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Utilisation of personal care services in Scotland: the influence of unpaid carers

Abstract

Context: Unpaid carers may have an influence on the formal care utilisation of the cared for. Whether this influence is positive or negative will have important implications for the costs of formal care provision. Scotland, where personal care services are free to all individuals aged 65+, provides an interesting context in which to study this relationship. Moreover, the Scottish Government is unique in its collection of administrative data on all social care clients.

Objective: To investigate how the presence of an unpaid carer influences personal care use by those aged 65+ in Scotland.

Methods: Two-Part Models (2PMs) are estimated using Scotland's Social Care Survey (SCS) for the years 2014-2016. An Instrumental Variable (IV) approach is also implemented to deal with endogeneity concerns.

Findings: The results suggest that unpaid care complements personal care services. In particular, the presence of an unpaid carer is associated with an increase in weekly personal care hours by 1 hour and 14 minutes per week, on average, other things being equal.

Limitations: Concerns are noted surrounding the generalisability of results and lack of information available on client need and unpaid carers, arising from the very nature of conducting research using administrative data. Nevertheless, the findings are robust to a variety of sensitivity checks.

Implications: Complementarity between unpaid and paid care may imply that unpaid carers are encouraging service use or demanding services on behalf of the cared for. Thus, policy interventions aimed at incentivising unpaid care could in fact lead to increased personal care costs to local authorities. Having said that, the complementary relationship might suggest that unpaid carers are being supported in their role and this might reduce pressure on formal care services longer term.

Keywords: unpaid, care, informal, formal, substitution, complementary, older people

JEL codes: I11, I12, J14

1. INTRODUCTION

Population ageing - the increasing proportion of older people in a population - is a global phenomenon. The United Nations (2017) report on World Population Ageing found that almost every country in the world will see an increase in the share of their populations aged 60+ between 2017 and 2050. As the population ages, pressure on health and social care services is expected to increase. This will be further increased if there is an expansion of morbidity, i.e. an increase in the number of people living with chronic conditions related to age. If ageing is associated with an expansion of morbidity, as much of the literature suggests (Walter et al., 2016; Campolina et al., 2014; Beltrán-Sánchez et al., 2016), it is likely it will be associated with an even larger increase in demand for formal care services than that warranted by population ageing alone. Having said this, evidence also exists to suggest a compression of morbidity (Stallard, 2016). Pressure on long term care (LTC) provision is already high in the UK. Age UK (2011)

published a report highlighting the issue of under-funding within the UK care system and the knock-on effects this has on the quantity and quality of care that is provided. Since funding for social care has not adequately kept up with an increasing number of older people requiring support, a shrinking social care resource is being spread over an increasing number of individuals in need. This inevitably leads to unmet need.

Unpaid care might offset pressure on formal care services. Unpaid carers are those who provide care to family members, partners or neighbours because they are frail, ill or have a disability (Carers UK, 2014). They often step in to provide help to older people when they experience difficulties with Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs). ADLs are fundamental self-care tasks such as washing, dressing and eating. Care for ADLs is often referred to as personal care. IADLs refer to activities that require more thinking and organisational skills such as shopping, housework, taking medication and paying bills. Help with IADLs is often referred to as home care.

In the absence of unpaid care, it seems likely that the demand for state provision would increase. One mechanism to reduce this demand is for policy intervention to incentivise unpaid care. For example, through offering financial support, like the UK Carers Allowance, to unpaid carers (DWP, 2017). However, policies which incentivise unpaid care will only be effective in terms of reducing pressure on formal LTC services, if unpaid care is a substitute for formal care (Bremer et al., 2017). That is, assuming unpaid care is an effective substitute and further, that substitution occurs independently from the need of the cared for, which may not be realistic especially in the case of severe disability (Bonsang, 2009).

There are currently two competing hypotheses in the literature: the *substitution hypothesis* and the *complementary hypothesis*. The former posits that unpaid care indeed substitutes for formal care. In other words, as unpaid care increases, the utilisation of formal care by the cared for decreases. For example, an unpaid carer might perform tasks such as help with getting dressed, that would otherwise be carried out by a formal carer. The policy implications of this hypothesis might be to encourage unpaid care giving, in an attempt to reduce reliance on formal LTC services provided by the government (Bremer et al., 2017). In contrast, the complementary hypothesis suggests that unpaid and formal care are positively related. As unpaid care rises, so does the use of formal care services by the cared for. This might be because unpaid carers act as mediators and gate keepers when it comes to access and knowledge about services available to the cared for (Bass and Noelker, 1987). Moreover, since unpaid carers are involved in daily care provision, they may have considerable knowledge about the needs of the cared for and the potential benefits that formal care could offer (Bass and Noelker, 1987). For example, an unpaid carer might provide help with IADLs, but realise that the person they are caring for also needs help with ADLs. They may therefore endeavour to increase the level of support for the cared for by engaging with the formal care sector on their behalf or encouraging them to engage themselves. At the same time, they might encourage formal care use in order to reduce their own care responsibility, fore example to enable them to remain in employment (Pickard et al., 2015; Brimblecombe et al., 2018). Further, a complementary relationship might exist because as underlying need increases, the use of both unpaid and paid care increases. If unpaid care complements formal care in this way, incentivising unpaid care could lead to increased pressure on formal care services.

Clearly, the two opposing hypotheses could have significant impacts on the utilisation and consequent costs of formal LTC services. Thus, in order to design social care policy to respond optimally to the changing structure of the population, it is crucial that the relationship between unpaid and formal care is

better understood. The existing evidence in the literature is somewhat mixed in terms of which hypothesis holds true. Since Greene (1983) published evidence on the substitutability between unpaid and formal care, a significant body of research has supported the substitution hypothesis (Boaz and Muller, 1994; Pezzin et al., 1996; Kehusmaa et al., 2013; Van Houtven and Norton, 2008, 2004; Charles and Sevak, 2005; Lo Sasso and Johnson, 2002; Coughlin et al., 1992). More recently, Kehusmaa et al. (2013) investigated the effect that unpaid care has on public expenditure for older people in Finland. Their findings showed that older people without an unpaid carer had the highest costs of formal care services, whilst those who lived with the person caring for them had the lowest costs.

On the other hand, there is evidence in support of the complementary hypothesis (Chappell and Blandford, 1991; Geerts and Van den Bosch, 2012; Litwin and Attias-Donfut, 2009; Bass and Noelker, 1987; Pickard et al., 2015). In particular, Geerts and Van den Bosch (2012) in their analysis of the effect that needs-based entitlements for LTC has on the dynamics of formal and unpaid care utilisation, found that in all countries studied, formal and unpaid care were more often complements. Furthermore, analysis of European data by Litwin and Attias-Donfut (2009) concluded that unpaid care was often supplemented with formal care.

Some studies have found a mixture of substitution and complementarity effects, depending on the needs of the cared for and the type of formal care service used (Bolin et al., 2008; Bonsang, 2009; Lo Sasso and Johnson, 2002). For example, Bolin et al. (2008) found that whilst unpaid care tended to substitute for formal social care services such as personal and home care, the relationship was in fact complementary for health care services like doctor visits and hospital stays. Other authors have suggested that the nature of the relationship between unpaid and formal care depends on the relationship between the unpaid carer and the person being cared for. For example, substitution is more likely for spouses and family carers, whilst complementarity is more likely for friends or neighbour carers (Geerlings et al., 2005). Furthermore, some research has found evidence that unpaid care has no effect at all on formal care service utilisation (Weaver and Weaver, 2014; Zhu et al., 2008; Langa et al., 2001).

The conflicting evidence in the existing literature highlights the complexity of the relationship between unpaid and formal care. This is further complicated by the ongoing debate of the endogeneity of unpaid care in the analysis. Specifically, there is a concern that there could be a reverse causality occurring between unpaid and formal care. This could be because an unpaid carer could change their decision to provide unpaid care based on how much formal care is being utilised. In fact, several studies have examined how the use of formal care services affects unpaid care (Christianson, 1988; Penning, 2002; Johansson et al., 2003; Shelley and Rose, 2004; Li, 2005; Franca et al., 2008; McNamee, 2006; Bell et al., 2007; Arntz and Thomsen, 2011; Pickard, 2012; McMaughan Moudouni et al., 2012; Karlsberg Schaffer, 2015). Furthermore, there might be other unobserved characteristics, for example health characteristics, which could influence both the demand for formal and unpaid care. Both of these sources of endogeneity would lead to Ordinary Least Squares (OLS) estimates being biased. Some studies have ignored the issue of endogeneity (Kehusmaa et al., 2013; Geerlings et al., 2005; Coughlin et al., 1992) whilst others have used Instrumental Variables (IV) techniques to try and account for it (Bonsang, 2009; Bolin et al., 2008; Van Houtven and Norton, 2008, 2004; Charles and Sevak, 2005). Overall, there are mixed conclusions on the extent to which endogeneity is an issue. Several authors have found limited evidence of it (Weaver and Weaver, 2014; McMaughan Moudouni et al., 2012; Bolin et al., 2008) and some have found that endogeneity is present and that failing to remedy it alters results considerably

(Van Houtven and Norton, 2004, 2008).

The Scottish context provides a unique opportunity to analyse the effect that unpaid carers have on older peoples' use of LTC services. Like the rest of the world, Scotland has experienced significant ageing in its population in recent decades, a trend that will continue until at least 2040 (National Records of Scotland, 2016b). The Scottish Government estimates there were 744,000 unpaid carers aged 18+ in Scotland in 2017 (Scottish Government, 2017). That is around 17% of the adult population (National Records of Scotland, 2016a). On 1st July 2002, the Community Care and Health (Scotland) Act 2002 was implemented and Free Personal and Nursing Care (FPNC) was introduced to those aged 65 or over, who were assessed as needing it (Scottish Executive, 2002).

The existence of FPNC in Scotland makes it unlike other jurisdictions analysed in the existing literature, where the financial burden of LTC services are often borne by the individual and their families. The existence of such a policy may mean quite different financial incentives for care givers, leading to contrasting conclusions surrounding complementarity and substitution. Furthermore, Scotland collects rich administrative data on all social care service recipients, including FPNC clients who are receiving personal care services at home, in an annual Social Care Survey (SCS), which provides an opportunity to analyse the whole personal care population. This paper will provide new evidence on the existence of substitution or complementarity between unpaid and formal care. Specifically, it adds to the existing literature by utilising the unique Scottish SCS and demonstrating for the first time how unpaid carers influence personal care use by Scots aged 65 and over.

The remainder of the paper will be structured as follows: Section 2 describes the data and characteristics of the SCS sample. Section 3 introduces the theoretical framework and discusses the empirical specifications of the models to be estimated. Following this, Section 4 outlines the results and provides a discussion. Finally, Section 5 concludes.

2. DATA

The data used in this paper come from the 2014, 2015 and 2016 Scottish SCS[1]. This is a comprehensive survey set up by the Scottish Government and administered annually during the census week in March by each of the 32 local authorities in Scotland. All individuals who receive at least one of seven possible social care services are included in the survey. Those services are: home care, personal care, telecare, meals services, self directed support (SDS), social work and housing support [2]. The SCS contains information on which care packages individuals' are receiving, how many hours of care they receive, as well as additional information on their basic demographics, needs and unpaid care status.

As discussed in Section 1, FPNC was introduced in Scotland in 2002. The FPNC policy can be split into two categories: care in care homes (which covers personal and nursing care) and care at home (which covers personal care only). The type of care analysed in this paper is personal care at home. This part of the policy makes personal care at home free to all individuals aged 65 and over in Scotland, subject to a needs assessment. Personal care at home can be provided directly by the local authority or the local authority can purchase personal care from the private and voluntary sectors. It is intended to help individuals maintain their independence and enable them to continue to live in their own homes.

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[1] Approval to access this data was granted by the Scottish Government in January 2017. Project number:SG000-000850.

[2] For a detailed description of the information included in the SCS please see Scottish Government (2016)

It comprises help with personal hygiene, continence management, food and diet, immobility problems, counselling and support, simple treatments and personal assistance[3].

Sample Selection Criteria

This paper focuses on social care clients' aged 65 and over. In total, across the three years studied, there were approximately 335,000 social care clients in Scotland aged 65 and over, who were receiving social care services due to problems associated with age [4].

The sample is restricted further to include those clients who had unpaid carer information available. The recording of unpaid carer information is optional for local authorities and as such a large proportion (around 80%) of these clients have an 'unknown' unpaid care status. Unfortunately it is difficult to confirm whether or not the recording of this information is missing at random and as such the extent to which it could introduce selection bias into the final sample. As a sensitivity check, a comparison of the main descriptive statistics between the sample before removing those without unpaid care information and after was carried out. This comparison didn't reveal any large differences between the samples, with the exception of the personal care variable in which only 34% of the pre-unpaid care selection sample were receiving FPC, compared to 44% in the final sample. This suggests that the final sample is likely to be a higher needs sub-sample of social care clients. Furthermore, as a further sensitivity check, the main models are estimated for those local authorities who recorded the unpaid carer information for the majority of individuals [5].

Removing the clients with missing unpaid carer information results in a final sample of almost 68,000 [6] social care clients across the three years. Although in theory clients can be linked across the years using a unique client identifier, this linkage is not consistent across local authorities and as a result the analysis is carried out as a cross section.

The following section will outline the model of interest, explore the difficulties encountered when working with skewed explanatory variables and propose three approaches to estimate the model which account for skewness.

3. METHODS

In this section, the problems associated with estimating the relationship of interest and motivation for the choice of a Two-Part Model (2PM) to estimate that relationship are outlined. Specifically, this paper aims to estimate the effect of an unpaid carer on an individuals' utilisation of personal care services. In theory, personal care services PC_i are described as a function of unpaid care UC_i and other observed and unobserved characteristics:

$$PC_i = f(UC_i, X_i, \epsilon_i) \tag{1}$$

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[3]The formal definition for personal care can be found in schedule 1 of the Community Care and Health Act 2002 (Scottish Executive, 2001).

[4]The SCS categorises clients into one of eight client groups. Those are: dementia, physical disability, frail older people, mental health problems, learning disability, learning and physical disability, other and not known. The first three categories are used as criteria to select individuals most likely to be receiving social care services due to problems associated with older age. These three groups account for about 78% of all social care clients aged 65+.

[5]Please see Table 6 in the Appendix

[6]Note that this figure does not reflect the total number of individuals because some clients will appear in more than one year.

Where i indexes individuals for $i = 1...n$, X_i represents other socio-demographic and health characteristics of the individual, and ϵ_i is the unobserved error term.

In the empirical estimations of the relationship as described by Eq. 1, the dependent variable is PC_i and is a continuous variable measuring the number of hours of personal care services individual i received during the census week. The explanatory variable of interest, UC_i is a binary indicator which is equal to 1 if the individual was known to have an unpaid carer and 0 if the individual was known not to have an unpaid carer.

As is the case for many health outcomes, weekly personal care hours are highly positively skewed. In particular, for those who have positive personal care hours, a large proportion of them have very few hours of care and a small proportion have a very large number of hours of care. Heavily skewed distributions of health outcomes, such as hours of personal care, is a common problem in the analysis of health care data. Heavily skewed dependent variables in standard regression models such as OLS can lead non-normal residuals which will yield inconsistent estimates of marginal and treatment effects. One solution to deal with this is to use a Generalized Linear Model (GLM). This approach has increasingly been applied in health economics research (Deb et al., 2017).

A second problem encountered when modelling hours of care is that traditional models are conditional on an individual having positive hours in the first place. This condition results in a loss of information since those clients who do not have positive hours, are ignored. That is, we know that many clients in fact have zero hours of care. Using statistical models that ignore this mass at zero might mean that the effects of the explanatory variables on the outcome cannot be generalised to the whole population. Specifically, OLS and GLM only describe the effect of an unpaid carer on personal care hours for those who receive personal care, however this effect might differ from the effect of an unpaid carer on whether or not a person receives personal care in the first instance. Thus, it is important to explicitly model the mass at zero, and subsequently calculate marginal and incremental effects which account for this.

One model which does this is the two-part model (2PM). It involves firstly estimating the probability of having a non-zero outcome via probit or logit, and subsequently estimating the mean of the outcome, conditional on having a non-zero outcome via OLS or GLM. 2PMs have widely been used and discussed in the health economics literature (Mihaylova et al., 2011; Duan et al., 1984; Mullahy, 1998; Buntin and Zaslavsky, 2004) and have often been shown to outperform other models when a large proportion of zeroes exist in the data (Mihaylova et al., 2011). Moreover, the 2PM is frequently employed within the literature on the relationship between unpaid and formal care (Bonsang, 2009; Charles and Sevak, 2005; Bolin et al., 2008; Van Houtven and Norton, 2004). Intuitively, there are different decisions occurring in the two parts of the 2PM, which implies that covariates may have different effects on the dependent variable each step (Deb and Trivedi, 2002). Firstly an individual decides whether or not to demand any personal care services, and secondly the local authority decides how much care to supply. The 2PM is therefore appealing in this setting because it takes both decisions into account.

Other approaches to deal with a high proportion of zeroes include Heckman's 2-step selection model. Compared to the 2PM, where the zeroes are observed or 'genuine', the Heckman model treats the zeroes as unobserved individuals. Thus, it is argued that the 2PM is the most appropriate model for the analysis in this paper because those with zero hours of personal care are observed in the sample. Nevertheless, it is worth noting that there are unobserved individuals i.e. those in the general population who do not

receive social care services at all, and as a result are missing from the dataset. Thus, it is important to bear in mind that the probit model in the first part of the 2PM is estimated for a population who are perhaps already at an increased risk of requiring personal care.

Formally, the 2PM can be written as:

$$Pr[PC_i > 0 | UC_i, X_i] = \mathbf{\Phi}(\alpha_{uc} UC_i + X_i'\alpha + \xi_i) \tag{2}$$

$$E[PC_i | PC_i > 0, UC_i] = g^{-1}(\beta_{uc} UC_i + X_i'\beta + \epsilon_i) \tag{3}$$

The threshold in Eq. 2 is modelled as a binary probit model where Φ represents the cumulative density function of the standard normal distribution. This is known as the 1st part of the 2PM. The dependent variable PC_i and key explanatory variable of interest UC_i are as described above. Here, $\mathbf{X}'$ is a vector of explanatory variables including an intercept. The parameters to be estimated are in the vector α and ξ_i is the error term.

Eq. 3 is a GLM model for individuals with strictly positive hours of personal care and is known as the 2nd part of the 2PM. Here, g^{-1} is the inverse of the log-link function and the outcome variable, PC_i, is generated by the gamma distribution. The decision to use the log-link function and gamma distribution family is based on Akaike and Bayesian Information Criteria, AIC and BIC respectively, and statistical tests including the Box-Cox and Modified Park tests [7]. The log-link and gamma family is a common choice for GLM models of health care expenditures and costs (Deb et al., 2017, pg.86). The parameters to be estimated are in the vector β and ϵ_i is the error term. Estimation of the 2PM is carried out in Stata using the `twopm` command (Belotti et al., 2015). GLM's are especially useful because they model heteroskedasticity directly and avoid the re-transformation of the outcome variable back to the raw scale as with log-linear models. This means that marginal and incremental effects can more easily be calculated. Specifically in the GLM, the incremental effect of the presence of an unpaid carer on personal care hours can be calculated as:

$$\frac{\Delta E[PC_i | X_i]}{\Delta UC} = \Phi(X_i'\alpha | UC = 1)e^{(X_i'\beta | UC=1)} - \Phi(X_i'\alpha | UC = 0)e^{(X_i'\beta | UC=0)} \tag{4}$$

Where $X_i'\alpha_i$ are the linear predictions from Eq. 2 and α_{uc} is the estimated parameter on the unpaid care indicator. As before $X_i'\beta_i$ and β_{uc} are the respective predictions from Eq. 3.

Endogeneity

As mentioned in Section 1, there are potential sources of endogeneity that could exist in the model. Firstly, endogeneity might be present due to omitted variable bias where an omitted variable is correlated with both unpaid care and the dependent variable. One potential omitted factor is the need of the social care client. The models account for client need via several variables. If these do not fully reflect client need, there could be a correlation between unpaid care and the error term, leading to the estimate of the incremental effect of unpaid care being biased. Unfortunately, the SCS is limited in its collection of detailed needs indicators. Whilst it does have an entry for an Indicator of Relative Need (IoRN) score.

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[7]Output from tests available on request.

This is a non-mandatory item in the survey and as a result it is very poorly recorded by local authorities. To give an indication of the direction and extent of any bias due to the omission of need, the results from the 2PM are presented such that need controls are added incrementally, to show how the marginal effect of unpaid care changes as a result.

Secondly, endogeneity might be present due to the potential reverse relationship that could exist between unpaid and formal care services. For example, the number of hours of personal care a person receives might influence the decision of their unpaid carer to provide care. As outlined in Section 1, a number of studies have found that not accounting for this reverse causality can significantly alter model results (Van Houtven and Norton, 2004, 2008). In order to test and account for this reverse causation, Instrumental Variables (IV) methods can be used. Of the literature which implements IV techniques, the most commonly used instruments are varying characteristics of the care givers. Much of the literature focusses explicitly on children caring for parents, hence among the most frequently used instruments are, proportion of daughters, distance to nearest child and age of eldest child (Bonsang, 2009; Bolin et al., 2008; Van Houtven and Norton, 2008, 2004; Charles and Sevak, 2005). Unfortunately, since the SCS data are collected for administrative purposes, they don't contain any information on the carer themselves and as a result make finding a suitable instrument difficult. Instead, an IV analysis is carried out as a sensitivity check, by constructing instruments from Census information.

Other methods to account for endogeneity may have been implemented, for example exploiting the panel nature of the SCS data and using lagged hours of personal care or some quasi-experimental methods. However, due to the large variation in recording of unique identifiers by local authorities across Scotland, exploiting the panel nature of the SCS may not provide reliable estimates.

The next section presents and discusses the model results. Further sensitivity checks are also carried out to see if there is any evidence of reverse causality confounding the estimates and to check how robust the results are to different specifications.

4. RESULTS

Descriptive Statistics

Table 1 provides a set of basic descriptive statistics for the whole sample, the personal care clients and the unpaid care clients [8]. The gender and age distributions are broadly similar across the three samples. In terms of years, around 42% of the sample are from the 2016 census, compared to 36% from 2015 and just 22% from 2014. This is due to increases over time in the number of social care clients receiving care in each of the selected client groups. The SCS previously variable indicates where the client received social care in more than one of the three years.

In terms of unpaid care status, approximately 34% of the whole sample have an unpaid carer compared to 39% of the personal care sample. Furthermore, around 45% of the whole sample receive personal care services i.e. have a positive number of hours of personal care, compared to 51% of the unpaid care sample. This might suggest that individuals with an unpaid carer are more likely to receive personal care services. It may also indicate that they have a higher level of need.

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[8] Please see Table 4 in the Appendix for a full description of all variables

Overall, around 11% of the sample have been assigned a dementia status[9]. This is similar for personal care clients. This is somewhat lower than the 2017 population estimate of almost 20%, for those aged 65+ (Alzheimer Scotland, 2017; National Records of Scotland, 2016a). In contrast, nearly 19% of clients with an unpaid carer have been assigned the dementia client group. This might indicate that individuals with dementia are far more likely to have an unpaid carer looking after them.

The number of other services variable is the total number of social care services an individual is receiving, excluding home care and personal care. Other services include meals services, telecare services, housing support and social work. On average, clients receive one other service. Although, those with an unpaid carer receive closer to an average of two other services.

Table 1 also provides information on the distribution of weekly hours of personal care and the number of staff providing personal care to the individual. The median number of hours of care is zero per week for the whole sample and seven hours per week for the personal care and unpaid care sub-groups.

Finally, the multistaff variable indicates whether or not a personal care client requires two or more members of care staff helping them. This is the case when a client has significant mobility problems such that they need more than one person to help them move around the house. Therefore, this variable will provide an indication of need. Around 10% of personal care clients have been assigned the multistaff indicator.

Model Results

Table 2 displays the model results from four versions of the 2PM. In each version, an additional control for client need is added. The table shows the parameter estimates from each part of the 2PMs where the dependent variable in the first part is the probability of receiving personal care, and in the second it is the number of hours of personal care, conditional on receiving any.

Overall, the signs of coefficients are generally in line with a priori expectations. In Part 1 of all specifications of the model, older age is associated with a higher likelihood of receiving personal care. In particular, compared to those aged 65-74, those aged 75-84 are significantly more likely to receive personal care. This is consistent with the idea that ageing is associated with increased frailty and need for care. Having said that, there is no difference in the likelihood of receiving care between those aged 65-74 and those aged 85 and over. Furthermore, females are more likely to have a positive number of hours of personal care. This result is significant across all versions of the model at the 1% significance level. Interestingly, the number of other social care services that an individual is receiving reduces their probability of receiving personal care. This might reflect the fact that the other services, like meals and telecare, are possibly preventing older people from requiring personal care. Moreover, individuals are less likely to receive personal care in 2015 and 2016, compared to 2014, other things being equal. With respect to the unpaid care indicator, the probit models consistently show a positive and significant relationship with the probability of receiving personal care. That is, older people who have an unpaid carer

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[9]The dementia status of an individual is based on a care workers assessment of the individual and thus cannot be considered a medical diagnosis of dementia.

[INSERT TABLE 2 HERE]

are more likely to receive personal care services. This finding offers support to the complementary hypothesis.

In the second part of the 2PMs, the signs and significance of coefficients are generally consistent as each additional control for need is added. Overall, clients who are aged 75-84 and receiving personal care services receive fewer hours of care each week compared to those aged 65-74. This result is significant at the 10% level across all specifications except 2PM-2. Furthermore, the oldest old i.e. those aged 95+, receive a significantly higher number of personal care hours compared to those aged 65-74. This result is significant at the 1% level in all specifications except 2PM-1. Once again, with the exception of 2PM-1 gender is positive and significant suggesting that for those who receive personal care services, females receive a higher number of personal care hours each week compared to males. Moreover, the greater the number of other services a client is receiving, i.e. over and above personal care, the higher are their weekly personal care hours. The number of other services variable will act as a proxy for level of need and thus the positive relationship is what one would expect. As in the first part of the model, in the second part of the model weekly personal care hours are significantly lower in both 2015 and 2016 compared to 2014. Again, this is consistent across the four specifications. Finally, the unpaid carer variable again indicates a possible complementary relationship between unpaid care and personal care, displaying a significantly positive coefficient across all specifications of the second part of the model.

In 2PM-1, the full marginal effect of an unpaid carer, as calculated using Eq. 4, is 1.55. This result implies that individuals who have an unpaid carer receive 1 hour and 33 minutes more of personal care per week, compared to those without an unpaid carer, other things being equal. This result is significant at the 1% significance level. Of course, the concern with 2PM-1 as it is specified is that it may not fully capture client need. In 2PM-2, an additional control to indicate whether or not the person required two members of personal care staff, is added. This will capture the level of need of the client in the sense that it is those who have substantial mobility problems who require two or more staff to help them with personal care tasks. The multistaff variable is significant and positive confirming our a priori expectations that those who have two members of staff looking after them and therefore have higher need, will have a higher number of weekly hours of personal care. The addition of the multistaff variable In 2PM-2 reduces the full incremental effect of unpaid care from 1.55 to 1.35. In other words, personal care clients with an unpaid carer receive around 1 hour and 21 minutes more per week compared to personal care clients without an unpaid carer, ceteris paribus. This result remains statistically significant at the 1% level.

In 2PM-3, the additional control SCS previously is added, indicating whether or not the individual had received social care in more than one year. In this way, it will capture a clients' long term need for social care. In 2PM-3 and 2PM-4 the indicator is found to be positive and significant in both parts of the model, suggesting that having received social care for at least two years, increases an individuals' probability of receiving personal care and also their weekly hours of personal care once they receive any. The addition of the SCS previously indicator reduces the overall incremental effect of an unpaid carer to 1.24, or about 1 hour and 14 minutes per week. That is, personal care clients with an unpaid carer receive around 1 hour and 14 minutes more per week compared to personal care clients without an unpaid carer, ceteris paribus. Once again, this effect is statistically significant at the 1% level. Lastly, in 2PM-4, a

[INSERT TABLE 3 HERE]

dementia indicator is added as a further control for client need. The variable is found to be insignificant and only slightly reduces the marginal effect of unpaid care.

Overall, the results presented in Table 2 suggest that including additional controls for need reduces the marginal effect of unpaid care on weekly hours of personal care. This conveys that any bias resulting from not accounting for need will tend to lead to overestimates of the marginal effect of unpaid care. Having said that, the results find that as additional controls for need are added, the change in the marginal effect gets smaller and smaller. This is promising and indicates that altering the model specification to include additional controls for need will make little difference to the estimated marginal effect of unpaid care. In summary, the results suggest a complementary relationship between unpaid care and personal care services in Scotland.

As discussed previously, it is highly debated within the literature whether or not there is a reverse causality between formal and unpaid care, which would result in the unpaid care variable being endogenous and parameter estimates biased. To test for this, IV models are estimated for the two parts of the model using two data zone[10] level instruments, constructed from 2011 Census data. Those are, the number of one person households and the number of married individuals, both as proportions of the data zone populations. In Scotland, around 78% of carers are living with someone in a couple (Scottish Government, 2015). Thus, both of the proposed data zone level rates are thought to be good predictors of an individuals' likelihood of having an unpaid carer, i.e. living in an area with a high marriage rate or low one-person household rate should be highly positively correlated with a persons unpaid care status, but have no influence on a specific individuals' personal care utilisation. Both IVs are used to instrument the carer variable. Due to the recording of data zones in the SCS, which changes between the three years, this approach is only possible for those clients who were in either all three years, 2016 only, 2016 and 2015, or 2016 and 2014.

An additional income variable is also included in the IV regressions because income might be correlated with household composition, which in turn could influence hours of FPC. This variable captures the proportion of the data zone which are determined to be income deprived.

IV models are estimated for the two parts of the 2PM using two data zone level instruments. Two-stage least squares is used for both parts of the model. Table 3 shows the key statistics from the IV regressions, first using one instrument and then using both. The table shows that in all cases the instruments are good predictors of unpaid care status. This is indicated by the first stage Kleibergen-Paap Wald rk F-statistics, which are all above the 'rule of thumb' requirement of 10. When both instruments are included, they also pass the over identification test. Lastly, the Durbin-Wu-Hausman Chi-square statistics for the exogeneity of unpaid care are consistently insignificant at the required 5% significance level, suggesting that the carer variable can be treated as exogenous. The parameter estimates from the second-stage regressions are shown in Table 5 in the Appendix. The findings from the second-stage IV regressions are broadly consistent with the main results. However, the unpaid carer variable becomes negative and insignificant in part two of the model. Moreover, the finding that those aged 75-84 consis-

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[10]A data zone is a small-area statistical geography in Scotland containing populations of between 500 and 1,000 residents.

tently receive a higher number of hours of care compared to those aged 65-74, is replaced by significantly positive coefficients on all age variables in part one of the IV results. Having said this, since the Durbin-Wu-Hausman tests conclude that the unpaid carer variable can be treated as exogenous, the results from the main 2PM are preferred.

On the whole, the results outlined in this section show that unpaid care tends to complement personal care services. That is, in general, the presence of an unpaid carer is associated with an increase in the number of weekly personal care hours. This finding supports the complementary hypothesis.

Sensitivity Checks

As mentioned in Section 3, a variety of sensitivity checks are carried out to check how robust the results are. Firstly, to check that the results are not sensitive to the recording of unpaid care information by local authorities, the 2PM (including the full set of need variables) is estimated for the sample of local authorities in which more than 50% of individuals had unpaid carer information recorded. The output from this model is shown in Table 6 in the Appendix. Secondly, to check that the results are not sensitive to the specification of the model, they are also estimated the via simple OLS, with and without transforming the dependent variable, as a GLM and lastly as a 2PM using the log of hours of care in the second stage. The results from each of these specifications is shown in Table 7 in the Appendix. Finally, the models are re-estimated for those clients who appeared in 2016 only. Estimating the models for individuals only present in 2016 acts as a check against reverse causality, assuming that those who were not present in earlier years, were receiving social care for the first time in 2016 and as a result, the decision of their unpaid carer to provide care is less likely to be influenced by the number of hours of care the client is receiving [11].

Overall, the results from the sensitivity checks agree with the main model conclusions and consistently find that unpaid carers complement personal care services for the over 65s in Scotland.

5. DISCUSSION AND CONCLUSION

This paper contributes to the existing evidence on the relationship between unpaid and paid long term care using a unique administrative data set and for the first time demonstrates how unpaid carers influence older peoples use of free personal care services in Scotland. Overall, it finds that unpaid care tends to complement personal care services. In particular, the incremental effect of an unpaid carer is 1 hour 14 minutes per week. This finding is consistent with other evidence offered in the existing literature (Chappell and Blandford, 1991; Geerts and Van den Bosch, 2012; Litwin and Attias-Donfut, 2009; Bass and Noelker, 1987; Pickard et al., 2015). There are a number of potential explanations for a complementary relationship including that unpaid carers are well-informed agents, both in terms of knowledge of services and the needs of the cared for, which allows them to encourage the use of and seek out appropriate services (Bass and Noelker, 1987).

The finding of complementarity in this paper might not be surprising, given the sample of individuals analysed are social care clients and likely have higher level of need compared to the general population. Intuitively, a complementary relationship might be expected for those with a higher level of dependency

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[11] Output from this specification is available on request

since the skill level required to provide care increases with this dependency and unpaid carers might need to rely on the support of formal care services to cope. This finding is consistent with previous research which demonstrates that complementarity is more likely to exist for those with high levels of need (Bonsang, 2009). Further investigation into different sub-samples might be useful in determining whether or not a complementary relationship holds for other groups. For example, for social care clients who are receiving home care only, that is help with IADLs, a substitution effect might be more likely.

Furthermore, the finding of complementarity in Scotland for those aged 65+ may be unsurprising given that personal care is free for those individuals. To expand, unpaid care is generally provided by a spouse or an older child. In jurisdictions where personal care bears a financial cost, it might fall on the unpaid carer to finance this. In that case, there is more likely to be a substitution because an unpaid carer may prefer to take on that cost themselves than pay someone externally to do so. This hypothesis is consistent with evidence from the United States (Van Houtven and Norton, 2004, 2008). On the contrary, in Scotland, where there is no cost attached to personal care, unpaid carers may be more likely to encourage the use of services and advocate on behalf of the cared for, to ensure they get the care they require. Thus, the complementary relationship in Scotland might suggest that unpaid carers are supported by the formal care sector and this is effective in enabling them to remain in employment (Pickard et al., 2015; Brimblecombe et al., 2018). At the same time, it may also demonstrate that unpaid carers are providing a different kind of help to the person they are caring for compared to the formal care sector. For example, unpaid carers might help with the persons finances or simply by helping them to maintain a sense of self (Farina et al., 2017). However, further investigation would be needed to verify this.

The existence of a complementary relationship between unpaid and formal care is concerning in two dimensions. Firstly, it might mean that as the Scottish population ages and family members take on the role of unpaid carers, the pressure on local authorities providing LTC to older individuals could increase, especially if unpaid carers demand services on behalf of the cared for. If this is the case, planning for future social care spending will have to take this into account. Having said this, as discussed the complementarity between the two may suggest that unpaid carers are being supported in their role as care givers. As a result, they might provide care for longer and prevent the need for increased use of formal care or other forms of formal care such as residential care, and subsequently lower costs to the government overall. A second concern arising from the finding of a complementary relationship between unpaid and paid care is that there could be unmet need for those individuals who do not have an unpaid carer. This is especially highlighted in the 1st part of the 2PM, in which it is predicted that those without unpaid carers are significantly less likely to receive personal care services in the first place. Both concerns require further investigation.

There are however, some caveats in this paper which warrant comment. Firstly, concerning the generalisability of the results to the entire population. Specifically, as mentioned the sample of the population analysed here is already a higher needs group in that they require some form of social care service. Thus, the findings of complementarity between unpaid and paid care might not extend beyond personal care clients. Related to this, the sub-sample of unpaid carers captured in the SCS might be systematically different from unpaid carers in the general population, for example in terms of the care they provide, once again threatening the generalisability of the complementary results reported here.

Secondly, the analysis is somewhat constrained by the sample selection criteria, which in the case of

the unpaid care information, is poorly recorded by local authorities. Specifically, there are differences in the proportions of local authorities who record the unpaid care information, which could introduce sample selection bias into the models. As a sensitivity check, the 2PM is estimated for those local authorities who had recorded the unpaid carer information for more than 50% of their social care clients[12]. In addition, a comparison of the main descriptive statistics between the pre-unpaid care selection sample and the final sample was also carried out. This comparison did not reveal any large differences between the two groups apart from in terms of personal care status. Specifically, the pre-unpaid care selection sample had a lower proportion of individuals receiving personal care by around 10%. This finding once again suggests that the final sample analysed here is likely to be a higher needs sub-set of the social care population analysed. Understanding if this selection criteria introduces bias into the sample is still difficult to tell and future research would benefit greatly from inquiring with individual local authorities to understand more about their recording practices and shed light on the probability that this introduces selection bias.

Thirdly, it is acknowledged that the variables which attempt to control for the need/health status of care clients are only proxies and might not fully capture the care needs of formal care recipients. If need is not fully captured by the included covariates in the model, the unpaid carer variable may act as a proxy for need. For example, it could be that unpaid carers provide care up to the point at which they can no longer meet the needs of the person they are caring for, and after this point, they seek additional help from the local authority. This could result in those with unpaid carers having higher personal care needs compared to those without. Further investigation with more detailed information on individuals need would be necessary to check this.

Further, it is worth reflecting on the possibility of reverse causality between unpaid care and personal care hours. A previous study, which looked at the effect of the introduction of FPC on unpaid care in Scotland, found evidence of a complementary relationship (Karlsberg Schaffer, 2015). This finding highlights the simultaneity of the relationship between unpaid care and formal care. If it is the case that the availability of formal care services causes unpaid carers to increase the amount of care they provide as Karlsberg Schaffer (2015) finds, it is possible that the finding of complementarity in this paper is upwardly biased. Having said this, another Scottish paper found no evidence of an effect (Bell et al., 2007) and the IV results from this paper also suggested that unpaid care could be treated as exogenous.

Lastly, the analysis is limited by the lack of information available on unpaid carers. For example, it is unknown if the carer is a child caring for a parent outside the household, or a partner caring for their other half in their own home. This information would be useful to check if the results would differ depending on the relationship between the cared for and carer, which some evidence suggests is the case (Geerlings et al., 2005; van den Berg and Ferrer-i Carbonell, 2007). Moreover, the SCS doesn't contain information on the type of care provided or time spent caring by unpaid carers. Understanding more about the type of care unpaid carers are supplying would offer a further insight into the relationship between unpaid and formal LTC provision. In addition, information on the employment status of the unpaid carer would be useful in determining whether or not the relationship between unpaid and paid care changes with this status. For example, it might be that substitution is more likely when a carer is retired and has time to take on more caring duties themselves.

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[12]Results are shown in Table 6 in the Appendix

Notwithstanding these limitations, this paper has used Scotland's unique SCS to estimate the effect that unpaid carers have on older peoples' use of personal care services. The results consistently suggest that there is a complementary relationship between unpaid care and personal care services in Scotland. These findings are robust a variety of sensitivity checks.

6. APPENDIX

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[INSERT TABLES 4 - 7]

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Acknowledgements

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Table 1: Descriptive Statistics

Variable	Whole Sample N = 67,695		PC Clients n = 30,359		UC Clients n = 23,066	
	No of Obs	% of N	No of Obs	% of N	No of Obs	% of N
Gender						
Female	46,650	68.91	21,284	70.11	15,229	66.02
Male	21,045	31.09	9,075	29.89	7,837	33.98
Age						
65-74	10,281	15.19	4,337	14.29	3,468	15.04
75-84	26,386	38.98	811,949	39.36	8,835	38.30
85-94	27,421	40.51	12,405	40.86	9,339	40.49
95+	3,607	5.33	1,668	5.49	1,421	6.17
Year						
2014	15,099	22.3	8,140	26.81	2,952	12.8
2015	24,455	36.13	10,738	35.37	9,379	40.66
2016	28,141	41.57	11,481	37.82	10,735	46.54
SCS Previously						
Yes	29,763	43.97	15,609	51.41	12,527	54.31
No	37,932	56.03	14,750	48.59	10,539	45.69
Dementia						
Yes	7,425	10.97	3,454	11.38	4,368	18.94
No	60,270	89.03	26,905	88.62	18,698	81.06
Unpaid Carer						
Yes	23,066	34.07	11,811	38.9	23,066	100
No	44,629	65.93	18,548	61.1	-	-
Personal Care						
Yes	30,359	44.85	30,359	100	11,811	51.21
No	37,336	55.15	-	-	11,255	48.79
No. other Services						
Mean	1.39	-	1.31	-	1.72	-
Weekly PC Hours						
Min	0	-	0.08	-	0.08	-
Mean	3.17	-	8.44	-	9.35	-
Median	0	-	7	-	7	-
Max	168	-	168	-	168	-
Multistaff						-	-
Yes	-	-	3,104	10.22	-	-
No	-	-	27,255	89.78		

Table 2: 2PM Results: Accounting for client need

Variable	2PM-1		2PM-2		2PM-3		2PM-4	
	(P1)	(P2)	(P1)	(P2)	(P1)	(P2)	(P1)	(P2)
Aged 75-84	0.0546***	-0.113***	0.0546***	-0.0257	0.0513***	-0.0268*	0.0511***	-0.0273*
	(0.016)	(0.018)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Aged 85-94	0.0221	-0.0909***	0.0221	0.0273*	0.0156	0.0254	0.0155	0.0252
	(0.016)	(0.018)	(0.016)	(0.017)	(0.016)	(0.017)	(0.016)	(0.017)
Aged 95+	0.0433	-0.0215	0.0433	0.127***	0.0325	0.124***	0.0326	0.125***
	(0.027)	(0.025)	(0.027)	(0.023)	(0.027)	(0.023)	(0.027)	(0.023)
Female	0.0359***	-0.00745	0.0359***	0.0284***	0.0313***	0.0263***	0.0313***	0.0262**
	(0.011)	(0.012)	-0.0112	-0.0102	-0.0112	-0.0102	-0.0112	-0.0102
Has unpaid carer	0.298***	0.196***	0.298***	0.114***	0.269***	0.107***	0.269***	0.106***
	(0.014)	(0.014)	(0.014)	(0.012)	(0.014)	(0.013)	(0.015)	(0.013)
No. Oth Services	-0.172***	0.105***	-0.172***	0.102***	-0.184***	0.100***	-0.185***	0.100***
	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)	(0.007)
Demenita	-	-	-	-	-	-	0.00458	0.0161
	-	-	-	-	-	-	(0.018)	(0.015)
Multistaff	-	-	-	0.939***	-	0.938***	-	0.939***
	-	-	-	(0.014)	-	(0.014)	-	(0.015)
SCS previously	-	-	-	-	0.169***	0.0438***	0.169***	0.0437***
	-	-	-	-	(0.014)	(0.012)	(0.014)	(0.012)
2015	-0.626***	-0.104***	-0.626***	-0.105***	-0.663***	-0.120***	-0.663***	-0.120***
	(0.021)	(0.021)	(0.021)	(0.018)	(0.021)	(0.018)	(0.021)	(0.018)
2016	-0.323***	-0.0633***	-0.323***	-0.0610***	-0.353***	-0.0735***	-0.353***	-0.0742***
	(0.021)	(0.022)	(0.021)	(0.019)	(0.021)	(0.019)	(0.021)	(0.019)
Constant	0.421***	2.073***	0.421***	1.869***	0.513***	1.894***	0.511***	1.886***
	(0.127)	(0.120)	(0.127)	(0.123)	(0.127)	(0.123)	(0.128)	(0.123)
Observations	67,682	25,423	67,682	25,423	67,682	25,423	67,682	25,423
Marginal Effect	1.55***		1.35***		1.24***		1.23***	
Marginal Effect in Minutes	1 hour and 33 minutes		1 hour and 21 minutes		1 hour and 14 minutes		1 hour and 14 minutes	

Robust standard errors are shown in parentheses
*p <0.10, ** p <0.05, *** p <0.01*
Local authority dummies are included but are not presented in output.

Table 3: Instrumental Variables Specification Tests

Dependent Variable	Instruments	Strength of Instruments	Overidentification Test	Exogeneity Test
Positive Personal Care Hours	% one person households in data zone	F(1, 5757) = 64.49***	Equation exactly identified	Chi-sq(1) = 0.08
Personal Care Hours	% one person households in data zone	F(1, 4583) = 39.38***	Equation exactly identified	Chi-sq(1) = 0.38
Positive Personal Care Hours	% one person households in data zone; % of married people in data zone	F(2, 5757) = 33.54***	Chi-sq(1) = 0.16	Chi-sq(1) = 0.07
Personal Care Hours	% one person households in data zone; % married people in data zone	F(2, 4583) = 19.80***	Chi-sq(1) = 0.67	Chi-sq(1) = 0.35

Table 4: Variable Descriptions

Variable	Description
Gender	0 if male, 1 if female
Age	0 if 65-74; 1 if 75-84; 2 if 85-94; 3 if 95+
Year	2014;2015;2016
SCS Previously	0 if received social care in one year only; 1 if received social care in more than one year
Dementia	0 if client not assigned dementia client group; 1 if client assigned dementia client group
Unpaid Carer	0 if client does not have an unpaid carer; 1 if client has an unpaid carer
No. oth services	Continuous variable from 0-5. Sum of services other than home care that a client is receiving. Those services are: telecare, meals services, self directed support; housing support; social work.
Weekly personal care hours	Continuous variable from 0 to 168.
Multistaff	0 if personal care client had one member of staff looking after them; 1 if personal care client had more than one member of staff caring for them.
Income Deprivation	Average proportion of data zones within the local authority which are income deprived.

Table 5: Sensitivity Analysis- IV 2SLS Second Stage Results

	IV_A (P1)	IV_A (P2)	IV_B (P1)	IV_B (P2)
Has unpaid carer	0.522**	-0.203	0.490*	-0.21
	(0.254)	(0.333)	(0.255)	(0.331)
Aged 75-84	0.0425***	0.0103	0.0421***	0.0102
	(0.008)	(0.022)	(0.008)	(0.022)
Aged 85-94	0.0382***	0.0615***	0.0377***	0.0614***
	(0.009)	(0.022)	(0.009)	(0.022)
Aged 95+	0.0449***	0.132***	0.0446***	0.131***
	(0.014)	(0.038)	(0.014)	(0.038)
Female	0.0345***	0.0258	0.0337***	0.0255
	(0.008)	(0.019)	(0.008)	(0.019)
No. Oth Services	-0.00362	0.128***	-0.0029	0.129***
	(0.008)	(0.014)	(0.008)	(0.014)
SCS previously	-0.0228	0.124***	-0.021	0.124***
	(0.017)	(0.022)	(0.017)	(0.022)
Dementia	-0.0445	0.0651	-0.04	0.0659
	(0.038)	(0.047)	(0.039)	(0.047)
Income Deprivation	0.0828**	0.0701	0.0820**	0.0702
	(0.036)	(0.073)	(0.036)	(0.073)
Two or more staff	-	0.991***	-	0.992***
	-	(0.044)	-	(0.044)
2015	-0.247***	-0.0679	-0.243***	-0.0669
	(0.041)	(0.055)	(0.041)	(0.055)
2016	-0.357***	0.0256	-0.351***	0.0266
	(0.045)	(0.059)	(0.045)	(0.059)
Constant	0.581***	-	0.596***	-
	-0.125	-	-0.126	-
Observations	42,009	15,751	42,009	15,751

*Standard errors are clustered at the data zone level and shown in parentheses: * p <0.10, ** p <0.05, *** p <0.01*
Local authority dummies are included but are not presented in output.

Table 6: Sensitivity Analysis- Local authorities with good unpaid care information

	2PM	
	P1	P2 (GLM)
Aged 75-84	0.103***	0.0386*
	(0.027)	(0.023)
Aged 85-94	0.0468*	0.0887***
	(0.028)	(0.024)
Aged 95+	-0.0701	0.224***
	(0.049)	(0.040)
Female	0.0058	0.00332
	(0.021)	(0.017)
Has unpaid carer	0.516***	0.0758***
	(0.031)	(0.023)
No. oth services	-1.065***	0.122***
	(0.021)	(0.014)
Eilean Siar	1.090***	0.270***
	(0.075)	(0.041)
Glasgow City	-0.584***	0.550***
	(0.027)	(0.032)
2015	-0.272**	-0.237***
	(0.114)	(0.050)
2016	0.255**	-0.221***
	(0.116)	(0.052)
SCS previously	-0.154***	0.0164
	(0.023)	(0.020)
Multistaff	-	0.700***
	-	(0.037)
Dementia	0.313***	0.0548
	(0.062)	(0.036)
Constant	1.072***	1.645***
	(0.118)	(0.064)
Observations	23175	8560
Marginal Effect		1.62***
Marginal Effect in Minutes		1 hour and 37 minutes

Robust standard errors are shown in parentheses
*p <0.10, ** p <0.05, *** p <0.01
Local authorities included in this estimation are Glasgow City, East Renfrewshire and Eilean-Siar

Table 7: Sensitivity Analysis- Different Model Specifications

	OLS	OLS	GLM	2PM	
	pchours	ln(pchours)	Gamma, Log-link	P1- Probit	P2- OLS ln(pchours)
Aged 75-84	-0.356**	-0.00818	-0.0273*	0.0511***	-0.00818
	(0.142)	(0.016)	(0.016)	(0.016)	(0.016)
Aged 85-94	-0.0404	0.0506***	0.0252	0.0155	0.0506***
	(0.142)	(0.016)	(0.017)	(0.016)	(0.016)
Aged 95+	0.726***	0.150***	0.125***	0.0326	0.150***
	(0.208)	(0.026)	(0.023)	(0.027)	(0.026)
Female	0.251***	0.0250**	0.0262**	0.0313***	0.0250**
	(0.087)	(0.011)	(0.010)	(0.011)	(0.011)
Has unpaid carer	0.891***	0.114***	0.106***	0.269***	0.114***
	(0.106)	(0.013)	(0.013)	(0.015)	(0.013)
SCS previously	0.446***	0.0633***	0.0437***	0.169***	0.0633***
	(0.101)	(0.013)	(0.012)	(0.014)	(0.013)
No. Oth Services	0.783***	0.125***	0.100***	-0.185***	0.125***
	(0.056)	(0.007)	(0.007)	(0.008)	(0.007)
Dementia	-0.0209	0.0222	0.0161	0.00458	0.0222
	(0.133)	(0.017)	(0.015)	(0.018)	(0.017)
Multistaff	10.89***	0.994***	0.939***	-	0.994***
	(0.224)	(0.016)	(0.015)	-	(0.016)
2015	-1.035***	-0.156***	-0.120***	-0.663***	-0.156***
	(0.161)	(0.020)	(0.018)	(0.021)	(0.020)
2016	-0.543***	-0.113***	-0.0742***	-0.353***	-0.113***
	(0.170)	(0.021)	(0.019)	(0.021)	(0.021)
Constant	6.399***	1.521***	1.886***	0.511***	1.521***
	(1.072)	(0.126)	(0.123)	(0.128)	(0.126)
Observations	25,423	25,423	25,423	67,682	25,423

Robust standard errors are shown in parentheses
*p <0.10, ** p <0.05, *** p <0.01
Local authority dummies are included but are not presented in output.