (6.7%).

The distributional statistics for the 6 domains, 3 response-levels carer SCQoL included in the Personal Social Services Survey of Adult Carers in England (SACE) are presented in Table 8.

Table 6. Distributional statistics for the ASCOT-Carer INT4 (7 domains, 4 response-levels) and all ASCOT-Carer domains – current scores

Variable	Mean (SD)
ASCOT-Carer: SCRQoL-EW Score	**13.43 (4.7)**
Control over daily life	1.65 (0.91)
Occupation	1.86 (0.84)
Self-care	2.05 (0.95)
Personal safety	2.64 (0.67)
Social participation and involvement	1.95 (0.97)
Space and time to be yourself	1.71 (0.88)
Feeling encouraged and supported	1.60 (0.99)

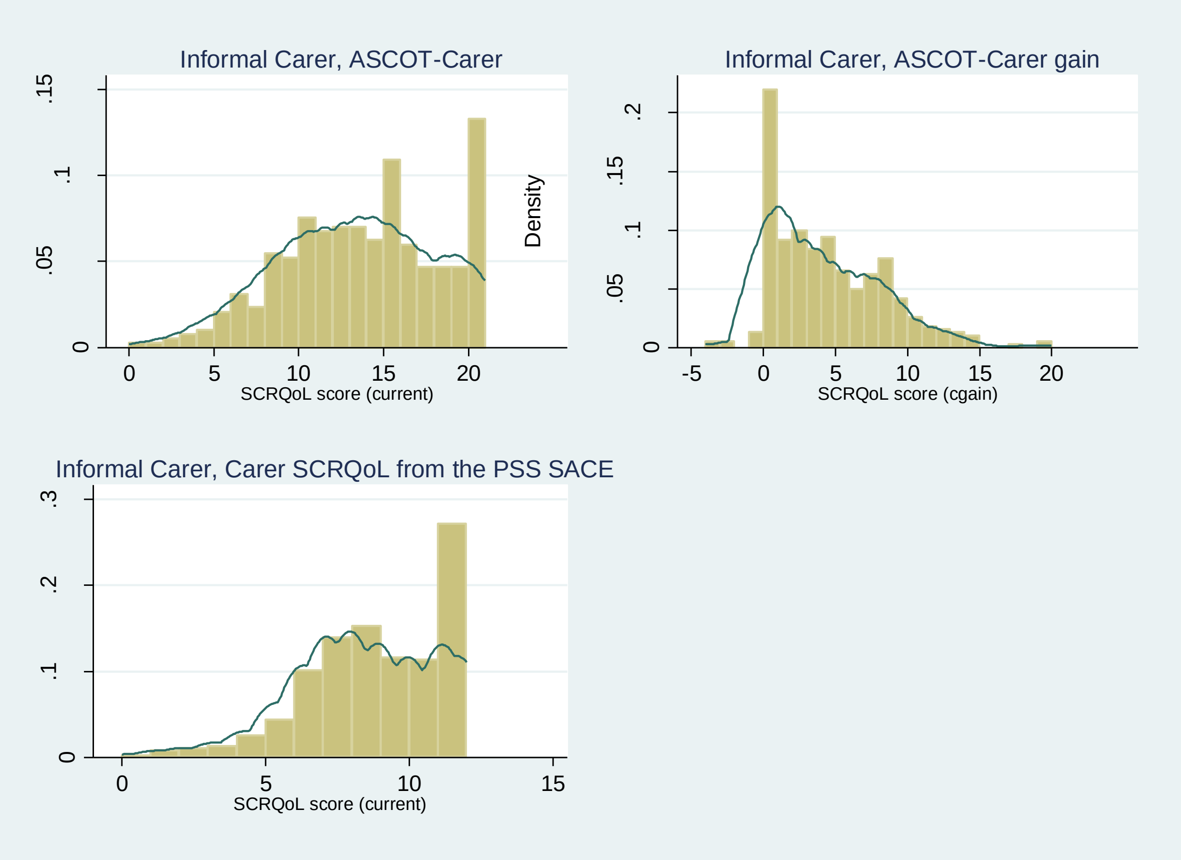
Table 7. Distributional statistics for the ASCOT-Carer INT4 (7 domains, 4 response-levels) and all ASCOT-Carer domains – expected score

Variable	Mean (SD)
ASCOT-Carer: expected SCRQoL-EW Score	**9.43 (5.57)**
Control over daily life	0.96 (0.99)
Occupation	1.16 (0.99)
Self-care	1.53 (1.06)
Personal safety	2.12 (1.05)
Social participation and involvement	1.44 (1.10)
Space and time to be yourself	1.17 (1.00)
Feeling encouraged and supported	1.08 (1.05)

Table 8. Distributional statistics for the Carer SCRQoL (6 domains, 3 response-levels) and all domains included in the Personal Social Services Survey of Adult Carers in England (SACE)

Variable	Informal carers Mean (SD)
Carer SCRQoL -EW Score	**8.55 (2.56)**
Control over daily life	1.25 (0.57)
Occupation	1.36 (0.56)
Self-care	1.65 (0.57)
Personal safety	1.73 (0.50)
Social participation and involvement	1.34 (0.65)
Encouragement and support	1.22 (0.69)

Figure 4. Distribution of ASCOT-Carer (7 items, 4 response-level) and Carer SCRQoL from the SACE (6 items, 3 response-level) score



4.3 Service intensity

There are a number of possible measures of service intensity available in the data that can be used as a value of x_i in the analysis of (2). The IIASC data provided detailed accounts of the type and intensity of services that people used. Information was collected on a range of services: home care (care workers); meals; day care; equipment; and professional support.

Unit costs information for these services was drawn from either the Personal Social Services Expenditure (PSSEX1) data return from the Health and Social Care Information Centre, or from the PSSRU Unit Costs report (Curtis 2013), as follows:

- Home care: £16.80 per week (PSSEX1)
- Day care: £35 to £57 per session, depending on client group (Curtis 2013, Table 5.3)
- Meals: £ 33.80 per week (PSSEX1)
- Equipment: £224.10 to £888.60 per person per annum, depending on client group (PSSEX1)
- Professional support: we assumed half an hour of face-to-face and half an hour of client-related work per visit by a social worker, at £107 per visit (Curtis 2013, social worker costs)

These unit costs figures were used to provide a common currency (£ per week) to arrive at the total cost of services used by individuals in the IIASC sample, so producing cost-weighted utilisation totals.

Self-reported service use data were collected in the IIASC interviews for the PSI and MH client group. We did not collect equivalent data from people with LD because a different interview schedule was used in that case.

Table 9 provides descriptive statistics of the four service-intensity variables:

- Home care worker hours: the sum of the hours per week of care received from care workers, as calculated using IIASC data.
- Cost-weighted use of home care: cost-weighted utilisation of home care services, as calculated using IIASC data.
- Cost-weighted use of all community care: cost-weighted total use of any of the following: home care (care workers); meals; day care; equipment; and professional support, as calculated using IIASC data.
- Gross budget (ASCS): the total expenditure per week on all forms of care, as provided in the ASCS data.

The gross budget data provided in the ASCS had a very high level of missing values and our strong preference was to use IIASC data. Comparing the cost-weighted average figures, home care (care workers) comprised just over 80% of the total use of all services.

As is common for service use, the distribution of usage across individuals is skewed to the right (with a long rightward tail to the distribution). Consequently, we used (natural) log-transformed service use totals in the analysis. This transformation substantially reduces the skewedness of this data.

Table 9. Service intensity measures – PSI and MH client groups

stats		mean	min	median	max	SD	skewness	kurtosis	N
Home care worker - total hours per week	per week	11.09	0	3	168	26.14	4.51	24.92	735
	log (+1)	1.40	0	1.39	5.13	1.40	0.56	2.36	735
Cost-weighted use of home care (£)	per week	186.25	0	50.4	2822.4	439.20	4.51	24.92	735
	log (+1)	2.97	0	3.94	7.95	2.63	-0.03	1.42	735
Cost-weighted use of all comm care (£)	per week	228.00	0	101.81	2832.87	444.25	4.30	23.26	730
	log (+1)	4.27	0	4.63	7.95	1.74	-0.54	3.13	730
Gross budget (ASCS) (£)	per week	137.66	0	72	2399.92	220.53	4.73	39.13	349
	log (+1)	0.93	0	0.87	3.85	0.80	0.66	2.83	349

4.4 External factors

As outlined in section 2.4, we expect three sets of factors to influence SCRQoL:

- First, the (potential) service user's underlying conditions, such as their degree of impairment and health status
- Second, other personal characteristics, including social, demographic and socio-economic factors. These factors are likely to mediate the impact of impairment on quality of life.
- Third are circumstantial and environment characteristics such as the availability of informal care, the suitability of the person's accommodation and also the local community.

A wide range of variables were collected in the study to quantify these factors.[18] The main variables were:

- ***Impairment/functional limitations indicators***: Activities of daily living (ADLs) or instrumental activities of daily living (IADLs) as a total count; number of I/ADLs with difficulty; and number of I/ADLs cannot do alone. Either as a scale with the eight I/ADLs in the ASCS (all client groups) or thirteen I/ADLs from the older people (65+ years) social care questionnaire (Blake et al. 2010) (PSI and MH client groups only), or alternatively considered as individual I/ADL items.
- ***Disability***: Self-reported long-standing illness or disability; physical disability; sight or hearing loss; mental health problem (excluding dementia); dementia; learning disability.
- ***Health***: Self-rated health; EQ-5D items of self-rated mobility, self-care and usual activities (PSI and MH only); EQ-5D items of pain and anxiety/depression.
- ***Socio-demographic characteristics***: age; sex; education (educational level, not LD group); marital status; ethnicity.
- ***Informal care***: married/partners; lives alone or other living arrangements; self-reported informal care arrangements.
- ***Financial means***: Home owner (bought outright, mortgage or shared ownership); household receives means-tested benefits (PSI, MH and informal carers only); socioeconomic classification; car or van owned; self-rated household financial situation (PSI, MH and informal carers only).
- ***Home environment***: Self-reported assessment of home's suitability given needs (How well do you think your home is designed to meet your needs?)
- ***Local environment***: Getting around outside of the home; local area population density (at LSOA level); Index of Multiple Deprivation (IMD) score (2010) for the respondent's place of residence (by lower super output area), and scores in the following ID subdomains: barriers to housing and services; crime and disorder; education, skills and training; employment; health, deprivation and disability; income; and living environment.
- ***Survey administration and completion***: Help and support during the interview etc.; survey type (face-to-face or by telephone); interviewer code.
- ***Caregiver characteristics*** (informal care sample): co-residency; duration of caregiving; health status of the caregiver

Selection of variables for the final estimation was initially made according to theoretical validity and the statistical performance. A particular statistical issue is the high correlation between (collinearity of) variables measuring the same implicit factor. Employing the principle of parsimony (Occam's razor), we selected as few variables as possible to reasonably capture the underlying construct.

5. Results for adult social care clients

5.1 Adjustment estimations

Variants of equation (2) were estimated using the IIASC data. After experimentation, the statistical analysis suggested that the physical and sensory impairment (PSI) and mental health conditions

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[18] Full details of the variables collected as given in Appendices 4 and 5.

(MH) groups of people could be combined. We estimated models for the group of people with learning disabilities separately.

In all models we sought to test the inclusion of a range of variables as proxies for the factors outlined in section 2.4. In general, variables that were not statistically significant were dropped unless there was a strong theoretical case for their inclusion. Personal characteristics such as age, sex and ethnicity were tested but dropped if they were not significant.

5.1.1 Physical and sensory impairment (PSI) or mental health conditions (MH)

In the study we used variants that differed in the following dimensions: the adjustment model, the service intensity variable (if applicable) and the set of external factors.

As outlined above, we used three different adjustment models: the *production function* model; the *risk-adjustment* model; and the *expected SCRQoL* model.

Regarding the set of external factors included in the adjustment process, the main variants were:

- Base (ASCS) adjustors. These are variables that are available in the current ASCS, with the addition of local area environmental population characteristics (population density) and survey administration/completion variables.
- Primary (IIASC) adjustors. This set of risk factors also included variables that were collected in the IIASC study.
- Expanded (IIASC) adjustors. This set of factors added indicators of psychological conditions, particularly reported levels of anxiety and depression (from the EQ-5D measure).

We distinguished models with and without the inclusion of the latter psychological conditions factors because they seek to capture aspects of people's experience that are closely (negatively) correlated to quality of life. There is a danger of tautology when including variables as risk factors that might be regarded as outcomes. Also, there is a concern that these are experiences that the ASC system should be trying to affect, and so adjusting them away would undermine the incentive to make improvements in this regard.

Specifications of the production function models also differed according to which social care intensity variable (x_i) was used. There was the choice to either focus just on *homecare provided by care workers* or to include the range of services collected in the IIASC survey as outlined above (see section 4.3). For the latter, the corresponding variable was: *cost-weighted use of all community care*.

We estimated each model using both casewise-deletion (non-imputed) and imputed datasets. Although the distribution of the SCRQoL does depart somewhat from the normal distribution, as shown in Figure 5, this was felt to be sufficiently modest to justify the use of an untransformed dependent variable and linear regression.

The *risk-adjustment* and *expected SCRQoL* models were estimated using ordinary least squares (OLS) multivariable regression. The *production function* models were estimated using instrumental variable (IV) estimation.[19] As regards the latter, additional 'instrumental variables' were used alongside the other independent variables to estimate a value for the service intensity variable. This predicted value is then used in the main estimation. The instruments were:

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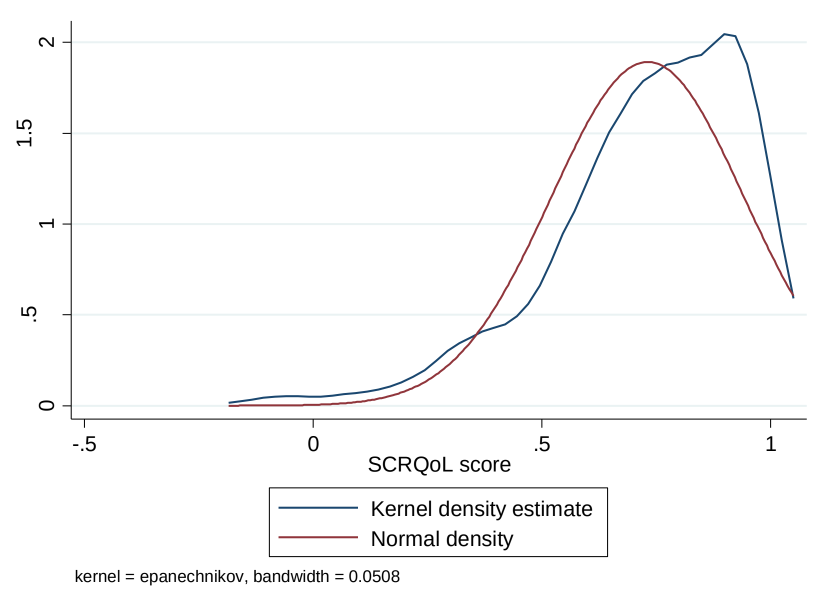
[19] See Appendix 5 for details.

- Whether the household was in receipt of benefits. This instrument reflects the means-tested nature of social care, and the differences between service use by LA-supported and self-funded people.
- Dummies for LA type. This variable reflects that LAs have different preferences for provision of social care. After experimentation, just a dummy for metropolitan LAs was used.
- Spatial lagged values of the service intensity variable. Specifically, spatial lags were calculated for each respondent as the mean of service intensity across all other respondents in the sample in the same LA as the respondent in question. This instrument again reflects the different preferences of LAs in providing services and support.

Figure 5. Density of current SCRQoL for PSI & MH groups combined (n = 654)



Overall, the statistical properties of the models were good.[20] The results of the models are reported below in the following tables:

Adjusted SCRQoL Model			Model name	Table
Type	**Intensity**	**Spec**		
Prod func	home care	base	PF1	Table 10
Prod func	total care	base	PF2	Table 10
Risk adjust		base	RA1	Table 11
Expected		base	EX1	Table 11
Prod func	home care	primary	PF3	Table 12
Prod func	total care	primary	PF4	Table 12
Risk adjust		primary	RA2	Table 13
Expected		primary	EX2	Table 13
Prod func	home care	extended	PF5	Table 14
Prod func	total care	extended	PF6	Table 14
Risk adjust		extended	RA3	Table 15
Expected		extended	EX3	Table 15

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[20] The relevant model diagnostic tests were all supportive of the specifications chosen.

Table 10. Production function model estimates for adults with physical disability, sensory impairment and mental health: base specification

	Model PF1		Model PF2	
	Non-imputed	**Imputed**	**Non-imputed**	**Imputed**
Homecare care worker (£/wk) - log	0.0346**	0.0391**		
	(0.0141)	(0.0167)		
Cost-weighted comm care (£/wk) - log			0.0729**	0.0865**
			(0.0293)	(0.0388)
Older person (65+)	0.0328**	0.0312*	0.0428**	0.0473**
	(0.0163)	(0.0171)	(0.0194)	(0.0228)
Self-rated health: fair	-0.00698	-0.0157	-0.00368	-0.0148
	(0.0157)	(0.0159)	(0.0174)	(0.0184)
Self-rated health: bad or very bad	-0.103***	-0.114***	-0.0976***	-0.109***
	(0.0214)	(0.0212)	(0.0231)	(0.0239)
Count of ADL diffs or fails	-0.0132***	-0.0141***	-0.0177***	-0.0202***
	(0.00439)	(0.00481)	(0.00609)	(0.00776)
Limiting mental health problem	-0.0538***	-0.0427**	-0.0576***	-0.0434**
	(0.0168)	(0.0169)	(0.0172)	(0.0184)
Design of home: meets most needs	-0.0535***	-0.0454**	-0.0388*	-0.0308
	(0.0164)	(0.0176)	(0.0205)	(0.0232)
Design of home: meets some needs or inappropriate	-0.141***	-0.136***	-0.137***	-0.125***
	(0.0232)	(0.0236)	(0.0244)	(0.0276)
Access to local environ: difficult to get to all places	-0.0664***	-0.0619***	-0.0635***	-0.0603***
	(0.0167)	(0.0170)	(0.0183)	(0.0197)
Access to local; environ: unable to get to places/ do not leave home	-0.132***	-0.121***	-0.120***	-0.110***
	(0.0207)	(0.0208)	(0.0212)	(0.0223)
Population density (LSOA)	-0.000513***	-0.00044***	-0.00054***	-0.00051***
	(0.000161)	(0.000158)	(0.000177)	(0.000184)
Assisted when reporting SCRQoL	-0.0152	-0.0238	-0.0197	-0.0234
	(0.0207)	(0.0203)	(0.0224)	(0.0232)
Sample: MH	-0.0240	-0.0232	-0.0241	-0.0179
	(0.0178)	(0.0175)	(0.0196)	(0.0206)
Constant	0.921***	0.901***	0.726***	0.666***
	(0.0390)	(0.0441)	(0.107)	(0.142)
Observations	676	770	673	770
R-squared	0.246		0.132	
rmse	0.183		0.196	
Under-ident test	29.09		17.17	
Under-ident prob	2.15e-06		0.000653	
Weak instruments test	11.48		6.782	
Weak inst crit value (Stock-Yogo 10%)	6.46		6.46	
Over-identification test	0.552		0.296	
Over-identification prob	0.759		0.863	
Endogeneity test	6.386		7.576	
Endogeneity prob	0.0115		0.00592	
Imputations		20		20

Robust standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 11. Risk-adjustment models – current and expected SCRQoL for adults with physical disability, sensory impairment and mental health: base specification

	Model RA1		**Model EX1**	
	Non-imputed	**Imputed**	**Non-imputed**	**Imputed**
Older person (65+)	0.0135	0.0132	0.0486**	0.0500**
	(0.0132)	(0.0133)	(0.0205)	(0.0203)
Self-rated health: fair	-0.0171	-0.0172	-0.0395	-0.0400*
	(0.0138)	(0.0138)	(0.0246)	(0.0242)
Self-rated health: bad or very bad	-0.124***	-0.125***	-0.0768***	-0.0753***
	(0.0191)	(0.0190)	(0.0287)	(0.0282)
Count of ADL diffs or fails	-0.00332**	-0.00328**	-0.0281***	-0.0285***
	(0.00162)	(0.00165)	(0.00255)	(0.00254)
Limiting mental health problem	-0.0573***	-0.0554***	-0.0218	-0.0193
	(0.0141)	(0.0142)	(0.0210)	(0.0208)
Design of home: meets most needs	-0.0656***	-0.0637***	0.0197	0.0220
	(0.0138)	(0.0137)	(0.0217)	(0.0213)
Design of home: meets some needs or inappropriate	-0.153***	-0.156***	-0.0511**	-0.0513**
	(0.0192)	(0.0194)	(0.0244)	(0.0245)
Access to local environ: difficult to get to all places	-0.0577***	-0.0543***	-0.107***	-0.107***
	(0.0147)	(0.0147)	(0.0240)	(0.0237)
Access to local environ: unable to get to places/ do not leave home	-0.112***	-0.109***	-0.107***	-0.102***
	(0.0177)	(0.0178)	(0.0271)	(0.0268)
Population density (LSOA)	-0.000346**	-0.000338**	-0.000266	-0.000299
	(0.000139)	(0.000139)	(0.000186)	(0.000186)
Assisted when reporting SCRQoL	-0.0170	-0.0222	0.0106	0.00807
	(0.0185)	(0.0187)	(0.0287)	(0.0288)
Sample: MH	-0.0306*	-0.0328**	0.00833	0.00502
	(0.0159)	(0.0162)	(0.0237)	(0.0238)
Constant	0.980***	0.978***	0.629***	0.636***
	(0.0277)	(0.0278)	(0.0454)	(0.0450)
Observations	732	770	725	770
R-squared	0.375		0.316	
rmse	0.167		0.246	
Imputations		20		20

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 12. Production function model estimates for adults with physical disability, sensory impairment and mental health: primary specification

	Model PF3		Model PF4	
	Non-imputed	**Imputed**	**Non-imputed**	**Imputed**
Homecare care worker (£/wk) - log	0.0345**	0.0407**		
	(0.0150)	(0.0181)		
Cost-weighted comm care (£/wk) - log			0.0713**	0.0861**
			(0.0295)	(0.0394)
Age	0.00123**	0.00136**	0.00137**	0.00175**
	(0.000572)	(0.000625)	(0.000630)	(0.000791)
Ethnicity: White	0.0338	0.0470*	0.0442	0.0484
	(0.0259)	(0.0269)	(0.0307)	(0.0313)
Education: prof qual or degree	-0.0479***	-0.0397**	-0.0570***	-0.0522***
	(0.0163)	(0.0159)	(0.0187)	(0.0199)
Self-rated health: fair	-0.00629	-0.0173	-0.00275	-0.0184
	(0.0159)	(0.0159)	(0.0176)	(0.0183)
Self-rated health: bad or very bad	-0.105***	-0.117***	-0.0992***	-0.115***
	(0.0208)	(0.0206)	(0.0222)	(0.0226)
Count of ADL diffs or fails	-0.0105***	-0.0117***	-0.0135***	-0.0156***
	(0.00364)	(0.00408)	(0.00474)	(0.00595)
Limiting mental health problem	-0.0572***	-0.0443***	-0.0629***	-0.0463***
	(0.0161)	(0.0164)	(0.0164)	(0.0175)
Number of adults in household	0.0277*	0.0370**	0.0276*	0.0357**
	(0.0146)	(0.0163)	(0.0148)	(0.0167)
Design of home: meets most needs	-0.0524***	-0.0457**	-0.0400*	-0.0329
	(0.0167)	(0.0178)	(0.0205)	(0.0228)
Design of home: meets some needs or	-0.136***	-0.132***	-0.135***	-0.124***
	(0.0239)	(0.0244)	(0.0242)	(0.0275)
Access to local environ: difficult to get to all places	-0.0690***	-0.0609***	-0.0653***	-0.0597***
	(0.0167)	(0.0167)	(0.0181)	(0.0193)
Access to local environ: unable to get to places/ do not leave home	-0.127***	-0.116***	-0.113***	-0.104***
	(0.0203)	(0.0203)	(0.0209)	(0.0218)
Population density (LSOA)	-0.000338*	-0.000282*	-0.000343*	-0.000326*
	(0.000178)	(0.000171)	(0.000190)	(0.000189)
Assisted when reporting SCRQoL	-0.0199	-0.0314	-0.0225	-0.0298
	(0.0210)	(0.0211)	(0.0227)	(0.0235)
Sample: MH	-0.0196	-0.0174	-0.0204	-0.0113
	(0.0181)	(0.0178)	(0.0196)	(0.0209)
Constant	0.778***	0.718***	0.575***	0.469**
Observations	657	770	654	770
R-squared	0.272		0.171	
rmse	0.180		0.192	
Under-ident test	27.76		16.43	
Under-ident prob	4.07e-06		0.000927	
Weak instruments test	10.61		6.563	
Weak inst crit value (Stock-Yogo 10%)	6.46		6.46	
Over-identification test	0.568		0.427	
Over-identification prob	0.753		0.808	
Endogeneity test	5.057		6.209	
Endogeneity prob	0.0245		0.0127	
Imputations		20		20

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 13. Risk-adjustment models – current and expected SCRQoL for adults with physical disability, sensory impairment and mental health: primary specification

	Model RA2		Model EX2	
	Non-imputed	**Imputed**	**Non-imputed**	**Imputed**
Age	0.000501	0.000406	0.00165***	0.00166***
	(0.000425)	(0.000420)	(0.000583)	(0.000572)
Ethnicity: White	0.0239	0.0351	-0.0110	0.0160
	(0.0221)	(0.0237)	(0.0361)	(0.0359)
Education: prof qual or degree	-0.0264*	-0.0250*	-0.0535***	-0.0527***
	(0.0141)	(0.0137)	(0.0205)	(0.0201)
Self-rated health: fair	-0.0154	-0.0178	-0.0482*	-0.0454*
	(0.0140)	(0.0139)	(0.0248)	(0.0241)
Self-rated health: bad or very bad	-0.124***	-0.127***	-0.0807***	-0.0861***
	(0.0192)	(0.0188)	(0.0284)	(0.0276)
Count of ADL diffs or fails	-0.00272**	-0.00268**	-0.0200***	-0.0201***
	(0.00123)	(0.00123)	(0.00183)	(0.00180)
Limiting mental health problem	-0.0591***	-0.0562***	-0.0239	-0.0252
	(0.0139)	(0.0139)	(0.0211)	(0.0208)
Number of adults in household	0.00712	0.00654	0.0389***	0.0414***
	(0.00787)	(0.00795)	(0.0122)	(0.0119)
Design of home: meets most needs	-0.0627***	-0.0640***	0.0190	0.0170
	(0.0139)	(0.0137)	(0.0218)	(0.0212)
Design of home: meets some needs or inappropriate	-0.147***	-0.155***	-0.0436*	-0.0529**
	(0.0197)	(0.0193)	(0.0248)	(0.0245)
Access to local environ: difficult to get to all places	-0.0636***	-0.0540***	-0.111***	-0.109***
	(0.0148)	(0.0146)	(0.0244)	(0.0237)
Access to local environ: unable to get to places/ do not leave home	-0.115***	-0.106***	-0.113***	-0.100***
	(0.0180)	(0.0179)	(0.0275)	(0.0269)
Population density (LSOA)	-0.000270*	-0.000255	-0.000178	-0.000169
	(0.000158)	(0.000156)	(0.000194)	(0.000196)
Assisted when reporting SCRQoL	-0.0169	-0.0225	-0.00904	-0.00469
	(0.0189)	(0.0191)	(0.0293)	(0.0292)
Sample: MH	-0.0322**	-0.0323**	0.0170	0.0170
	(0.0162)	(0.0162)	(0.0236)	(0.0235)
Constant	0.928***	0.918***	0.482***	0.450***
	(0.0511)	(0.0502)	(0.0739)	(0.0734)
Observations	709	770	702	770
R-squared	0.382		0.318	
rmse	0.167		0.246	

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 14. Production function model estimates for adults with physical disability, sensory impairment and mental health: extended specification

	Model PF5		Model PF6	
	Non-imputed	Imputed	Non-imputed	Imputed
Homecare care worker (£/wk) - log	0.0380**	0.0459**		
	(0.0148)	(0.0183)		
Cost-weighted comm care (£/wk) - log			0.0778***	0.0972**
			(0.0291)	(0.0408)
Age	0.00115**	0.00138**	0.00129**	0.00182**
	(0.000557)	(0.000621)	(0.000619)	(0.000811)
Ethnicity: White	0.0331	0.0462*	0.0440	0.0477
	(0.0268)	(0.0276)	(0.0322)	(0.0331)
Education: prof qual or degree	-0.0497***	-0.0407**	-0.0603***	-0.0546***
	(0.0161)	(0.0161)	(0.0187)	(0.0206)
Self-rated health: fair	-0.00491	-0.0147	-3.63e-05	-0.0146
	(0.0160)	(0.0163)	(0.0179)	(0.0193)
Self-rated health: bad or very bad	-0.0861***	-0.0949***	-0.0792***	-0.0940***
	(0.0208)	(0.0210)	(0.0228)	(0.0238)
Count of ADL diffs or fails	-0.0109***	-0.0128***	-0.0142***	-0.0170***
	(0.00360)	(0.00416)	(0.00471)	(0.00620)
Limiting mental health problem	-0.0304*	-0.0210	-0.0335*	-0.0205
	(0.0166)	(0.0172)	(0.0180)	(0.0196)
Anxiety/depression (EQ5D): moderate	-0.0232	-0.0209	-0.0333*	-0.0340*
	(0.0168)	(0.0171)	(0.0178)	(0.0188)
Anxiety/depression (EQ5D): extreme	-0.103***	-0.0994***	-0.109***	-0.0981***
	(0.0265)	(0.0253)	(0.0298)	(0.0302)
Number of adults in household	0.0353**	0.0459***	0.0340**	0.0434**
	(0.0145)	(0.0164)	(0.0148)	(0.0171)
Social contact: at least weekly by phone	0.0620***	0.0522***	0.0489**	0.0407*
	(0.0204)	(0.0195)	(0.0225)	(0.0226)
Design of home: meets most needs	-0.0466***	-0.0388**	-0.0341*	-0.0245
	(0.0167)	(0.0180)	(0.0204)	(0.0235)
Design of home: meets some needs or	-0.125***	-0.120***	-0.125***	-0.112***
	(0.0245)	(0.0250)	(0.0249)	(0.0288)
Access to local environ: difficult to get to all places	-0.0615***	-0.0541***	-0.0561***	-0.0524**
	(0.0172)	(0.0173)	(0.0188)	(0.0205)
Access to local environ: unable to get to places/do not leave home	-0.117***	-0.108***	-0.101***	-0.0946***
	(0.0205)	(0.0207)	(0.0214)	(0.0227)
Population density (LSOA)	-0.000348*	-0.000298*	-0.000346*	-0.000339*
	(0.000179)	(0.000172)	(0.000195)	(0.000197)
Assisted when reporting SCRQoL	-0.0129	-0.0250	-0.0165	-0.0238
	(0.0211)	(0.0217)	(0.0230)	(0.0247)
Sample: MH	0.00137	0.00293	-0.000542	0.00857
	(0.0189)	(0.0183)	(0.0204)	(0.0218)
Constant	0.688***	0.627***	0.485***	0.361*
	(0.0949)	(0.109)	(0.161)	(0.218)
Observations	655	770	652	770
R-squared	0.276		0.154	
rmse	0.179		0.193	
Under-ident test	27.04		16.35	
Under-ident prob	5.77e-06		0.000963	
Weak instruments test	10.35		6.510	
Weak inst crit value (Stock-Yogo 10%)	6.46		6.46	
Over-identification test	1.610		1.207	
Over-identification prob	0.447		0.547	
Endogeneity test	5.689		7.230	
Endogeneity prob	0.0171		0.00717	
Imputations		20		20

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 15. Risk-adjustment models – current and expected SCRQoL for adults with physical disability, sensory impairment and mental health: extended specification

	Model RA3		Model EX3	
	Non-imputed	Imputed	Non-imputed	Imputed
Age	0.000359	0.000276	0.00161***	0.00163***
	(0.000411)	(0.000404)	(0.000583)	(0.000571)
Ethnicity: White	0.0225	0.0331	-0.0101	0.0155
	(0.0218)	(0.0235)	(0.0363)	(0.0359)
Education: prof qual or degree	-0.0263*	-0.0236*	-0.0542***	-0.0546***
	(0.0139)	(0.0135)	(0.0206)	(0.0202)
Self-rated health: fair	-0.0141	-0.0144	-0.0498**	-0.0473*
	(0.0137)	(0.0135)	(0.0252)	(0.0244)
Self-rated health: bad or very bad	-0.106***	-0.106***	-0.0706**	-0.0792***
	(0.0189)	(0.0186)	(0.0291)	(0.0281)
Count of ADL diffs or fails	-0.00231*	-0.00247**	-0.0202***	-0.0205***
	(0.00119)	(0.00120)	(0.00184)	(0.00181)
Limiting mental health problem	-0.0343**	-0.0331**	-0.0161	-0.0222
	(0.0142)	(0.0141)	(0.0232)	(0.0228)
Anxiety/depression (EQ5D): moderate	-0.0305**	-0.0298**	0.0129	0.0176
	(0.0138)	(0.0136)	(0.0243)	(0.0235)
Anxiety/depression (EQ5D): extreme	-0.0968***	-0.0979***	-0.0581*	-0.0377
	(0.0245)	(0.0234)	(0.0325)	(0.0322)
Number of adults in household	0.0111	0.0109	0.0407***	0.0422***
	(0.00794)	(0.00795)	(0.0122)	(0.0119)
Social contact: at least weekly by phone	0.0526***	0.0519***	-0.000588	-0.00941
	(0.0178)	(0.0172)	(0.0234)	(0.0226)
Design of home: meets most needs	-0.0560***	-0.0581***	0.0188	0.0153
	(0.0136)	(0.0134)	(0.0221)	(0.0213)
Design of home: meets some needs or inappropriate	-0.138***	-0.146***	-0.0443*	-0.0536**
	(0.0199)	(0.0194)	(0.0250)	(0.0247)
Access to local environ: difficult to get to all places	-0.0558***	-0.0459***	-0.105***	-0.105***
	(0.0150)	(0.0147)	(0.0248)	(0.0239)
Access to local environ: unable to get to places/ do not leave home	-0.105***	-0.0962***	-0.107***	-0.0969***
	(0.0176)	(0.0174)	(0.0280)	(0.0272)
Population density (LSOA)	-0.000272*	-0.000267*	-0.000161	-0.000159
	(0.000156)	(0.000154)	(0.000190)	(0.000194)
Assisted when reporting SCRQoL	-0.00782	-0.0137	-0.0103	-0.00648
	(0.0187)	(0.0190)	(0.0294)	(0.0292)
Sample: MH	-0.0149	-0.0144	0.0232	0.0188
	(0.0166)	(0.0164)	(0.0244)	(0.0240)
Constant	0.867***	0.857***	0.469***	0.453***
	(0.0533)	(0.0517)	(0.0788)	(0.0778)
Observations	707	770	700	770
R-squared	0.408		0.323	
rmse	0.163		0.246	

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

5.1.2 Learning disability (LD)

The data available regarding people with learning disabilities were more limited than for the other client groups. As such, we were not able to estimate production function models. Rather, we concentrated on risk-adjustment models using both current SCRQoL and expected SCRQoL.

Figure 6 shows that the distribution of current SCRQoL for people with LD was more peaked than the normal distribution. It was, however, a fairly continuous single peaked distribution, which again allowed us to use linear (OLS) regression models.

As before, we used a base specification (Table 16) and also an extended specification (Table 17) that included a psychological condition variable, namely anxiety and depression.

Figure 6. Density of current SCRQoL for LD group (n = 204)

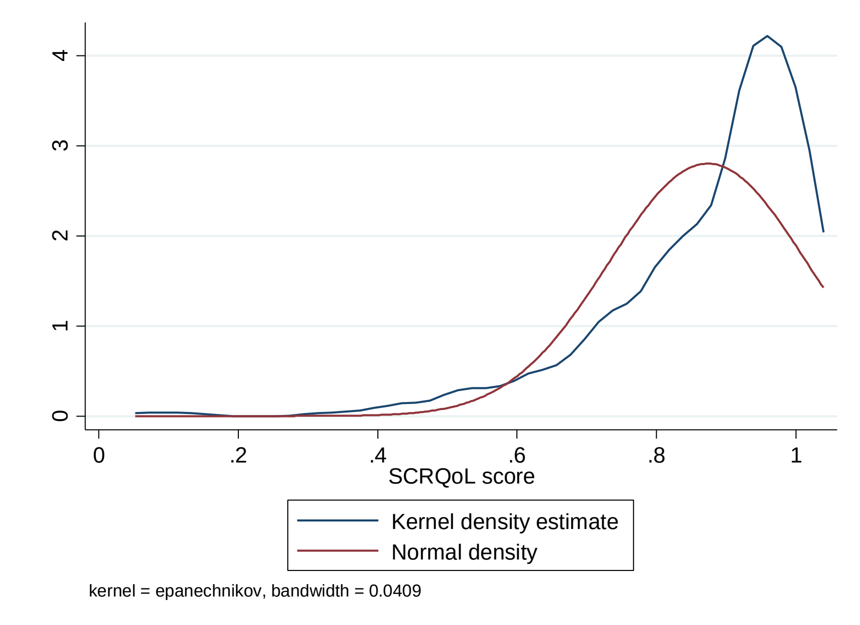

Table 16. Risk-adjustment models – current and expected SCRQoL for adults with learning disability: base specification

	Model RA 1		Model EX1	
	Non-imputed	**Imputed**	**Non-imputed**	**Imputed**
Age (log)	-0.0356	-0.0396*	-0.0676	-0.0670
	(0.0236)	(0.0239)	(0.0463)	(0.0463)
Self-rated health: quite healthy	-0.00532	-0.00230	0.0192	0.0224
	(0.0203)	(0.0217)	(0.0461)	(0.0455)
Self-rated health: ok/not very good/very bad	-0.0654***	-0.0558**	-0.0331	-0.0242
	(0.0240)	(0.0246)	(0.0481)	(0.0480)
Count of ADL diffs	-0.00915*	-0.00986*	-0.0285***	-0.0269***
	(0.00508)	(0.00547)	(0.0100)	(0.0100)
Limiting mental health problem	-0.0440**	-0.0432**	-0.0870*	-0.0823*
	(0.0200)	(0.0209)	(0.0442)	(0.0432)
Design of home: meets some needs or inappropriate	-0.0800***	-0.0744***	-0.117***	-0.118***
	(0.0248)	(0.0251)	(0.0413)	(0.0405)
Help with questionnaire: from a care worker	0.0772***	0.0749***	-0.184***	-0.177***
	(0.0203)	(0.0207)	(0.0497)	(0.0492)
Help with questionnaire: from relative/friend	0.00136	0.00589	0.0210	0.0135
	(0.0264)	(0.0268)	(0.0600)	(0.0576)
Assisted when reporting SCRQoL	-0.0694**	-0.0665**	-0.0243	-0.0146
	(0.0288)	(0.0280)	(0.0488)	(0.0469)
Constant	1.080***	1.089***	0.923***	0.916***
	(0.0853)	(0.0861)	(0.169)	(0.171)
Observations	204	220	204	220
R-squared	0.293		0.226	
rmse	0.122		0.256	
F	11.16	7.799	6.976	6.394
Imputations		20		20

Table 17. Risk-adjustment models – current and expected SCRQoL for adults with learning disability: extended specification

	Model RA 2		Model RA-exp 2	
	Non-imputed	Imputed	Non-imputed	Imputed
Age (log)	-0.0355	-0.0395	-0.0676	-0.0669
	(0.0237)	(0.0240)	(0.0464)	(0.0464)
Self-rated health: quite healthy	-0.00434	-0.000619	0.0197	0.0231
	(0.0206)	(0.0222)	(0.0459)	(0.0452)
Self-rated health: ok/not very good/very bad	-0.0592**	-0.0498*	-0.0295	-0.0215
	(0.0251)	(0.0255)	(0.0478)	(0.0477)
Count of ADL diffs	-0.00940*	-0.0100*	-0.0286***	-0.0270***
	(0.00511)	(0.00548)	(0.0101)	(0.0101)
Limiting mental health problem	-0.0392*	-0.0385*	-0.0843*	-0.0802*
	(0.0213)	(0.0222)	(0.0444)	(0.0433)
Design of home: meets some needs or inappropriate	-0.0774***	-0.0719***	-0.116***	-0.117***
	(0.0246)	(0.0248)	(0.0415)	(0.0407)
Help with questionnaire: from a care worker	0.0734***	0.0722***	-0.187***	-0.178***
	(0.0212)	(0.0213)	(0.0499)	(0.0495)
Help with questionnaire: from relative/friend	0.000985	0.00659	0.0209	0.0138
	(0.0261)	(0.0266)	(0.0604)	(0.0579)
Assisted when reporting SCRQoL	-0.0655**	-0.0634**	-0.0222	-0.0132
	(0.0282)	(0.0274)	(0.0490)	(0.0471)
Anxiety/depression: not worried or sad at all	0.0220	0.0211	0.0127	0.00933
	(0.0194)	(0.0196)	(0.0361)	(0.0360)
Constant	1.066***	1.075***	0.915***	0.909***
	(0.0838)	(0.0848)	(0.171)	(0.172)
Observations	204	220	204	220
R-squared	0.298		0.227	
rmse	0.122		0.256	
F	10.21	7.116	6.234	5.727
Imputations		20		20

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

5.2 Adjusting SCRQoL score

As outlined in section 3, the adjusted social care-related quality of life score is found by subtracting the impact of the risk adjustors from the current SCRQoL score. With reference to (2) above, this subtraction gives:

$$y_i - (\beta_0 + \beta_2 z_i^0 + \beta_3 z_i^1 + \beta_3 z_i^2) = f^x(x_i, q_i; \beta_1) + e_i \tag{3}$$

All the values on the left-hand side are available either directly from the data (current SCRQoL y_i and the risk adjustors: the z's in the model), or from the above estimations (the β coefficients). Plugging these numbers into the equation therefore gives an estimate of $f^x(x_i, q_i; \beta_1) + e_i$, which is the impact of care services/support and the independently distributed error term. If we assume that on average the latter is equal to zero (i.e. $\overline{e_i} = 0$), then what we are left with is an estimate of the impact of care services/support, which is what we want to compare between LAs.

Although the principle is the same, the results from the different statistical models are used in a slightly different way to produce the estimate of the impact of services/support. The details are outlined in Annex 1 of this report.

The result in each case is an adjusted SCRQoL score which is calculated using (3). In this section we apply this calculation in the IIASC sample in order to assess the difference that adjustment makes. In the next section we apply the calculation at local authority level to provide an adjusted SCRQoL score that can be used in the ASCOF.

5.2.1 Physical and sensory impairment and mental health client group

In applying the adjusted score, we would expect the relative ranking of local authorities (from highest to lowest) using the *adjusted* score would be different to the ranking using the *unadjusted* score. For example, areas with relatively poor health/high frailty populations will likely move up the ranking.

We can get a sense of how much the ranking would change by looking at the correlation between the adjusted and unadjusted scores in the IIASC sample (i.e. at the individual level). Table 18 presents this analysis with adjusted scores derived from the listed models. Lower correlation numbers indicate that the particular adjusted score changes from the unadjusted score to a greater degree. For example, the adjusted score derived from the production function model with primary specification and using total care the intensity variable is 0.64 correlated with the unadjusted score. The linear risk-adjustment model with the same (primary) specification is 0.79 correlated.

The results also indicate how much the production function models differ from the risk-adjustment models (as illustrated in the last column of the table).

Table 18. Adjusted SCRQoL score, IIASC sample, correlation with unadjusted score and RA model adjusted score (imputed dataset) – PSI & MH group

Adjusted SCRQoL model			Correlation with	
Type	Intensity	Spec	Unadjusted SCRQoL	Primary RA adjusted SCRQoL
Prod func	total care	primary	0.64	0.89
Prod func	total care	base	0.66	0.90
Prod func	total care	extended	0.60	0.85
Prod func	home care	primary	0.69	0.94
Prod func	home care	base	0.71	0.95
Prod func	home care	extended	0.65	0.90
Risk adjust		primary	0.79	1.00
Risk adjust		base	0.79	1.00
Risk adjust		extended	0.77	0.98
Expected		primary	0.68	0.81
Expected		base	0.68	0.80
Expected		extended	0.67	0.80

The above results do not give any indication of which adjustment model to choose. To gain some insight to this question, we can compare the how well the adjusted SCRQoL scores – which are supposed to measure the impact of services – compares with participants' own estimate of how much services improve their care-related quality of life: i.e. the SCRQoL *gain* score.

Table 19 reports the correlation between SCRQoL gain and the adjusted SCRQoL scores from each adjustment model. The production functions produce adjusted scores that are more highly correlated with SCRQoL gain than the risk-adjustment model: e.g. 0.48 correlation compared with 0.35 correlation from the risk-adjustment model.

Table 19. Adjusted SCRQoL score, IIASC sample, correlation with SCRQoL gain (imputed dataset)

Adjusted SCRQoL Model			
Type	Intensity	Spec	Correlation with SCRQoL gain
Prod func	total care	primary	0.48
Prod func	total care	base	0.48
Prod func	total care	extended	0.48
Prod func	home care	primary	0.46
Prod func	home care	base	0.45
Prod func	home care	extended	0.46
Risk adjust		primary	0.35
Risk adjust		base	0.35
Risk adjust		extended	0.34
Expected		primary	0.54
Expected		base	0.54
Expected		extended	0.54

We also found that the production function models produced adjusted scores that were more highly correlated with the adjusted scores from the expected models (0.95) than when correlating adjusted scores from the RA models with adjusted scores from the expected models (0.81).

Comparisons of individuals within the IIASC sample give some sense of the impact of adjustment. However, as noted above, in this case the independently distributed 'other factors' are likely to differ significantly between individuals. This adjustment methodology is better designed to give results at the aggregate level: in particular, at the LA level. In that case, when comparing mean adjusted scores, the effects of other non-observed factors should have largely averaged out.

5.2.2 Learning disability client group

We can also look at the correlations for the learning disability group between the adjusted score and both the current SCRQoL and the SCRQoL gain – see Table 20. As above, the base risk-adjustment model is quite closely correlated with the current SCRQoL score but only relatively weakly correlated with the measure of SCRQoL gain in the IIASC sample. Using the expected SCRQoL score as the basis for the adjustment factor gives a lower correlation with the current score, but higher correlation with the gain.

Table 20. Adjusted SCRQoL score, IIASC sample, correlation with unadjusted score and SCRQoL gain (imputed dataset) – LD group

Adjusted SCRQoL score			
Model	**Model specification**	**Current SCRQoL**	**SCRQoL gain**
RA1	Risk-adjustment model - base spec	0.861	0.329
RA2	Risk-adjustment model - extended spec	0.858	0.328
EX1	Expected SCRQoL RA model - base spec	0.680	0.526

5.3 Adjusted SCRQoL score for local authorities

5.3.1 Physical and sensory impairment and mental health client group

The regression results reported above provide the coefficients for generating adjustment formulae that can be used with the (current) ASCS data. The formula is applied to each respondent in the ASCS sample to provide an individual person adjustment factor. This figure is subtracted from the person's current SCRQoL score (using the utility-weighted version) to produce adjusted SCRQoL. The final step involves taking the ACSC sample average value of this variable across all respondents in the local authority.

We have calibrated (i.e. re-scaled by a constant factor) the adjustment equation so that it produces the IIASC sample mean gain in SCRQoL as given in the data as the expected SCRQoL in IIASC (0.389).[21] This re-scaling is for presentation. It would not affect the ranking of local authorities.

Below we list four adjustment formulae, as based on two production function models (home care and all community care), the risk-adjustment and the expected SCRQoL modes. In each case we used just the base external factors specification (as we use the ASCS data).

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[21] This amount is also very similar to that produced by the production function (all care) model.

(1) Production function (home care) model estimates for adults with physical disability, sensory impairment and mental health: base specification (Model PF1, Imputed; Table 8)

Adjustment factor =		0.5602
Age:- Is the person over ≥ 65 years: if Yes, add:	(+)	0.0312
Self-rated health: if the rating is ‘fair’ then subtract:	(−)	0.0157
Self-rated health: if the rating is ‘bad’ or ‘very bad’ then subtract:	(−)	0.1140
Count of ADL diffs or fails: subtract:	(−)	0.0141 × count
Design of home: if it ‘meets most needs’, subtract:	(−)	0.0454
Design of home: if it ‘meets some needs or inappropriate’, then subtract:	(−)	0.1360
Access to local environment: if ‘difficult to get to all places’, subtract:	(−)	0.0619
Access to local environment: if ‘unable to get to all places or do not leave home’ subtract	(−)	0.1210

(2) Production function (all community care) model estimates for adults with physical disability, sensory impairment and mental health: base specification (Model PF2, Imputed; Table 8)

Adjustment factor =		0.5798
Age:- Is the person over ≥ 65 years: if Yes, add:	(+)	0.0473
Self-rated health: if the rating is ‘fair’ then subtract:	(−)	0.0148
Self-rated health: if the rating is ‘bad’ or ‘very bad’ then subtract:	(−)	0.1090
Count of ADL diffs or fails: subtract:	(−)	0.0202 × count
Design of home: if it ‘meets most needs’, subtract:	(−)	0.0308
Design of home: if it ‘meets some needs or inappropriate’, then subtract:	(−)	0.1250
Access to local environment: if ‘difficult to get to all places’, subtract:	(−)	0.0603
Access to local environment: if ‘unable to get to all places or do not leave home’ subtract	(−)	0.1100

(3) Risk-adjustment models – current SCRQoL for adults with physical disability, sensory impairment and mental health: base specification (Model RA1, Imputed; Table 9)

Adjustment factor =		0.5046
Age:- Is the person over ≥ 65 years: if Yes, add:	(+)	0.0132
Self-rated health: if the rating is ‘fair’ then subtract:	(−)	0.0172
Self-rated health: if the rating is ‘bad’ or ‘very bad’ then subtract:	(−)	0.1250
Count of ADL diffs or fails: subtract:	(−)	0.0033 × count
Design of home: if it ‘meets most needs’, subtract:	(−)	0.0637
Design of home: if it ‘meets some needs or inappropriate’, then subtract:	(−)	0.1560
Access to local environment: if ‘difficult to get to all places’, subtract:	(−)	0.0543
Access to local environment: if ‘unable to get to all places or do not leave home’ subtract	(−)	0.1090

(4) Risk-adjustment models – expected SCRQoL for adults with physical disability, sensory impairment and mental health: base specification (Model RA-exp 1, Imputed; Table 9)

Adjustment factor =		0.6164
Age:- Is the person over ≥ 65 years: if Yes, add:	(+)	0.0500
Self-rated health: if the rating is 'fair' then subtract:	(−)	0.0400
Self-rated health: if the rating is 'bad' or 'very bad' then subtract:	(−)	0.0753
Count of ADL diffs or fails: subtract:	(−)	0.0285 × count
Design of home: if it 'meets most needs', subtract:	(−)	0.0220
Design of home: if it 'meets some needs or inappropriate', then subtract:	(−)	0.0513
Access to local environment: if 'difficult to get to all places', subtract:	(−)	0.1070
Access to local environment: if 'unable to get to all places or do not leave home' subtract	(−)	0.1020

In each case, the adjusted indicator is then:

Adjusted SCRQoL = Current (utility weighted) SCRQoL - Adjustment factor

Our recommendation is to use either adjustment equation (2) or (4). They produce very similar results (they are over 95% correlated).

A mean value of the adjusted score can be calculated for each LA as described above. An example can illustrate the calculation of the adjusted score. Take Mrs X from Anyshire local authority. She is: over 65; her self-rated health is 'bad'; she has difficulty with five ADLs; her home design is 'inappropriate'; and she finds that she is 'unable to get to all places' in terms of the access to the local environment. Using adjustment equation (2) above, her

Adjustment factor = 0.5798 + 0.0473 + 0 – 0.109 – 0.101 + 0 – 0.125 + 0 – 0.11 = 0.182

Mrs X reports her current SCRQoL as 0.400, which is calculated directly from the ASCS survey using the ASCOT utility weights[22]. Therefore her adjusted score is 0.218 (i.e. 0.400- 0.182). The adjusted score for each respondent in the Anyshire survey is calculated and the sample average is calculated to give the Anyshire mean adjusted SCRQoL score.

The intention is that the adjusted SCRQoL score is a better indicator of impact than the unadjusted score. We can see how much difference this makes for each LA by comparing how they would be ranked with their scores using the adjusted figure as opposed to the unadjusted figure (as currently used in ASCOF 1A).

These results are illustrated in Figure 7, with four sets of graphs corresponding to the four adjustment models (with the base specification). The first chart is the correlation between LA-average unadjusted and adjusted SCRQoL mean values for each LA. A smaller correlation indicates that using the adjusted figure makes *more* difference. The second chart shows the amount by which the score changes following adjustment (centred around the mean average change). To give some context, this figure is expressed as a percentage of the range between the highest and lowest LA-level (unadjusted) SCRQoL score (0.17).

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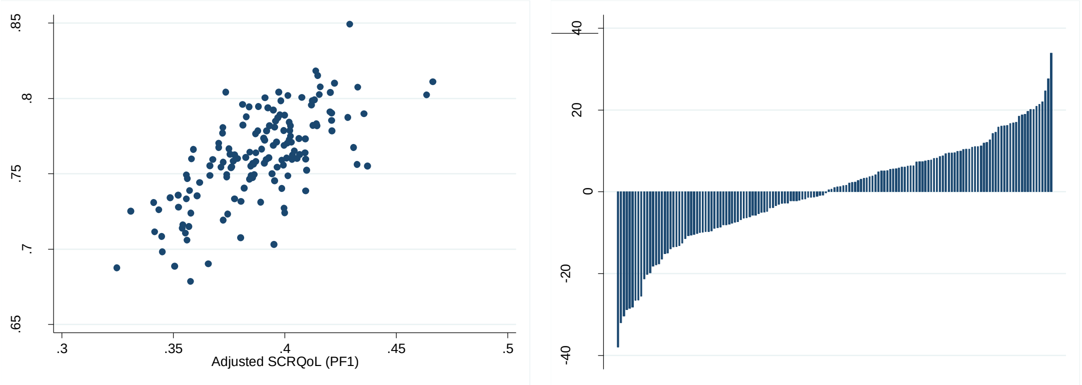
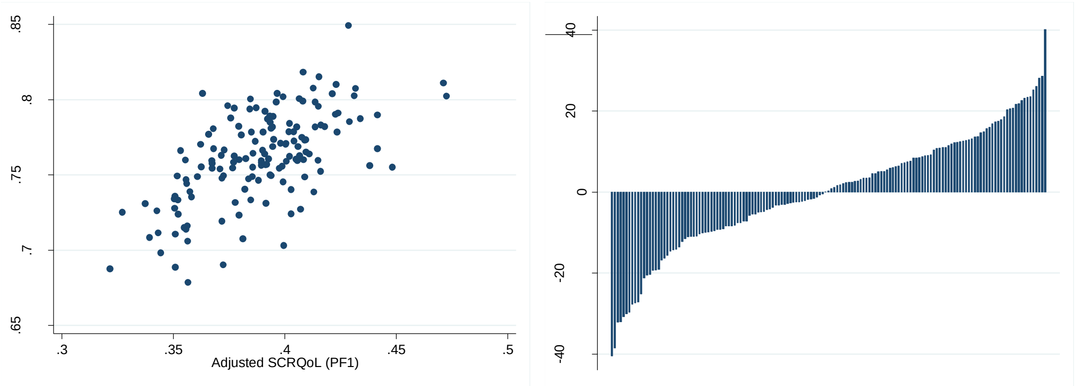
[22] These weights are available at www.ascot.ac.uk.

Figure 7. Correlations between actual and adjusted (LA-mean) SCRQoL and rank of difference between actual and adjusted (LA-mean) SCRQoL – exemplified using ASCS 2013

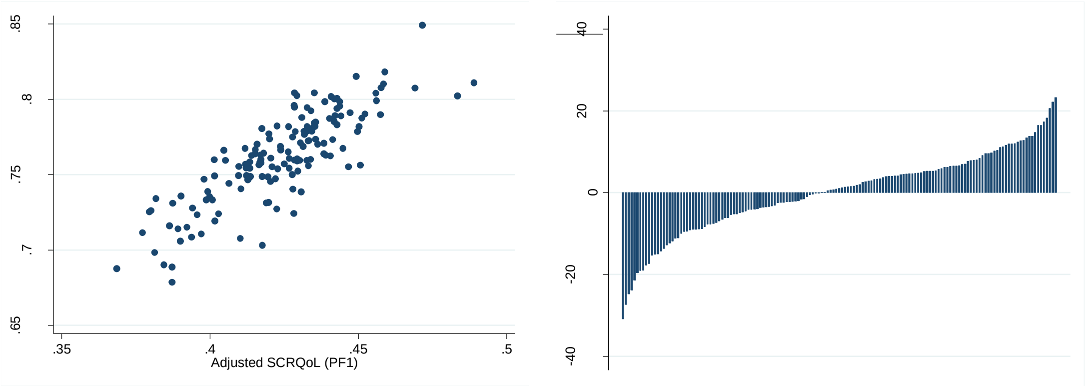
a) Multiple imputation production function model with weekly home care utilisation (corr = 0.69)



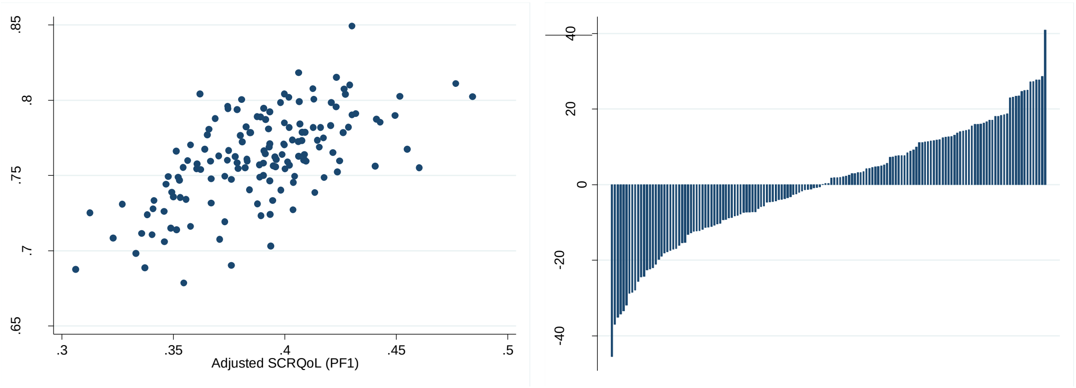
b) Multiple imputation production function model with all community care utilisation (corr = 0.62)



c) Multiple imputation risk-adjustment model (corr = 0.83)



d) Multiple imputation risk-adjustment model for expected SCRQoL (corr = 0.62)



The difference that adjustment makes to the ranking of LAs by score can be appreciated by comparing the rank position of each LA on the basis of the unadjusted and adjusted scores. Table 21 below gives changes in rank by quartile i.e. which quartile the LA is in for adjusted and unadjusted score using the 2013 ASCS data (and adjustment model 2 above). Around 44% of LAs would stay in the same quartile when their score is adjusted. Another 37% would move one quartile up or down, and the remaining 19% would move more than one quartile.

Table 21. Change in rank quartile between unadjusted and adjusted SCRQoL score – PSI+MH group, 2013 ASCS data (model 2)

	Adjusted SCRQoL				
Unadjusted SCRQoL	Q1	Q2	Q3	Q4	Total
Q1	23	8	5	2	38
Q2	8	12	11	6	37
Q3	6	9	12	10	37
Q4	1	8	9	19	37
Total	38	37	37	37	149

Statistical significance – LA level

Although LAs can have different scores – either adjusted or unadjusted – the difference in score from one LA to another might be not be a statistically valid difference. The LA-average value of SCRQoL (adjusted or unadjusted) is drawn from a sample and therefore reflects the ‘true’ value of population care-related quality of life with a degree of uncertainty. Assuming an underlying statistical distribution, sample average scores are subject to statistical error. If the difference in average score between LAs is less than this error, then that difference is not statistically significant.

In other words, if we take the England average value of SCRQoL as the baseline (or ‘target value’), then only LAs with substantially higher or lower LA-average scores will have meaningfully different population quality of life (statistically speaking).

The ‘funnel plot’ charts below (see Figure 8 and Figure 9) display this information visually – for unadjusted and adjusted SCRQoL respectively. The charts each have a target value – the England average value of the score – plotted as the red solid line. The dashed lines are the control values and are the boundary between LAs that are statistically significantly different from the England-average value and those which are not (for difference thresholds of statistical significance, either the 5% confidence level or the 0.2% significance level, or approximately 2 or 3 standard deviations).

The x-axis has the sample size of the ASCS for each LA, which is plotted against the SCRQoL score (on the y-axis). The dashed line control values become narrower for high sample size as a result of the smaller statistical error from larger samples. It is clear in the charts that the majority of LAs do not have sample mean SCRQoL scores that are statistically significantly different from the England average. Around a third of LAs have either significantly higher or lower scores than the England average.

Figure 8. Funnel plot (LA-mean) SCRQoL – exemplified using ASCS 2014

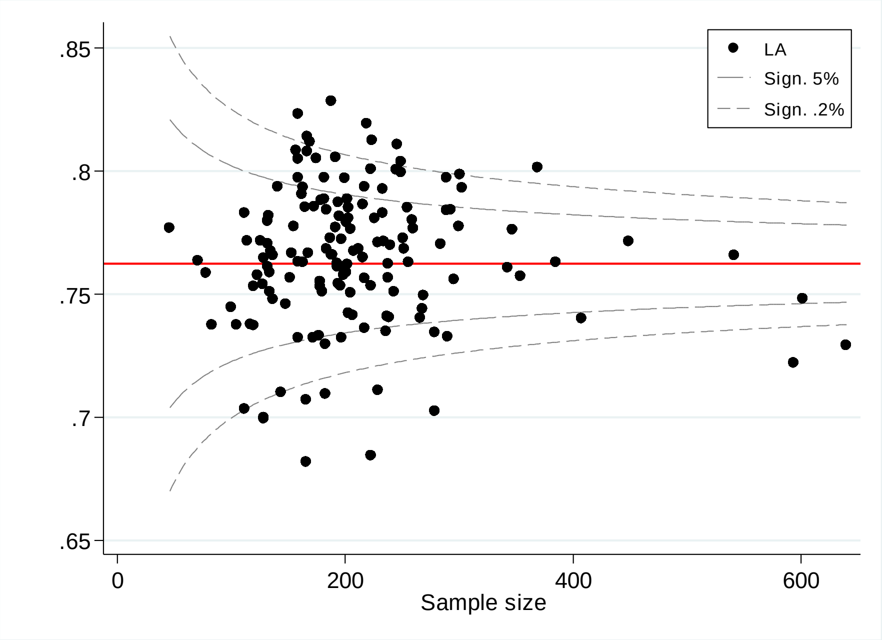
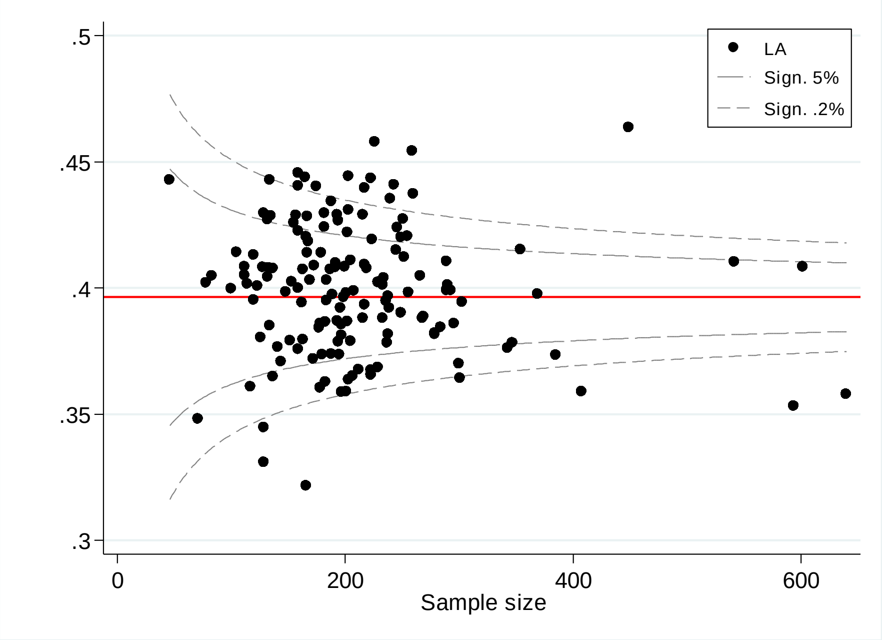


Figure 9. Funnel plot (LA-mean) adjusted SCRQoL – exemplified using ASCS 2014



5.3.2 Learning disability client group

The regression results for the LD sample provide the coefficients for generating an adjustment formula that can be used with the (current) ASCS data. This is calculated on the same basis as for the PSI/MH sample. In this case, we calibrated to achieve an adjusted SCRQoL score that predicts the mean level of SCRQoL gain observed in the IIASC sample (0.36). We report four potential adjustment equations below, as based on the results in the previous section. These are applied in exactly the same way as the PSI/MH adjustments: i.e. by subtracting the adjustment factor from current SCRQoL to produce adjusted SCRQoL.

(1) RA model estimates LD group: base specification (Model RA1, Imputed; Table 16)

Adjustment factor =		0.733
Age: Subtract:	(−)	0.040 × log(age)
Self-rated health: if the rating is ‘quite healthy’ then subtract:	(−)	0.002
Self-rated health: if the rating is ‘ok’, ‘not very good’ or ‘very bad’ then subtract:	(−)	0.056
Count of ADL diffs: subtract:	(−)	0.010 × count
Health: has ‘Limiting mental health problem’, subtract:	(−)	0.043
Design of home: if it ‘meets some needs’ or is ‘inappropriate’, then subtract:	(−)	0.074

(2) Expected model estimates LD group: base specification (Model EX1, Imputed; Table 16)

Adjustment factor =		0.875
Age: Subtract:	(−)	0.067 × log(age)
Self-rated health: if the rating is ‘quite healthy’ then add:	(+)	0.022
Self-rated health: if the rating is ‘ok’, ‘not very good’ or ‘very bad’ then subtract:	(−)	0.024
Count of ADL diffs: subtract:	(−)	0.027 × count
Health: has ‘Limiting mental health problem’, subtract:	(−)	0.082
Design of home: if it ‘meets some needs’ or is ‘inappropriate’, then subtract:	(−)	0.118

(3) RA model estimates LD group: extended specification (Model RA2, Imputed; Table 17)

Adjustment factor =		0.719
Age: Subtract:	(−)	0.040 × log(age)
Self-rated health: if the rating is ‘quite healthy’ then subtract:	(−)	0.001
Self-rated health: if the rating is ‘ok’, ‘not very good’ or ‘very bad’ then subtract:	(−)	0.050
Count of ADL diffs: subtract:	(−)	0.010 × count
Health: has ‘Limiting mental health problem’, subtract:	(−)	0.039
Anxiety/depression: if ‘not worried or sad at all’, then add:	(+)	0.021
Design of home: if it ‘meets some needs’ or is ‘inappropriate’, then subtract:	(−)	0.072

(4) Expected model estimates LD group: extended specification (Model EX2, Imputed; Table 17)

Adjustment factor =		0.869
Age: Subtract:	(−)	0.067 × log(age)
Self-rated health: if the rating is ‘quite healthy’ then add:	(+)	0.023
Self-rated health: if the rating is ‘ok’, ‘not very good’ or ‘very bad’ then subtract:	(−)	0.022
Count of ADL diffs: subtract:	(−)	0.027 × count
Health: has ‘Limiting mental health problem’, subtract:	(−)	0.080
Anxiety/depression: if ‘not worried or sad at all’, then add:	(+)	0.009
Design of home: if it ‘meets some needs’ or is ‘inappropriate’, then subtract:	(−)	0.117

We are unable to estimate production function models in this case. On the basis of the results from the PSI/MH groups, the closest equivalent is the model based on the expected score. As such, we would recommend using adjustment (2) above.

6. Results for carers

6.1 Adjustment estimations for informal carers

As with cared-for people, we estimated models to predict current and expected care-related quality of life of carers – see section 4.2.2. In this case, the expected score is the carer’s own report of their care-related quality of life if no services or support were available, to either the carer or the cared-for person.

The analysis was conducted using the 7-item ASCOT-Carer INT4 measure. Preference weights are not available for carer SCRQoL, so the measure was equally-weighted. Figure 10 shows the distribution of the current score in the IIASC sample. Figure 11 shows the distribution for the expected score. In the main – and especially the expected score – we have single-peaked distributions.

Data were collected on a range of carer services, but, given the variety of support people can receive, we did not use production function models. Rather, we report below estimates from risk-adjustment models and from expected carer SCRQoL models. Three main specifications were used:[23]

- a primary specification drawn from IIASC survey variables (models CA-RA1 and CA-EX1);
- a base specification using only SACE variables (models CA-RA2 and CA-EX2); and
- an extended specification that also uses carer-reported anxiety and depression (from EQ-5D) (models CA-RA3 and CA-EX3).

In each specification we used three groups of external factor variables: long-term conditions of the cared-for person; socio-demographical characteristics of carer; and long-term conditions of the carer. Given the nature of the dependent variables, OLS models were estimated.

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[23] A range of alternative specifications – estimated to look at sensitivity – are reported in Appendix 6.

Figure 10. Density of current SCRQoL for carers (n = 375)

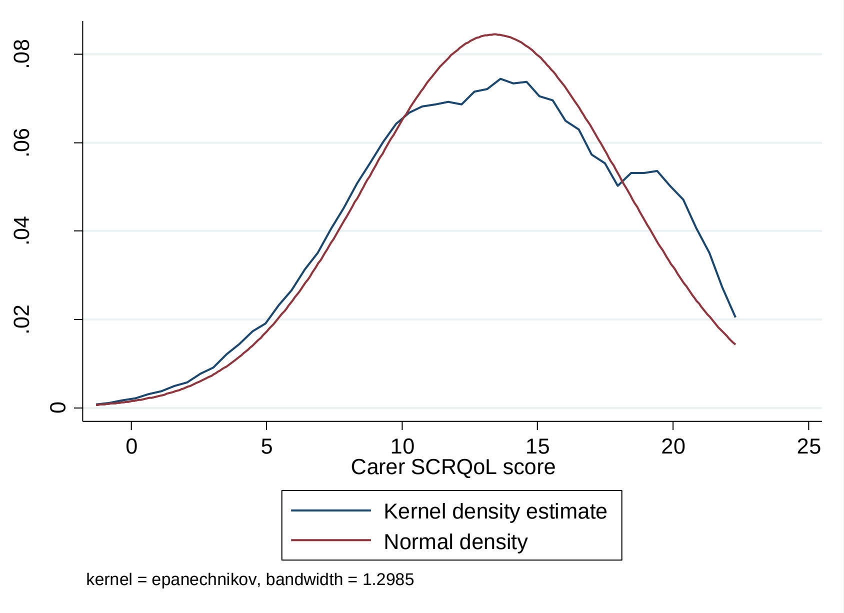

Figure 11. Density of expected SCRQoL for carers (n = 373)

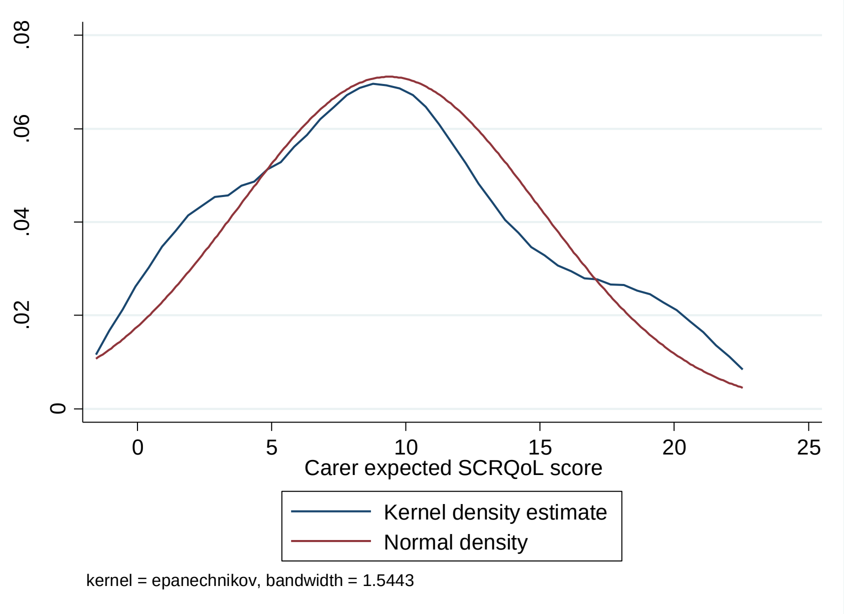

Table 22. Risk-adjustment models for carers: primary specification

	CA-RA1 - primary spec		CA-EX1 - primary spec	
	Non-imputed	**Imputed**	**Non-imputed**	**Imputed**
Care recipient's scale of I/ADLs: 8 items from the ASCS	-0.175***	-0.178***	-0.272***	-0.274***
	(0.0308)	(0.0305)	(0.0369)	(0.0363)
Care recipient: 65+	1.349***	1.349***	1.607***	1.576***
	(0.414)	(0.406)	(0.511)	(0.501)
Care recipient: disorientated	-1.523***	-1.565***	-1.517***	-1.556***
	(0.417)	(0.408)	(0.501)	(0.494)
CR challenging behaviour: very unusual	-0.837	-0.760	-1.621**	-1.469**
	(0.527)	(0.519)	(0.704)	(0.691)
CR challenging behaviour: sometimes/freq	-2.084***	-2.065***	-1.965***	-1.826***
	(0.472)	(0.460)	(0.607)	(0.592)
Care recipient: sensory impairment	-0.943*	-0.927*	-1.187**	-1.236**
	(0.502)	(0.491)	(0.574)	(0.566)
Carer: 45+	-1.378***	-1.297**	-1.898***	-1.785**
	(0.517)	(0.511)	(0.703)	(0.692)
Carer: male	1.344***	1.303***	1.546***	1.490***
	(0.400)	(0.395)	(0.480)	(0.476)
Carer: White	1.412**	1.367**	0.729	0.612
	(0.657)	(0.650)	(0.714)	(0.713)
Carer: employed full-time	1.154**	1.240**	0.351	0.393
	(0.581)	(0.577)	(0.764)	(0.752)
Carer lives with care recipient	-1.902***	-1.828***	-2.126***	-2.069***
	(0.485)	(0.475)	(0.649)	(0.631)
Carer: physical problem	-0.625	-0.629	-1.701***	-1.759***
	(0.417)	(0.412)	(0.515)	(0.508)
Carer: mental health problem	-0.907	-0.917	-1.088*	-1.078*
	(0.585)	(0.568)	(0.614)	(0.606)
Carer self-rated health: bad or very bad	-2.766***	-2.703***	-1.580**	-1.502**
	(0.646)	(0.634)	(0.638)	(0.635)
Constant	17.99***	17.95***	16.48***	16.45***
	(0.888)	(0.879)	(1.135)	(1.129)
Observations	375	387	374	387
R-squared	0.422		0.380	
F	21.01		19.30	
Imputations		20		20

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 23. Risk-adjustment models for carers: base specification

	CA-RA2 - base spec		CA-EX2 - base spec	
	Non-imputed	Imputed	Non-imputed	Imputed
Care recipient: dementia	-1.251*	-1.365**	-1.930**	-1.820**
	(0.682)	(0.683)	(0.756)	(0.761)
Care recipient: mental health problem	-1.250***	-1.243***	-0.746	-0.703
	(0.458)	(0.454)	(0.535)	(0.525)
Care recipient: sensory impairment	-1.186**	-1.155**	-1.457**	-1.508**
	(0.551)	(0.545)	(0.640)	(0.629)
Carer: 45+	-1.328**	-1.281**	-1.839**	-1.807**
	(0.597)	(0.595)	(0.742)	(0.737)
Carer: male	1.472***	1.446***	1.446***	1.437***
	(0.446)	(0.444)	(0.541)	(0.537)
Carer: White	1.498**	1.471**	0.721	0.634
	(0.742)	(0.730)	(0.824)	(0.814)
Carer: employed full-time	1.035	1.123*	-0.0796	-0.0360
	(0.638)	(0.636)	(0.738)	(0.726)
Carer lives with care recipient	-3.197***	-3.102***	-3.433***	-3.339***
	(0.528)	(0.525)	(0.665)	(0.650)
Carer: physical problem	-1.326***	-1.296***	-2.454***	-2.401***
	(0.478)	(0.470)	(0.551)	(0.543)
Carer: mental health problem	-1.346**	-1.310**	-1.424**	-1.419**
	(0.653)	(0.641)	(0.659)	(0.650)
Constant	16.57***	16.51***	14.37***	14.35***
	(0.979)	(0.970)	(1.170)	(1.160)
Observations	378	387	377	387
R-squared	0.245		0.225	
F	13.38	13.21	11.71	11.36
Imputations		20		20

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 24. Risk-adjustment models for carers: extended specification

	CA-RA3 - extended spec		CA-EX3 - extended spec	
	Non-imputed	**Imputed**	**Non-imputed**	**Imputed**
Care recipient's scale of I/ADLs: 8 items from the ASCS	-0.176***	-0.183***	-0.276***	-0.277***
	(0.0294)	(0.0293)	(0.0369)	(0.0361)
Care recipient: 65+	1.279***	1.290***	1.537***	1.532***
	(0.390)	(0.387)	(0.502)	(0.494)
Care recipient: disorientated	-1.313***	-1.346***	-1.308**	-1.391***
	(0.409)	(0.400)	(0.506)	(0.497)
CR challenging behaviour: very unusual	-0.953*	-0.919*	-1.764**	-1.588**
	(0.504)	(0.498)	(0.696)	(0.681)
CR challenging behaviour: sometimes/freq	-1.943***	-1.924***	-1.852***	-1.720***
	(0.458)	(0.448)	(0.600)	(0.587)
Care recipient: sensory impairment	-0.974**	-1.032**	-1.223**	-1.315**
	(0.494)	(0.478)	(0.576)	(0.560)
Carer: 45+	-1.056**	-0.982**	-1.698**	-1.549**
	(0.509)	(0.495)	(0.709)	(0.687)
Carer: male	1.173***	1.157***	1.442***	1.381***
	(0.389)	(0.384)	(0.472)	(0.467)
Carer: White	1.434**	1.409**	0.757	0.644
	(0.673)	(0.658)	(0.721)	(0.715)
Carer: employed full-time	1.172**	1.141**	0.248	0.318
	(0.539)	(0.542)	(0.766)	(0.738)
Carer lives with care recipient	-1.785***	-1.633***	-1.980***	-1.923***
	(0.451)	(0.446)	(0.642)	(0.622)
Carer: physical problem	-0.799*	-0.819**	-1.856***	-1.902***
	(0.415)	(0.411)	(0.522)	(0.514)
Carer: mental health problem	0.381	0.419	-0.0367	-0.0750
	(0.618)	(0.606)	(0.682)	(0.673)
Carer self-rated health: bad or very bad	-2.174***	-2.252***	-1.198*	-1.164*
	(0.611)	(0.600)	(0.624)	(0.614)
Carer EQ-5D anxiety or depression: moderate or extreme	-2.478***	-2.424***	-1.974***	-1.819***
	(0.446)	(0.443)	(0.568)	(0.558)
Constant	18.42***	18.33***	16.85***	16.73***
	(0.859)	(0.848)	(1.117)	(1.109)
Observations	373	387	372	387
R-squared	0.472		0.401	
F	22.75		18.71	
M_mi		20		20

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

The base specification mainly differs from the primary specification in having fewer variables relating to the long-term conditions of the cared-for person. The SACE has dummy variables for condition rather than the more sophisticated metrics available in the IIASC data (which were used in the primary specification). For example, we had carer's self-reported health status in addition to (just) dummy variables for the carer's own conditions.

The extended specification also adds the carer's self-reported anxiety/depression (from EQ-5D). This variable is highly significant as we might expect, but it is not clear that it is a causal factor in the carer's SCRQoL or rather a correlated outcome variable. As such, it is difficult to regard this as a factor we should 'control for' when adjusting SCRQoL.

6.2 Adjusted SCRQoL of carers

The same methodology can be used for adjusting carers' quality of life scores than is used for social care clients. As before, the idea is to control for external factors, removing their effect from the current SCRQoL of the carer.

Table 25 gives some descriptive statistics for carer SCRQoL in the IIASC sample. On a 0 to 21 scale (7 times 4 domains, rated 0 to 3), the current score averages 13.44, whilst the expected (without services) score is lower at 9.42. The difference of 4.02 is the mean amount by which respondents reported their SCRQoL to be improved by services and support. If we re-scale to a 0 to 1 range (which is more comparable with clients' preference weighted SCRQoL), the gain would be 0.19.

Table 25. Carer SCRQoL scores: current, expected and gain - imputed sample

	Current	Expected	Gain
mean	13.44	9.42	4.02
median	14	9	3
SD	4.69	5.56	3.94
min	0	0	-7
max	21	21	20
1st quartile	10	5	1
3rd quartile	17	13	7

Table 26 reports correlations between the adjusted carer SCRQoL score in the IIASC sample and both the current SCRQoL score and the gain in carer SCRQoL. Consistent with results above for cared-for people, the expected model with the extended specification generates an adjusted score that departs the most from the current score. The expected models produce an adjusted score that is more closely correlated with (unadjusted) SCRQoL gain.

Table 26. Adjusted carer SCRQoL score, IIASC sample, correlation with unadjusted score and SCRQoL gain (imputed dataset) – carers

Model name	Model	Spec	Current carer SCRQoL	Carer SCRQoL gain
CA-RA1	Risk adj	Prim	0.76	0.28
CA-RA3	Risk adj	Extended	0.73	0.27
CA-RA2	Risk adj	Base	0.87	0.23
CA-EX1	Expected	Prim	0.70	0.34
CA-EX3	Expected	Extended	0.68	0.34
CA-EX2	Expected	Base	0.84	0.27

6.3 Adjusted carer SCRQoL score for local authorities

The adjustment process can be applied using the data for each respondent in the SACE survey. The mean value for the local authority is then worked out and used to rank each authority. The adjustment factor is a (linear) formula.

There are potential adjustment factor equations for each of the SCRQoL models that were estimated. We can narrow the options by just considering the results from the imputed models. Moreover, we can drop the extended model given our concerns about the anxiety/depression indicator being a legitimate external factor. As a result we have four options, as given below.

(1) RA model estimates for carers: primary specification (Model CA-RA1, Imputed; Table 22)

Carers adjustment factor =		13.931
Care recipient's ADLs: Count of I/ADLs: 8 items from the ASCS, subtract	(−)	0.178 × count
Care recipient age: If aged ≥65 then add	(+)	1.349
Care recipient: If 'disorientated' then subtract	(−)	1.565
CR challenging behaviour: If 'very unusual', then subtract	(−)	0.760
CR challenging behaviour: if 'sometimes' or 'frequent', then subtract	(−)	2.065
Care recipient: has 'sensory impairment', subtract:	(−)	0.927
Carer: is 45+, then subtract:	(−)	1.297
Carer: is 'male', then add:	(+)	1.303
Carer: is 'white', then add:	(+)	1.367
Carer: is 'employed full-time', then add:	(+)	1.240
Carer: if the 'carer lives with care recipient', then subtract:	(−)	1.828
Carer: if the carer has a 'physical problem', then subtract:	(−)	0.629
Carer: if the carer has a 'mental health problem' then subtract:	(−)	0.917
Carer: if the carer's self-rated health is 'bad' or 'very bad' then subtract:	(−)	2.703

(2) Expected model estimates for carers: primary specification (Model CA-EX1, Imputed; Table 22)

Carers adjustment factor =		16.452
Care recipient's ADLs: Count of I/ADLs: 8 items from the ASCS, subtract	(−)	0.274 × count
Care recipient age: If aged ≥65 then add	(+)	1.576
Care recipient: If 'disorientated' then subtract	(−)	1.556
CR challenging behaviour: If 'very unusual', then subtract	(−)	1.469
CR challenging behaviour: if 'sometimes' or 'frequent', then subtract	(−)	1.826
Care recipient: has 'sensory impairment', subtract:	(−)	1.236
Carer: is 45+, then subtract:	(−)	1.785
Carer: is 'male', then add:	(+)	1.490
Carer: is 'white', then add:	(+)	0.612
Carer: is 'employed full-time', then add:	(+)	0.393
Carer: if the 'carer lives with care recipient', then subtract:	(−)	2.069
Carer: if the carer has a 'physical problem', then subtract:	(−)	1.759
Carer: if the carer has a 'mental health problem' then subtract:	(−)	1.078
Carer: if the carer's self-rated health is 'bad' or 'very bad' then subtract:	(−)	1.502

(3) RA model estimates for carers: base specification (Model CA-RA2, Imputed; Table 23)

Carers adjustment factor =		12.490
Care recipient: has ‘dementia’, then subtract:	(−)	1.365
Care recipient: has ‘mental health problem’, subtract:	(−)	1.243
Care recipient: has ‘sensory impairment’, subtract:	(−)	1.155
Carer: is 45+, then subtract:	(−)	1.281
Carer: is ‘male’, then add:	(+)	1.446
Carer: is ‘white’, then add:	(+)	1.471
Carer: is ‘employed full-time’, then add:	(+)	1.123
Carer: if the ‘carer lives with care recipient’, then subtract:	(−)	3.102
Carer: if the carer has a ‘physical problem’, then subtract:	(−)	1.296
Carer: if the carer has a ‘mental health problem’ then subtract:	(−)	1.310

(4) Expected model estimates for carers: base specification (Model CA-EX2, Imputed; Table 23)

Carers adjustment factor =		14.353
Care recipient: has ‘dementia’, then subtract:	(−)	1.820
Care recipient: has ‘mental health problem’, subtract:	(−)	0.703
Care recipient: has ‘sensory impairment’, subtract:	(−)	1.508
Carer: is 45+, then subtract:	(−)	1.807
Carer: is ‘male’, then add:	(+)	1.437
Carer: is ‘white’, then add:	(+)	0.634
Carer: is ‘employed full-time’, then subtract:	(−)	0.036
Carer: if the ‘carer lives with care recipient’, then subtract:	(−)	3.339
Carer: if the carer has a ‘physical problem’, then subtract:	(−)	2.401
Carer: if the carer has a ‘mental health problem’ then subtract:	(−)	1.419

At present only the base specification can be used fully with the SACE data. It would in theory be possible to apply the primary specification by treating the missing variables as having their IIASC mean values. However, the base specification was chosen to include alternative variables for missing external factors as far as possible, so is likely to be the better approach for this purpose. Furthermore, we would suggest that the (base) model using the expected carer SCRQoL score would be the better option: i.e. the adjustment equation is (4) above (CA-EX2).

Currently the carers’ survey uses the three-level SCRQoL measure. The analysis was conducted using the ASCOT 7-item version of carer’s SCRQoL. The main rationale was that the expected care SCRQoL is only available with the ASCOT version. Nonetheless, the ASCOT version and SACE versions are very similar (they are highly correlated in the IIASC sample).

An adjusted SCRQoL score using the SACE would be given by the following formula.

$$\begin{aligned}\textit{Adjusted carer SCRQoL score} \quad &= 3.88 + 0.604 \times \textit{SACE carer SCRQoL score} \\ &+ 0.055 \times (\textit{SACE carer SCRQoL score})^2 \\ &- \textit{Adjustment factor}\end{aligned}$$

The IIASC data were used to produce the conversion between ASCOT and SACE carer quality of life.

There remains a question of whether the ASCOT carer measure might replace the existing SCRQoL measure in the survey. Further analysis, comparing the two versions, can be undertaken using the IIASC data to help address this question. Nonetheless, the two measures produce very similar results, and so taken a more pragmatic position, there is no problem in basing an adjusted score on the current carer measure.

7. Discussion

The Adult Social Care Outcomes Framework (ASCOF) uses local authority population-averaged SCRQoL score as a core indicator. This indicator captures the respondent's self-reported SCRQoL at the time of the survey – i.e. their *current* SCRQoL. Given that the principle goal of the care system is to improve the wellbeing of care clients – as laid out in the 2014 Care Act – then the use of a quality of life indicator to measure the impact of the ASC system is a consistent approach (Forder and Fernandez 2014). However, there are methods to improve the degree to which we can use SCRQoL indicators to measure the *impact* of social care services and support. In particular, we can use additional survey data to produce an adjusted SCRQoL indicator that should be a better measure of impact than the current SCRQoL indicator on its own.

Current SCRQoL in a population will reflect not only the improvement produced by the care system, but also of other influences, including the negative effects of having care needs – such as the effects of people's long-term conditions – and the impact of a range of related life experiences, such as family support, the person's housing situation, and their more general economic situation. These latter influences are likely to be outside the control of local authorities, but could systematically affect populations in different ways between different LAs. If we accept the principle that local authority adult social care systems should be assessed in terms of how far they improve (care-related) quality of life of their local populations, then we should identify and remove the influence of these external factors as far as possible.

7.1 Making an adjustment

This study has outlined several methods for making this adjustment. All involve using statistical models along with a series of empirical variables to analyse the effects of external factors on SCRQoL. The study considers both people with care needs and their carers. As regards the former, the external factors include variables measuring: the extent of the person's underlying long-term condition; their personal characteristics; access to informal care support; and other environmental characteristics (e.g. housing). As regards carers, external factors include: the cared-for person's condition as well as the characteristics and environment of the carer.

The *risk-adjustment* approach analyses the relationship between the current SCRQoL score and the external factors. The *production function* approach builds on this by also including indicators of service/support intensity. Potentially this allows us to produce indicators of service effectiveness as well as overall impact. The third approach is to use the *expected SCRQoL* score: that is, respondent's reported quality of life in the absence of services and support. The statistical modelling in that case looks at the relationship between the expected score and the external factors. In all three cases the overall effect of the external factors – as given by the adjustment formula – was subtracted from the current SCRQoL score to give an *adjusted* SCRQoL score for each respondent.

There were options as to which variables were used as indicators of the external factors. By design, the range of available variables for the external factors was greater in the IIASC survey than for the respective ASCS or SACE. In general, this meant that IIASC models could 'explain' the net effect of external factors to a greater degree than when using just ASCS or SACE variables. Nonetheless, the adjustment formula is designed to be applied to the national survey results. It is therefore constrained in practice to only using the variables in the national surveys. If we want to use the IIASC variable-specified models for this purpose, any missing variable has to be set to its IIASC sample constant value.

In considering the choice between the different methods for generating adjustment equations, there are two main criteria to consider. The first is the degree of to which we capture external factors. Models that capture the most external effects are to be preferred, although it is important that models are not 'over-fitted': that is, use variables that are closely associated with current SCRQoL but are not causal factors. An example of this issue is when an *outcome* indicator is used as a predictor of a similar outcome.

The second criteria concerns 'bias'. The overall effect of external factors is composed of a series of individual effects. Bias occurs if the individual effects are mis-estimated (even in large samples). It is generally better to estimate models with a low likelihood of bias, even if that means sacrificing (as it sometimes does) the degree to which the overall effect is captured. After all, we can never hope to capture all possible external effects. Rather, the aim should be to improve on the assessment we can make using just the unadjusted SCRQoL score.

The production function models are in theory the preferred choice over the risk-adjustment models because the omission of service/support intensity in the latter is a potential source of (endogeneity) bias. In practice, however, the technical challenges of estimating production functions should also be considered. The expected SCRQoL models are also a good option as long as we are confident that respondents are a good judge of their likely SCRQoL in the absence of support. We cannot test this assumption directly, but we did find that the correlation of the results of this model – and of the production function model – with the reported gain in SCRQoL in the sample was greater than the correlation of the risk-adjustment models results and SCRQoL gain. Moreover, the production function models did indicate that the service intensity variables were statistically significant and endogenous.

As to the choice of specification of external factor variables, the IIASC variable set produced a greater degree of explained variation than the national survey sets (i.e. a greater 'r-squared' value[24]). However, for the care recipient groups the difference in this regard was relatively small. For the carer models, the equivalent difference between the base models and the primary and extended (IIASC) models was much greater (doubling of the r-squared values). The main difference in the variable sets in this case was the measure of the cared-for person's condition.

For both cared-for people and carers, the results suggest that important adjustments can be made using data that are already collected in the ASCS or SACE. In other words, it appears quite feasible to make adjustments that should meaningfully improve an ASCOF indicator designed to measure impact (or at least differences in impact between LAs). It was clear that the use of further data or

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[24] Note that we cannot compare r-squared figures between model types (PF vs RA), only as between variable specifications for the same type of model.

refinements, over and above that in the national surveys, would improve the adjustment, especially regarding carers/SACE. In the latter case, introducing a way to link a combination of the responses of cared-for people in ASCS with their carers in SACE (where both parties were respondents) would be highly beneficial, without increasing the length of the SACE survey.

Although the results of the analyses of IIASC data were used to develop the adjustment formulas (with the choice of the methods as outlined above), in practice only the formulas using variables available in the ASCS or SACE can be applied at the current time.

7.2 SCRQoL indicators

Two main indicators of care-related quality of life were used in this report. First, for service users, we used the utility weighted ASCOT measure, rather than the equally weighted version that is in the ASCOF. The main rationale is that previous research has shown that people do attribute quite different degrees of importance to the different aspects of their life measured by ASCOT. Second, the study used the new ASCOT 4-level carers measure rather than the 3-level version in the PSS-SACE. The main motivations in this case were that the ASCOT version is more consistent with the service user measure and also, importantly, allows direct reporting of SCRQoL gain through the use of the 'expected' score. Nonetheless, our investigation showed that the results only changed to a small degree if the 3-level version was used.

7.3 Limitations and extensions

A number of limitations to our analysis need to be considered. First, sample sizes were relatively small. Second, the IIASC sample was not always representative of the ASCS sample. We have not used weighting in the above analysis, but that option could be considered. Third, estimating the production functions was challenging, and the available techniques for estimation of such models are somewhat sensitive to assumptions. Fourth, we had self-reported data on service use, with potential associated problems of recall bias. Fifth, there was, as expected, missing data, which had to be tackled.

A number of extensions and refinements to the analysis could be made. First, we have the opportunity to analyse the SCRQoL *gain* measure. Second, further consideration of principles of performance measure would be beneficial in light of the results. One issue is the extent to which we can discount the effects of 'other (independently distributed) factors'. Another issue is about the representativeness of ASCS as the main source of data for performance assessment, and the consequences of potential changes in ASCS and other social care data collections.

7.4 Interpreting adjusted SCRQoL

Having calculated adjusted SCRQoL scores for each respondent in the relevant national survey, the resultant mean values by local authority can be used to compare and rank LAs against other LAs, and assess changes over time. How much difference does it make using adjusted scores?

We gained some insight into this question by comparing adjusted and unadjusted scores at the individual person level (i.e. comparing people in the IIASC sample). For the PSI/MH group, correlation between the scores ranged from 60% to 79%, depending on the model type and variable set. For the LD group, the equivalent correlation was 68% to 86%. As regards the carers' sample, the same correlation ranged between 68% and 87%.

Insight was also be gained by comparing the *mean* unadjusted and adjusted SCRQoL scores for each LA. In this analysis, we used the 2012/13 ASCS data for the PSI/MH group. The exemplifications were made using the base variable specification. In this case, correlation between the mean adjusted and unadjusted scores was between 62% (for the all-care production function and the expected models) and 83% (for the risk-adjustment model). The size of the difference between the LA mean unadjusted and adjusted SCRQoL scores was between 40% less than and 40% more than the size of the difference in mean unadjusted SCRQoL score between the LA with the highest score and the one with the lowest score in 2012/13. We can conclude that adjustment for external factors would make quite a difference to the ranking of local authorities.

The principle of territorial justice as a basis for performance assessment calls for external factors beyond the control of local authorities to be accounted for in any comparison. Applying this principle requires a determination of which factors – and in particular which of the corresponding empirical variables – are beyond the control of local authorities and which might potentially be affected by them. Socio-demographic characteristics are clearly beyond the control of care services. But other factors, such as self-reported need or health, may be potentially affected by the activity of care services. Since the focus is on measuring long-term conditions and personal impairment, as control factors, this problem may be fairly limited in practice. Nonetheless, it is important to understand the implications of controlling for external factors, and how this might influence the incentives that local authorities face with regard to the planning of their activities.

Furthermore, while there may be factors/variables that are beyond the control of LAs, principles concerning discrimination may apply to restrict their use in any adjustment. Explicitly controlling for differences in ethnicity between areas is an example.

7.5 Implications for the Adult Social Care Outcomes Framework

Our immediate conclusions with respect to the ASCOF are that adjustment for external effects is (a) merited in theory, and (b) feasible and empirically meaningful given the data available. With regard to the latter point, the data currently in the ASCS and SACE national surveys can be used to make adjustments. Further data collection and/or linkage of data sets would bring some improvements in how well we account for external factors.

While there is substantial correlation between unadjusted and adjusted SCRQoL scores, using the adjusted value will change the normative ranking of LAs in terms of how well they are improving care-related quality of life in their local populations.

Finally, as with any assessment indicator – whether adjusted or unadjusted – a number of assumptions and principles are embodied in its use. Differences in these assumptions or principles will change our conclusions about adjustment and, in turn, the results of performance comparisons.

Annex 1: estimating adjusted SCRQoL

The risk-adjustment approach

The general approach is to estimate a variant of (2), dropping the service/support impact i.e.

$$y_i = \beta_0^{RA} + \beta_2^{RA} z_i^0 + \beta_3^{RA} z_i^1 + \beta_3^{RA} z_i^2 + e_i^{RA} \tag{4}$$

where in this case the superscripts RA denote estimated parameters (β's) and the RA error as derived from the risk-adjustment regression model.

The RA error is the difference between the actual SCRQoL and the SCRQoL score predicted just on the basis of the external factors. Compared to the full model (2), the error of this model is: $e_i^{RA} = e_i + f^x(x_i, q_i; \beta_1)$: that is, it contains both the independently distributed error (which accounts for other, non-related factors that affect SCRQoL) and the effects of services.

By making two assumptions, any difference in the mean value of the RA error for different LAs (e.g. $\overline{e_{i1}^{RA}}$ and $\overline{e_{i2}^{RA}}$) will be the mean difference in the impact of their services/support. These assumptions are (a) that the independently-distributed error (e_i) is unrelated to the local authority in which people live, which means it should have a mean value of zero for both subsamples.[25] And (b) that we assume the coefficients are unbiased estimates of the βs.

The latter assumption will generally *not* hold because of the correlation between $f^x(x_i, q_i; \beta_1)$ and the external factor variables (see also below). The β^{RA} coefficients will pick up some baseline impact of services. As a result, this approach is best used to compare changes in the impact over time, by comparing changes in the adjusted SCRQoL score. These changes: $\left(e_{it+1}^{RA} - e_{it}^{RA}\right)$ will be a reasonable estimate of the change in impact of the care system, year on year.

The production function approach

The production function approach is a variation on the risk-adjustment approach. In this case, the basis for the adjustment is an estimation of the full model (2). In other words, the direct effect of care services – the $f^x(x_i, q_i; \beta_1)$ term – is estimated.

In applying a production function (PF) approach in this study we have assumed that the function $f^x(x_i, q_i; \beta_1)$ takes a log form: $\ln\left(x_i^{\beta_1} q_i\right)$. This means that (2) is now:

$$y_i = \beta_0^{PF} + \beta_1^{PF} \ln(x_i) + \beta_2^{PF} z_i^0 + \beta_3^{PF} z_i^1 + \beta_3^{PF} z_i^2 + e_i^{PF} \tag{5}$$

where $e_i^{PF} = e_i + \ln(q_i)$. This regression model is then estimated using the instrumental variables method (IV)[26].

As in the RA approach, we can calculate the adjusted error (e_i^{PF}) over subsamples relating to different LAs. Given the above assumptions, and also that the coefficients are estimated without

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[25] The likelihood that this assumption is appropriate will generally depend on how far we can capture all relevant factors in our risk adjustors. The better we can capture relevant factors directly, the less likely is the chance that the independently distributed error (e_i) will pick up effects that are specific to the local authority. Obviously, if we are unable to capture relevant effects then differences in the risk-adjusted error between local authorities may be due to these unobserved factors as well as differences in care system performance.

[26] This method is used as the intensity of service use x_i is likely to be correlated with the error term e_i^{PF}. This correlation might be due to (a) any unobserved need variables that affect how much service people use, and (b) any link between effectiveness q_i and intensity (although perhaps less likely). In that case OLS estimation is biased.

bias, we can use the results in two ways. First, we calculate an adjusted SCRQoL as being the error (e_i^{PF}). This indicator will give a comparison of the relative *effectiveness* of care services in improvement quality of life – i.e. of $\ln(q_i)$ – between LAs. Second, we could calculate adjusted SCRQoL as being $e_i^{TPF} = e_i^{PF} + \beta_1^{PF} \ln(x_i)$. This option gives an indicator which compares LAs in terms of the overall impact of services. It is the option which is the closest analogy to the risk-adjustment approach.

Under the PF approach, the coefficients on the risk factors (z's) measure the impact of need and other effects, and should not embody any service intensity effects.

In theory, therefore, the production function approach can tackle two issues that concern the RA approach. The first is that the OLS estimation of (4) used in the RA approach is likely to be biased (called endogeneity bias) in the sense that estimated coefficients on the risk adjustors will partly reflect the influence of services. This occurs because service intensity is affected by people's need characteristics (through the operation of LAs' care assessment processes). As a result, in the RA approach what we are really measuring when we compare the mean-adjusted error is the total impact of services standardised for the whole-sample average impact of needs. Consequently, some differences between LAs in terms of the relative impact of services might be adjusted out.

The second concern is that the RA approach can only provide an indication of the total impact of care services, being unable to differentiate from an intensity as compared to an effectiveness difference.

There are limitations to the production function approach. First, it requires more data (specifically on service intensity) than with RA. Second, it requires statistical estimation techniques that could – if improperly applied – produce greater bias than from OLS estimates of (4). Third, it requires assumptions to be made about the functional form of the intensity function $f^x(x_i, q_i; \beta_1)$ that captures the impact of care services.

The expected SCRQoL approach

With reference to the full model (2), the expected SCRQoL score is:

$$y_i^{EX} = y_i - f^x(x_i, q_i; \beta_1) = \beta_0 + \beta_2 z_i^0 + \beta_3 z_i^1 + \beta_3 z_i^2 + e_i \qquad (6)$$

With the results of this estimation, we can use the coefficients to produce an estimate of y_i^{EX}: i.e. the predicted value $\widehat{y_i^{EX}}$. An adjusted SCRQoL indicator calculated as $y_i - \widehat{y_i^{EX}}$ is therefore an estimate of $f^x(x_i, q_i; \beta_1) = y_i - \widehat{y_i^{EX}}$, the impact of care services/support. The crucial assumption with this approach is that when directly asked for their expected SCRQoL without support – the value of y_i^{EX} – respondents can give an unbiased answer.

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