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A comparative examination of healthcare use related to hearing impairment in Europe

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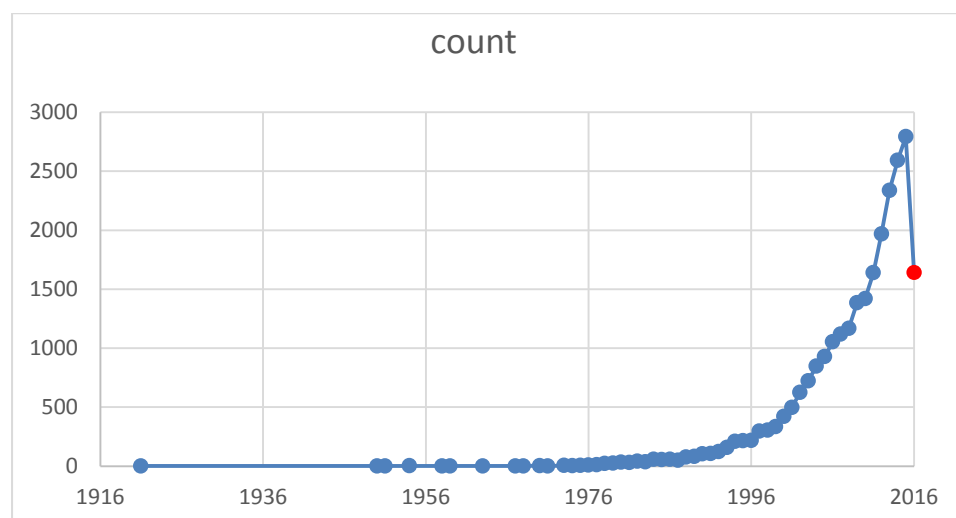
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Impaired health resulting from whatever source presents challenges to individuals and societies. These challenges can be presented in terms of an economic burden - costs and dis-utilities - that arise from the experience of and efforts to manage or resolve the health issue. Examining this burden can help us understand the magnitude and distribution of the burden within society, how it might impact different agents and what impact particular resource allocation decisions might have on these. An examination of the burden associated with impaired health can throw into sharp relief the interconnectedness of different budgets, for example, and how attempts to effect savings in one area can have unintended and potentially greater consequences in others.

The study of economic burden has become increasingly popular in the health and health economics literatures. Figure 1, for example, shows the trend over time in the number of academic papers located using a popular search engine in health sciences (PUBMED) using the search term “economic burden”. As can be seen they have risen almost exponentially over time. In part their popularity, as noted, reflects the insights they can afford into issues of cost, disutility and the distribution of these within society. In part too though their popularity reflects their usefulness in drawing attention to specific conditions/diseases among policy makers with a view to increasing the priority afforded them in resource allocation decisions. As healthcare budgets have come under increasing pressure and competition for resources increases, so too has the importance of garnering the attention of policy makers; it is perhaps unsurprising therefore that efforts to gain their attention using such studies has also increased.

Figure 1

Number of publications located with search term “economic burden” in pubmed overtime



Source pubmed September 2016.

Economic burden can be decomposed into two parts: a financial element – sometimes referred to as cost-of-illness - and a non-financial element. The latter refers to the dis-utility associated with lost health-related quality and quantity of life occasioned by a condition. It is possible in principle to monetise such disutility. Preference elicitation techniques such as contingent valuation and discrete choice experimentation as well as revealed preference techniques such as hedonic pricing and travel cost analyses offer methods by which this may be achieved. Alternatively thresholds used in health technology assessment - notionally reflective of societal willingness to pay for a given amount of health such as a quality adjusted life year - can be used for this adopting what is sometimes referred to as a net monetary benefit approach. Such approaches tend to be infrequently used in burden of illness studies though; disutility being more readily reflected and understood with reference to measures of morbidity and mortality associated with a specific condition.

Financial costs can also be separated into two parts: those related to use of services - health, social and personal services associated with treatment/management of the condition - and non-health care related costs associated, for example, with lost production arising from absenteeism, early retirement and premature death that may arise as a result of the condition. Within publicly funded health care systems there is an understandable focus on the financial burden the condition's management typically generates for services and in particular those for which state agencies are responsible either for funding or providing. That a condition can have significant financial costs, for example, among unpaid carers or in budgets not directly related to health such as education though is clear (Dee et al, 2014; Dee et al 2015, O'Neill et al, 2001).

The economic burden of hearing impairment is a relatively neglected area of research. While a large body of research has examined the association between hearing impairment, falls, mental health, mortality and cognition compared to many diseases relatively few studies have examined the economic burden associated with hearing impairment from a societal perspective (Kervasdoue and Hartmann (2016); O'Neill et al (2016); Foley et al (2014); Mohr et al (2000); Honeycutt et al (2004)) and a smaller number of these studies have been subject to peer review (O'Neill et al (2016); Foley et al (2014) Mohr et al (2000); Honeycutt et al (2004)). A small number of studies have examined aspects of economic burden related to hearing impairment, though these have tended to be confined to particular population sub-groups defined, for example, by age (Genther et al, 2013) or the role specific causes such as disease (Taylor et al, 2009) or noise (Nelson et al, 2005). The difficulty with such approaches is that either important aspects of economic burden may be omitted because they are not relevant to the population studied or in focusing on the role of specific causes they ignore large sections of society who may experience impairment but not as a result of these causes.

Only four studies that we are aware of, have examined the relationships between service use and hearing impairment (Mohr et al, (2000) ; Honeycutt et al (2004); O'Neill et al, (2016); Foley et al

2014)). The broad consensus among these is that hearing impairment is associated with additional healthcare expenditures by Foley et al's estimate for those aged 65 and over – of roughly \$392 (2012 prices). Among these, those that allowed a comparison with other aspects of burden (Mohr et al, (2000) ; Honeycutt et al (2004)) whose analyses adopted a lifetime approach to costs, it is clear that direct medical costs are modest relative to other aspects of disease burden. Both Mohr et al (2000) and Honeycutt et al (2004) for example suggest approximately 70% of costs are related to productivity losses, roughly 7% (Honeycutt et al (2004)) being related to direct medical expenditures. A more recent study estimated the economic burden related to disutility associated with hearing impairment in France using epidemiological data, the impact of hearing impairment on quality of life and a notional value of a willingness to pay for health-related quality of life (Kervadoue and Hartman, 2016).

To the best of our knowledge no comparative analyses of the economic burden of hearing impairment as it is experienced in different countries have been undertaken using the same methodology. In this paper we build on work undertaken by O'Neill et al (2016) that examined the association between hearing impairment and healthcare use in the UK. We examine the association between healthcare use and hearing impairment in 14 European countries; we compare countries in terms of the additional service use related to hearing impairment and relative to other commonly reported health conditions.

Methods

Data were extracted from the most recent wave of the Survey of Health Ageing and Retirement in Europe (SHARE) undertaken in 2013. In brief this is a survey on the physical and psychological health, socio-economic status, demographic characteristics, and social and family networks support of about 123,000 individuals aged 50 and over and their partners. The survey is undertaken in a number of European and surrounding countries; in 2013 these comprised Austria, Germany, Sweden, the Netherlands, France, Spain, Denmark, Italy, Switzerland, Estonia, Luxembourg, Belgium, the Czech Republic and Slovenia as well as Israel. Further details of the survey, sampling approach, response rates and questionnaires are available from (SHARE, 2016). Aspects of the survey are panel in nature and linked in terms of timing and scope with similar surveys undertaken in the US, China, England, Japan, Brazil and South Korea.

Data extracted for analysis included details of the respondent's age, gender, education, marital status, country of residence, use of health care services and health status. Health status is captured in a series of conditions/events the individual is asked if they had experienced. In total 16 conditions were identified explicitly including diabetes, hypertension, stroke, heart attack, cancer, epilepsy, emotional problems (including anxiety and depression). A full list is presented in Table 1. In addition individuals are asked if they experience problems with near or far vision and (separately) if they experienced hearing impairment.

Use of health services related to primary and secondary care are also gathered. The specific questions asked are detailed in appendix 1. In respect of both primary and secondary care the interval to which use relates is the previous twelve months. In respect of primary care, the question

does not permit the identification of, for example, visits to the GP as distinct from consultations with a practice nurse or telephone consultations as opposed to office visits but rather simply the total number of consultations. In respect of secondary care, the survey question (also reported in appendix 1.) identified the number of nights spent in hospital; no data on outpatient or day-case use was available.

Poisson regression models were used to analyse the relationship between the number of visits/number of nights in hospital and hearing impairment controlling for a number of covariates. Covariates controlled for were a dummy variable for each of the other conditions the individual reported having (1 if present 0 otherwise) age (in years) and age squared to allow for non-linear relationships, gender (1 if male, 0 otherwise), marital status (married or living as such, separated/divorced, never married or widowed – in each case as a dummy variable equal to 1 or 0 as relevant) and years of education. Separate models were estimated for primary and secondary care use in respect of each country.

Table 1

Conditions respondents were asked if they had been told by a doctor they had

Condition
A heart attack including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure
High blood pressure or hypertension
High blood cholesterol
A stroke or cerebral vascular disease
Diabetes or high blood sugar
Chronic lung disease such as chronic bronchitis or emphysema
Cancer or malignant tumour, including leukaemia or lymphoma, but excluding minor skin cancers
Stomach or duodenal ulcer, peptic ulcer
Parkinson disease
Cataracts
Hip fracture
Other fractures
Alzheimer's disease, dementia, organic brain syndrome, senility or any other serious memory impairment
Other affective or emotional disorders, including anxiety, nervous or psychiatric problems
Rheumatoid Arthritis
Osteoarthritis, or other rheumatism
Other

Results

Summary statistics by country in respect of the sample used in final regression analyses are detailed in appendix 2. In a number of instances data on socio-economic variables, for example education, marital status as well as in respect of health care service use was poorly reported. In consequence

the usable sample was often quite small. This is seen to particularly affect a number of countries such as Switzerland and France (see for example the sample size for regressions in Tables 3 and 4). The potential impact of this on results is discussed below.

In Table 2 the correlation between hearing impairment status and a range of conditions included in Table 1 are shown. As can be seen hearing impairment is significantly and positively correlated with many of these including emotional issues, Alzheimer's disease, heart attack, stroke and hypertension. As the data are cross-sectional in nature these cannot be interpreted as causative relationships.

Table 2 pairwise correlation between self-reported hearing impairment and other conditions

Condition	Correlation (significance level)
Emotional/mood disorders	0.05 (<0.01)
Alzheimer's Disease	0.10 (<0.01)
Stroke	0.07 (<0.01)
Hypertension	0.08 (<0.01)
Heart Attack	0.11 (<0.01)
Cancer	0.03 (<0.01)

N = 65,912

In Table 3 and 4 (see appendix 3) the marginal effects from a series of regression analyses on the use of primary and secondary care services are detailed by country. The marginal effects with respect to hearing impairment is reported separately in Table 5 for those countries where the sample size was thought to be sufficient for meaningful analysis. As noted given the nature of the dependent variables count models – specifically poisson models – the marginal effect shows the additional number of visits/night that are incurred associated with impaired hearing. In each case the marginal effect shows the impact on service use of hearing impairment where other variables are held at the

respective sample mean for that country's sample. As can be seen with the exception of those countries in which the sample size fell below 300 and Denmark in respect of secondary care, the impact of hearing impairment is uniformly to increase both primary and secondary care use, though the extent to which care use is increased varies between countries.

Table 5

Marginal effects with respect to impaired hearing

Country	Marginal effect for primary care	Marginal effect for secondary care
Belgium	0.98	0.61
Czech Rep	0.83	0.88
Germany	0.47	1
Denmark	1.25	-0.46
Spain	0.36	0.3
Italy	0.81	0.61
Holland	1.17	0.33
Sweden	0.45	0.48
Slovenia	1.21	0.56

Discussion

The premise of this investigation is that additional healthcare needs arise as a result of sub-optimally managed hearing impairment and that those needs will manifest themselves in additional – potentially avoidable - use of other healthcare services. An extensive literature linking hearing impairment to poorer mental and emotional well-being as well as to acute episodes of physical ill-health (related to for example to falls) exists. Studies in Iceland (Fisher et al, 2014), Australia (Karpa et al, 2010) and the USA (Genther et al, 2015) show an increased risk of all-cause mortality among older persons (Karpa et al, aged 50 and over; Fisher et al, aged over 66; Genther et al aged over 69) with a hearing impairment relative to those without such an impairment. Studies by Viljanen et al (2009) in Finland and Lin and Ferrucci (2012) in the USA have demonstrated an increased risk of falls among older persons with hearing impairment relative to those without such an impairment, a recent literature review underscoring these relationships (Jiam and Agrawal (2016). Hearing impairment has also been associated with cognitive decline and various studies have demonstrated relationships with depression, anxiety and poorer social relationships (Fellinger et al (2007);

Bernabei et al (2011); Ceisla et al (2016)). That additional needs arising from induced morbidity is therefore perhaps to be expected

Five countries of the countries examined in this study exhibited low response rates in respect of important socio-demographic information such as years of education, age or marital status – France, Switzerland, Austria, Estonia and Luxembourg. For example, in respect of France while 4,506 individuals were included in the SHARE sample, just 523 provided details of their marital status and just 215 details of their years of education. In respect of these countries, the resultant usable sample was significantly reduced and legitimate questions as to how representative the remaining sample was of the overall sample could be raised. While results for these countries are reported in the tables, for completeness no inference is drawn from them as to the nature of relationships between service use and hearing impairment.

With respect to the remaining nine countries, the comparative analysis shows (with the exception of Denmark in respect of secondary care) a consistent pattern across primary and secondary care in which hearing impairment is associated with increased service use. The amount by which service use increased in the presence of hearing impairment, controlling for a range of covariates including age and other measures of health, clearly varies between countries. It is important, however, to examine the additional service use with respect to primary and secondary care together as well as separately to obtain a fuller appreciation of the factors that might underlie these relationships. Taking both primary and secondary care together, the combined marginal effects (that is additional service use) on hearing impairment were between (approximately) 1.4 and 1.8 in respect of Belgium, the Czech Republic, Germany, Italy, the Netherlands and Slovenia. In the cases of Spain and Sweden the combined marginal effects were 0.66 and 0.93 respectively. In the case of Denmark while those with hearing impairment used on average 1.25 more primary care visits they used 0.46 fewer secondary care visits, an issue returned to below. Neither differences in overall healthcare spend - measured in terms of US dollars adjusted for purchasing par parity - nor the percentage of GDP spent on healthcare, offer consistent explanations for the pattern of resource use observed in respect of both primary and secondary care combined. While, for example, Slovenia had a healthcare spend of \$2595 USPPP adjusted per person (approximately 9.2% of GDP) in 2013 (WHO Regional Office, Europe, 2015) and Sweden a spend of \$4244 USPPP adjusted per person (approximately 9.7% of GDP) in 2013, Slovenian's with a hearing impairment, relative to those without, undertook more visits to primary and secondary care physicians than their counterparts in Sweden. Similarly while spend and the percentage of GDP spent on healthcare is lower in Italy (3126 USPPP adjusted) than Sweden, again visits to primary and secondary care physicians relative to those without a hearing impairment are higher than is exhibited in Sweden.

Some insight into the pattern of service use may be offered through an examination of how hearing impairment is managed across countries. Of the countries included in this analysis, Godinho (2015) provides figures for sales of hearing aids per thousand of the population in Spain (2.81 per 1000), Italy (4.69 per 1000), Belgium (6.67 per 1000), Germany (10.84 per 1000) and Denmark (22.40 per

1000). The author also offers figures on the number of persons fitted with hearing aids per 1000 of the population in Italy (2.81), Germany (4.93) and Denmark (12.17) as well as the percentage of persons with hearing loss who enjoyed bilateral fitting in Italy (44%), Germany (76%) and Denmark (84%). While incomplete both in terms of the countries covered and in terms of the detail provided (how good the hearing aids on offer were, what compliance was etc.) a correlation with healthcare use is evident. Relative to the other countries Denmark clearly enjoys superior access and – with the exception of Spain - lower levels of total additional service use. A rank ordering in terms of sales per 1000 inhabitants and total service use, for example, is evident between Denmark, Germany and Belgium. While Italy has lower total use service use than Belgium or Germany, its operation of a gatekeeping system to secondary care which is argued to provide for more efficient use of care services may in part explain this. It is unclear why Spain should have so much lower additional service use patterns. While per capita expenditure on care is lowest in Spain of the western economies included in the analysis \$2846 (USPPP adjusted) compared with \$4526 for Belgium \$4812 for Germany \$4552 for Denmark, \$3126 for Italy \$5601 for Holland and \$4244 for Sweden, it is still higher for those in Slovenia (\$2595) and the Czech Republic (\$1982) where higher additional service use is recorded.

As noted it is important to consider both total additional use and use at different levels of the service to obtain a fuller appreciation of the factors underlying service patterns. With respect to the distribution across primary and secondary care sectors a relatively clear and consistent pattern of service use is evident. In those countries where primary care physicians act as gatekeepers to secondary care (Spain, Italy, Holland, Slovenia and Denmark) the marginal effect (that is the additional service use) associated with hearing impairment in primary care is higher than that associated with secondary care. By contrast in those countries where there is no gate-keeping role for primary care, either the marginal effect in secondary care associated with hearing impairment is higher than in primary care (Czech Republic, Germany, Sweden) or the difference between primary and secondary care is modest (Belgium). This pattern is entirely consistent with primary care physicians ensuring a more efficient use of what are generally more expensive secondary care services through appropriate referral systems.

Our analyses show, consistent with O'Neill et al (2016), that hearing impairment is associated with additional use of healthcare in the clear majority of the countries examined. Our comparative approach demonstrates the consistency of experience in this regard but importantly the variation in experience between countries provides valuable potential insights into how such demands might be managed. Clearly, where primary care acts as a gatekeeper to hospital services, the use of hospital services – often more expensive than those in primary care – are reduced. It is also clear that where access to hearing assistive technologies is greatest the impact of hearing impairment on health service use is also reduced. In this respect the case of Denmark is perhaps instructive where the use of inpatient services by respondents with a hearing impairment is actually less than that (other variables controlled for) of those without a hearing impairment.

It is difficult to discern a clear pattern in the relative size of the marginal effects reported in Tables 3 and 4. Frequently the additional number of visits associated with hearing impairment is about half of that associated with diabetes in primary care, for example, but as is clear from the experience of

Germany and Italy the relative size can be higher or lower. This is similarly the case with respect to inpatient services where again not only does the size of the marginal effect for hearing impairment vary relative to other conditions but the sign is also seen to vary.

There are a number of limitations to our analysis. The reduced sample size in respect of a number of countries renders us mute in respect of the relationship between hearing impairment and health service use in these instances. That the experience in these countries may be consistent with that reported here for other countries though remains plausible. We are not able to observe how severe hearing impairment is in the case of those reporting a hearing impairment or how this might vary between countries. While there is every reason to believe self-reported hearing impairment would be positively correlated with objectively measured hearing levels that different thresholds of measured impairment may operate in different countries before self-reported impairment is triggered (or vice versa) is entirely possible. Finally that we are unable to disaggregate service use further within primary care or examine the relationship between hearing impairment and other services such as outpatient care is a limitation.

Conclusions

Hearing impairment is generally associated with increased use of primary and secondary healthcare services when other aspects of health have been controlled for. The additional use is likely related to health problems occasioned as a result of impairment. Our comparative analysis shows that variations in this association exist, variations that may provide valuable insights into how the burden of illness might be reduced. Where gatekeeping operates in respect of access to secondary services the impact of hearing impairment on hospital use is seen to be less than where no gatekeeping function is in place. Where access to hearing assistive technologies are greatest (Denmark), use of services by the hearing impairment is not only seen to be less than elsewhere but less than that among those with normal hearing in the case of hospital services. This suggests that expanded access to services may have a role in reducing the burden of illness associated with hearing impairment. This and the impact of system structure particularly that afforded primary care warrant on the burden of illness associated with hearing impairment warrant further investigation.

Appendix 1

Questions on use of health services:

Now please think about the last 12 months. About how many times in total have you seen or talked to a medical doctor or qualified nurse about your health? Please exclude dentist visits and hospital stays, but include emergency room or outpatient clinic visits.

:

Please also count contacts by telephone or other means.

Please include all kind of therapists here (i.e. also vocational therapists, physiotherapists, osteopath, psychiatrists, psychologists, homeopaths).

How many nights altogether have you spent in hospitals during the last twelve months?

Appendix 2

the summary statistics by country for the regression sample

	Primary care							Second ary care				
	Variable	N	Mean	Std. Dev.	Min	Max		N	Mean	Std. Dev.	Min	Max
Aus.	age	155	64.88	10.45	42	97		156	64.71795	10.600	54	97
	male	155	0.54	0.50	0	1		156	.5320513	.50058	0	1
	Marital status											
	married and living together/partner	155	0.06	0.23	0	1		156	.0576923	0.233912	0	1
	separated/divorced	155	0.04	0.19	0	1		156	.0384615	0.192927	0	1
	Never married	155	0.03	0.18	0	1		156	.0320513	0.176704		
	Education years	155	8.75	5.17	1	24		156	5.181866	8.711538	1	24
Belg.	age	1,458	62.11	10.84	22	94		1,472	62.19701	10.86863	22	94
	male	1,458	0.47	0.50	0	1		1,472	0.467391	0.4991051	0	1
	Marital status											
	married and living together/partner	1,458	0.07	0.26	0	1		1,472	0.074728	0.2630417	0	1
	separated/divorced	1,458	0.12	0.33	0	1		1,472	0.125	0.3308313	0	1

	Never married	1,458	0.06	0.24	0	1		1,472	0.061821	0.240914	0	1
	Education years	1,458	12.76	3.87	0	25		1,472	12.72418	3.881314	0	25
Czech Rep.	age	1,474	64.95	9.84	26	101		1,486	64.9556	9.8	26	101
	male	1,474	0.42	0.49	0	1		1,486	0.4246299	0.49	0	1
	Marital status											
	married and living together/partner	1,474	0.16	0.37	0	1		1,486	.1628533	.3693561	0	1
	separated/divorced	1,474	0.15	0.35	0	1		1,486	.1460296	.3532548		
	Never married	1,474	0.03	0.16	0	1		1,486	.026245	0.1599167	0	1
	Education years	1,474	12.14	3.23	1	23		1,486	12.13122	3.236514	1	23
Swit.	age	96	65.63	9.23	47	89		96	65.625	9.23181	47	89
	male	96	0.48	0.50	0	1		96	0.4791667	0.5021882	0	1
	Marital status											
	married and living together/partner	96	0.05	0.22	0	1		96	0.0520833	0.2233615	0	1
	separated/divo	96	0.06	0.24	0	1		96	0.0625	0.24333	0	1

	rced		3						21			
	Never married	96	0.04	0.20	0	1		96	0.04166 67	0.20087 53	0	1
	Education years	96	9.70	4.81	0	23		96	9.69791 7	4.81252 7	0	23
Ger.	age	4,49 7	63.4 6	10.4 1	31	10 1		4,510	63.4851 4	10.4257	31	10 1
	male	4,49 7	0.47	0.50	0	1		4,510	0.46762 75	0.49900	0	1
	Marital status											
	married and living together/partn er	4,49 7	0.10	0.30	0	1		4,510	0.09778	0.29705		
	separated/divo rced	4,49 7	0.10	0.30	0	1		4,510	0.10133	0.30179 9	0	1
	Never married	4,49 7	0.06	0.23	0	1		4,510	0.05720 6	0.13226 2	0	1
	Education years	4,49 7	12.5 5	3.69	0	25		4,510	12.5406	3.6996	0	25
Den.												
	age	1,91 6	63.3 2	10.1 7	31	99		1,930	63.4155 4	10.2663	31	99
	male	1,91 6	0.46	0.50	0	1		1,930	0.46062 18	0.49857 61	0	1
	Marital status											
	married and living together/partn er	1,91 6	0.08	0.27	0	1		1,930	0.08082 9	0.27264 3	0	1
	separated/divo	1,91	0.11	0.32	0	1		1,930	0.11139	0.31470	0	1

	rced	6						9	71			
	Never married	1,916	0.06	0.24	0	1		1,930	0.0642487	0.245259	0	1
	Education years	1,916	13.08	3.77	0	25		1,930	13.05751	3.778923	0	25
Estonia	age	215	65.13	10.30	38	87		218	65.18349	10.35336	38	87
	male	215	0.54	0.50	0	1		218	.5458716	.4990373	0	1
	Marital status											
	married and living together/partner	215	0.02	0.15	0	1		218	.0275229	.1639779	0	1
	separated/divorced	215	0.07	0.26	0	1		218	.0688073	.2537088	0	1
	Never married	215	0.04	0.20	0	1		218	.0412844	.1994051	0	1
	Education years	215	11.98	3.44	5	23		218	11.9633	3.43183	5	23
Spain	age	3,313	66.61	11.43	30	101		3,350	66.72358	11.48585	30	101
	male	3,313	.47	.50	0	1		3,350	0.4704478	0.4992004	0	1
	Marital status											
	married and living together/partner	3,313	0.10	0.31	0	1		3,350	0.1062687	0.3082272	0	1
	separated/divo	3,31	0.41	0.20	0	1		3,350	0.04089	0.19807	0	1

	rced	3						55	77			
	Never married	3,313	.04	0.20	0	1		3,350	0.0408955	0.1980777	0	1
	Education years	3,313	10.01	5.04	0	25		3,350	9.990149	5.04245	0	25
Franc e	age	211	63.35	10.82	39	91		213	63.47887	10.89425	39	91
	male	211	0.46	0.50	0	1		213	.4553991	.4991799	0	1
	Marital status											
	married and living together/partner	211	0.04	0.20	0	1		213	.0422535	.2016409	0	1
	separated/divorced	211	0.08	0.27	0	1		213	.084507	.278802	0	1
	Never married	211	0.03	0.17	0	1		213	.028169	.1658453	0	1
	Education years	211	10.93	3.66	0	23		213	10.9108	3.650604	0	23
Italy	age	1,829	63.96	10.74	32	102		1,852	63.97624	10.79726	32	102
	male	1,829	0.45	0.50	0	1		1,852	.4514039	.4977672	0	1
	Marital status											
	married and living together/partner	1,829	0.11	0.31	0	1		1,852	.1074514	.3097699	0	1
	separated/divo	1,82	0.05	0.22	0	1		1,852	.050216	.218449	0	1

	rced	9							3			
	Never married	1,829	0.08	0.27	0	1		1,852	.0799136	.2712326	0	1
	Education years	1,829	9.60	4.74	0	25		1,852	9.591253	4.733958	0	25
Lux.	age	155	64.88	10.45	42	97		156	64.71795	10.60054	40	97
	male	155	.54	.50	0	1		156	0.5320513	0.5005787	0	1
	Marital status											
	married and living together/partner	155	.06	.23	0	1		156	0.0576923	0.2339116	0	1
	separated/divorced	155	.04	.19	0	1		156	0.0384615	0.192927	0	1
	Never married	155	.03	.18	0	1		156	0.0320513	0.1767036	0	1
	Education years	155	8.75	5.17	1	24		156	8.711538	5.181866	1	24
Neth.	age	1,739	64.08	10.06	32	98		1,749	64.10749	10.08272	32	98
	male	1,739	0.46	0.50	0	1		1,749	0.4591195	0.4984685	0	1
	Marital status											
	married and living together/partner	1,739	0.09	0.28	0	1		1,749	0.0903373	0.2867464	0	1
	separated/divo	1,73	0.09	0.28	0	1		1,749	0.08690	0.28177	0	1

	rced	9						68	9			
	Never married	1,739	0.05	0.21	0	1		1,749	0.0480274	0.2138854	0	1
	Education years	1,739	11.75	3.62	0	25		1,749	11.73185	3.636142	0	25
Swed	age	2533	66.19	9.58	31	95		2,590	66.2251	9.607672	31	95
	male	2533	.47	.50	0	1		2,590	.4722008	.499323	0	1
	Marital status											
	married and living together/partner	2533	.08	0.27	0	1		2,590	.0779923	.2682112	0	1
	separated/divorced	2533	.12	.33	0	1		2,590	.1212355	.3264638	0	1
	Never married	2533	.08	.27	0	1		2,590	.0799228	.271226	0	1
	Education years	2533	11.70	3.95	0	25		2,590	11.62973	3.962255	0	25
Slov.	age	976	65.26	10.22	44	97		984	65.32215	10.23989	44	97
	male	976	.44	.50	0	1		984	.4390244	.4965204	0	1
	Marital status											
	married and living together/partner	976	.13	.33	0	1		984	.1310976	.3376787	0	1
	separated/divo	516	.04	.20	0	1		984	.040650	.197579	0	1

	rced								4	4		
	Never married	516	.04	.20	0	1		984	.041666 7	.199927 9	0	1
	Education years	976	10.4 0	3.44	0	21		984	10.3729 7	3.45117 4	0	21

Appendix 3
Table 3

	Austria	Belgium	Czech Republic	Switzerland	Germany	Denmark	Estonia
Dependent variable: the number of times seen medical doctor/qualified nurse in the past 12 months							
Diabetes	-0.249 (1.046)	2.148*** (0.216)	2.421*** (0.184)	2.946*** (1.069)	2.532*** (0.123)	1.967*** (0.174)	3.900** (0.482) *
Hypertension	3.804** (0.538) *	1.248*** (0.158)	1.701*** (0.159)	1.134 (0.907)	1.267*** (0.0968)	0.998*** (0.122)	-0.0582 (0.373)
Heart attack	1.888** (0.689) *	1.904*** (0.233)	1.214*** (0.211)	-0.454 (1.061)	2.680*** (0.127)	1.214*** (0.157)	2.018** (0.433) *
Stroke	8.930** (1.448) *	3.421*** (0.390)	1.036*** (0.290)	-12.49* (6.689)	2.096*** (0.170)	1.265*** (0.238)	2.946** (0.540) *
Cataracts	1.874** (0.846)	0.223 (0.260)	2.142*** (0.227)	-2.391 (1.483)	0.687*** (0.141)	-0.0279 (0.175)	3.748** (0.686) *
cholesterol	-1.520** (0.623)	-0.0739 (0.164)	1.883*** (0.173)	-2.571** (1.034)	-0.110 (0.112)	0.619*** (0.128)	1.493** (0.471) *
Chronic lung Disease	-0.195 (1.163)	1.903*** (0.261)	3.107*** (0.250)	8.251*** (1.581)	1.888*** (0.144)	2.250*** (0.167)	0.744 (0.692)
Cancer	6.240** (0.754) *	4.354*** (0.232)	3.107*** (0.268)	6.124*** (1.015)	4.033*** (0.124)	3.790*** (0.148)	4.957** (0.690) *
Stomach	-1.240	1.196***	4.156***	-0.505	0.544***	1.265***	- 3.001** *
Hip fracture	(1.158) 4.275**	(0.224) 1.880***	(0.270) 0.0424	(1.476) -1.205	(0.193) 3.231***	(0.215) 3.497***	(0.710) 2.926
Other fracture	(1.917) -0.819	(0.407) 2.063***	(0.430) -0.0870	(1.521) 6.886***	(0.249) 1.490***	(0.310) 0.617***	(2.476) -0.369
Alzheimer	(0.842) 8.700** *	(0.226) -0.0839	(0.273) - 9.177***	(1.052)	(0.124) 1.367***	(0.159) 4.743***	(0.746) -1.445
Emotional	(1.401) 5.049** *	(0.621) 3.589***	(1.464) 4.119***	-0.833	(0.332) 4.142***	(0.634) 2.385***	(1.098) 2.921** *
Rheumatoid	(1.116) 5.870** *	(0.218) 2.536***	(0.380) 1.684***	(1.346) -0.437	(0.135) 2.029***	(0.191) 2.143***	(0.645) - 1.344**
Osteoarthritis	(0.795) 3.188** *	(0.245) 1.219***	(0.206) 1.652***	(1.500) 0.198	(0.128) 1.979***	(0.239) 1.558***	(0.625) 0.419
	(1.002)	(0.170)	(0.176)	(0.899)	(0.108)	(0.119)	(0.623)

eyesight	0.0937	-	0.809***	2.677***	0.385***	-0.437**	2.150**
		0.705***					*
	(0.652)	(0.174)	(0.161)	(0.736)	(0.109)	(0.189)	(0.402)
Hear	0.405	0.980***	0.835***	0.844	0.469***	1.247***	-0.293
	(0.585)	(0.184)	(0.179)	(1.309)	(0.115)	(0.144)	(0.424)
Age	1.886**	-	0.0177	-0.294	-	0.0554	-0.137
	*	0.367***			0.222***		
	(0.276)	(0.0605)	(0.0772)	(0.435)	(0.0480)	(0.0574)	(0.193)
age2	-	0.00272*	-	0.00296	0.00154*	-9.75e-05	0.000758
	0.0137**	**	0.000491		**		
	(0.00205)	(0.000465)	(0.000578)	(0.00321)	(0.000361)	(0.000429)	(0.00146)
Gender	-	-	-0.364**	0.573	-0.0204	-0.275**	-
	1.354**	0.937***					1.511**
	*						*
(male=1)	(0.481)	(0.152)	(0.162)	(0.698)	(0.0954)	(0.113)	(0.358)
Marital status							
married and living	-	1.324***	-0.264	2.070	0.602***	0.798***	-
	5.187**						1.622**
	*						*
together/partner separated/divorced	(0.567)	(0.234)	(0.213)	(1.518)	(0.152)	(0.180)	(0.626)
	-1.811	0.661**	-	8.994***	-0.362*	1.502***	-0.348
			2.085***				
	(1.491)	(0.310)	(0.417)	(2.901)	(0.194)	(0.262)	(0.964)
Never married	2.807**	-0.304	-0.232	6.478***	0.758***	-0.420**	-0.773
	(1.382)	(0.276)	(0.222)	(2.013)	(0.165)	(0.184)	(1.048)
Education years	0.0455	-	-	-0.135**	0.0367**	0.115***	-0.0201
		0.0809**	0.207***		*		
		*					
	(0.0455)	(0.0195)	(0.0242)	(0.0687)	(0.0129)	(0.0152)	(0.0541)
Parkinson		6.604***	6.394***		7.805***	7.280***	
		(0.624)	(0.621)		(0.338)	(0.548)	
Constant							
Observations	155	1,458	1,474	96	4,497	1,916	215

Primary care cont'd

	Spain	France	Italy	Luxemb	Holland	Sweden	Slovenia
Dependent variable: the number of times seen medical doctor/qualified nurse in the past 12							
Diabetes	1.385*** (0.101)	-0.320 (0.642)	0.116*** (0.0238)	-0.249 (1.046)	2.370** (0.171)	0.227*** (0.0323)	1.716*** (0.193)
Hypertension	0.877*** (0.0826)	-0.674 (0.421)	0.188*** (0.0191)	3.804** (0.538)	0.790** (0.133)	0.109*** (0.0226)	1.218*** (0.159)
Heart attack	1.799*** (0.110)	3.974*** (0.584)	0.252*** (0.0248)	1.888** (0.689)	1.507** (0.161)	0.261*** (0.0324)	2.430*** (0.191)
Stroke	2.207*** (0.195)	4.509*** (1.033)	0.486*** (0.0344)	8.930** (1.448)	1.245** (0.247)	0.235*** (0.0379)	-0.713** (0.349)
Cataracts	-0.0436 (0.119)	0.418 (0.738)	0.0618** (0.0304)	1.874** (0.846)	0.287 (0.209)	0.0431 (0.0314)	-0.138 (0.263)
cholesterol	0.0658 (0.0873)	1.356*** (0.445)	0.213*** (0.0203)	-1.520** (0.623)	1.171** (0.147)	0.147*** (0.0272)	-0.00136 (0.182)
Chronic lung Disease	1.622*** (0.135)	3.335*** (0.727)	0.209*** (0.0325)	-0.195 (1.163)	2.341** (0.163)	0.172*** (0.0430)	0.750** (0.306)
Cancer	2.764*** (0.125)	2.700*** (0.582)	0.629*** (0.0264)	6.240** (0.754)	3.693** (0.169)	0.420*** (0.0290)	4.560*** (0.226)
Stomach	1.042*** (0.154)	1.137 (0.734)	0.120*** (0.0408)	-1.240 (1.158)	1.499** (0.292)	0.196*** (0.0418)	-0.563* (0.304)
Hip fracture	0.826*** (0.218)	-1.808 (1.149)	-0.105* (0.0545)	4.275** (1.917)	0.435 (0.305)	0.0614 (0.0545)	-1.123** (0.497)
Other fracture	2.038*** (0.111)	1.023 (0.984)	0.264*** (0.0319)	-0.819 (0.842)	0.871** (0.189)	0.220*** (0.0327)	2.035*** (0.230)
Alzheimer	0.101 (0.198)	-0.112 (1.364)	0.208*** (0.0499)	8.700** (1.401)	- (0.705)	1.136*** (0.0603)	1.144*** (0.389)
Emotional	2.097*** (0.119)	2.418*** (0.568)	0.325*** (0.0310)	5.049** (1.116)	1.209** (0.245)	0.466*** (0.0356)	1.979*** (0.224)
Rheumatoid	-0.0293 (0.108)	-11.31** (4.622)	0.288*** (0.0274)	5.870** (0.795)	1.942** (0.229)	0.216*** (0.0511)	-0.208 (0.250)
Osteoarthritis	1.241*** (0.121)	2.476*** (0.423)	-0.0360 (0.0238)	3.188** (1.002)	1.068** (0.146)	0.332*** (0.0241)	1.934*** (0.333)
Eyesight	1.262*** (0.0862)	-0.792* (0.446)	0.0965** (0.0184)	0.0937 (0.652)	-0.264* (0.138)	0.0668** (0.0264)	- (0.162)
Hear	0.357*** (0.0943)	-1.022** (0.494)	0.104*** (0.0219)	0.405 (0.585)	1.170** (0.138)	0.119*** (0.0261)	1.211*** (0.188)
Age	0.105*** (0.0390)	-0.419** (0.173)	0.0840** (0.00831)	1.886** (0.276)	-0.0514 (0.0647)	- (0.0114)	0.471*** (0.0967)
age2	- (0.000000)	0.00338* (0.00171)	- (0.000175)	- (0.000075)	0.00050 (0.00027)	0.000447 (0.00021)	- (0.000000)

	(0.00028	(0.00128	(6.01e-05)	(0.00205	(0.0004	(8.40e-05)	(0.00071
Gender	-	-	-0.162***	-	-	-0.0344	0.624***
(male=1)	(0.0832)	(0.409)	(0.0185)	(0.481)	(0.125)	(0.0218)	(0.159)
Marital status	-0.209	4.408***	0.289***	-	-	0.0792**	-0.613*
married and	(0.191)	(0.934)	(0.0380)	(0.567)	(0.183)	(0.0310)	(0.350)
together/partne	0.550***	1.420	0.142***	-1.811	1.561**	0.119***	-0.822**
separated/divo	(0.196)	(1.103)	(0.0305)	(1.491)	(0.321)	(0.0392)	(0.383)
	-0.266**	-0.153	-0.0547**	2.807**	-0.254	-0.0219	0.0390
Never married	(0.120)	(0.791)	(0.0273)	(1.382)	(0.200)	(0.0385)	(0.253)
	-	-	-	0.0455	-	-	-
Education	(0.00825	(0.0510)	(0.00211)	(0.0455)	(0.0170)	(0.00282)	(0.0231)
	2.453***	2.850	0.285***		3.915**	0.693***	-0.0494
Parkinson	(0.250)	(2.633)	(0.0711)		(0.445)	(0.111)	(0.711)
			-1.637***			3.230***	
Constant			(0.286)			(0.385)	
	3,313	211	1,829	155	1,739	2,533	976

Secondary care

	Austria	Belgium	Czech Republic	Switzerland	Germany	Denmark	Estonia
Dependent variable: the number of times seen medical doctor/qualified nurse in the past 12 months							
Diabetes	0.0901 (0.507)	1.198*** (0.0916)	0.599*** (0.111)	0.691 (0.834)	0.989*** (0.0592)	0.708*** (0.0657)	1.650** (0.297)
Hypertension	3.471** *	0.761*** (0.0739)	-0.171* (0.0966)	0.876 (0.898)	0.292*** (0.0499)	- (0.0548)	0.345 (0.211)
Heart attack	- 1.425** *	1.371***	1.150***	-4.570***	1.289***	0.246***	0.391
Stroke	8.418** *	2.110*** (0.0901)	0.515*** (0.117)	-20.31 (1.700)	1.219*** (0.0593)	0.740*** (0.0632)	3.587** (0.240)
Cataracts	1.890** *	-0.239** (0.140)	1.868*** (0.165)	-49.58 (632,744)	-0.0229 (0.0741)	0.471*** (0.0838)	2.822** (0.364)
Cholesterol	- 0.967**	-0.885*** (0.105)	0.0969 (0.126)	1.571 (10,014)	-0.350*** (0.0688)	0.385*** (0.0627)	-0.568* (0.372)
Chronic lung	0.957 (0.411)	1.725*** (0.0846)	1.909*** (0.111)	4.695** (0.959)	1.050*** (0.0581)	1.400*** (0.0546)	2.736** (0.299)
Disease	(0.622)	(0.0977)	(0.141)	(2.054)	(0.0668)	(0.0624)	(0.361)
Cancer	3.755** *	0.331***	1.687***	8.469***	1.484***	1.377***	2.930** *
Stomach	(0.482) 1.388*	(0.119) -0.366***	(0.153) 1.408***	(1.240) -0.508	(0.0602) 0.442***	(0.0605) 0.544***	(0.405) - 2.180** *
Hip fracture	(0.817) -31.68 (1,073)	(0.113) 0.894*** (0.173)	(0.170) 0.848*** (0.219)	(0.780) 1.996 (3.231)	(0.0873) 0.326** (0.131)	(0.0807) 1.483*** (0.0953)	(0.480) -19.64 (2,354)
Other fracture	3.112** *	-0.307**	0.0864	-2.078	1.000***	-0.148**	0.590
Alzheimer	(0.493) 1.607	(0.137) -1.978***	(0.158) 0.548	(3.160)	(0.0585) -1.528***	(0.0706) 0.220	(0.408) - 7.638** *
Emotional	(1.325) 3.732** *	(0.282) 1.036***	(0.549) 4.114***	-36.96	(0.192) 1.613***	(0.263) - 0.367***	(1.090) 2.130** *
Rheumatoid	(0.681) - 6.147** *	(0.109) 0.206*	(0.180) - 0.705***	(3,428) -6.610**	(0.0661) -0.0337	(0.0914) - 1.489***	(0.348) - 2.114** *

	(1.091)	(0.118)	(0.143)	(2.657)	(0.0696)	(0.187)	(0.490)
Osteoarthritis	-	-0.228***	0.0872	-7.144***	-0.242***	0.0212	-
	4.677**						2.961**
	*						*
	(1.719)	(0.0815)	(0.110)	(1.593)	(0.0586)	(0.0523)	(0.694)
Eyesight	-0.165	-0.158*	-	2.415**	0.0268	0.646***	0.231
			0.700***				
	(0.561)	(0.0838)	(0.104)	(1.177)	(0.0547)	(0.0613)	(0.234)
Hear	3.670**	0.611***	0.882***	3.547***	1.005***	-	0.820**
	*					0.458***	*
	(0.417)	(0.0825)	(0.104)	(0.835)	(0.0538)	(0.0705)	(0.238)
Age	0.279	0.508***	0.145***	-1.022**	-0.200***	-0.00507	-0.178
	(0.200)	(0.0430)	(0.0492)	(0.517)	(0.0238)	(0.0217)	(0.138)
age2	-	-	-	0.00948*	0.00171*	0.000111	0.00146
	0.00174	0.00342*	0.000598	**	**		
		**	*				
	(0.0014	(0.000315	(0.00035	(0.00362)	(0.000176	(0.00015	(0.0010
	7))	7))	9)	2)
Gender	0.283	0.192***	0.0600	0.821	0.668***	-0.0431	-
							1.318**
							*
(male=1)	(0.372)	(0.0739)	(0.101)	(0.835)	(0.0500)	(0.0484)	(0.253)
married and	-1.188	1.950***	-	-1.377***	1.251***	0.912***	1.083
living			0.506***				
together/partner	(0.734)	(0.159)	(0.133)	(0.134)	(0.0915)	(0.103)	(0.813)
separated/divor	2.536	-0.708***	0.397	31.76	0.485***	0.886***	-
ced							1.473**
							*
	(2.926)	(0.105)	(0.355)	(19.93)	(0.108)	(0.145)	(0.0857
)
Never married	-0.0456	0.400***	-	11.74	0.114	-0.0294	4.290**
			0.630***				
	(0.623)	(0.121)	(0.121)	(7.661)	(0.0776)	(0.0683)	(1.892)
Education years	-0.0367	-0.106***	-	-0.249***	-	-0.00125	-0.0287
			0.278***		0.0282**		
					*		
	(0.0364	(0.00959)	(0.0151)	(0.0777)	(0.00662)	(0.00655	(0.0344
)))
Parkinson		-0.491	0.398		0.500**	0.610	
		(0.498)	(0.466)		(0.214)	(0.425)	
Constant							
Observations	156	1,472	1,486	96	4,510	1,930	218

Secondary care cont'd

	Spain	France	Italy	Luxemb	Holland	Sweden	Slovenia
Dependent variable: the number of times seen medical doctor/qualified nurse in the past 12							
Diabetes	0.406*** (0.0412)	2.294** (0.337)	0.174*** (0.0546)	0.0901 (0.507)	0.602** (0.0577)	1.205*** (0.0478)	0.245** (0.107)
Hypertension	-0.0209 (0.0366)	-0.297 (0.261)	-0.0774* (0.0465)	3.471*** (0.402)	0.144** (0.0498)	-0.503*** (0.0455)	0.656*** (0.0936)
Heart attack	0.578*** (0.0430)	2.012** (0.280)	0.828*** (0.0480)	- (0.502)	0.584** (0.0535)	0.641*** (0.0527)	1.489*** (0.0982)
stroke	0.886*** (0.0648)	0.375 (0.554)	1.246*** (0.0594)	8.418*** (0.827)	0.411** (0.0716)	0.287*** (0.0614)	- (0.224)
cataracts	0.150*** (0.0450)	1.906** (0.324)	- (0.0707)	1.890*** (0.589)	-0.176** (0.0844)	-0.869*** (0.0652)	- (0.158)
cholesterol	- (0.0412)	- (0.329)	0.0223 (0.0503)	-0.967** (0.411)	0.425** (0.0520)	0.687*** (0.0476)	- (0.105)
Chronic lung disease	0.701*** (0.0493)	2.962** (0.353)	0.477*** (0.0704)	0.957 (0.622)	0.277** (0.0573)	0.527*** (0.0734)	0.728*** (0.141)
cancer	0.862*** (0.0493)	2.714** (0.298)	1.327*** (0.0484)	3.755*** (0.482)	0.634** (0.0603)	1.263*** (0.0488)	2.401*** (0.122)
stomach	0.248*** (0.0641)	0.661* (0.353)	- (0.128)	1.388* (0.817)	0.699** (0.0840)	0.177** (0.0840)	- (0.213)
Hip fracture	1.095*** (0.0618)	1.793** (0.449)	0.841*** (0.0837)	-31.68 (1,073)	0.605** (0.0830)	1.056*** (0.0807)	0.639*** (0.224)
Other fracture	0.234*** (0.0498)	-0.0393 (0.492)	0.640*** (0.0679)	3.112*** (0.493)	0.264** (0.0634)	-0.342*** (0.0775)	0.958*** (0.122)
Alzheimer	- (0.0805)	- (1.174)	1.052*** (0.0837)	1.607 (1.325)	-11.89 (568.9)	2.936*** (0.0609)	1.702*** (0.149)
emotional	0.151** (0.0589)	1.509** (0.324)	0.435*** (0.0690)	3.732*** (0.681)	-0.0410 (0.0975)	0.901*** (0.0635)	0.855*** (0.111)
Rheumatoid	-0.00993 (0.0455)	0.620 (1.548)	- (0.0788)	- (1.091)	-0.0158 (0.0864)	-0.546*** (0.110)	1.467*** (0.110)
Osteoarthritis	0.275*** (0.0528)	-0.702** (0.289)	0.0450 (0.0547)	- (1.719)	0.170** (0.0531)	-0.490*** (0.0607)	0.619*** (0.175)
eyesight	0.160*** (0.0385)	-0.120 (0.284)	0.0407 (0.0460)	-0.165 (0.561)	-0.0446 (0.0508)	-0.0438 (0.0479)	0.651*** (0.0879)
hear	0.301*** (0.0385)	0.0288 (0.240)	0.435*** (0.0476)	3.670*** (0.417)	0.248** (0.0497)	0.454*** (0.0438)	0.560*** (0.0961)
age	0.0706** (0.0188)	0.0619 (0.137)	0.356*** (0.0225)	0.279 (0.200)	0.0167 (0.0269)	-0.132*** (0.0210)	0.438*** (0.0648)
age2	- (0.00013)	0.00020 (0.00095)	- (0.00015)	-0.00174 (0.00147)	- (0.00019)	0.000977* (0.000152)	- (0.00047)
Gender (male=1)	0.235*** (0.0389)	-0.181 (0.245)	0.398*** (0.0442)	0.283 (0.372)	0.108** (0.0472)	0.00832 (0.0422)	0.429*** (0.0904)
Marital status married and together/partne	-0.108 (0.0917)	1.956** (0.972)	- (0.151)	-1.188 (0.734)	0.0787 (0.0741)	0.559*** (0.0545)	- (0.143)
	0.304***	11.80**	0.539***	2.536	0.0543	0.928***	-

separated/divor	(0.0962)	(4.895)	(0.0736)	(2.926)	(0.108)	(0.0644)	(0.166)
	0.168***	-	1.112***	-0.0456	-0.0311	0.321***	-
Never married	(0.0537)	(0.313)	(0.0523)	(0.623)	(0.0698)	(0.0659)	(0.110)
	-	-0.0339	0.0462**	-0.0367	-	-	-
Education	(0.00391	(0.0368)	(0.00463	(0.0364)	(0.00683	(0.00572)	(0.0139)
	0.231**	-20.05	1.180***		1.035**	-0.0404	-
parkinson	(0.106)	(2,008)	(0.0946)		(0.120)	(0.450)	(1.125)
			-			4.252***	
Constant			(0.804)			(0.713)	
	3,350	213	1,852	156	1,749	2,590	984

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