

This is a repository copy of *Investigating the economic case of a service to support carers of people with dementia : a cross-sectional survey-based feasibility study in England*.

White Rose Research Online URL for this paper:

<https://eprints.whiterose.ac.uk/146413/>

Version: Accepted Version

---

**Article:**

Longo, Francesco orcid.org/0000-0002-1833-7328, Neves De Faria, Rita Isabel orcid.org/0000-0003-3410-1435, Parker, Gillian Mary orcid.org/0000-0002-2221-6748 et al. (4 more authors) (2019) Investigating the economic case of a service to support carers of people with dementia : a cross-sectional survey-based feasibility study in England. *Health and Social Care in the Community*. e734-e743. ISSN 1365-2524

<https://doi.org/10.1111/hsc.12799>

---

**Reuse**

Items deposited in White Rose Research Online are protected by copyright, with all rights reserved unless indicated otherwise. They may be downloaded and/or printed for private study, or other acts as permitted by national copyright laws. The publisher or other rights holders may allow further reproduction and re-use of the full text version. This is indicated by the licence information on the White Rose Research Online record for the item.

**Takedown**

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing [eprints@whiterose.ac.uk](mailto:eprints@whiterose.ac.uk) including the URL of the record and the reason for the withdrawal request.

## Supporting Material

Table S1 – Unit costs of health and social care resources.

Item	Unit cost, £	Source	Notes
<b>Hospital services</b>			
Hospital outpatient appointment	120	NHS reference costs 2016	Average consultant led, non-consultant led and outpatient procedures.
Planned hospital admission without staying overnight	733	NHS reference costs 2016	Average day case
Planned hospital admission with an overnight stay	3750	NHS reference costs 2016	Average elective inpatient
Unplanned hospital admission	1609	NHS reference costs 2016	Trim point= Average non-elective inpatient, including short stay
Other hospital admissions	389	NHS reference costs 2016	Regular day or night admissions
<b>Other health care services (rounded to units)</b>			
GP appointment	36	PSSRU 2016 p.154	Per surgery consultation of 9.22 minutes including direct care staff costs and qualification costs
Nurse appointment	11	PSSRU 2016 p.152  PSSRU 2015 p.183	Nurse based at GP practice including qualification costs: £44 per hour Average contact duration is 15.5 minutes (PSSRU 2015)
Nurse specialist appointment	13	PSSRU 2016 p.151  PSSRU 2015 p.184	Nurse Band 7 including qualification costs: £52 per hour Assumes Average contact duration is 15.5 minutes (PSSRU 2015) as per nurse based at GP practice.

Item	Unit cost, £	Source	Notes
Therapist appointment: occupational therapist, physiotherapist, speech therapist, chiropodist, podiatrist	9	PSSRU 2016 p.194	Allied health professionals Band 5: £34 per hour Assumes Average contact duration is 15.5 minutes (PSSRU 2015) as per nurse based at GP practice.
<b>Social care services</b>			
Home care, per appointment	12	PSSRU 2016 p.169	Face-to-face weekday: £24 per hour Assume 30 minutes per session (ref UKHCA 2016 report)
Day care, per hour	61	PSSRU 2016 p.37	£61 per client attendance
Meals, per meal	4	Glendenning <i>et al.</i> p.201; inflated to 2015-16	
Social service appointment: social worker	20	PSSRU 2016 p.165	Per hour of client-related work including qualifications=£79 Assumes Average contact duration is 15.5 minutes (PSSRU 2015) as per nurse based at GP practice.
Memory café, per session	14	Rotary club 2015	Based on example of memory café, at £138.33/monthly session. Assumes 10 carer- dementia pairs per session.

Table S2 – Unit costs used for costing informal care with proxy good method.

<b>Item</b>	<b>Unit cost, £</b>	<b>Source</b>	<b>Notes</b>	<b>Informal care activity</b>
Paid carer, per hour	24.6	PSSRU 2016 p.169	Weighted average of weekday, night and weekend hours.	Personal care, physical help, keeping company, transport, keeping an eye
Citizen Advice Bureau adviser, per hour	52	PSSRU 2016 p.171	Knapp <i>et al.</i> , 2013 used the cost of a family support worker to reflect the cost of an adviser.	Dealing with care services and benefits
Finance administrator, per hour	25	PSSRU 2016 p.146; NHS Agenda for change	Finance officer is at Agenda for change Band 3 ( <a href="#">here</a> ).	Dealing with other paperwork and financial matters
Cleaner/handy person, per hour	21	PSSRU 2016 p.146	Housekeeping assistant is at Agenda for change Band 1. Mid-point Band 1 is £15,500/year. See <a href="#">here</a> . Calculated from the ratio wages/hourly cost Band 2.	Practical help

Table S3 – Descriptive statistics on Admiral Nursing dummy and observed confounders.

Covariate	All carers				AN		Non-AN	
	Freq	Mean	95% CI		Freq	Mean	Freq	Mean
Admiral nursing	132	46.8%	41.0%	52.7%	132	100.0%	0	0.0%
Male (ref)	87	30.9%	25.7%	36.5%	45	34.1%	42	28.0%
Female	195	69.1%	63.5%	74.3%	87	65.9%	108	72.0%
16 to 54 years old (ref)	50	17.7%	13.7%	22.7%	16	12.1%	34	22.7%
55 to 64 years old	71	25.2%	20.4%	30.6%	29	22.0%	42	28.0%
65 to 69 years old	31	11.0%	7.8%	15.2%	17	12.9%	14	9.3%
70 to 74 years old	42	14.9%	11.2%	19.6%	22	16.7%	20	13.3%
75 years or older	88	31.2%	26.0%	36.9%	48	36.4%	40	26.7%
Below university education (ref)	203	72.0%	66.4%	76.9%	102	77.3%	101	67.3%
Bachelor's degree	55	19.5%	15.3%	24.6%	26	19.7%	29	19.3%
Master's degree and above	24	8.5%	5.8%	12.4%	4	3.0%	20	13.3%
Full/part-time job	59	20.9%	16.5%	26.1%	21	15.9%	38	25.3%
Look after full time	70	24.8%	20.1%	30.2%	39	29.5%	31	20.7%
Retired	164	58.2%	52.3%	63.8%	81	61.4%	83	55.3%
No financial difficulties (ref)	66	23.4%	18.8%	28.7%	26	19.7%	40	26.7%
Some financial difficulties	92	32.6%	27.4%	38.3%	41	31.1%	51	34.0%
Severe financial difficulties	89	31.6%	26.4%	37.3%	50	37.9%	39	26.0%
Don't know/prefer not to say	35	12.4%	9.0%	16.8%	15	11.4%	20	13.3%
EQ-5D score	282	0.774	0.752	0.795	132	0.752	150	0.793
Main carer (ref)	261	92.6%	88.8%	95.1%	129	97.7%	132	88.0%
Joint or not main carer	21	7.5%	4.9%	11.2%	3	2.3%	18	12.0%
Care recipient's spouse/partner (ref)	190	67.4%	61.7%	72.6%	98	74.2%	92	61.3%
Care recipient's child/child-in-law	81	28.7%	23.7%	34.3%	30	22.7%	51	34.0%
Other relationship with care recipient	11	3.9%	2.2%	6.9%	4	3.0%	7	4.7%
Personal care	198	70.2%	64.6%	75.3%	99	75.0%	99	66.0%
Physical care	136	48.2%	42.4%	54.1%	71	53.8%	65	43.3%
Total hours of care	282	12	11	13	132	13	150	11
Caring for less than 1 year (ref)	18	6.4%	4.0%	9.9%	6	4.6%	12	8.0%
Caring for 1 to 3 years	91	32.3%	27.0%	38.0%	48	36.4%	43	28.7%
Caring for 3 to 5 years	78	27.7%	22.7%	33.2%	31	23.5%	47	31.3%
Caring for 5 to 10 years	66	23.4%	18.8%	28.7%	33	25.0%	33	22.0%
Caring for 10 years or more	29	10.3%	7.2%	14.4%	14	10.6%	15	10.0%
Replacement for a break (ref)	116	41.1%	35.5%	47.0%	43	32.6%	73	48.7%
No replacement for a break	166	58.9%	53.0%	64.5%	89	67.4%	77	51.3%
45 to 64 years old (ref)	28	9.9%	6.9%	14.0%	10	7.6%	18	12.0%
65 to 74 years old	57	20.2%	15.9%	25.3%	28	21.2%	29	19.3%
75 years or older old	197	69.9%	64.2%	75.0%	94	71.2%	103	68.7%
Duration of symptoms under 1 year (ref)	13	4.6%	2.7%	7.8%	8	6.1%	5	3.3%
Duration of symptoms from 1 to 5 years	166	58.9%	53.0%	64.5%	79	59.8%	87	58.0%
Duration of symptoms from 6 to 10 years	79	28.0%	23.1%	33.6%	35	26.5%	44	29.3%
Duration of symptoms for 11 years or more	24	8.5%	5.8%	12.4%	10	7.6%	14	9.3%
Formal diagnosis of dementia (ref)	272	96.5%	93.5%	98.1%	128	97.0%	144	96.0%
No diagnosis of dementia/don't know	10	3.6%	1.9%	6.5%	4	3.0%	6	4.0%
Alzheimer's	171	60.6%	54.8%	66.2%	68	51.5%	103	68.7%
Vascular dementia	94	33.3%	28.0%	39.1%	58	43.9%	36	24.0%
Other dementia	76	27.0%	22.1%	32.5%	34	25.8%	42	28.0%
Mild perceived severity (ref)	29	10.3%	7.2%	14.4%	9	6.8%	20	13.3%
Moderate perceived severity	178	63.1%	57.3%	68.6%	85	64.4%	93	62.0%
Severe perceived severity	75	26.6%	21.7%	32.1%	38	28.8%	37	24.7%

Obs=total number of observations; Freq=number of observations for each category (it is equivalent to Obs for continuous variables); Mean=proportion for dummy variables and average for continuous variables; CI=confidence intervals; ref=reference category.

The sample included 282 carers, of which 132 AN carers and 150 non-AN carers. The descriptive statistics reported in this table were calculated on the ASCOT-Carer score's sample.

Table S4 – Full results of the regression analysis on outcomes.

Variable		ASCOT-Carer score	Self-efficacy on symptoms management	Self-efficacy on service use	Overall life satisfaction	Happiness yesterday
Admiral nursing	Coeff	0.382	1.243	1.990*	0.087	0.433
	Std Err	(0.397)	(1.317)	(1.060)	(0.266)	(0.279)
Female	Coeff	-0.539	-2.384	-3.842***	-0.166	0.001
	Std Err	(0.495)	(1.446)	(1.232)	(0.334)	(0.344)
55 to 64 years old	Coeff	-0.134	-2.399	-1.712	-0.387	-0.618
	Std Err	(0.705)	(1.982)	(1.853)	(0.439)	(0.466)
65 to 69 years old	Coeff	0.127	-2.214	0.596	-0.181	-0.300
	Std Err	(0.979)	(3.030)	(2.805)	(0.664)	(0.719)
70 to 74 years old	Coeff	0.202	-1.761	1.448	-0.015	0.227
	Std Err	(0.903)	(2.777)	(2.510)	(0.641)	(0.654)
75 years old or older	Coeff	0.833	-3.149	-5.370*	0.629	0.545
	Std Err	(1.023)	(3.090)	(2.796)	(0.721)	(0.735)
Bachelor's degree	Coeff	-0.483	-2.408*	-2.403*	-0.456	-0.467
	Std Err	(0.444)	(1.441)	(1.293)	(0.300)	(0.313)
Master's degree and above	Coeff	-0.871	-3.096	-1.205	-0.083	0.157
	Std Err	(0.685)	(2.494)	(1.849)	(0.508)	(0.540)
Full/part-time job	Coeff	1.212*	2.045	1.227	0.069	-0.042
	Std Err	(0.663)	(2.039)	(1.886)	(0.401)	(0.430)
Look after full time	Coeff	0.273	0.264	0.743	0.050	0.055
	Std Err	(0.486)	(1.534)	(1.397)	(0.319)	(0.346)
Retired	Coeff	1.159**	2.216	2.152	0.289	0.499
	Std Err	(0.564)	(1.893)	(1.643)	(0.376)	(0.403)
Some financial difficulties	Coeff	-1.531***	-1.384	-3.928***	-0.830**	-1.075***
	Std Err	(0.580)	(1.802)	(1.419)	(0.378)	(0.389)
Severe financial difficulties	Coeff	-2.281***	-2.936	-3.926***	-1.308***	-1.382***
	Std Err	(0.605)	(1.800)	(1.399)	(0.393)	(0.403)
Don't know/prefer not to say	Coeff	-2.636***	-1.904	-4.371**	-0.740	-1.136**
	Std Err	(0.782)	(2.338)	(1.837)	(0.472)	(0.490)
EQ-5D score	Coeff	7.131***	13.295***	8.581***	4.129***	4.160***
	Std Err	(1.145)	(3.722)	(2.887)	(0.934)	(0.957)
Joint or not main carer	Coeff	0.543	2.790	3.307	0.823*	0.535
	Std Err	(0.962)	(1.898)	(2.112)	(0.483)	(0.484)
Care recipient's child/child-in-law	Coeff	0.889	0.375	-2.327	0.336	0.407
	Std Err	(0.818)	(2.534)	(2.211)	(0.570)	(0.603)
Other relationship with care recipient	Coeff	0.063	-4.703	-5.352*	-0.200	-0.206
	Std Err	(1.262)	(3.610)	(3.094)	(0.806)	(0.720)
Personal care	Coeff	-0.495	-1.076	-0.896	-0.214	-0.031
	Std Err	(0.505)	(1.553)	(1.294)	(0.314)	(0.350)
Physical care	Coeff	-0.578	2.578*	0.964	0.108	0.003
	Std Err	(0.468)	(1.436)	(1.201)	(0.319)	(0.344)
Total hours of care	Coeff	-0.084***	0.213**	0.042	-0.023	-0.029
	Std Err	(0.030)	(0.094)	(0.081)	(0.018)	(0.019)
Caring for 1 to 3 years	Coeff	-0.142	2.512	6.458***	0.274	0.765
	Std Err	(1.082)	(2.976)	(2.160)	(0.719)	(0.669)
Caring for 3 to 5 years	Coeff	-0.195	1.496	4.667**	0.331	0.895
	Std Err	(1.142)	(3.174)	(2.213)	(0.742)	(0.710)
Caring for 5 to 10 years	Coeff	-0.108	2.149	5.895**	-0.141	0.453
	Std Err	(1.211)	(3.386)	(2.397)	(0.771)	(0.774)
Caring for 10 years or more	Coeff	-0.658	0.493	4.568	-0.021	0.360
	Std Err	(1.342)	(4.155)	(3.045)	(0.845)	(0.892)
No replacement for a break	Coeff	-1.192***	-3.433**	-2.829***	-0.746***	-0.772***
	Std Err	(0.440)	(1.341)	(1.083)	(0.281)	(0.293)
65 to 74 years old	Coeff	0.782	0.187	1.552	0.529	0.640
	Std Err	(0.708)	(2.736)	(2.078)	(0.507)	(0.520)
75 years old or older	Coeff	0.665	2.396	4.932**	0.290	0.367
	Std Err	(0.762)	(2.884)	(2.095)	(0.575)	(0.563)
Symptoms for 1 to 5 years	Coeff	0.107	1.565	0.402	0.961	-0.185
	Std Err	(1.175)	(3.644)	(3.661)	(0.760)	(0.635)
Symptoms for 6 to 10 years	Coeff	-0.247	2.725	0.117	1.260	0.429
	Std Err	(1.289)	(4.091)	(4.004)	(0.861)	(0.798)
Symptoms for 11 years or more	Coeff	0.993	6.705	1.174	1.567*	0.985
	Std Err	(1.289)	(4.091)	(4.004)	(0.861)	(0.798)

	Std Err	(1.450)	(4.809)	(4.508)	(0.910)	(0.953)
No diagnosis of dementia/don't know	Coeff	-1.424	-6.734***	-4.891*	-0.208	-0.329
	Std Err	(0.926)	(2.574)	(2.584)	(0.454)	(0.486)
Vascular dementia	Coeff	-0.722	-1.211	-1.682	-0.096	0.159
	Std Err	(0.445)	(1.373)	(1.148)	(0.308)	(0.326)
Other dementia	Coeff	-0.561	-0.827	-4.162***	-0.062	0.218
	Std Err	(0.450)	(1.618)	(1.308)	(0.322)	(0.338)
Moderate perceived severity	Coeff	-0.585	-2.828	-3.692**	-0.827*	-1.012*
	Std Err	(0.715)	(2.080)	(1.688)	(0.474)	(0.531)
Severe perceived severity	Coeff	-1.722**	-5.450**	-4.208**	-1.574***	-1.795***
	Std Err	(0.783)	(2.533)	(2.066)	(0.552)	(0.597)
Constant	Coeff	7.928***	17.986***	18.970***	2.271	2.782*
	Std Err	(2.007)	(5.858)	(4.716)	(1.435)	(1.482)
Observations		282	274	268	287	285
R-squared		0.459	0.260	0.350	0.340	0.335

Coeff=estimated coefficient; Std Err=robust standard errors.

Most of the coefficients on dummies are interpreted in relation to the reference category. The reference categories for carer characteristics are respectively: Male, Age 16 to 54 years, Below university education, No financial difficulties. The reference categories for the characteristics of the caring role are: Main carer status, Person with dementia is spouse/partner, Duration of caring under 1 year. Finally, the reference categories for the care recipient characteristics are: Age 45 to 64, Duration of symptoms under 1 year, Severity of dementia is Mild. Table 3 shows the reference categories.

Robust standard errors in parentheses; \*\*\*=p-value<0.01, \*\*=p-value<0.05, \*=p-value<0.1

Table S5 – Regression and IV results after clustering standard errors or using local authority random effects.

	ASCOT-Carer score	Self-efficacy on symptoms management	Self-efficacy on service use	Overall life satisfaction	Happiness yesterday	Overall costs	Carer's healthcare costs	Care recipient's healthcare costs	Social care costs
Regression with clustered standard errors within local authorities									
Coeff	0.361	1.020	1.651	0.047	0.375	46.455	-183.693	-105.097	77.329
Std Err	(0.357)	(1.454)	(1.286)	(0.318)	(0.363)	(193.965)	(182.582)	(139.727)	(105.901)
Regression with local authority random effects and clustered standard errors									
Coeff	0.361	1.020	1.078	0.103	0.490	46.455	-178.775	-48.940	77.333
Std Err	(0.333)	(1.353)	(1.370)	(0.343)	(0.397)	(177.772)	(151.431)	(225.510)	(98.388)
Instrumental Variables with clustered standard errors within local authorities									
Coeff	1.472	2.899	2.586	0.174	0.937	-29.413	-44.331	187.689	-440.286
Std Err	(0.874)*	(2.651)	(2.772)	(0.461)	(0.454)**	(336.732)	(265.401)	(209.150)	(293.622)

Coeff=estimated coefficient on the Admiral Nursing dummy; Std Err=robust standard errors.

In all regressions, we controlled for carer characteristics (including gender, age, education, work situation, household financial difficulties, whether the carer was a sole carer, relationship with the care recipient, type and amount of time of care provided, number of years caring, availability of a replacement for a break, and HRQoL) and care recipient characteristics (including age, duration of symptoms of dementia, existence of a formal diagnosis, type of dementia such as Alzheimer, vascular dementia, or other type of dementia, and perceived severity of dementia). In the IV regression, the instrument was the travel time to the closest AN provider.

Clustered standard errors in parenthesis; \*\*\*=p-value<0.01, \*\*=p-value<0.05, \*=p-value<0.1



Table S6 – Regression results using GLM for outcomes and two-part model for costs.

	ASCOT-Carer score	Self-efficacy on symptoms management	Self-efficacy on service use	Overall life satisfaction	Happiness yesterday	Overall costs	Carer's healthcare costs	Care recipient's healthcare costs	Social care costs
	GLM regression with log link and normal distribution					Two-part model (logit, GLM with log link and normal distribution)			
Coeff	0.168	0.836	1.569	0.078	0.295	192.415	-	-	266.575
Std Err	(0.404)	(1.214)	(0.987)	(0.249)	(0.251)	(582.366)	-	-	(323.136)
	GLM regression with log link and gamma distribution					Two-part model (logit, GLM with log link and gamma distribution)			
Coeff	0.689	1.663	2.522	0.062	0.613	409.218	-55.264	-54.377	118.241
Std Err	(0.425)	(1.401)	(1.175)**	(0.314)	(0.339)*	(252.277)	(79.839)	(93.319)	(151.750)

Coeff=estimated coefficient on the Admiral Nursing dummy; Std Err=robust standard errors.

The two-part model using GLM with log link and normal distribution in the second part did not converge when the dependent variable was the carer's healthcare costs and the care recipient's healthcare costs. Estimates are therefore omitted.

In all regressions, we controlled for carer characteristics (including gender, age, education, work situation, household financial difficulties, whether the carer was a sole carer, relationship with the care recipient, type and amount of time of care provided, number of years caring, availability of a replacement for a break, and HRQoL) and care recipient characteristics (including age, duration of symptoms of dementia, existence of a formal diagnosis, type of dementia such as Alzheimer, vascular dementia, or other type of dementia, and perceived severity of dementia). In the IV regression, the instrument was the travel time to the closest AN provider.

Robust standard errors in parenthesis; \*\*\*=p-value<0.01, \*\*=p-value<0.05, \*=p-value<0.1

Table S7 – Missing data.

Variable	Resp	Miss	Prop
<b>Outcome</b>			
ASCOT-Carer score	317	29	8.4%
Self-efficacy on symptoms management	310	36	10.4%
Self-efficacy on service use	302	44	12.7%
Overall life satisfaction	330	16	4.6%
Happiness yesterday	328	18	5.2%
<b>Costs</b>			
Overall costs	260	86	24.9%
Carer's healthcare costs	306	40	11.6%
Care recipient's healthcare costs	297	49	14.2%
Social care costs	307	39	11.3%
<b>Carer characteristics</b>			
Gender	340	6	1.7%
Age	340	6	1.7%
Education	339	7	2.0%
Work situation	346	0	0.0%
Household financial difficulties	316	30	8.7%
EQ-5D score	330	16	4.6%
Caring status	336	10	2.9%
Relationship with the care recipient	333	13	3.8%
Provision of personal care	346	0	0.0%
Provision of physical care	346	0	0.0%
Total hours of caring	328	18	5.2%
Duration of caring	339	7	2.0%
Availability of a replacement for a break	337	9	2.6%
<b>Care recipient characteristics</b>			
Age	331	15	4.3%
Duration of symptoms of dementia	339	7	2.0%
Formal diagnosis of dementia	340	6	1.7%
Type of dementia	346	0	0.0%
Perceived severity of dementia	339	7	2.0%
<b>Instruments</b>			
Travel time	327	19	5.5%
Unitary LA	327	19	5.5%
County LA	327	19	5.5%
London LA	327	19	5.5%
Metropolitan LA	327	19	5.5%

Resp=number of respondents, Miss=Number of missing responses,  
Prop=proportion of missing responses.

Numbers and proportions are calculated considering the 346 in-scope questionnaires.

Table S8 – Regression results using fewer covariates.

Variable	ASCOT-Carer score	Self-efficacy on symptoms management	Self-efficacy on service use	Overall life satisfaction	Happiness yesterday	Overall costs	Carer's healthcare costs	Care recipient's healthcare costs	Social care costs
Admiral nursing	0.290 (0.381)	0.986 (1.273)	2.334** (1.033)	0.008 (0.258)	0.414 (0.270)	59.667 (194.057)	-149.215 (125.449)	-90.373 (129.852)	62.143 (143.216)
Female	-0.565 (0.478)	-2.293 (1.449)	-4.517*** (1.248)	-0.242 (0.316)	-0.128 (0.320)	-30.147 (207.972)	202.421 (183.805)	-1.196 (145.176)	9.332 (169.158)
75 years old or older	0.366 (0.524)	-0.739 (1.574)	-3.738*** (1.281)	0.658* (0.341)	0.562 (0.347)	-25.753 (245.002)	219.301 (192.749)	-4.414 (174.937)	29.910 (172.547)
Bachelor's degree	-0.543 (0.459)	-2.193 (1.399)	-2.523** (1.244)	-0.431 (0.292)	-0.460 (0.305)	395.924* (217.122)	-125.268* (68.130)	-101.558 (99.827)	377.812** (156.532)
Master's degree and above	-0.925 (0.661)	-3.516 (2.356)	-2.270 (1.869)	-0.138 (0.481)	0.038 (0.510)	383.993 (376.738)	-35.129 (270.650)	-129.931 (187.357)	314.823 (257.183)
Retired	0.453 (0.447)	0.768 (1.427)	2.513** (1.237)	0.211 (0.293)	0.530* (0.309)	209.308 (214.228)	211.766 (145.108)	19.017 (141.940)	242.305* (142.832)
Some financial difficulties	-1.595*** (0.551)	-1.059 (1.719)	-3.342** (1.372)	-0.737** (0.355)	-1.006*** (0.360)	25.096 (207.259)	-10.190 (89.092)	9.388 (120.851)	-27.000 (149.520)
Severe financial difficulties	-2.319*** (0.563)	-2.207 (1.709)	-3.713*** (1.378)	-1.287*** (0.365)	-1.379*** (0.376)	55.588 (204.679)	155.485 (154.623)	-87.986 (119.780)	270.256 (174.600)
Prefer not to say financial difficulties	-2.857*** (0.773)	-1.498 (2.254)	-4.474** (1.838)	-0.792* (0.444)	-1.200** (0.481)	733.524 (458.802)	396.569 (293.583)	416.838 (324.569)	219.481 (240.939)
EQ-5D score	7.096*** (1.076)	14.795*** (3.652)	9.571*** (2.527)	4.174*** (0.918)	4.169*** (0.946)	426.484 (413.041)	-448.593 (458.009)	-69.056 (266.576)	398.446 (336.976)
Joint or not main carer	0.694 (0.904)	4.135** (1.708)	3.000 (2.074)	1.026** (0.452)	0.797* (0.478)	292.988 (481.382)	-172.807 (139.352)	120.858 (320.606)	186.536 (252.849)
Total hours of care	-0.102*** (0.028)	0.235*** (0.087)	0.082 (0.077)	-0.023 (0.017)	-0.027 (0.017)	10.482 (13.672)	-11.903* (6.296)	13.182 (9.195)	-10.776 (9.575)
Caring for 5 years or more	-0.459 (0.432)	0.355 (1.429)	0.257 (1.094)	-0.234 (0.269)	-0.043 (0.304)	-171.311 (223.739)	-155.215 (104.922)	-395.307** (154.709)	309.536* (167.524)
No replacement for a break	-1.275*** (0.427)	-3.091** (1.262)	-2.469** (1.055)	-0.686** (0.267)	-0.700** (0.276)	27.120 (191.521)	-248.147* (135.473)	-95.026 (134.575)	52.929 (143.035)
75 years old or older	0.418 (0.458)	2.560* (1.540)	2.516** (1.229)	0.067 (0.306)	0.065 (0.331)	161.804 (204.810)	34.627 (80.891)	198.617 (137.661)	-53.246 (143.388)
Symptoms for 11 years or more	0.811 (0.632)	4.123* (2.227)	0.574 (1.912)	0.511 (0.405)	0.726 (0.553)	321.109 (419.557)	-80.269 (244.166)	360.467 (321.130)	-111.081 (271.786)

Variable	ASCOT-Carer score	Self-efficacy on symptoms management	Self-efficacy on service use	Overall life satisfaction	Happiness yesterday	Overall costs	Carer's healthcare costs	Care recipient's healthcare costs	Social care costs
No diagnosis of dementia/don't know	-1.729* (0.953)	-7.323*** (2.323)	-5.335** (2.601)	-0.103 (0.441)	-0.124 (0.510)	270.059 (647.331)	-190.345 (230.279)	162.840 (588.173)	-209.160 (312.728)
Vascular dementia	-0.733* (0.425)	-0.972 (1.320)	-1.369 (1.158)	-0.048 (0.288)	0.148 (0.299)	-2.642 (188.934)	43.662 (113.589)	251.909** (116.078)	-183.553 (144.196)
Other dementia	-0.606 (0.442)	-0.686 (1.545)	-3.824*** (1.211)	-0.075 (0.321)	0.148 (0.336)	20.163 (235.290)	147.075 (175.882)	235.617 (177.272)	-102.371 (175.228)
Moderate perceived severity	-0.570 (0.641)	-2.420 (1.838)	-3.591** (1.539)	-0.548 (0.401)	-0.813* (0.431)	-181.598 (301.172)	57.881 (111.574)	-147.063 (197.803)	19.629 (157.864)
Severe perceived severity	-1.930*** (0.718)	-4.637** (2.231)	-4.218** (1.880)	-1.271*** (0.482)	-1.541*** (0.515)	546.147 (376.130)	477.513* (259.581)	95.133 (254.283)	532.823** (211.172)
Constant	9.246*** (1.473)	18.735*** (4.486)	23.400*** (3.315)	3.408*** (1.136)	3.548*** (1.188)	68.503 (570.341)	401.477 (569.224)	204.128 (394.070)	-115.178 (394.955)
Observations	282	274	268	287	285	227	269	259	266
R-squared	0.428	0.222	0.289	0.320	0.303	0.134	0.147	0.123	0.134

Most of the coefficients on dummies are interpreted in relation to the reference category. The reference categories for carer characteristics are respectively: Male, Younger than 75 years old, Below university education, No financial difficulties, Main carer status, Duration of caring under 5 years. The reference categories for the care recipient characteristics are: Younger than 74 years old, Duration of symptoms under 11 years, Mild severity of dementia.

Robust standard errors in parentheses; \*\*\*=p-value<0.01, \*\*=p-value<0.05, \*=p-value<0.1

Table S9 – Logit regression on the Admiral Nursing dummy.

	Variable	Admiral Nursing
Carer's characteristics	Female	0.816
	55 to 64 years old	1.905
	65 to 69 years old	3.129
	70 to 74 years old	2.036
	75 years old or older	1.935
	Bachelor's degree	1.015
	Master's degree and above	0.222**
	Full/part-time job	1.115
	Look after full time	1.241
	Retired	0.832
	Some financial difficulties	1.088
	Severe financial difficulties	1.697
	Don't know/prefer not to say	1.258
	EQ-5D score	0.483
Caring role	Joint or not main carer	0.398
	Child/child-in-law	0.829
	Other relationship	1.154
	Personal care	1.300
	Physical care	1.117
	Total hours of care	1.009
	Caring for 1 to 3 years	3.834*
	Caring for 3 to 5 years	2.327
	Caring for 5 to 10 years	3.860
	Caring for 10 years or more	3.871
No replacement for a break	1.512	
Care recipient's characteristics	65 to 74 years old	0.986
	75 years old or older	1.132
	Symptoms for 1 to 5 years	0.135**
	Symptoms for 6 to 10 years	0.084**
	Symptoms for 11 years or more	0.067**
	No diagnosis/don't know	0.668
	Vascular dementia	2.456***
	Other dementia	1.055
Moderate severity	2.367	
Severe severity	2.444	
Constant	0.440	
Observations	282	

Logit regression analysis on ASCOT-Carer score's sample. The Admiral Nursing dummy is the dependent variable. Most of the coefficients on dummies are interpreted in relation to the reference category. Table 3 shows the reference categories.

Robust standard errors estimated but not reported; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table S10 – Comparison between PSM techniques on average standardised difference of the covariates.

Technique	Sample	Mean bias	Median bias
Kernel	Unmatched	14.4	11.4
	Matched	3.4	3.1
Nearest neighbour	Unmatched	14.4	11.4
	Matched	8.4	7.6
Calliper (0.2)	Unmatched	14.4	11.4
	Matched	8.4	7.6

Table S11 – PSM results when the logit regression uses fewer covariates.

Variable	ASCOT-Carer score	Self-efficacy on symptoms management	Self-efficacy on service use	Overall life satisfaction	Happiness yesterday	Overall costs	Carer's healthcare costs	Care recipient's healthcare costs	Social care costs
Admiral nursing	0.538 (0.527)	1.474 (1.471)	2.937 (1.288)**	0.133 (0.314)	0.541 (0.330)	-43.233 (211.553)	-175.572 (129.353)	-130.078 (132.273)	-12.104 (137.414)
Estimated coefficients from Logit regression in which the AN dummy is the dependent variable									
Female	-0.296 (0.322)	-0.185 (0.327)	-0.234 (0.326)	-0.236 (0.317)	-0.211 (0.318)	-0.419 (0.361)	-0.256 (0.327)	-0.168 (0.327)	-0.367 (0.338)
75 years old or older	0.203 (0.355)	0.376 (0.366)	0.287 (0.366)	0.337 (0.355)	0.322 (0.356)	-0.059 (0.415)	0.088 (0.364)	0.288 (0.374)	0.104 (0.369)
Bachelor's degree	-0.030 (0.334)	0.042 (0.338)	-0.028 (0.339)	0.002 (0.333)	-0.023 (0.333)	0.119 (0.386)	-0.045 (0.342)	0.095 (0.361)	-0.009 (0.340)
Master's degree and above	-1.660 (0.621)***	-1.944 (0.690)***	-1.953 (0.685)***	-1.603 (0.620)***	-1.623 (0.618)***	-2.150 (0.848)**	-1.481 (0.633)**	-1.515 (0.629)**	-1.933 (0.708)***
Retired	-0.047 (0.315)	-0.016 (0.324)	0.040 (0.327)	-0.063 (0.316)	-0.062 (0.316)	-0.001 (0.379)	0.068 (0.320)	-0.059 (0.333)	-0.049 (0.332)
Some financial difficulties	0.104 (0.364)	0.154 (0.373)	0.151 (0.372)	0.086 (0.360)	0.079 (0.361)	0.392 (0.413)	0.015 (0.368)	0.111 (0.374)	0.325 (0.379)
Severe financial difficulties	0.446 (0.378)	0.503 (0.385)	0.531 (0.383)	0.405 (0.371)	0.429 (0.373)	0.824 (0.433)*	0.333 (0.380)	0.464 (0.388)	0.671 (0.388)*
Prefer not to say financial difficulties	0.256 (0.497)	0.216 (0.507)	0.279 (0.513)	0.207 (0.494)	0.174 (0.492)	0.394 (0.595)	0.130 (0.504)	0.397 (0.517)	0.221 (0.524)
EQ-5D score	-0.625 (0.792)	-0.756 (0.807)	-0.497 (0.820)	-0.668 (0.791)	-0.668 (0.789)	-0.041 (0.914)	-1.031 (0.846)	-0.316 (0.806)	-0.872 (0.866)
Joint or not main carer	-1.175 (0.697)*	-1.448 (0.691)**	-1.482 (0.690)**	-1.452 (0.686)**	-1.305 (0.690)*	-0.833 (0.755)	-1.429 (0.692)**	-1.358 (0.710)*	-1.191 (0.701)*
Total hours of care	0.012 (0.019)	0.006 (0.020)	0.005 (0.020)	0.010 (0.019)	0.012 (0.019)	0.028 (0.022)	0.010 (0.019)	0.016 (0.020)	0.024 (0.020)
Caring for 5 years or more	0.096 (0.303)	0.077 (0.313)	0.090 (0.313)	0.175 (0.300)	0.137 (0.300)	0.226 (0.349)	0.232 (0.311)	0.254 (0.319)	0.058 (0.314)
No replacement for a break	0.383 (0.281)	0.451 (0.291)	0.404 (0.291)	0.436 (0.279)	0.430 (0.281)	0.675 (0.327)**	0.448 (0.284)	0.447 (0.292)	0.406 (0.293)
Care recipient 75 years old or older	-0.022 (0.324)	-0.158 (0.331)	-0.068 (0.337)	-0.100 (0.324)	-0.051 (0.324)	0.181 (0.373)	-0.128 (0.332)	0.007 (0.340)	0.011 (0.337)

Variable	ASCOT-Carer score	Self-efficacy on symptoms management	Self-efficacy on service use	Overall life satisfaction	Happiness yesterday	Overall costs	Carer's healthcare costs	Care recipient's healthcare costs	Social care costs
Symptoms for 11 years or more	-0.254 (0.520)	-0.204 (0.546)	0.028 (0.543)	-0.242 (0.518)	-0.237 (0.518)	-0.021 (0.560)	-0.384 (0.526)	-0.307 (0.538)	-0.184 (0.533)
No diagnosis of dementia/don't know	-0.225 (0.728)	-0.495 (0.710)	-0.554 (0.703)	-0.484 (0.705)	-0.512 (0.703)	-0.675 (0.888)	-0.729 (0.762)	-0.961 (0.877)	-0.366 (0.709)
Vascular dementia	0.999 (0.303)***	0.969 (0.314)***	0.900 (0.315)***	0.939 (0.301)***	0.916 (0.300)***	1.010 (0.339)***	0.756 (0.306)**	0.820 (0.310)***	0.903 (0.311)***
Other dementia	0.113 (0.325)	0.062 (0.328)	0.116 (0.331)	0.101 (0.323)	0.096 (0.325)	-0.086 (0.370)	-0.035 (0.333)	-0.005 (0.337)	-0.114 (0.339)
Moderate perceived severity	0.425 (0.466)	0.440 (0.470)	0.363 (0.474)	0.411 (0.467)	0.398 (0.471)	0.113 (0.517)	0.392 (0.471)	0.321 (0.487)	0.249 (0.474)
Severe perceived severity	0.474 (0.534)	0.438 (0.540)	0.283 (0.543)	0.403 (0.533)	0.364 (0.536)	-0.075 (0.600)	0.414 (0.539)	0.230 (0.556)	0.297 (0.546)
Constant	-0.623 (1.034)	-0.549 (1.048)	-0.658 (1.052)	-0.582 (1.030)	-0.589 (1.031)	-1.487 (1.182)	-0.027 (1.075)	-0.843 (1.059)	-0.443 (1.102)
Observations	282	274	268	287	285	227	269	259	266

Most of the coefficients on dummies are interpreted in relation to the reference category. The reference categories for carer characteristics are respectively: Male, Younger than 75 years old, Below university education, No financial difficulties, Main carer status, Duration of caring under 5 years. The reference categories for the care recipient characteristics are: Younger than 74 years old, Duration of symptoms under 11 years, Mild severity of dementia.

Robust standard errors in parentheses; \*\*\*=p-value<0.01, \*\*=p-value<0.05, \*=p-value<0.1



Table S12 – First-stage results on the instrument of the IV approach.

Instrumental Variable	ASCOT-Carer score	Self-efficacy on symptoms management	Self-efficacy on service use	Overall life satisfaction	Happiness yesterday	Overall costs	Carer's healthcare costs	Care recipient's healthcare costs	Care recipient's social care costs
Two-Stage Least Square estimator: first-stage estimated coefficient in main analysis									
Travel time	-1.314***	-1.242***	-1.303***	-1.267***	-1.284***	-1.376***	-1.354***	-1.444***	-1.277***
CD F statistic	48.153	41.741	41.138	45.057	45.341	47.155	49.597	56.661	43.216
Two-Stage Least Square estimator: first-stage estimated coefficient in sensitivity analysis									
Travel time	-1.119***	-1.088***	-1.145***	-1.127***	-1.123***				
County LA	0.418***	0.395***	0.428***	0.386***	0.399***				
London LA	0.052	-0.003	-0.015	-0.004	0.015				
Metropolitan LA	0.090	0.086	0.080	0.068	0.071				
CD F statistic	25.267	0.630	24.255	22.990	23.712				
SH test	0.187	0.889	0.112	0.783	0.441				

LA=local authority; CD F statistic=Cragg-Donald F statistic; SH test=p-value of the Sargan-Hansen test; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table S13 – IV results when the logit regression uses fewer covariates.

Variable	ASCOT-Carer score	Self-efficacy on symptoms management	Self-efficacy on service use	Overall life satisfaction	Happiness yesterday	Overall costs	Carer's healthcare costs	Care recipient's healthcare costs	Social care costs
Admiral nursing	1.206 (0.832)	1.692 (2.980)	3.048 (2.519)	0.126 (0.644)	1.022 (0.641)	78.250 (430.475)	-37.698 (182.731)	132.775 (226.054)	-339.518 (317.961)
Female	-0.502 (0.471)	-2.440 (1.381)*	-4.634 (1.223)***	-0.247 (0.304)	-0.125 (0.311)	-28.544 (200.534)	202.795 (174.873)	1.039 (139.468)	-21.963 (164.331)
75 years old or older	0.330 (0.504)	-0.670 (1.541)	-3.701 (1.216)***	0.657 (0.334)**	0.540 (0.342)	-25.490 (233.544)	221.863 (188.263)	-14.220 (169.471)	35.980 (169.726)
Bachelor's degree	-0.536 (0.451)	-2.250 (1.353)*	-2.561 (1.194)**	-0.434 (0.282)	-0.462 (0.299)	395.374 (205.187)*	-125.189 (65.191)*	-107.790 (92.935)	376.839 (148.976)**
Master's degree and above	-0.651 (0.688)	-3.466 (2.292)	-2.169 (1.847)	-0.115 (0.499)	0.186 (0.504)	390.435 (384.573)	-11.330 (285.682)	-73.337 (188.187)	180.982 (289.328)
Retired	0.458 (0.440)	0.829 (1.376)	2.535 (1.183)**	0.214 (0.284)	0.542 (0.304)*	209.323 (203.524)	211.057 (140.206)	22.755 (138.350)	238.874 (143.209)*
Some financial difficulties	-1.609 (0.536)***	-1.041 (1.654)	-3.332 (1.322)**	-0.736 (0.341)**	-1.006 (0.349)***	23.628 (200.511)	-8.590 (84.422)	6.982 (118.033)	-1.702 (147.276)
Severe financial difficulties	-2.418 (0.562)***	-2.033 (1.652)	-3.619 (1.356)***	-1.284 (0.352)***	-1.405 (0.374)***	52.210 (218.317)	154.272 (152.217)	-103.427 (123.662)	330.809 (186.860)*
Prefer not to say financial difficulties	-2.903 (0.753)***	-1.502 (2.176)	-4.510 (1.789)**	-0.795 (0.427)*	-1.218 (0.468)***	731.766 (433.377)*	393.986 (283.079)	398.984 (314.593)	240.235 (238.753)
EQ-5D score	7.216 (1.043)***	15.135 (3.521)***	9.793 (2.448)***	4.204 (0.886)***	4.288 (0.933)***	426.686 (392.938)	-417.874 (430.666)	-46.986 (271.094)	324.842 (344.914)
Joint or not main carer	0.854 (0.868)	4.433 (1.748)**	3.272 (2.027)	1.060 (0.451)**	0.941 (0.467)**	295.323 (463.459)	-142.682 (126.331)	173.247 (309.812)	110.006 (256.545)
Total hours of care	-0.105 (0.027)***	0.247 (0.082)***	0.092 (0.073)	-0.022 (0.016)	-0.027 (0.017)	10.382 (13.143)	-11.737 (5.933)**	12.825 (8.752)	-8.790 (9.244)
Caring for 5 years or more	-0.468 (0.422)	0.150 (1.360)	0.112 (1.046)	-0.248 (0.258)	-0.083 (0.296)	-172.137 (217.238)	-165.672 (102.202)	-412.900 (156.512)***	313.522 (161.671)*
No replacement for a break	-1.348 (0.421)***	-3.144 (1.229)**	-2.525 (1.031)**	-0.696 (0.258)***	-0.751 (0.268)***	24.609 (181.394)	-258.181 (134.056)*	-115.666 (127.202)	85.345 (136.017)
75 years old or older	0.405 (0.443)	2.800 (1.484)*	2.688 (1.177)**	0.081 (0.296)	0.094 (0.322)	160.927 (191.720)	43.467 (78.937)	203.690 (132.626)	-47.528 (140.259)
Symptoms for 11 years or more	0.869 (0.626)	3.929 (2.125)*	0.424 (1.840)	0.506 (0.382)	0.733 (0.541)	321.304 (399.610)	-76.477 (242.323)	369.355 (318.194)	-129.195 (264.733)

Variable	ASCOT-Carer score	Self-efficacy on symptoms management	Self-efficacy on service use	Overall life satisfaction	Happiness yesterday	Overall costs	Carer's healthcare costs	Care recipient's healthcare costs	Social care costs
No diagnosis of dementia/don't know	-1.672 (0.916)*	-7.381 (2.229)***	-5.344 (2.472)**	-0.099 (0.432)	-0.074 (0.493)	272.897 (608.973)	-178.472 (223.001)	202.151 (538.307)	-243.448 (310.076)
Vascular dementia	-0.927 (0.455)**	-1.187 (1.405)	-1.561 (1.181)	-0.075 (0.296)	0.021 (0.310)	-6.534 (199.681)	24.100 (118.761)	211.136 (118.339)*	-107.603 (147.352)
Other dementia	-0.636 (0.432)	-0.410 (1.467)	-3.625 (1.145)***	-0.059 (0.313)	0.179 (0.329)	20.426 (224.680)	158.149 (171.690)	246.435 (174.690)	-112.455 (171.303)
Moderate perceived severity	-0.660 (0.613)	-2.493 (1.801)	-3.664 (1.509)**	-0.559 (0.392)	-0.868 (0.415)**	-182.157 (284.872)	47.465 (105.708)	-163.398 (189.087)	44.009 (172.782)
Severe perceived severity	-2.037 (0.689)***	-4.358 (2.158)**	-4.017 (1.810)**	-1.261 (0.472)***	-1.543 (0.497)***	546.178 (357.364)	477.390 (253.730)*	94.181 (245.877)	561.977 (219.377)**
Constant	8.933 (1.428)***	17.963 (4.407)***	22.821 (3.333)***	3.335 (1.099)***	3.257 (1.170)***	65.113 (558.894)	332.547 (539.411)	118.415 (408.036)	43.584 (424.088)
Observations	281	273	267	286	284	227	268	258	266
R-squared	0.415	0.224	0.287	0.318	0.285	0.134	0.145	0.112	0.100

Most of the coefficients on dummies are interpreted in relation to the reference category. The reference categories for carer characteristics are respectively: Male, Younger than 75 years old, Below university education, No financial difficulties, Main carer status, Duration of caring under 5 years. The reference categories for the care recipient characteristics are: Younger than 74 years old, Duration of symptoms under 11 years, Mild severity of dementia.

Robust standard errors in parentheses; \*\*\*=p-value<0.01, \*\*=p-value<0.05, \*=p-value<0.1

Figure S1 – Distribution of HRQoL and total hours of informal care.

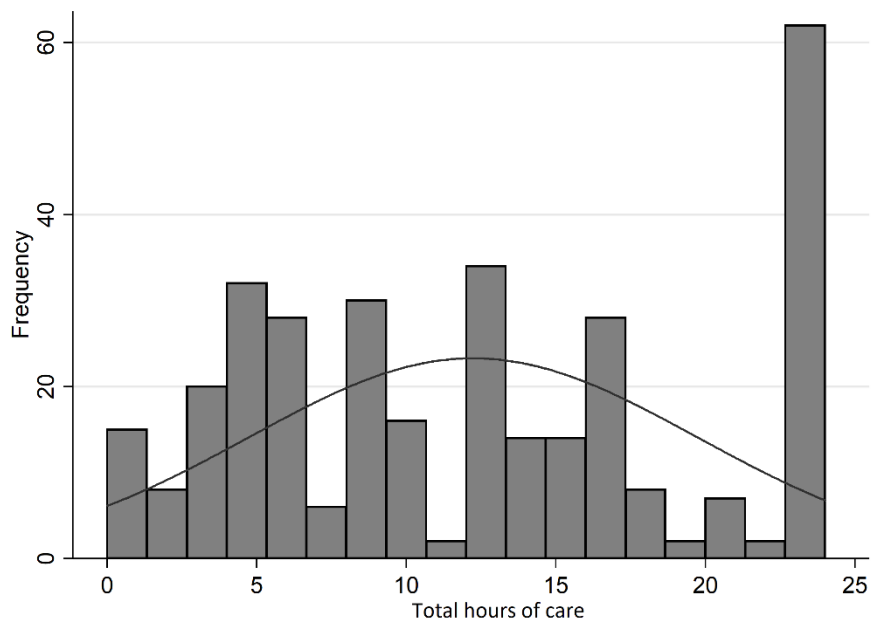
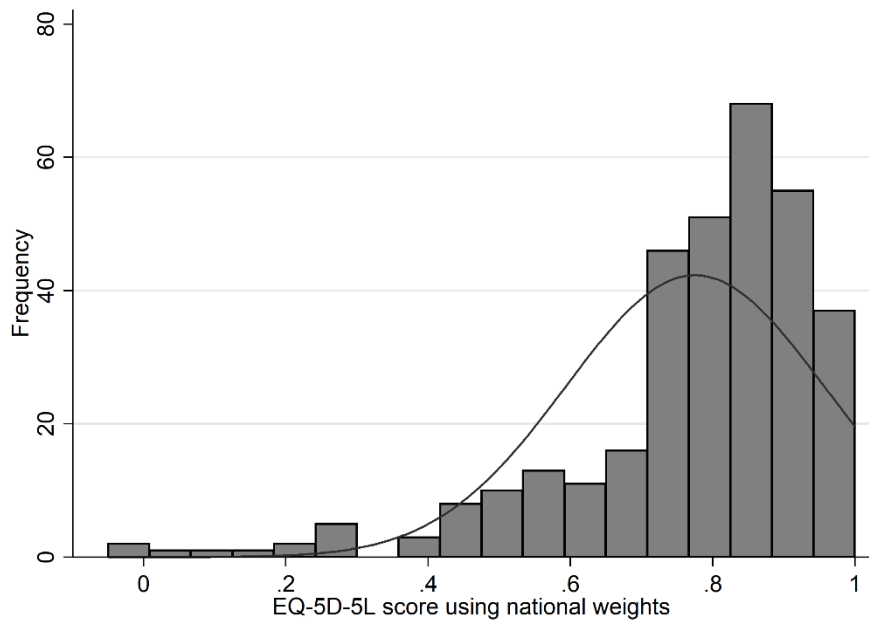


Figure S2 – Standardised difference in covariates before and after matching.

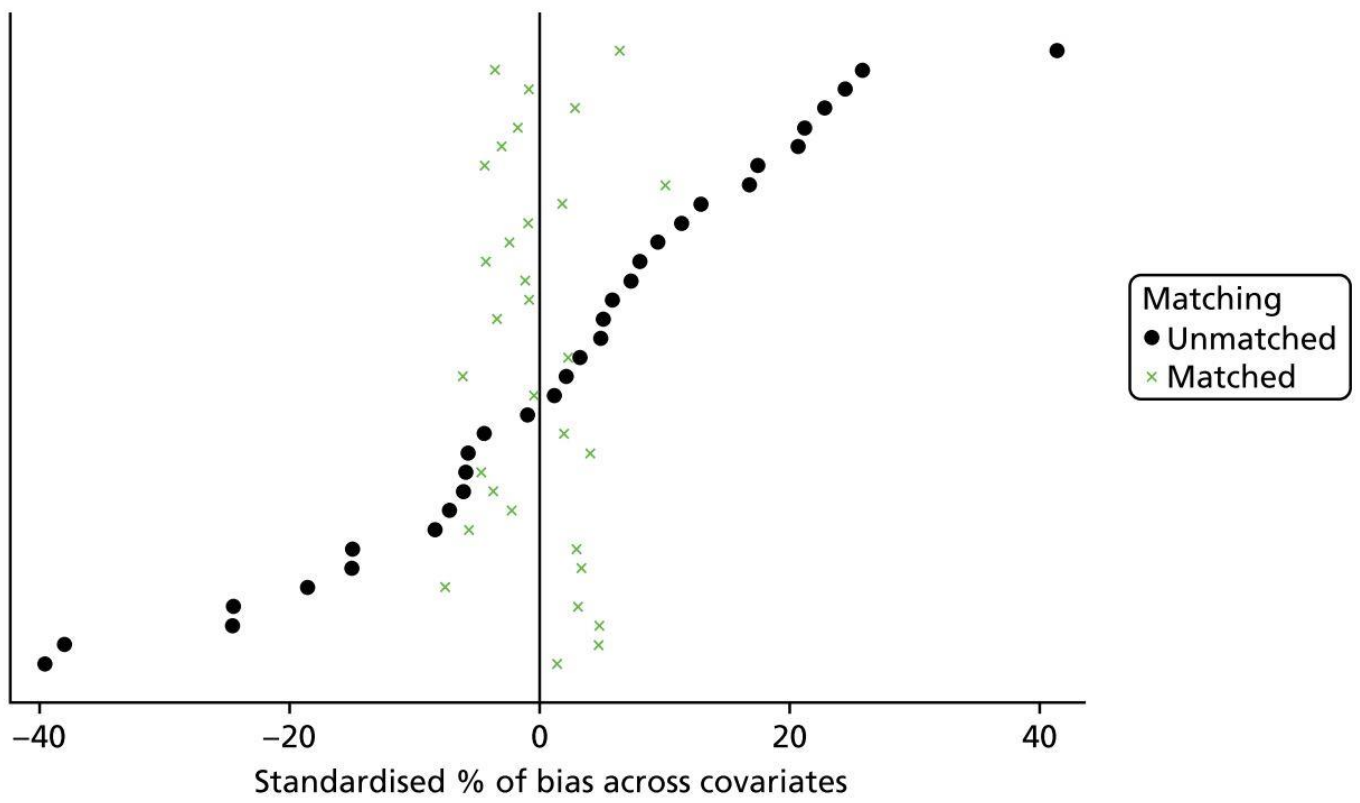


Figure S3 – Propensity score overlap before and after matching.

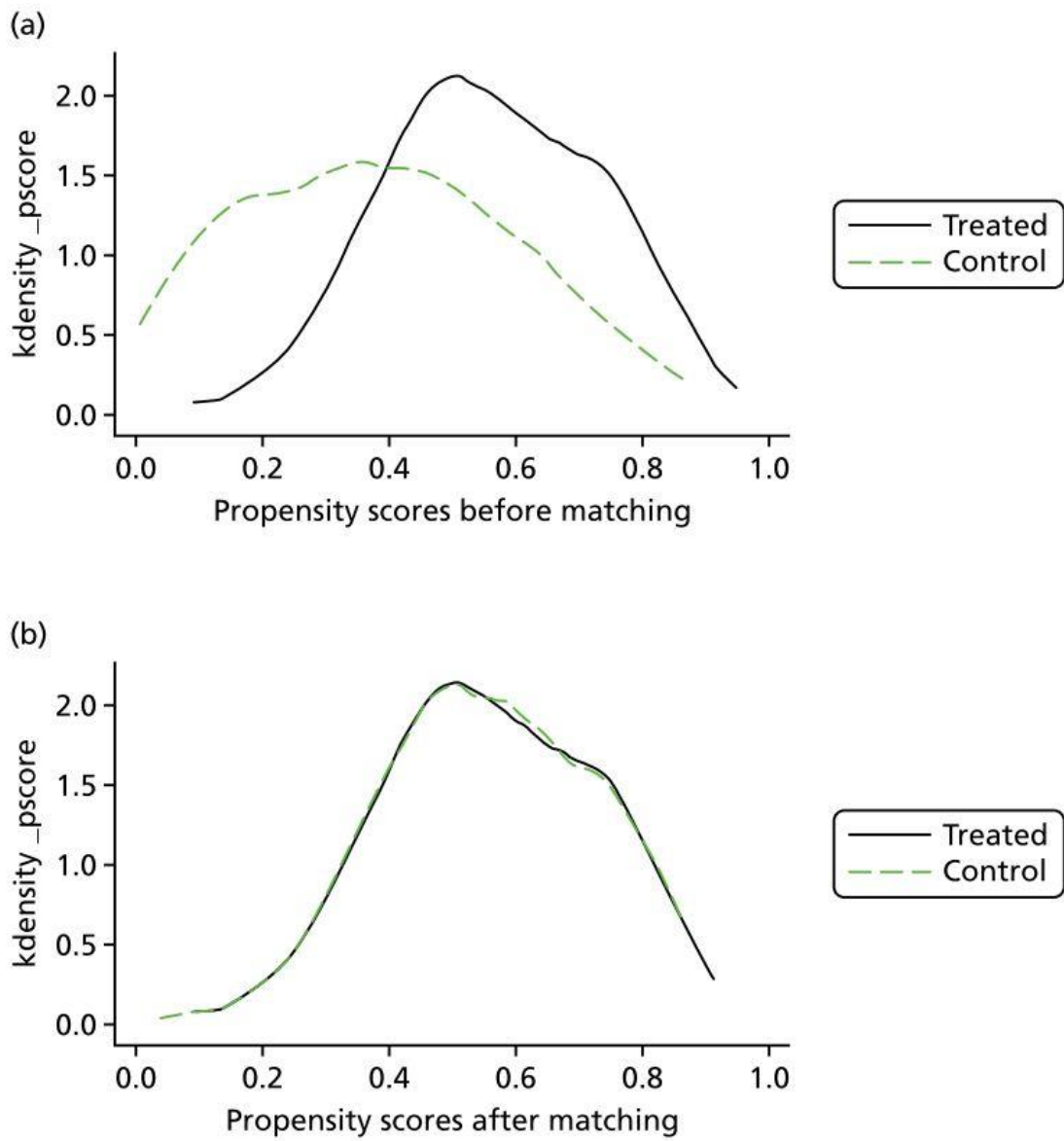


Figure S4 – Distribution of travel time.

