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RESEARCH ARTICLE

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Disability and multidimensional quality of life: A capability approach to health status assessment

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Abstract

This paper offers an approach to assessing quality of life, based on Sen's (1985) theory, which it uses to understand loss in quality of life due to mobility impairment. Specifically, it provides a novel theoretical analysis that is able to account for the possibility that some functionings may increase when a person's capabilities decrease, if substitution effects are large enough. We then develop new data consistent with our theoretical framework that permits comparison of quality of life between those with a disability (mobility impairment) and those without. Empirical results show that mobility impairment has widespread rather than concentrated impacts on capabilities and is associated with high psychological costs. We also find evidence that a small number of functionings are higher for those with a disability, as our theory allows. The paper concludes by discussing possible implications for policy and health assessment methods.

KEYWORDS

capabilities, disability, extra-welfarism, health, mobility impairment, Sen

JEL CLASSIFICATION

D60; I31

1 | INTRODUCTION

Interest in the application of Sen's (1979, 1985, 2010) capability approach to health economics continues to grow following earlier discussions in the literature about its capacity to change the informational basis of policy evaluation and technology assessment (Culyer, 1989). Sen's approach was essentially developed as a constructive response to some of the problems that economists and philosophers had identified in the theoretical foundations of welfare economics. It argues instead for an account of quality of life that emphasises multidimensionality, the importance of what people are free to do, a production function for quality of life that is based on resources and abilities and recognises that people are heterogeneous in their abilities to generate quality of life. In this paper, we contribute to the problem of understanding what happens when the capability approach is used to structure empirical analysis relevant to health economics by providing novel evidence of a pattern of diverse capability deprivation for those with a mobility impairment. We also contribute to theory by providing a more general theoretical analysis of capabilities and their determinants than has been discussed to date and use this to help interpret our empirical findings.

Within health economics, Anand (2005), Brouwer, Culyer, van Exel, and Rutten (2008), and Coast, Smith, and Lorgelly (2008) have emphasised the theoretical promise that this approach offered to broaden the informational scope of economic evaluations. As they note, welfarism restricts information to utilities, whereas extra-welfarism goes beyond this by supplementing it with additional information about nongoods characteristics, such as whether individuals have the freedom and ability to do everyday activities or are free from pain or happy. One of the key problems for Sen's approach has been its operationalization. It emphasised the importance of human potential—what people are enabled to do—and yet this seemed to be difficult to measure compared with the activities people engage in or states they experience. However, over the years, this has given rise to a growing body of research by economists on the value of autonomy in health (Abadian, 1996; Ruger, 2010), safety nets for and prevalence and nature of disability (Burchardt, 2004; Kuklys, 2005; Mitra, 2006; Wolff & De-Shalit, 2007; Dubois & Trani, 2009),[1] child development and the promotion of non-cognitive skills (Heckman, 2007), global health governance and social justice (Ruger, 2004), women's quality of life in a low income country (Greco, Skordis-Worrall, Mkandawire, & Mills, 2015), opportunities for exercise and health diets (Ferrer et al., 2014), as well as the development of new measures of health status for evaluations such as the ICECAP family of measures (Coast et al., 2008; Al-Janabi et al., 2013; Coast, 2014; Keeley, Al-Janabi, Lorgelly, & Coast, 2013) or the OCAP/OXCAP family of measures developed by Simon et al. (2013) and Lorgelly, Lorimer, Fenwick, Briggs, and Anand (2015).[2]

Our paper contributes to the practical use of the approach by developing data on the capabilities, functionings and happiness of a group of adults with a disability and then using the data to explore what it might tell us about the quality of life of this group. In addition, because we find that a small number of functionings increase with disadvantage (e.g. sleeping during the day) in a manner not dissimilar to the behaviour of inferior goods in conventional consumer theory, we develop a theoretical framework that allows for this possibility. Our research question can be considered, therefore, to be what can data (and theory) based on the capability approach to quality of life tell us about people with disabilities? The paper is primarily a contribution to the health economics of quality of life measurement, particularly from a capability perspective, but it is also relevant to work on disability more generally, or the operationalisation of the Sen–Nussbaum approach to economics and social justice.

The paper is structured as follows. Section 2.1 offers an account of the capability approach focussing particularly on the concept of capability and then develops some theory that makes a novel theoretical contribution to capability analysis connecting it more generally with traditional consumer theory and that we use to structure our interpretation of results. Section 2.2 describes the data categories that we populate on the basis of the theory described in 2.1. It also provides a valuation formula used towards the end of the empirical results section. Section 3 carries the results and descriptive data comparing capabilities, activity involvement and subjective-wellbeing measures for people with a capability impairment. We then report the results of regression models in which capabilities and subjective wellbeing depend on mobility impairment as well as a range of other resource and conversion factors and use this to argue that the pattern of capability deprivation is such that *most* capabilities are on average lower for those with a mobility impairment than for those without; and, using a subjective valuation method, the costs appear significant. In Section 4, we discuss these results, noting that our results indicate that workplace and other losses are important when measuring the true value of health, that recent disability policy reform in Australia can be understood through a capability lens and that the subjective measures in this case appear to confirm significant quality of life loss associated with extensive capability deprivation. We also suggest that whether these results could be described as being consistent with a utility approach is less important than the fact that the approach provides a definition of quality of life that provides a rationale for collecting such data and offers an agenda for further research.

[1]Economists working on health have emphasised that disability can profoundly impact the ability of people to convert resources into valued activities or states and this paper provides an opportunity to complement the work of Trani, Bakhshi, Brown, Lopez, and Gall (2018) and to test the proposition in a high-income country context.

[2]Following his widely cited International Health Economics Association (IHEA) presidential address published in this journal, Sen (2002), a wide array of topics have been shown to be addressable with the approach including work on maternal health, Osmani and Sen (2003), disability classification, Saleeby (2007), recovery in mental health, Hopper (2007), health inequalities and social determinants, Marmot et al. (2008), the value of agency for health, Abel and Frohlich (2012), health and justice, Venkatapuram (2013), patient-centred care, Entwistle and Watt (2013), theoretical foundations for health assessment, Bleichrodt and Quiggin (2013) and Brazier and Tsuchiya (2015), psychometric properties of health measures, Al-Janabi et al. (2013), Hofmann, Schori, and Abel (2013), Vergunst et al. (2017) and ageing and quality of life Zaidi and Howse (2017). For a review of applications of the Sen–Nussbaum capability approach in health see Mitchell, Roberts, Barton, and Coast (2017).

2 | THEORY AND METHODS

2.1 | Theoretical framework

We start by developing a framework based on Sen (1985, pp. 11–14) that emphasises the importance of capabilities, functionings (activities and states) and subjective wellbeing (e.g. 'experienced utility' or 'happiness') for quality of life assessment. The freedom to choose things, in and of itself, is not well captured in traditional welfare economics. In particular, welfare economics makes no reference to how bliss points, identified with optimal baskets of goods and services, are arrived at. In Sen's framework, and therefore in our analysis, we begin by emphasising the importance of what people are enabled to do or be. We denote the set of all such activities and states that an individual i can achieve as the set $\boldsymbol{Q_i}$, and note that conditional on a person's resources, and abilities to convert them, this can be a significant measure of a person's wellbeing. This set can also be thought of as the outcome of a vector of production functions, denoted by $\mathbf{f_i}$, of resources and personal abilities, $\mathbf{c}_i$. So, for the ith individual we can define the capability set:

$$\boldsymbol{Q_i} \equiv \{\mathbf{f}_i, ; \mathbf{c}_i\} \text{ where } \mathbf{f}_i \in \mathbb{R}^n. \tag{1}$$

Variations in personal abilities are central to disability, even in social models, and so, this framework is a promising one with which to understand how disability impacts the production of quality of life.

A capability set specifies feasible activities[3] that are achievable with given resources and personal characteristics. We denote the functioning vector thus

$$\mathbf{f}'_i = < f_{i,1}(\mathbf{c_i}), f_{i,2}(\mathbf{c}_i), \cdots, f_{i,n}(\mathbf{c}_i) > \in \mathbb{R}^n, \tag{2}$$

where n denotes the number of elements in the space of possible activities or states. The value of this vector depends on the individual's ability to convert resources into activities, so in the analysis, we shall estimate equations consistent with this. Finally, our framework includes a third equation denoting the amount of pleasure or happiness a person derives from any particular vector of activities and states, which depends also on their resources and personal characteristics, $\mathbf{c}_i$. We can represent this as

$$U_i = u\left(f_{i,1}, f_{i,2}, \cdots, f_{i,n}, \mathbf{c}_i\right). \tag{3}$$

This last relation can be thought of as representing what has come to be called experienced utility, to distinguish it from the decision-based concept of utility proposed by Samuelson (1937).

This is, in essence, Sen's (1985, pp. 11–14) original model, with only minor notational differences. What people are free to do, as distinct from what they actually do, is important for assessing a person's overall advantage. This distinction is reflected in standard measures of health that include both actual experience of pain as well as the ability to get around (e.g. EuroQol 1990). In many situations, activities or states can be ends in themselves, whereas happiness could be a driver or by-product of some desirable state or activity. Happiness, however, is adaptive, and people can adapt to both goods and bads, so Sen (1985, pp. 11–14) emphasises that it cannot be relied on as a gold standard measure of value. This important observation has led some to interpret Sen's capability approach as not being concerned about human happiness Bruni, Comim, and Pugno (2008). That is not the case, however, so we focus on this aspect of quality of life.

Although all three aspects of wellbeing (capabilities, activities and happiness) are important to understand a person's overall quality of life, our data on capabilities are the most novel. In Figure 1, we illustrate how capability sets can be visualised. In this particular example, a star graph indicates that person B has more capabilities in all but one domain but does not dominate A who has better access to services.

In the empirical work here as elsewhere (see for instance Anand, Krishnakumar, & Tran, 2011), we develop data that measure the vertices of each set. Rather than trying to estimate the elements of the set, which is feasible only for very small sets, our approach relies on the fact that the set of all possible activity and state vectors defines another set of

[3]For the rest of this paper, we focus on activities and use the term 'functioning' synonymously.

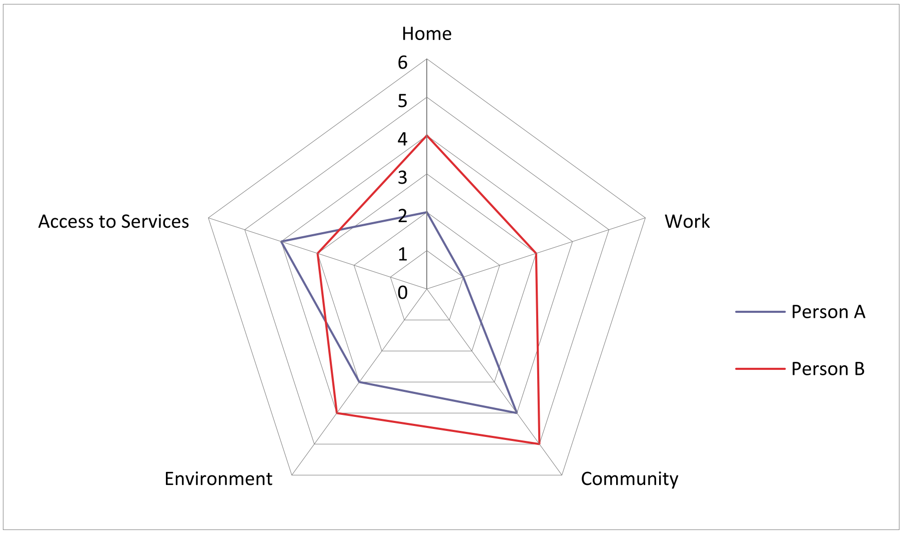

FIGURE 1 Capability sets for two individuals [Colour figure can be viewed at wileyonlinelibrary.com]

maximal points on each dimension. Using the fact that the set $\boldsymbol{Q_i}$ defines a set of maximum points in the n-dimensional space indexed by j, we can define an estimator of the ith individual's capability set thus

$$\hat{\boldsymbol{Q}}_{\boldsymbol{i}} = \left\{d^*_{i,1}, d^*_{i,2}, \cdots, d^*_{i,n}\right\}, \tag{4}$$

where $d^*_{i,j}$ are the capability assessments for each of the j dimensions. This estimator reflects what a person is able to do on a dimension by dimension basis.[4]

To assess the impact of disability on capabilities and activities, we first denote disability by $D_i \in \mathbb{R}^+$, where higher values denote increasing disability. We assume that in general $\frac{\partial d^*_{i,j}}{\partial D_i} \leq 0$; that is, $d^*_{i,j}$ is weakly decreasing in D_i for all i,j. In other words, a disability is not capability enhancing in any of the n dimensions. However, disability could be expected to reduce some capabilities more than others. Thus, if an unimpaired individual with a capability set $\boldsymbol{Q_i} = \left\{d^*_{i,1}, d^*_{i,2}, ..., d^*_{i,n}\right\}$ were subsequently to become impaired, the resulting capability set $\boldsymbol{Q'_i} = \left\{d'^*_{i,1}, d'^*_{i,2}, ..., d'^*_{i,n}\right\}$ would have the following two features:

i $\sum_{j=1}^{n} d'^*_{i,j} \leq \sum_{j=1}^{n} d^*_{i,j}$

ii In general, $d'^*_{i,j}/d'^*_{i,k} \neq d^*_{i,j}/d^*_{i,k}$.

We could expect a similar impact of disability on the set of activities: (i) a reduction in *total* activities but also (ii) a change in the *relative frequency* of activities. These effects might be considered loosely analogous to the income and substitution effects in the standard neoclassical constrained optimisation problem. In the standard neoclassical problem, these effects arise from the reduction in the budget set and the change in relative prices, arising from one good's price increase. Here, the effects arise from the overall reduction that a disability causes in an individual's opportunity to engage in activities, together with the fact that this reduction is not uniform across different types of activity, making certain activities relatively more ‘costly.’

$$\textit{Opportunity effect of impairment}: \sum_{j=1}^{n} f'_{i,j} \leq \sum_{j=1}^{n} f_{i,j} \tag{5}$$

$$\textit{Substitution effect of impairment}: \frac{f'_{i,j}}{\sum_{l=1}^{n} f'_{i,l}} = \alpha_j \frac{f_{i,j}}{\sum_{l=1}^{n} f_{i,l}} \text{ for some } \alpha_j \in \mathbb{R}_+. \tag{6}$$

[4]Geometrically it amounts to proxying the individual's capability set with a multidimensional polyhedron in line with theory discussed by Klemisch-Ahlert (1993).

The overall levels of opportunity, or resource, for engaging in activities are lower for disabled people so they 'purchase' fewer activities in Equation 5. However, relative prices are also different, resulting in a substitution in Equation 6 away from activities that have been particularly affected (e.g. more physically demanding activities such as walks in the park) to those which may now be only marginally more difficult (e.g. reading a book).

In Equation 6, if $\alpha_j > 1$,this indicates a substitution towards activity j from the $n - 1$ other activities (and conversely if $\alpha_j < 1$). In theory, it is quite possible for this effect to be large enough to outweigh the 'opportunity' effect in Equation 5 so that the net effect of disability is an increase in frequency of activity j. To see this, note that Equation 5 can be rewritten as:

$$\sum_{l=1}^{n} f'_{i,l} + \beta = \sum_{l=1}^{n} f_{i,l} \text{ for some } \beta \geq 0, \tag{7}$$

where β indicates the absolute size of the opportunity effect of impairment.

Substituting Equation 7 into Equation 6, we have $\frac{f'_{i,j}}{\sum_{l=1}^{n} f'_{i,l}} = \frac{\alpha_j f_{i,j}}{\beta + \sum_{l=1}^{n} f'_{i,l}}$. Rearranging, we have $\frac{f'_{i,j}}{f_{i,j}} = \frac{\alpha_j \sum_{l=1}^{n} f'_{i,l}}{\beta + \sum_{l=1}^{n} f'_{i,l}}$. Therefore, $f'_{i,j} > f_{i,j} \Longleftrightarrow \alpha_j \sum_{l=1}^{n} f'_{i,l} > \beta + \sum_{l=1}^{n} f'_{i,l}$, which simplifies to the condition that

$$f'_{i,j} > f_{i,j} \Longleftrightarrow \alpha_j > 1 + \frac{\beta}{\sum_{l=1}^{n} f'_{i,l}}. \tag{8}$$

The intuition from the condition in Equation 8 is clear. The net effect of disability on frequency of activity j depends on the size of the substitution effect α_j relative to the size of the opportunity cost of impairment as a proportion of total activities. For the substitution effect to lead to increased frequency of activity j, it is always the case that $\alpha_j > 1$. As the opportunity cost of impairment tends towards zero, there need only be an infinitesimally small substitution effect towards j in order for activity j to increase due to impairment.

Almost all applications to date of Sen's theory assume that capabilities are positively related to an individual's resources and ability to convert resources into valued activities. Our framework is also, however, able to allow for negative relations when 'substitution' effects are sufficiently high compared with opportunity effects. If any activities behave like inferior goods, then a framework that does not rule out positive relations between disability and activities, counter-intuitive though this may seem, is required.[5]

2.2 | Data and empirical implementation

The data developed for our analysis were produced through a population level survey in the UK designed to deliver a profile of overall quality of life at national level. To ensure that our sample population was as close as possible to being nationally representative, the panel of respondents was drawn equally from England, Scotland and Wales and is representative of working age adults in terms of age, gender and social class. The survey was conducted by YouGov in 2012 and supplemented in 2013 with an additional sample of people, all of whom had a doctor diagnosed mobility problem or were registered disabled (due to mobility impairment)[6].[7] These individuals were asked exactly the same questions as the original representative 2012 sample. In total this provides us with 2013 data for a sample of 633 mobility impaired individuals and 1,172 nonimpaired individuals.

[5]It should be stressed that the purpose is not to suggest that capabilities or activities often decrease with better health but rather to allow, theoretically, for the possibility that this can happen. Most goods are consumed more when income rises, but some, like supermarket own brands, though valued are consumed less as income rises—our point is that some activities are similar in regards to their 'income' elasticities.

[6]The precise question respondents answered was 'Have you been diagnosed by a doctor, or are you registered as disabled [in the following way]: A condition that substantially limits one or more basic physical activities such as walking, climbing stairs, reaching, lifting or carrying.' Ethics approval for the collaboration with YouGov was granted by the Human Research Ethics Committee (HREC) Open University.

[7]Background analysis and early use of related data in health economics can be found, for example in Chirikos and Nestel (1984).

Data were collected on capabilities, activity involvement and psychological cost, as well as a range of socio-economic variables[8] (see Anand, Roope, and Peichl (2016) for further details for the derivations of these questions). The most distinctive component of our dataset relates to the measurement of capabilities; these are reproduced in the online supplementary materials[9] and relate to the opportunities and constraints individuals face across five domains—Home (i.e. domestic and family life), Work, Community, the Environment in which one lives and Access to Services. In each of these domains, several 'subdomain' questions were asked, regarding various specific things that people are able to do or to achieve. In total, data were collected for 29 capabilities across these domains. Only respondents who reported being employed or self-employed at the time were asked the Work domain questions.

Consider a set of individuals $i = 1,2,\cdots,N$. As discussed above, we distinguish between their capabilities, d_i, things that they can do; their activities or functionings, f_i, the things that they actually do; and their well-being, u_i, their satisfaction with life. These are all influenced by their mobility impairment, if any, D_i; their income Y_i; and a vector of resources and personal characteristics, c_i, such as gender, age, race, education, whether working, living with a partner or with dependent children.

From the survey we have data on 29 capability indicators, d_i^j (such as able to get to places easily); 30 activity indicators f_i^k, (such as doing exercise); and 8 wellbeing measures, u_i^l (such as satisfaction with life or with colleagues). Mobility impairment was either diagnosed by a doctor or the person was registered disabled. Sample size differed between general responses and responses specific to the subsample who worked.

Three sets of equations were estimated. For capabilities $j = 1,2,\cdots,29$

$$d_i^j = \beta_0^j + \beta_1^j D_i + \beta_2^j Y_i + \gamma^j c_i + \varepsilon_i^j$$

For activities $k = 1,\cdots,30$

$$f_i^k = \beta_0^k + \beta_1^k D_i + \beta_2^k Y_i + \gamma^k c_i + \varepsilon_i^k$$

For well-being indicators $l = 1,2,\cdots,8$

$$u_i^l = \beta_0^l + \beta_1^l D_i + \beta_2^l Y_i + \gamma^l c_i + \varepsilon_i^l.$$

These are cross-section equations, and, since at least Friedman (1957), it has been common to interpret the between-unit association as representing the long-run permanent relationship rather than the transitory, within-unit, adjustment process. Thus, although there are likely to be person-specific features, such as how long the respondent's mobility has been impaired, the cross-section variation is likely to dominate, as discussed by Pesaran and Smith (1995).

We report two analyses. First, we know from previous capability research using secondary data that the costs of disability can be high, though we do not know why. By developing and comparing capability indicators for people with a mobility impairment and those without, we can in principle distinguish between two plausible patterns associated with mobility impairment: one in which capability losses are concentrated and a second in which they are widespread. Both are plausible though appropriate policy responses will differ.

Second, we use the subjective wellbeing regressions to derive a monetary estimate of the impact of mobility impairment on life-satisfaction. We use the compensating variation approach, where the value of mobility impairment is estimated as

$$CV = \exp\left(-\frac{\beta_{mi}}{\beta_y} + \ln\bar{y}\right) - \bar{y}, \tag{10}$$

[8]For a discussion of socio-economic variables correlated with health, see for example Fuchs (2004).

[9]All the capability questions are detailed in supplementary Appendix A. Derivation is further discussed across several papers but see for example Anand et al (2009, 2016), and Simon et al (2013).

where β_{mi} and β_y denote the coefficients on mobility impairment and (log) income, respectively, in an OLS model of life satisfaction, and $\bar{y}$ denotes mean income. This or similar methods have been used to assign market values to a wide variety of nonmarket goods.[10]

As an alternative way of quantifying the impact of mobility impairment in monetary terms, we use the association between mobility impairment and self-reported EQ-5D-3L health utility to estimate the value of quality of life lost as a result of mobility impairment, annually and discounted over remaining life expectancy, using the ceiling willingness to pay of the National Institute for Health and Care Excellence (NICE) of between £20,000 and £30,000 per Quality-Adjusted Life-Year (QALY) gained. EQ-5D-3L health utility was elicited in our survey instrument using standard questions developed by EuroQol (1990).[11] By definition, an individual's EQ-5D-3L health utility is equal to the proportion by which their life years are discounted to obtain their estimated QALYs. Thus, the mobility impairment coefficient in an OLS model of EQ-5D-3L health utility was used to provide an estimate of annual QALYs lost due to impairment. QALYs lost until death were estimated by multiplying this figure by remaining life expectancy. Our estimate of life expectancy was estimated simply by subtracting the mean age of the full sample (45.654) from the general population average life expectancy of 81.5 years and did not adjust for possible reduced life expectancy arising from mobility impairment.

3 | RESULTS

A descriptive summary of capability scores from our survey is reported in Table 1, showing that people with a mobility impairment are systematically worse off than those without a mobility impairment: pairwise *t*-tests suggest strongly statistically significant differences in all but two areas. Two out of the top three (in significance terms) are clearly related to spatial mobility (getting to places easily and access to parks), but it is interesting and perhaps less obvious that work–life is also highly related to the disability. Generally speaking, access to services are least significant and, in the case of getting help from doctors, nurses or the police, the differences are not statistically significant.

Turning to measures of functioning as measured by 'involvement yesterday in 28 different activities', Table 2 shows significant differences between impaired and nonimpaired respondents in 14 of the 28 areas and that these effects operate in both directions (as allowed in our theory). Thus, active involvement in commuting, cooking, drinking alcohol, exercise, housework, internet use for work, intimate relations, listening to music, paid employment and playing a musical instrument are reported significantly less often by those with mobility impairment compared with others. This does not rule out some substitution effect towards some of these activities, for example from those related to work to those done in the home, but does suggest that in these instances the direct effect of impaired mobility is dominant. By contrast, relaxing, self-care and smoking are reported more frequently by those with a mobility impairment, a pattern compatible with a substitution effect, which has considerable face validity as a possible explanation.

The third set of measures concern psychological wellbeing. Our initial results for the eight measures are reported in Table 3. Across all eight measures, people with mobility impairment report significantly lower wellbeing than nonimpaired respondents. In five cases, the difference is highly significant (<1%), whereas satisfaction with friendships is lower on average, but only at the 10% level of significance. Note that 'anxiety yesterday' is the only indicator in which higher scores indicate lower welfare, and is significantly higher on average for those with mobility impairment.

Table 4 reports ordered probit results for each of the 29 capability measures. Income and mobility impairment are the most consistent predictors of capabilities across all the areas covered by our indicators. That said, for some services, including healthcare, mobility impairment is not a significant predictor. Being white also stands out as a predictor of access to a range of services, whereas having a partner and dependent children are often statistically significant predictors of capabilities related to the environment.[12] [13]

[10]These nonmarket goods (and bads) include the cost of domestic violence (Santos, 2013), air quality (Luechinger, 2009) and (Levinson, 2012), flood disasters (Luechinger & Raschky, 2009), terrorism (Frey, Luechinger, & Stutzer, 2007), noise (van Praag & Baarsma, 2005) and informal care (Van den Berg & Ferrer-i-Carbonell, 2007).

[11]For an overview of such methods see for instance Dolan, Gudex, Kind, and Williams (1996).

[12]Raw gradients are graphed in online materials (Figure B1).

[13]By way of extension, we also estimated a finite mixture model based on capabilities aggregated into subscales representing the five areas discussed. Exploratory results suggest that whilst mobility impairment is generally predictive of capability, there is evidence of two groups in the data differentiated by size of the mobility impact.

TABLE 1 Capability scores: Mobility impairment versus no mobility impairment

Capabilities	Impaired			Nonimpaired			
	n	Mean	SE	*n*	Mean	SE	*t*-test for Difference
Home life							
Make ends meet	633	5.701	0.12	1,172	7.323	0.079	11.29***
Find suitable home	633	6.553	0.124	1,172	7.713	0.079	7.88***
Enjoy personal relations	633	5.953	0.129	1,172	7.125	0.084	7.597***
Feel loved and valued	633	6.194	0.126	1,172	7.27	0.08	7.18***
Share tasks fairly	633	5.232	0.126	1,172	7.009	0.089	11.49***
Socialise with family members	633	6.229	0.123	1,172	7.308	0.079	7.358***
Work life							
Work–life balance	633	4.564	0.128	1,172	6.869	0.081	15.24***
Find work when need	205	6.21	0.218	889	7.562	0.092	5.7***
Can use skills	205	6.58	0.21	889	7.534	0.088	4.19***
Promotion opportunities	205	4.795	0.216	889	5.756	0.1	4.029***
Have good boss	205	6.054	0.229	889	7.018	0.097	3.885***
Treated as equal at work	205	6.517	0.224	889	7.828	0.087	5.446***
Socialise with colleagues	205	5.351	0.211	889	6.451	0.091	4.78***
Community life							
Participate social events	633	4.774	0.114	1,172	5.967	0.077	8.65***
Treated as equal	633	7.387	0.121	1,172	8.088	0.072	4.99***
Religious freedom	633	7.981	0.115	1,172	8.534	0.071	4.086***
Political freedom	633	7.733	0.113	1,172	8.091	0.073	2.657***
Local Environment							
Safe at night	633	6.664	0.122	1,172	7.893	0.072	8.65***
Access to parks	633	6.408	0.135	1,172	8.419	0.076	12.97***
Low pollution	633	5.348	0.127	1,172	6.98	0.084	10.74***
Can keep a pet	633	7.581	0.133	1,172	8.256	0.09	4.19***
Can get to places easily	633	4.795	0.125	1,172	7.994	0.077	21.84***
Access to Services							
Use financial services	633	7.942	0.109	1,172	8.658	0.065	5.645***
Get rubbish cleared	633	7.689	0.113	1,172	8.544	0.065	6.56***
Get house problems fixed	633	7.376	0.116	1,172	7.767	0.072	2.86***
Get doctor or nurse	633	8.299	0.1	1,172	8.264	0.067	−0.29
Help from police	633	7.662	0.107	1,172	7.83	0.069	1.32
Legal help	633	7.254	0.117	1,172	7.772	0.071	3.78***
Range of shops	633	6.886	0.124	1,172	8.498	0.068	11.38***
Total Capabilities	205	17.239	0.284	889	20.594	0.232	

Note. (1.) *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively; (2.) means are of quasi-Likert eleven point scales.

TABLE 2 Activity involvement: Impaired versus nonimpaired

	Impaired			Nonimpaired			
	n	Mean	SE	*n*	Mean	SE	*p*-value
Attending class	408	0.015	0.006	770	0.017	0.005	0.7778
Caring (unpaid)	408	0.083	0.014	770	0.068	0.009	0.3212
Commuting	408	0.123	0.016	770	0.305	0.017	<0.0001***
Cooking	408	0.370	0.024	770	0.461	0.018	0.0027***
DIY	408	0.056	0.011	770	0.079	0.010	0.1471
Drinking alcohol	408	0.145	0.017	770	0.209	0.015	0.0069***
Exercise	408	0.108	0.015	770	0.251	0.016	<0.0001***
Housework	408	0.377	0.024	770	0.461	0.018	0.0059***
Internet (personal)	408	0.787	0.020	770	0.764	0.015	0.3682
Internet (work)	408	0.105	0.015	770	0.231	0.015	<0.0001***
Intimate relations	408	0.069	0.013	770	0.105	0.011	0.0393**

TABLE 2 (Continued)

	Impaired			Nonimpaired			
	n	Mean	SE	*n*	Mean	SE	*p*-value
Listening to music	408	0.355	0.024	770	0.442	0.018	0.0042***
Looking after pet	408	0.377	0.024	770	0.343	0.017	0.2377
Other outdoor	408	0.054	0.011	770	0.069	0.009	0.3187
Paid employment	408	0.228	0.021	770	0.542	0.018	<0.0001***
Playing musical instrument	408	0.022	0.007	770	0.055	0.008	0.0091***
Praying or meditating	408	0.088	0.014	770	0.066	0.009	0.1695
Relaxing or napping	408	0.404	0.024	770	0.268	0.016	<0.0001***
Reading	408	0.419	0.024	770	0.423	0.018	0.8880
Self-care	408	0.370	0.024	770	0.242	0.015	<0.0001***
Smoking	408	0.199	0.020	770	0.119	0.012	0.0003***
Socialising	408	0.118	0.016	770	0.169	0.014	0.0196**
Shopping	408	0.272	0.022	770	0.316	0.017	0.1211
Time with children	408	0.194	0.020	770	0.235	0.015	0.1027
Visiting park or countryside	408	0.088	0.014	770	0.105	0.011	0.3544
Visiting cinema/concert/gallery/museum	408	0.056	0.011	770	0.066	0.009	0.5069
Volunteering	408	0.059	0.012	770	0.061	0.009	0.8792
Watching TV	408	0.757	0.021	770	0.731	0.016	0.3295

Note. (i) Smaller sample sizes than in Table 1 because these data relate only to 'those for whom yesterday was a normal working day'; (ii) . *p*-values are from chi-squared tests under null hypothesis of equal means for impaired and nonimpaired; means are of binary activity involvement reports; data relate to those for whom yesterday was a normal working day.

TABLE 3 Psychological wellbeing measures: Impaired versus nonimpaired

	Impaired			Nonimpaired			
	n	Mean	SE	*n*	Mean	SE	*t*-test
Life satisfaction	633	5.510	0.098	1,172	6.850	0.068	11.21***
Happy yesterday	633	5.641	0.101	1,172	6.718	0.071	8.74***
Anxious yesterday	633	5.548	0.112	1,172	5.234	0.076	−2.326**
Life worthwhile	633	5.905	0.113	1,172	6.933	0.070	7.768***
Satisfied with friendships	633	7.039	0.113	1,172	7.296	0.072	1.918*
Satisfied with colleagues	633	4.852	0.122	1,172	6.871	0.073	14.229***
Satisfied with neighbourhood	633	6.502	0.107	1,172	7.124	0.065	4.968***
Yesterday pleasurable	633	5.276	0.096	1,172	6.163	0.063	7.709***

Notes. (1.) *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively; (2.) means are of quasi-Likert 11-point scales.

Our results in Table 5 repeat the ordered probit analysis for measures of psychological wellbeing. Again, mobility impairment and income are the most consistent predictors across almost all measures, followed by having a partner. The one exception is satisfaction with friendships where there is no statistically significant difference between those with a mobility impairment and others. Controlling for other variables, we find little evidence of any association between ethnicity and subjective wellbeing.

An OLS regression was also performed to estimate the coefficient on mobility impairment, including the same set of variables as the ordered probit and with EQ-5D-3L utility as the dependent variable. These showed that mobility impairment is associated with an annual reduction of 0.428 QALYs. The results reported so far suggest that, contrary to concerns about adaptation (Oswald & Powdthavee, 2008a), those with a mobility impairment have a sustained experience and report continuing impaired capabilities and continuing lower wellbeing. Table 6 reports the results of monetizing these wellbeing losses, using the two approaches described in the methods section. Using the compensating variation method, we estimate that the impact of mobility impairment on life satisfaction ranges from £42,749 to £78,877 using a linear and log functional form, respectively. In our alternative valuation method, at NICE's £20,000 ceiling willingness to pay, the annual reduction in QALYs from impairment of 0.428 corresponds to a value of £8,552 over

TABLE 4 Mobility impairment impacts on capabilities: Ordered probit results. ordered probit models of mobility impairment impacts on capabilities

Variables	(1) Make ends meet	(2) Find suitable home	(3) Home–relations	(4) Home–loved	(5) Home–share	(6) Home–social	(7) Work–life balance	(8) Can find work	(9) Work–can use skills	(10) Work–opportunities
Mobility impaired	−0.401***	−0.365***	−0.327***	−0.283***	−0.446***	−0.293***	−0.662***	−0.342***	−0.253***	−0.220**
	(0.058)	(0.057)	(0.058)	(0.059)	(0.058)	(0.058)	(0.060)	(0.087)	(0.087)	(0.088)
Age	−0.097***	−0.015	−0.050**	−0.054***	−0.044**	−0.055***	−0.084***	−0.028	0.017	−0.021
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.028)	(0.027)	(0.028)
Age Squared/ 1000	1.112***	0.310	0.659***	0.664***	0.431*	0.668***	0.959***	0.272	−0.197	0.145
	(0.247)	(0.244)	(0.245)	(0.243)	(0.245)	(0.244)	(0.244)	(0.320)	(0.318)	(0.331)
Logged HH Equiv . Income	0.481***	0.260***	0.205***	0.199***	0.168***	0.174***	0.295***	0.480***	0.369***	0.249***
	(0.039)	(0.038)	(0.037)	(0.039)	(0.037)	(0.037)	(0.037)	(0.053)	(0.055)	(0.052)
Male	0.028	−0.084*	−0.059	−0.130***	0.245***	0.094*	0.074	0.107*	−0.061	−0.066
	(0.049)	(0.050)	(0.050)	(0.049)	(0.050)	(0.050)	(0.050)	(0.064)	(0.064)	(0.064)
Higher Educ.	0.194***	0.148***	0.106**	0.138**	0.071	0.038	0.122**	0.065	0.065	0.084
	(0.053)	(0.052)	(0.054)	(0.054)	(0.054)	(0.053)	(0.054)	(0.068)	(0.068)	(0.067)
White	−0.029	0.155	−0.052	0.042	−0.126	0.112	−0.080	0.313**	0.179	0.094
	(0.105)	(0.117)	(0.119)	(0.126)	(0.119)	(0.115)	(0.111)	(0.150)	(0.156)	(0.151)
Unemployed	−0.442***	−0.221**	−0.068	−0.165	−0.007	−0.088	−0.347***			
	(0.110)	(0.100)	(0.110)	(0.110)	(0.095)	(0.100)	(0.105)			
Married/live with partner	0.276***	0.304***	0.759***	0.576***	0.545***	0.365***	0.182***	0.109	0.114	0.034
	(0.056)	(0.056)	(0.056)	(0.056)	(0.059)	(0.057)	(0.056)	(0.073)	(0.072)	(0.072)
Have dep. Children	−0.035	−0.005	−0.085	−0.012	−0.087	0.049	0.047	0.100	0.016	0.046
	(0.059)	(0.059)	(0.061)	(0.060)	(0.057)	(0.059)	(0.058)	(0.075)	(0.077)	(0.077)
Observations	1,740	1,740	1,740	1,740	1,740	1,740	1,740	1,058	1,058	1,058
Pseudo *R*-squared	.0561	.0300	.0431	.0325	.0357	.0200	.0449	.0321	.0187	.0117
AIC	7711.707	7721.447	7788.847	7818.001	7748.991	7900.48	7726.841	4652.555	4731.427	4922.882
BIC	7820.94	7830.68	7898.08	7927.234	7858.224	8009.713	7836.074	4746.874	4825.745	5017.2

Note. (1.) *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively; (2.) Robust standard errors.

TABLE 4 Mobility impairment impacts on capabilities: Ordered probit results. ordered probit models of mobility impairment impacts on capabilities

Variables	(11) Work– good manager	(12) Work– equal	(13) Work– social	(14) Community– social	(15) Community– treated as equal	(16) Community– religion	(17) Community– political	(18) Environment– safe	(19) Environment– parks	(20) Environment– low pollution
Mobility impaired	−0.226**	−0.405***	−0.287***	−0.354***	−0.244***	−0.218***	−0.117**	−0.347***	−0.614***	−0.462***
	(0.090)	(0.090)	(0.090)	(0.059)	(0.058)	(0.057)	(0.057)	(0.058)	(0.059)	(0.059)
Age	−0.040	−0.032	−0.040	−0.061***	−0.070***	−0.035	−0.045**	−0.002	−0.036*	−0.010
	(0.028)	(0.028)	(0.028)	(0.021)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.021)
Age Squared/ 1000	0.391	0.383	0.368	0.748***	0.001***	0.494*	0.608**	0.064	0.468*	0.128
	(0.329)	(0.322)	(0.325)	(0.247)	(0.000)	(0.258)	(0.249)	(0.253)	(0.250)	(0.246)
Logged HH Equiv . Income	0.220***	0.200***	0.299***	0.212***	0.139***	0.118***	0.154***	0.160***	0.244***	0.196***
	(0.052)	(0.052)	(0.053)	(0.038)	(0.038)	(0.037)	(0.037)	(0.038)	(0.038)	(0.037)
Male	−0.076	0.035	0.019	−0.063	−0.174***	−0.043	−0.034	0.159***	0.059	0.023
	(0.064)	(0.064)	(0.063)	(0.049)	(0.050)	(0.051)	(0.050)	(0.050)	(0.050)	(0.050)
Higher Educ.	0.007	0.035	0.012	0.218***	0.071	0.245***	0.220***	0.151***	0.090*	0.120**
	(0.068)	(0.067)	(0.068)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.054)	(0.054)
White	0.239*	0.117	0.015	−0.014	0.478***	0.406***	0.357***	0.260**	0.221*	0.048
	(0.141)	(0.138)	(0.131)	(0.110)	(0.110)	(0.108)	(0.116)	(0.120)	(0.117)	(0.106)
Unemployed				−0.022	−0.054	−0.058	0.032	0.007	−0.110	−0.242**
				(0.106)	(0.105)	(0.110)	(0.107)	(0.098)	(0.108)	(0.098)
Married/live with partner	0.128*	0.055	0.107	0.238***	0.115**	0.020	0.040	0.050	0.102*	0.102*
	(0.073)	(0.074)	(0.071)	(0.055)	(0.055)	(0.057)	(0.056)	(0.056)	(0.057)	(0.056)
Have dep. Children	−0.017	−0.006	0.022	0.116*	0.137**	−0.001	0.015	0.078	0.204***	0.125**
	(0.077)	(0.076)	(0.074)	(0.059)	(0.060)	(0.060)	(0.059)	(0.059)	(0.060)	(0.060)
Observations	1,058	1,058	1,058	1,740	1,740	1,740	1,740	1,740	1,740	1,740
Pseudo *R*-squared	.0097	.0110	.0148	.0237	.0156	.0129	.0113	.0163	.0346	.0230
AIC	4857.995	4700.683	4876.292	7839.335	7436.077	6819.667	7272.027	7681.836	7434.294	7894.537
BIC	4952.313	4795.002	4970.61	7948.568	7545.309	6928.9	7381.26	7791.069	7543.527	8003.77

TABLE 4 Mobility impairment impacts on capabilities: Ordered probit results. ordered probit models of mobility impairment impacts on capabilities

Variables	(21) Environment– pets	(22) Environment– travel/access	(23) Services– bank	(24) Services– rubbish	(25) Services– fix problems	(26) Services– doctor	(27) Services– police	(28) Services– solicitor	(29) Services– shops
Mobility impaired	−0.255***	−1.021***	−0.238***	−0.329***	−0.076	0.034	−0.025	−0.126**	−0.536***
	(0.058)	(0.062)	(0.058)	(0.058)	(0.057)	(0.058)	(0.058)	(0.058)	(0.058)
Age	0.009	−0.068***	−0.015	−0.032	−0.019	−0.039*	−0.030	−0.031	−0.023
	(0.022)	0.022	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.021)	(0.022)
Age Squared/ 1000	0.034	0.809***	0.253	0.494*	0.264	0.520**	0.380	0.479*	0.333
	(0.258)	0.250	(0.250)	(0.253)	(0.250)	(0.255)	(0.252)	(0.246)	(0.249)
Logged HH Equiv . Income	0.140***	0.339***	0.234***	0.137***	0.177***	0.092**	0.123***	0.251***	0.216***
	(0.039)	(0.039)	(0.039)	(0.038)	(0.037)	(0.037)	(0.038)	(0.038)	(0.038)
Male	−0.158***	0.063	−0.014	−0.114**	−0.008	−0.069	−0.169***	−0.082*	−0.057
	(0.052)	(0.050)	(0.051)	(0.051)	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)
Higher Educ.	−0.114**	0.021	0.028	0.023	−0.050	−0.021	0.043	0.076	0.110**
	(0.055)	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.053)	(0.053)	(0.053)
White	0.474***	0.152	0.185	0.312***	0.235**	0.388***	0.359***	0.396***	0.321***
	(0.101)	(0.107)	(0.119)	(0.115)	(0.110)	(0.115)	(0.112)	(0.111)	(0.120)
Unemployed	−0.242**	−0.222**	−0.220**	−0.064	−0.128	−0.106	−0.037	−0.135	−0.075
	(0.105)	(0.101)	(0.104)	(0.103)	(0.101)	(0.096)	(0.096)	(0.100)	(0.100)
Married/live with partner	0.260***	0.141**	0.030	0.100*	0.159***	0.066	0.077	0.139**	0.061
	(0.059)	(0.056)	(0.057)	(0.056)	(0.056)	(0.056)	(0.057)	(0.057)	(0.056)
Have dep. Children	0.159***	0.203***	0.028	0.069	0.032	0.068	0.105*	0.142**	0.073
	(0.060)	(0.060)	(0.062)	(0.063)	(0.061)	(0.061)	(0.062)	(0.062)	(0.060)
Observations	1,740	1,740	1,740	1,740	1,740	1,740	1,740	1,740	1,740
Pseudo *R*-squared	.0229	.0696	.0149	.0144	.0085	.0057	.0069	.0189	.0265
AIC	7096.818	7591.317	7038.618	7224.921	7654.48	7235.591	7459.046	7468.43	7428.83
BIC	7206.051	7700.549	7147.85	7334.154	7763.713	7344.824	7568.279	7577.663	7538.063

Note. (1.) *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively; (2.) Robust standard errors.

TABLE 5 Mobility impairment in ordered probit models of subjective wellbeing

Variables	Life satisfaction	Happy yesterday	Anxious yesterday	Life worthwhile	Satisfied with friendships	Satisfied with colleagues	Satisfied with neighbourhood	Yesterday pleasurable
Mobility impaired	−0.467*** (0.057)	−0.371*** (0.056)	0.124** (0.056)	−0.315*** (0.058)	−0.080 (0.057)	−0.629*** (0.061)	−0.209*** (0.057)	−0.355*** (0.057)
Age	−0.098*** (0.022)	−0.080*** (0.022)	−0.006 (0.022)	−0.053** (0.021)	−0.021 (0.022)	−0.016 (0.022)	−0.013 (0.022)	−0.077*** (0.022)
Age squared (000 s)	1.158*** (0.252)	0.949*** (0.250)	0.008 (0.251)	0.699*** (0.245)	0.375 (0.251)	0.169 (0.255)	0.253 (0.251)	0.963*** (0.248)
Logged HH equiv income	0.292*** (0.039)	0.212*** (0.037)	−0.098*** (0.036)	0.231*** (0.038)	0.165*** (0.037)	0.308*** (0.038)	0.172*** (0.038)	0.197*** (0.036)
Male	−0.067 (0.050)	−0.065 (0.049)	−0.097** (0.049)	−0.153*** (0.049)	−0.180*** (0.049)	0.022 (0.049)	−0.169*** (0.049)	−0.174*** (0.049)
Higher Educ.	0.118** (0.053)	0.054 (0.053)	0.155*** (0.053)	0.215*** (0.053)	0.047 (0.053)	0.109** (0.054)	0.141*** (0.053)	0.040 (0.052)
White	0.166 (0.131)	0.055 (0.128)	0.020 (0.125)	0.179 (0.128)	0.064 (0.118)	0.005 (0.118)	0.217* (0.125)	0.148 (0.124)
Unemployed	−0.301*** (0.108)	−0.367*** (0.108)	0.136 (0.104)	−0.305*** (0.106)	0.024 (0.112)	−0.621*** (0.106)	−0.181* (0.104)	−0.162 (0.103)
Married/live with partner	0.360*** (0.055)	0.306*** (0.056)	−0.059 (0.055)	0.284*** (0.056)	0.178*** (0.055)	0.061 (0.057)	0.150*** (0.055)	0.253*** (0.056)
Have dep. children	0.050 (0.058)	0.044 (0.058)	−0.025 (0.060)	0.159*** (0.059)	−0.036 (0.059)	0.095 (0.059)	0.027 (0.059)	0.051 (0.057)
Observations	1,740	1,740	1,740	1,740	1,740	1,740	1,740	1,740
Pseudo *R*-squared	.0411	.0264	.0049	.0303	.0118	.0467	.0155	.0231
AIC	7461.392	7674.882	8057.937	7714.611	7725.453	7316.89	7513.98	7407.354
BIC	7570.625	7784.115	8167.17	7823.844	7834.686	7426.123	7623.213	7516.587

Note. (1.) *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels respectively; (2.) Robust standard errors.
Abbreviations: AIC, Akaike information criterion; BIC, Bayesian information criterion; HH, household.

TABLE 6 Valuations of mobility impairment based on life satisfaction (LS) and Quality-Adjusted Life-Years (QALYs) lost models

	Estimated Valuation (£)	Annual QALYs lost and values (95% CI)	QALYs lost until death (95% CI)
LS value–linear model	£42,749		
LS value–log model	£78,877		
QALYs lost		0.428 *(0.398, 0.457)*	15.327 *(14.263,16.392)*
QALY value (£20,000)		£8,552 *(£7,958, £9,146)*	£306,546 *(£285,260, £327,833)*
QALY value (£30,000)		£12,828 *(£11,937, £13,718)*	£459,820 *(£427,889, £491,750)*

Note. (1.) By definition, an individual's EQ-5D-3L variable is equal to the amount by which their life years are weighted to obtain their estimated QALYs. Our estimate of 0.428 annual QALYs lost due to impairment is the coefficient on mobility impairment in an unreported ordinary least square (OLS) model of EQ-5D-3L. This model, which is available from the authors upon request, controls for age, age-squared, log income, gender, education, ethnicity, employment status, marital status and having dependent children. QALYs lost until death is estimated by multiplying this figure by remaining life expectancy. Remaining Life expectancy is estimated by subtracting mean age of full sample (45.654) from general population average life expectancy of 81.5 years. No adjustment made for possible reduced life expectancy arising from implications or comorbidities relating to mobility impairment.
Abbreviations: CI, confidence interval.

this time frame and £306,546 over remaining life expectancy. At a £30,000 ceiling willingness to pay, the corresponding valuations are £12,828 and £459, 820.[14]

Taking these results together, our evidence paints a broad picture of differences in quality of life between those with a mobility impairment and their able-bodied counterparts. Mobility impaired individuals have lower capability and poorer subjective wellbeing in all measured dimensions. Mobility impaired individuals tend to take part in fewer activities, but there are a few plausible exceptions including relaxing, self-care and smoking.

4 | DISCUSSION

This paper demonstrates a way of assessing quality of life that operationalises Sen's theoretical framework to obtain a multidimensional assessment of health status that includes measures of capabilities, activities and wellbeing. Our empirical results show, inter alia, that in the case of mobility impairment, capabilities are lower in all domains of life, apart notably from access to health services. The finding probably reflects the universal nature of healthcare entitlements received by this population. But our results also show that psychological costs are high whereas many (though not all) daily activities are lower. In this regard, they echo those of Flores, Ingenhaag, and Maurer (2015) who, in a developing country context, concluded that interventions facilitating daily life hold much promise for improving experienced utility among people with disabilities. In our high-income country sample, many daily activities and several measures of experience are negatively impacted by disability.[15] Our theoretical accounting framework suggests that lower capabilities may be associated with lower, but in some cases higher, levels of activity as a result of substitution effects. Our empirical results were consistent with this and thereby confirm the value of a theoretical framework that allows for greater involvement in some activities as capabilities contract. The empirical results also indicate that the psychological costs of mobility impairment are high, suggesting that disability can be costly in quality of life terms because so many aspects of life are affected. They suggest also that the problems of mobility impairment are not ones to which adaptation is complete.

Taking these results together may help to explain the apparent ineffectiveness of many policies targeting disability. For example, Kidd, Sloane, and Ferko (2000) found that legislation requiring employers to make workplace adaptations for people with a disability had little impact on labour market participation. Whilst there may be many reasons for this, one possibility is that the legislation focussed on only a small subset of the many constraints imposed by disability. Our

[14]Though direct comparisons are not possible, Powdthavee and van den Berg (2011) find a mental health based valuation of £54,000 for those with 'problems connected with arms legs hand feet back etc'. These valuations are arguably consistent those previously developed by Kuklys who used satisfaction with income to estimate a cost equivalent of a quarter of income or more.

[15]From the original Senian perspective, activities that people have reason to value, and experiences on which they have reflected, such as judgments about life satisfaction, can be viewed as providing complementary evidence about different qualities of life. It is sometimes forgotten that although Sen emphasises capabilities, his original formal scheme explicitly allows for utility or happiness. We highlight the fact that if preferences are adaptive (von Weizsacker, 2005), then life satisfaction based methods may underestimate the value of losses due to disability.

evidence, by contrast, points in the direction of a more comprehensive approach to disability policy that might include workplace issues but also social resources and environmental context. Paradoxically, the fact that many areas of life appear negatively affected gives policymakers and practitioners many potential options and levers to consider when designing interventions to mitigate these losses.

The capability approach emphasises diversity. Recent disability policy changes in Australia appear to share this perspective by taking a personalised approach to disability in which important capabilities, such as the ability to access decent work, are established by understanding the individual's situation in some detail (National Disability Services, undated). The argument on which the Disability Care Australia policy is based is that by understanding what a person can or cannot do, and all the social as well as financial resources to which they have access, forms of support can be developed that maintain economic and social functioning more effectively and at lower cost. The issue of unsustainable disability program costs is one that has been given some prominence in the USA also, for example, Autor (2011), and only time will tell whether the new Australian reforms will be effective for people with disability and/or taxpayers. If they are, then understanding a disabled person's capabilities systematically, as illustrated here, will be a central feature of the policy's implementation.

Our findings may contribute to debates about the measurement of health also. To date, QALY measures have tended to focus on capturing the health status benefits of health interventions of populations (Gold, Stevenson, & Fryback, 2002), and this gives rise to the possibility of bias due to the omission of many potential nonhealth benefits of 'health' interventions (Anand & Hanson, 1997 p. 699). For example, appropriate software and a fast internet connection that allows a mobility impaired individual to work from home does not affect health status *per se* but could have a dramatic impact on overall quality of life. Such changes in the capability set can be recorded with our approach but are not easily measured or even detected by QALYs. One aspect of this concerns adaptation: the EQ-5D-5L asks whether a person has 'difficulties doing my usual activities', a benchmark that may inevitably adapt over time, resulting in underestimation of the value of interventions that help an individual engage in daily activities.[16] Although the present study suggests that adaptation does not exercise a strong effect, longitudinal data would be needed to investigate such an effect comprehensively. Capability approaches to health measurement may also contribute to the development of health measures where standard measures are either not feasible or lead to particularly controversial results. For example, standard QALY indices of health for very young children have been difficult to develop (Grosse, Prosser, Asakawa, & Feeny, 2010), whereas direct capability indicators based on parental or clinical assessment already exist.[17] Similarly, at the other end of the age spectrum, there are questions about the normative desirability or practicability of using QALY measures to assess the value of end of life care, for example in the presence of cognitive decline (Round, 2012). A capability approach could avoid at least some of these problems by identifying quality of life aspects that are particularly valued at that stage in life.

In our empirical results, we offered two sets of monetary estimates of the quality of life impact of mobility impairment in our sample. Estimates for other events, using the same life satisfaction method, have ranged from $156 for a 10Ku increase in aircraft noise to £206,000 for the loss of a spouse (Oswald & Powdthavee, 2008b), which plausibly locates our results (£43,000 to £79,000) for disability as being material but not extreme. The time period to which these estimates relate is somewhat ambiguous, being derived from annual earnings, and consequently, it is unsurprising that the estimates lie between the annual monetized QALY loss (£8,552 to £12,828) and the estimated loss over the remaining lifetime of participants (£306,546 and £459,820). Clearly, much further work remains to be done in this area, but these monetary valuations do offer another yardstick for measuring the magnitude of the quality of life effects we are addressing in the empirical example.

It can be questioned whether Sen's capability approach is compatible with a general and familiar utility approach.[18] It has not been our been purpose to explore this issue, and in general, if a theoretical utility function is allowed to be defined generally enough, then anything is compatible with it. However, our analyses and evidence might be taken as suggesting more compatibility than some realise. If for example, Sen's (1985) original three equations are accepted, then conventional utility analysis could be seen as a special case of a more general approach to quality of life in which a person's wellbeing is assessed not just in terms of their behaviour and existential states, and their experiential values of them, but also of their positive freedoms. However, Sen's approach, a little like that of Rawls, brings with it things that

[16]Hernandez-Alva and Pudney (2017) find significant differences in QALY rankings even when the informational basis is changed simply by expanding response categories.

[17]See the German Socio-Economic Panel Survey - https://www.diw.de/en.

[18]We are grateful to one of the referees for this point.

utility analysis does not. For example, he emphasises the importance of public deliberation[19] about social choices whereas utility-based welfare economics has, historically, been more agnostic about the need or value of public deliberation instead opting for valuations implicit in market transactions or using stated trade-off methods. The view this paper illustrates is that the practical value to analysts of the approach Sen advocates is that it enriches the way we explicitly think about aspects of value.

Finally, there are several limits of this paper that could be addressed in future research. It would be useful to compare different levels of mobility impairment or other disabilities to understand how capabilities, functionings and subjective wellbeing vary across a range of subgroups. It would also be useful know more about the use of assistive technologies and their capacity to improve the different aspects of life quality used here. Furthermore, though psychometric properties of capabilities are now becoming available, it would be useful to know more about them for this particular subgroup. The capability indicators reported here are still relatively novel but could easily be incorporated into evaluations of clinical interventions, which would help to address a range of follow-on issues that arise from applying the approach to mobility impairment. That said, the evidence from these data is that the costs of mobility impairment are neither trivial nor concentrated in just a few aspects of life while theory can allow for the fact that a possible result of capability deprivation will be that a few inferior functionings will increase.

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[19]For discussions of public deliberation in health, see for example Culyer (2006, 2009).

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