Valuing care experience using the compensating income variation method: a comparison of life satisfaction with health status

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Abstract

Background: Compensating income variation (CIV) is a well-known technique in economics for generating monetary values for changes in subjective well-being (SWB). Whilst there have been previous attempts to value health using CIV, there has been little research conducted on the sensitivity of CIV estimates to alternative measures of well-being.

Aim: To estimate CIV values using measures of life satisfaction and health for co-residential and extra-residential informal carers.

Methods: Data from the British Household Panel Survey are used with random effects panel data specifications estimated.

Findings: Monetary values of around £50 per hour are obtained for co-residential care from the health equations, with the corresponding value for life satisfaction around £20 per hour. For non-residential care, only the health value was statistically significant, with a magnitude of around £110 per hour.

Discussion: The method of CIV was able to generate monetary estimates of changes in subjective well-being. One explanation for the difference in values between types of carer relates to the utility generated from the care experience, although other factors may also be relevant. Further studies applying CIV to other measures of well-being would be helpful to gain a better understanding of the relationship between well-being, health and life satisfaction.

1 Introduction

Population ageing and pressures to contain public expenditures have rendered the provision of unpaid care (also known as informal care) an increasingly important source of support that allows frail older people to live longer in their own homes (McNamee and Stearns, 2003). However, the well known adverse health effects that such care has for carers (Bédard *et al.*, 2004; Buck *et al.*, 1997; Cameron *et al.*, 2006; Sawatzky and Fowler-Kerry, 2003; Brouwer, 2006) have rarely been accounted for in economic evaluations (Cantor *et al.*, 2006). At the same time however, it is argued that care provision may also generate some positive utility amongst care providers, although such effects are difficult to measure (Brouwer *et al.*, 2005). It is clear that good identification, measurement and valuation of the various aspects of informal care provision are important if unbiased policy conclusions of cost-effectiveness are to be reached.

Exclusion of informal care from economic evaluation studies may relate to problems of valuation. Given no market price is observed, shadow pricing techniques (e.g. opportunity and replacement cost methods) are often employed (Brouwer *et al.*, 1999; Carmichael and Charles, 2003). However, these methods are associated with a number of limitations (Van Den Berg and Ferrer-I-Carbonell, 2007; van den Berg *et al.*, 2004; McDaid, 2001). In this paper, we consider the application of the compensating income variation (CIV) method to valuing informal care.

Compensating variation is based on subjective well-being functions (Di Tella *et al.*, 2001; Frey and Stutzer, 2002; Clark and Oswald, 2002; Welsch, 2006) and allows for non-market valuations through the implied trade-offs between income and the situation of interest (i.e. informal care). CIV uses revealed preferences data, thereby avoiding the hypothetical biases associated with stated preference methods (e.g. contingent valuation), while at the same time has the ability to incorporate in the valuation a range of effects experienced by the caregiver.

Despite some attractive features, CIV has rarely been applied in health economics (Ferrer-i-Carbonell and van Praag, 2002; Groot and Maassen van den Brink, 2004; Groot *et al.*, 2004), with only one previous study applied to informal care (Van Den Berg and Ferrer-I-Carbonell, 2007). We extend this work in two ways. First, we employ a measure of health as well as information on life satisfaction to measure subjective well-being. The rationale behind this is that measures of health

may offer a different insight into well-being and therefore the experience of care than global measures of life satisfaction. Second, to accommodate potential unobserved heterogeneity, we extend the previous literature by employing longitudinal data.

The organisation of the paper is as follows. In Section 2, we describe the data, explain the CIV method, and discuss measurement and estimation issues. In Section 3 we report the estimation results, while Section 4 discusses the findings, potential implications and proposes areas of future research.

2 Data and methods

2.1 BHPS

For the estimations data from the British Household Panel Survey (BHPS) are used. The BHPS is an annual longitudinal survey carried out by the ESRC UK Longitudinal Studies Centre with the Institute for Social and Economic Research at the University of Essex. It has been conducted annually since 1991 and there are 15 available waves. It follows individuals 16 or over, sampling more than 5000 households, with around 10,000 individual interviews per wave. In waves 9 and 11 certain regions are over-sampled, allowing for analysis by regions. However, previous studies have shown that the differences within regions across the UK are very small, hardly affecting individual behaviour in matters of informal care (Leontaridi and Bell, 2001). For the application of the CIV method and for reasons of comparison, a sub-sample of the data was used where information on all necessary variables[1] was present.

2.2 The CIV method

Assuming individual well being is a function of certain variables

$$W = (IC, Y, X) \quad (1)$$

where W is well being and is taken as a proxy for utility, IC represents informal care, Y income and X denotes other variables of interest. More formally, under equilibrium conditions (Groot and van den Brink, M. H., 2006)

[1] Information for both life satisfaction and health status was available for waves 6, 7, 8, 9, 10, l2, 13, 14 and 15, which are subsequently used.

$$W(Y, IC = 0, X) = W(Y + CIV, IC = 1, X) \quad (2)$$

where CIV captures the necessary monetary compensation that a caregiver requires to be as well off as before the change in their state. Compensating variation is the amount of income paid or received that leaves the individual's well being at its initial level following a change taking place. That is, the amount of money that would leave the individual indifferent between providing informal care or not.

2.3 Modifying the CIV method

For informal care a question arises over how best to measure subjective well-being (SWB). Although the use of a single question on overall life satisfaction (LS) is a common approach, alternative measures have been employed to indicate subjective well-being, such as information on health, (Clark and Oswald, 2002; Gardner and Oswald, 2006). For informal care, three arguments could be made to support the use of such indicators alongside information on overall life satisfaction.

First, the retrieval of SWB from a single life satisfaction question may mean that it is more susceptible to noise. Changes in factors uncorrelated with informal care can cause changes in LS and yet, unless specifically controlled for, they are interpreted as influencing informal care. For example, births or deaths within a household are likely to affect LS. Unless explicitly controlled for, such a change would be attributed to informal care. Therefore, if alternative measures are better able to control for these factors, estimates may be more precise and lower than those from LS.

Second, it has been argued that a degree of positive SWB can be derived from the act of caregiving (Brouwer *et al.*, 2005). If the purpose is to obtain estimates of value associated with the experience of care, then it is better to use a measure that is more able to detect positive as well as negative effects. It is an empirical question whether detection of benefits associated with caregiving is more likely using LS measures or other measures, such as ones based on health status (HS). However, we may expect to see differences amongst different types of caregiver; it may be that greater positive SWB is achieved where one is caring for a spouse or blood relative than where the family relationship is more distant, all else being equal. Alternatively, factors such as the degree of choice in the decision to provide care may have an important relationship to SWB. If HS measures are better able to detect such

influences than LS measures, then informal care will have a stronger relationship to HS than LS, leading to higher CIV values, all else being equal**.**

Third, current epidemiological literature demonstrates causal links between mental health and provision of informal care (Cameron *et al.*, 2006; Schulz and Williamson, 1991). However, to the best of our knowledge, no such relationship has (yet) been demonstrated for LS, although there is some evidence of statistical association (Van Den Berg and Ferrer-I-Carbonell, 2007).

2.4 Dependent variables for CIV models

Two dependent variables are used to measure subjective well-being (SWB). First, we use a measure of life satisfaction (LS), obtained from the question: "*How dissatisfied or satisfied are you with your life overall?*", with seven possible answering levels ranging from "*not satisfied at all*" to "*completely satisfied*" (Table 1). This format is very common in the literature (van Praag and Baarsma, 2005; Mentzakis and Moro,).

Second, as a measure of health status, we use the 12-item General Health Questionnaire (GHQ). This asks a respondent to report whether, over the past few weeks, they have been able to concentrate, lost sleep over worry, played a useful part in things, felt constantly under strain, felt unable to overcome difficulties, been able to enjoy day-to-day activities, been able to face up to problems, been unhappy and depressed, lost self-confidence, thought of themselves as worthless, and been reasonably happy. Scores of 0 are assigned where these items are reported as 'much less than usual' or the 'same as usual', whilst 1 is recorded where the items are reported as 'more than usual' or 'much more than usual'. Responses are then summed across items, providing a score that ranges from 0 to 12, zero being the best and 12 the worst possible health state (Table 2). GHQ has been widely used in informal care (for example, Mentzakis *et al.*, In Press), and validated for use with a wide range of samples and in a variety of social and cultural environments (Montazeri *et al.*, 2003).

2.5 Independent variables for CIV models

The amount of informal care (IC) hours the individual provides is given in intervals. Following a question on whether they provide care to somebody, the respondent is asked, "*In total, how many hours do you spend each week looking after or helping*

(him/her/them)?" with possible answers *0 - 4 hours per week, 5 - 9 hours per week, 10-19 hours per week, 20-34 hours per week, 35-49 hours per week, 50-99 hours per week, 100 or more hours per week*" (Table 3). As the effects for a carer are likely to depend on their living arrangement with the care recipient, respondents are analysed separately according to residency status: co-residential and non-residential care. The former is provided to someone in the same household as the caregiver and the latter to someone in a separate household. The distinct distribution patterns of the two activities, as obtained from the BHPS, are shown in Table 3.

As our objective is to quantify the effects of informal care on SWB it is important to control for individuals' health status in the estimations using some objective health measure indicators (Groot, 2000). A number of health problems indicators are included, capturing a variety of physical health conditions (Table 4), while for the LS specifications, a GHQ indicator was additionally included as a covariate.

Regarding the measurement of income, annual equivalised household income (divided by 52 to transform to weekly) was used. Although informal care constitutes an activity performed by an individual, it is likely that the initial decision is influenced by household behaviour and financial status. Thus, equivalised income was deemed more appropriate for the analysis. Other variables (Table 5) used in the analysis were age and age squared of the individual, gender, household size, number and age of kids, marital status, employment, education, and a set of time dummies to account for unknown time trends and cyclical patterns or events. Such variables are commonly used in similar modelling exercises (Ferrer-i-Carbonell and van Praag, 2002; Contoyannis *et al.*, 2004).

2.6 Econometric specification of the CIV models

Assuming that health status[2] is a linear function of certain variables the following random effects panel model is estimated:

$$GHQ_{it}^{*} = \beta_0 + \beta_1 Y_{it} + \beta_2 IC_{it} + X_{it}'\beta_3 + \mu_i + \varepsilon_{it}, \quad where \quad i = 1,...,N; t = 1,...,T \qquad (3)$$

[2] All models are estimated for both GHQ and LS dependent variables. However, for brevity, only the GHQ formulations are presented. The respective LS models are obtained by directly substituting LS for GHQ where necessary.

GHQ_{it}^{*} is the unobserved latent variable for GHQ scores, where *i* denotes individuals and *t* time. Y_{it}, is annual equivalised household income. IC_{it} denotes the numbers of hours of informal care that the individual provides and represents seven binary indicators (the seven provision intervals) where no-care provided is the base category. Split sample analysis is employed to differentiate between co-residential and non-residential care.

Finally, X_{it} is a vector of several other independent variables (e.g. socio-demographics) that are believed to have an influence on health status and are given in Section 2.5. μ_i, is the time invariant individual parameter assumed to be uncorrelated with any of the regressors and ε_{it}, is the normally distributed random error assumed to be strictly exogenous, capturing the unobserved heterogeneity for well-being. Including individual specific time invariant components in the model specification allows for the control of unobserved heterogeneity and individual traits (Ferrer-i-Carbonell and Frijters, 2004).

Interpreting GHQ scores as a cardinal response requires a number of restricting assumptions and hence only the ordinal information was utilised (this also made the analysis directly comparable to SWB, which also is an ordinal indicator). Having a dependent variable with an ordinal structure and assuming a normal distribution, eq. 4 gives rise to an ordered probit model, where

$$\Pr(HS_{it} = j \mid k_{it}) = \Pr(\xi_{\text{j-1}} < HS_{it}^{*} \leq \xi_j \mid k_{it}) \qquad for \quad j = 1,\ldots, J-1 \qquad (4)$$

with predicted probability

$$\Pr(HS_{it} = j \mid k_{it}) = \Phi(\xi_{\text{j}} - k_{it}'\beta) - \Phi(\xi_{j-1} - k_{it}'\beta) \qquad (5)$$

Where k_{it} denotes all the variables on the right hand side of eq. 3, $\xi_0 = -\infty$ and $\xi_J = \infty$ with $\Phi(\xi_0) = 0$ and $\Phi(\xi_J) = 1$, and Φ being the standard normal cumulative function.

Following the estimations, the compensation necessary to keep health status equal between a carer and a non-carer (i.e. the necessary monetary compensation that a caregiver requires in order to become as well off (in health terms) as somebody that is not providing care) can be calculated by the ratio of the marginal effects of the

variables of interest, which here resolves to the ratio of the estimated coefficients from eq. 6, with β_2 being the coefficient of the care hours variable and β_1, the coefficient of income[3].

$$hCIV = -\frac{\beta_2}{\beta_1} \quad (6)$$

2.7 Measurement issues for CIV models

Having the IC variable recorded as a categorical variable (intervals) renders interpretation problematic, especially when observing wide, unequal intervals. CIV values obtained from these ratios indicate the total amount of compensations required to jump from no-care provision to the respective interval amount of provision. Hence, two methods were followed to obtain continuous representation of the IC variables.

First, the IC categorical variable was replaced by the middle point of each interval. As such, individuals that reported a within range amount of care were assumed to provide the amount of the middle point. For example, one stating the interval "*20-34 hours per week*" was assumed to provide 27 hours per week (the mid-points were for the intervals are 2 hours, 7 hours, 15 hours, 27 hours, 42 hours, 75 hours, and 100 hours).

Second, avoiding the strong assumptions of the middle point approach, it was decided to separately model the IC variable and obtain its predicted values, conditional on them falling within the pre-specified intervals. This provided an approximate distribution of IC over the whole range of values, rather than over seven intervals. To model informal care hours (IC), a random effects panel interval regression model was estimated:

$$IC_{it}^{*} = \exp(X_{it}'\beta + \mu_i + \varepsilon_{it}) \quad (7)$$

and, conditional on somebody being a carer, an interval regression was be specified as:

[3] Traditional compensating income variations is estimated from models with LS as the dependent

$$IC_{it}=j \quad \text{if} \quad \xi_{j-1} < IC^{*}_{it} \leq \xi_{j}, \qquad j=1,\ldots,m \qquad (8)$$

where IC^{*}_{it} is the latent variable denoting hours of care, ε_{it} is the idiosyncratic error which is assumed to be normally distributed and strictly exogenous and μ_i is the individual parameters, assumed to be uncorrelated with any of the X_{it}, which include the variables from Table 3. Following Chamberlain (Chamberlain, 1984) and Mundlak (Mundlak, 1978) and by parameterising μ_i {{; 264 Wooldridge, J. M. 2002; }} the no-correlation assumption between the individual effect and the regressors is relaxed.

Interval regression models are closely related to ordered probits, with the exception that the cut-offs points need not be estimated along with the coefficients, but are known a priori. The exact information of the cut off points (ξ) leads to more efficient estimates of the βs and to the possibility of identifying the variance error term σ^2 and hence, the scale of the IC variable (Van Doorslaer and Jones, 2003). In order to achieve concavity and convergence in the estimation of the log-likelihood, the logarithm of the observed intervals is modelled. Subsequently, the conditional predicted values for the number of hours of informal care provision is obtained for every individual that is a carer, while for the rest of the population in the sample, the variable takes the value of zero.

Having transformed the categorical variable IC into a continuous one (first as the mid-point and second by separately modelling it), the CIV and hCIV values from eq. 6 ratios denote the marginal values of informal care. Standard errors for the ratios are obtained through the Delta method (Greene, 2003).

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variable, $CIV = -\frac{\beta_2}{\beta_1}$, where coefficients are as in eq. 6.

3 Empirical Results[4]

3.1 Sample statistics

Tables 1-5 present the distributions and sample descriptive statistics for the dependent and independent variables included in the estimations. Looking at Table 1, low levels of life satisfaction are more common for co-residential caregivers, while at the same time higher levels are more common for non-residential caregivers and non-carers. In addition, Table 2 shows that more co-residential carers have poorer mental health, with 26% having a GHQ score of 4 or more, compared with 20% for non-residential carers and 18% for non-carers.

In Table 3 the empirical distribution of the two types of care provision are given and the dramatically distinct behaviour is observed. Co-residential caregivers report much higher levels of provision, with 34% of them admitting to provide more than 100 hours per week. On the other hand, 93% of the non-residential caregivers provide up to 19 hours per week.

Finally, looking at Tables 4 and 5, co-residential carers do almost always worse in the health indicators and also tend to report quite distinct characteristics to the other two groups. Co-residents have substantially lower weekly earnings and higher age, while they are much less likely to have a job, either part or full time. Moreover, they tend to be less educated, with 51% of them having no qualification. The corresponding value for the non-residential carers and non-carers are 30% and 27% respectively.

3.2 CIV, hCIV and experience valuations

Table 6 presents per hour informal care valuations for co-residential care. Employing the mid-point method, CIV (using LS) is £23.31 and hCIV (using GHQ) is £63.62, while using the predicted IC the corresponding values are £18.97 and £49.97. All values are highly significant. For both dependent variables the mid-point method produces higher monetary compensations and for both linearization methods, LS models tend to result in much lower, more than double, values.

However, these patterns are not observed for non-residential care. While income is significant in all specifications, informal care provision variables are not, giving rise to significant ratios only for the GHQ models. Using the mid-point approach, the hCIV is £110.54, while for the predicted IC it is £108.23.

4 Discussion

This study is the first to apply the CIV method for the valuation of informal care using panel data, as well as the first to apply the method to valuing informal care in the UK. In addition to the traditional method, a variant of the CIV is proposed, and findings compared. Focusing on valuations from the models with linear approximations of IC, co-residential care estimations showed values of £23.31 to £18.97 for LS and £63.62 to £49.97 for GHQ. These values are substantially higher than those obtained through opportunity and replacement cost methods, as well as, stated preference applications[5]. In the only study applying the CIV method to informal care, Van den Berg and Ferrer-i-Carbonell (Van Den Berg and Ferrer-I-Carbonell, 2007), distinguishing between care recipients who are and are not family members of the informal caregiver, generated values of around £6 to £6.7 (€9 to €10) for each. These smaller values may be explained by differences in study design. For example, they used a small cross-section of carers of people with chronic disease as opposed to the use of a large panel sample of general population. Additionally, the use of categorical rather than continuous income might have been a factor.

Within the co-residential and non-residential samples, we observe differences between values derived from LS and those derived from GHQ. As we have controlled for a variety of confounding factors, the differences observed may have arisen due to the use of different constructs of well-being; for example, GHQ questions relate to outcomes occurring over the 'past few weeks', and are scored from 'much less than usual' to 'much more than usual'. It is possible that such phrasing is better able to detect changes in the level and type of care provided, leading to higher values. A

[4] All estimations are performed in Stata/SE 10.1 using built-in or user-written routines. Full estimation results are omitted but can be provided upon request.

[5] Van den Berg et al. for the Netherlands (van den Berg *et al.*, 2006) estimated values ranging from £7.20 (€10.64) to £11.7 (€17.34)) and £9.14 (€13.51) to £13.7 (€20.24). Others reported values of

further explanation for the difference relates to the magnitude of the income coefficient. We observe a smaller income coefficient in the GHQ estimations, most probably as LS responses measure income and health related well-being, with GHQ mostly (or only) measuring health related well-being. Taken together, the larger informal care coefficient and the small income coefficient in the GHQ specifications serve to produce a higher ratio.

One issue that arises is whether the difference between hCIV and CIV of between £30 to £40 is a measure of the value of different care experiences. One interpretation is that the difference in levels of compensation between hCIV and CIV reflect differences in experience utility, with the LS measure capturing some elements of positive benefit, as the compensation is less under this measure. Further work is required to examine this, possibly using other datasets where direct questions are asked of the level of enjoyment associated with different types of caring.

Tables 6 and 7 reveal the non-residential GHQ coefficients to be approximately half that amongst co-residential carers. This implies that, for the same level of informal care input, co-residential carers require less monetary compensation to achieve the same level of health status, indicating that co-residential carers' menal health is not as adversely affected as non-residents, and/or that it is mitigated by receiving some positive benefits from caring (Van Den Berg and Ferrer-I-Carbonell, 2007).

On the other hand, the insignificant LS non-residential values indicate a different story. Either LS is not sensitive enough to capture the harmful effects of care-giving or the positive benefits from caring in the non-residential case are such that they cancel out the negative effects of caring. However, the latter explanation would imply that for LS, the positive benefits are higher in the non-residential case.

It is possible that non-residential carers derive greater benefit due to 'opting-in' (Wiseman, 1997), but that this effect diminishes when health (i.e. GHQ) is adversely affected through ever greater levels of care provision. Similar processes may apply to co-residential carers, except that they are less likely to experience changes in the level of care provided, or are somehow better able to adapt or normalise those effects than non-residential carers. Co-residential carers are likely to

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£10.3 (Schneider *et al.*, 2003) and £11 for the U.K. (McCrone *et al.*, 2003). Using contingent valuation others (van den Berg *et al.*, 2005) have estimated values of around £6.5 (€9.52).

have been in the caring role for longer, and hence more likely to have adapted, although this deserves some further research.

In a sensitivity analysis we also tested whether the difference between the figures can be partly explained by mental health. Pooled specifications of the LS estimation excluding GHQ from the covariates were rerun with results indicating higher CIV values. However, such higher CIV values were a consequence of larger informal care coefficients, implying that exclusion of GHQ from the covariates results in its effects wrongly being attributed to informal care.

The differences observed when comparing the corresponding monetary values between the predicted IC and the mid-point approach in the co-residential sample and their proximity in the non-residential sample can be attributed to the finer hour intervals within which most individual fall for the latter sample. Finer intervals imply less variation when modelling and predicting informal care hours; this effect is important as 37% of the co-residential sample had an open interval (100 hours or more)[6].

One important limitation of the results is the lack of knowledge for the tasks performed, as the BHPS does not provide such data. For example, one would expect that values would be affected according to whether personal care was being provided as opposed to joint production activities such as household chores. It is very likely that individuals providing a large amount of hours would be involved in joint production activities.

To conclude, LS and GHQ equations for monetary valuation of informal care have been presented. The fundamental differences between our methods and the traditional approaches do not easily allow for comments regarding the lack of proximity to the values produced by these other methods. In any case, the distinct behaviour between the two outcome variables is puzzling and should be further examined (Clark and Oswald, 2002; Gardner and Oswald, 2006). Enriched data with specific questions on well-being and health status changes that are directly related to informal care provision would be helpful in order to avoid many of the analytical problems currently faced.

[6] Obviously, as we talk about weekly indicators, the interval is (100, 168) but still much wider than the intervals within which most of the non-residential carers fall

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Table 1.Life Satisfaction (LS) in the BHPS

	Co-residential carers		Non-residential carers		Non-carers	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
1: not satisfied at all	86	2.25	76	0.98	757	1.17
2	135	3.53	138	1.78	1,149	1.77
3	344	8.99	446	5.74	3,455	5.33
4	679	17.75	1,070	13.76	8,561	13.20
5	1,001	26.17	2,355	30.29	19,441	29.98
6	944	24.68	2,657	34.18	22,476	34.66
7: completely satisfied	636	16.63	1,032	13.28	8,999	13.88
Total	3,825	100.00	7,774	100.00	64,838	100.00

Table 2. GHQ-12 scores in the BHPS

	Co-residential carers		Non-residential carers		Non-carers	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
0	1,750	46.28	4,188	54.10	35,839	55.54
1	508	13.44	969	12.52	8,537	13.23
2	304	8.04	594	7.67	4,863	7.54
3	235	6.22	421	5.44	3,393	5.26
4	183	4.84	293	3.79	2,457	3.81
5	149	3.94	248	3.20	1,946	3.02
6	118	3.12	215	2.78	1,566	2.43
7	126	3.33	159	2.05	1,291	2.00
8	93	2.46	150	1.94	1,077	1.67
9	69	1.82	124	1.60	948	1.47
10	84	2.22	114	1.47	841	1.30
11	78	2.06	122	1.58	755	1.17
12	84	2.22	144	1.86	1,019	1.58
Total	3,781	100.00	7,741	100.00	64,532	100.00

Table 3. Hours per week spent caring in the BHPS (pooled over all waves)

	Co-residential care		Non-residential care	
	Freq.	Percent	Freq.	Percent
0-4 hrs per week	627	16.58	4,453	57.52
5-9 hrs per week	540	14.28	1,818	23.49
10-19 hrs per wk	544	14.39	958	12.38
20-34 hrs per wk	422	11.16	372	4.81
35-49 hrs per wk	212	5.61	87	1.12
50-99 hrs per wk	162	4.28	31	0.40
100 + hrs per wk	1,274	33.69	22	0.28
Total	3,781	100.00	7,741	100.00

Table 4. Health Problem indicators (in percentages)

	Co-residential carers	Non-residential carers	Non-carers
Sight	7.67	4.08	3.81
Hearing	13.59	7.74	7.12
Skin conditions/allergy	11.40	13.33	11.89
Chest/breathing	17.96	12.45	12.19
Heart/blood pressure	26.84	17.00	14.10
Stomach or digestion	12.19	8.94	6.77
Diabetes	5.66	2.91	3.02
Epilepsy	1.38	0.80	0.72
Migraine	9.60	10.40	8.39

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Table 5. Definitions and descriptive statistics for continuous and categorical variables for the samples for the two types of care.

	Co-residential carers			Non-residential carers			Non-carers		
	Mean	Std Dev	Percent	Mean	Std Dev	Percent	Mean	Std Dev	Percent
income	371.86	243.04		523.64	384.68		524.31	373.22	
age	53.854	16.79		48.69	13.33		43.80	16.06	
hhsize (household size)	3.068	1.33		2.97	1.12		3.11	1.18	
nkids (number of kids)	.556	1.06		.579	.958		.717	1.01	
Ghq-36	12.37	5.84		11.42	5.35		10.96	5.25	
sex (female= 1)			51.97			62.45			52.12
emp2 (part time: lt 30 hrs =1)			9.05			19.71			15.16
emp3 (full time: 30 hrs + =1)			28.83			46.89			54.72
kids04 (having kids of age 0-4 =1)			6.90			7.88			15.21
kids511 (having kids of age 5 - 11 = 1)			18.01			18.68			22.30
kids1218 (having kids of age 12 - 18 = 1)			15.58			19.33			17.60
Single (=1)			13.86			5.92			12.69
Widowed (=1)			1.77			1.42			1.86
Divsep (divorced/separated = 1)			4.58			5.01			4.11
education2 (first degree, teaching, other higher or nursing qualification, gce a levels =1)			18.28			25.82			27.36
education3 (gce o levels, commercial qualification, cse grade 2-5,scot grade 4-5 = 1)			23.78			33.30			31.40
education4 (no qualification = 1)			51.79			30.10			27.25
Extra variables for IC modelling									
House (lag hours of housework per week)	16.63	13.35		13.96	11.96		10.63	10.41	

Car use (=1)	65.57	81.11	75.52
Formal care for the care recipient:			
Health service (=1)	58.43		
Health visitor (=1)	16.74		
Home help (=1)	5.00		
Meals on wheels (=1)	1.06		
Social worker (=1)	10.10		

Table 6. CIV results for LS and GHQ models with linear IC (co-residential care).

	Mid-point IC					Predicted IC			
	LS		GHQ			LS		GHQ	
	Estimated coef.	CIV (£)	Estimated coef.	hCIV (£)		Estimated coef.	CIV (£)	Estimated coef.	hCIV (£)
Income	0.000105***	23.31***	-5.21e-05***	63.62***	Income	0.000107***	18.97***	-5.27e-05***	49.97***
	(1.75e-05)	(5.75)	(1.87e-05)	(24.43)		(1.76e-05)	(4.58)	(1.88e-05)	(19.14)
Mid-IC	-0.00245***		0.00332***		IC	-0.00203***		0.00263***	
	(0.000441)		(0.000435)			(0.000355)		(0.000350)	
Observations	67989		68454			67850		68313	
rho	0.476***		0.436***			0.476***		0.436***	
Log-L	-86169		-106180			-85960		-105909	

* significant at 10%; ** significant at 5%; *** significant at 1%; Standard errors in parentheses

Table 7. CIV results for LS and GHQ models with linear IC (non-residential care).

	Mid-point IC					Predicted IC			
	LS		GHQ			LS		GHQ	
	Estimated coef.	CIV (£)	Estimated coef.	hCIV (£)		Estimated coef.	CIV (£)	Estimated coef.	hCIV (£)
Income	0.000115***	-12.00	-5.19e-05***	110.54**	Income	0.000115***	-9.67	-5.19e-05***	108.23**
	(1.69e-05)	(12.16)	(1.80e-05)	(46.86)		(1.69e-05)	(12.20)	(1.80e-05)	(46.22)
Mid-IC	0.00138		0.00573***		IC	0.00111		0.00562***	
	(0.00138)		(0.00140)			(0.00139)		(0.00140)	
Observations	71828		72309			71792		72273	
rho	0.482***		0.434***			0.482***		0.434***	
Log-L	-89697		-111372			-89656		-111318	

* significant at 10%; ** significant at 5%; *** significant at 1%; Standard errors in parentheses