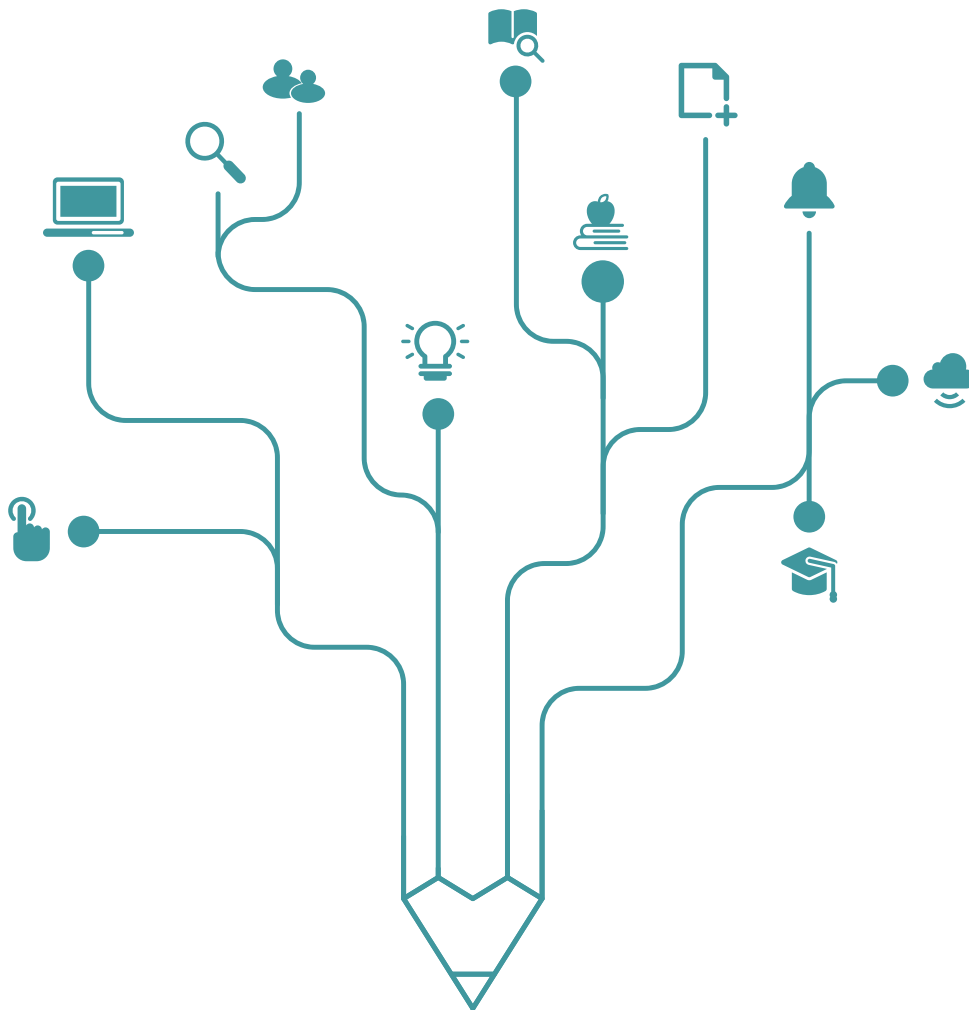# The Determinants of Unmet Needs
for Personal Assistance of the Disabled in South Korea

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Abstract: This paper examines determinants of unmet needs for personal assistance among the disabled in South Korea. Using National Survey of Disabled Persons of year 2011, 2014, and 2017, we estimate linear probability models and ordered logit models and find that older, female disabled with worse health status, longer disability years, and living alone are more likely to have absolute unmet needs. We divide the sample by sex and age. Our findings show that determinants of unmet needs for older adults (persons aged 65 or above) are not greatly different from those for younger adults (aged 18-64), but marital status for males and household income for females seem to be a key determinant of unmet needs. We also find that reliance on informal care (family members) is greater for married males, larger household size, worse health status, home owners among the elderly, for more severe disability, mentally disabled, home owners among the female group.

Introduction

In 2019, 2.62 million people (5.1% of the total population) were registered with the government as disabled in South Korea. Compared to those that are not, the disabled have lower levels of employment as well as income (Park 2020). Also, the disabled are reported to have less access to health care, lower health outcomes, and more unmet needs of health care (Sakellariou and Rotarou, 2017).

The purpose of this study is to identify the determinants of unmet need for personal assistance of the disabled in South Korea, using a multi-year nationally representative survey. The "unmet need for personal assistance" is defined as the difference between personal assistance deemed necessary by an individual and the actual assistance received. According to the National Survey of Disabled Persons, 20% or higher of the disabled experience unmet need for personal assistance. Given that about 60% of government budget for the disabled is directed to personal assistance services, identifying key determinants of unmet need for personal assistance is not only important for the individual welfare of the disabled but also effective for government budget allocation.

Because unmet care can reflect the structural inequalities of a society, we especially focus on females and the elderly disabled in our analysis. Literature has found high percentages of women in informal care-giving roles (see for instance Jang et. al. 2012) – of the disabled, so we wonder whether women are different in terms of their unmet needs for personal assistance and the determinants. While 48% of the disabled are 65 and older, and of the total population, 15% are 65 and older – the elderly have distinctive care needs due to their age. Do the elderly have different factors that influence their unmet needs?

While there is substantive literature on unmet needs for health care in South Korea (Park and Choi 2018; Shin 2013; Jeon and Kwon 2015; Kim et al. 2019), there is almost no work regarding the unmet needs for personal assistance. Beyond South Korea, the existing literature on the determinants of unmet needs of personal assistance focuses on specific Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs) of older disabled adults. For instance, studying a community-based sample of disabled elderly people in China, Chen et al. (2018) find that the closer the beneficiary's relationship is with the caregiver and lower the caregivers' income, the disabled had less unmet needs.

Kennedy (2001) finds that disabled Americans with ADL assistance deficits are more likely to live alone, to be in poor health, to be of a racial or ethnic minority, and to need help with multiple activities. Allen and Mor (1997) find that inability to meet expenses, having few or no reliable helpers, and greater impairment severity are key determinants of unmet need of the disabled in Massachusetts. Respondents with lower income as well as those who live alone, and who had difficulty performing an increasing number of ADLs were at increased risk of having an unmet need (Desai et al. 2001).

Given that in South Korea half of the disabled population is approaching 65 and older, and there has been no work regarding the topic, we believe our work has contributions. The survey data that we use has a direct question on one's perception of unmet needs for personal assistance, which can be considered more comprehensive than questions simply asking for unmet needs for a handful of specific ADLs or IADLs.

The rest of the paper is arranged as follows. Next section describes the data and research design. Results of the analyses follow with discussion.

DATA and RESEARCH DESIGN

DATA

The National Survey of Disabled Persons is a repeated cross-section survey downloadable from the Health and Welfare Data Portal (Korea Institute for Health and Social Affairs, https://data.kihasa.re.kr/microdata/apply/list). Years 2000, 2005, 2008, 2011, 2014, and 2017 provide disability related variables, such as registered disability status, disability level, disability type, disability body parts, daily life assistance variables, employment and work life, marriage, life satisfaction, welfare services, economic conditions, housing, and education variables.

 We use data from 2011, 2014, and 2017 Because years 2000 and 2005 do not include specific health related variables and year 2008 has a slightly different answer scale from those of 2011 and onwards.

Research Design

To estimate the determinants of unmet need for personal assistance, we use a linear probability model where the occurrence of unmet need is either 0 or 1. We study the determinants for disability grades 1 to 6. We also divide the sample by age group (19-64 and 65+) and sex.

$$Y_i = \beta_0 + \beta_1 X_i + Region + Year + u_i \quad (1)$$

X_i is the set of controls for individual i, Region is the regional dummy, Year is the year dummy, and u_i is the error term. The dependent variable is an indicator for the unmet need for personal assistance, which is measured using the three following questions in the section 3 of the survey – Personal Assistance of Daily Lives:

Q1: "Do you need help in your daily life?"
    1) I can do everything in my daily life by myself
    2) Most of the things in my daily life I can do by myself
    3) I need some help from others
    4) I need help from others mostly
    5) I need help from others almost always

Q2: "Do you have anyone that helps you with your daily life"
    1) Yes
    2) No

Q3: "How much help are you currently receiving?"
1)   Very sufficient 2) sufficient 3) insufficient 4) very insufficient

When respondents answer that they can do everything in their daily life by themselves (Q1=1), they do not have a need for personal assistance. Respondents that answer that they need some help in their daily lives (Q1=2, 3, 4, 5), we decided that they have a need for personal assistance. Of those who have a need for personal assistance (Q1=2, 3, 4, 5), those who answer that they have persons helping them with their daily lives and they find the assistance sufficient (Q3= 1, 2), we consider them not to have an unmet need for personal assistance. On the other hand, those who have a need for personal assistance (Q1=2, 3, 4, 5) but answer that they do not have anyone that helps them (Q2=2), we consider them

to have absolute unmet needs (UC1). Those who have a need for personal assistance (Q1=2, 3, 4, 5) ,answer that they have someone that helps (Q2=1), but find the assistance insufficient (Q3=3, 4), we consider them to have some unmet needs (UC2). The dependent variable of our interests would be absolute unmet needs (UC1) and overall unmet needs (UC1+UC2).

While literature has used unmet in Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs) in measuring the extent of unmet needs in personal assistance, we use the overall unmet needs question above because the activities that survey asks of regarding the ADLs and the IADLs are limited (12 activities for ADLs, 9 activities for IADLs) and we find the a direct question can be a more comprehensive indicator: individual's daily living consists of activities beyond the basic ADLs and IADLs and they vary.

Explanatory variables include age, sex (female =1), marital status (married=1), education status (high school graduate or higher =1), economically active (worked for the last week =1), income level (log of monthly average household income), home ownership (homeowner=1), household type (living alone =1), household size (# including oneself), subjective health status (okay, good, very good =1), existence of any chronic condition that has been lasting for more than 3 months (CD=1 if chronic condition Yes), Need for ADL assistance (there is need for ② partial support, ③substantial support, or ④ total support for at least one ADL question), Need for IADL assistance (there is need for ② partial support, ③substantial support, or ④ total support for at least one IADL), disability type (physical, mental, internal), disability grade (1 to 6, dummies for grades 1-2 or 1-3), and duration of disability (subtract the disability occurrence year from current year), regional dummy.

<insert table 1 about here>
<insert table 2 about here>

Results

In Table 3, column 1 to 3 show results from the linear probability model (1) exploring the determinants of the absolute, some, and overall unmet needs for

personal assistance.

<insert table 3 about here>

The probability that one would experience absolute unmet needs (UC1) is lower for non-severe disabilities, higher the income, and bigger the household size. The probability is higher for those who are older, female, have better health status, have physical or organ disabilities than mental, are employed, , with longer years of disability and living alone.

However, the determinants of those with some unmet needs (UC2) are different. For instance, the probability that one would experience some unmet needs (UC2) is lower for those with severe disabilities, who are older, have better subjective health, have organ disabilities than mental, are employed, with longer years of disability, and living alone. But if one is unmet in at least one ADL component and female, one is more likely to experience some unmet needs.

The take-away message here is that while the severely disabled and those live in larger households are likely to have a care-giver, the level of care is insufficient. When you are older, with better subjective health, with physical or organ disabilities, longer duration of disability, employed, and living alone, you are less likely to have a care-giver, but also less likely to claim that the care you receive is not enough. What stands out in this regression is the determinants for unmet needs for females. Females are not only more likely to claim not having care that they need, even when they receive care, they are not enough. Compared to those that are minor, the elderly (age 65+) are more likely to not have care-givers, but less likely to have insufficient care when they do have care-givers.

The next exercise shown in table 4 explores the determinants of the intensity of unmet needs for personal assistance taking UC1 and UC2 as relative intensity of unmet care – UC1 as severe and UC2 as less-severe – using OLS and ordered logit. If there is no unmet needs, the dependent variable is 0,if unmet needs is less severe, it is 1, and if the unmet needs is severe, then it is 2 for the ordered logit model.

<insert table 4 about here>

The coefficients for the ordered logit models are the proportional odd ratios. For instance, the odds that females would be in the severe category versus less-severe and no-unmet needs is 1.33 times higher than for males given the other variables are held constant. Also, the odds that females would be in the severe or less-severe unmet needs category versus no-unmet needs is 1.33 times higher than for males. We see that severity of unmet care for personal assistance increases for those that are female, with internal organ disabilities, with longer disability durations, have at least one ADL and IADL and live alone.

The above analysis assumes that absolute unmet needs (UC1) is more severe than some unmet needs (UC2), but this may not be true. For instance, if A needs 10 hours of care and there exists a care-giver and is supplied of 4 hours of care (equivalent to 6 hours of unmet care), and B needs 5 hours of care but with no caregiver equivalent to 5 hours of unmet care), our assumption considers B to have more severe unmet care than A. But if the extent of unmet care is important than nonexistence of caregiver, A should be considered to have more severe unmet care than B.

So the next exercise (presented in table 4 column 3) restricts the sample to those who have care-givers and take the severity of unmet needs using the answers of Q3 and perform the OLS and the ordered logit analysis. Qualitatively, the results are consistent with column 2. What is different is the role of the severity of disability and whether one has internal organ disability. For those that have some care, those with severe disability are more likely to experience unmet needs, and those with internal organ disability are less likely to experience unmet needs.

Next, Table 5 divides the sample into older adults (persons aged 65 or above) and younger adults (persons aged 18-64). We see that while physical disability does not influence the elderly to claim that they are absolutely unmet in personal assistance (with no care-giver), for the younger, it increases the probability. Moreover, with higher household income, the unmet needs decreases for the elderly, for the younger it does not have a statistically significant impact. Being a homeowner does not influence the elderly to claim unmet needs, but for the younger, it decreases the probability.

<insert table 5 about here>

In the above analyses, regardless of age, females consistently report greater unmet needs of personal assistance. Table 6 show how the determinants of unmet needs differ by sex. Interestingly, for males, while the elderly are more likely than those that are younger to report that they do not have a care-giver when they need one, we do not find any statistically significant relationship for females. Being married lowers absolute unmet needs for males, while it raises it for females. Household income does not influence unmet needs for males but it decreases it for females.

<insert table 6 about here>

Discussion

While for the elderly, their unmet needs do not differ, to a great extent, from those of the younger adults, females have it worse than males. The reason why females have greater unmet needs for personal assistance is probably because of the care dynamics in the households – around the world, it is the females that provide care in the household (Jang et al., 2013; Sharma et al. 2016).

First, let us establish that females receive less family care than males even when they are disabled. Table 7 shows answers for reasons why the respondents think they have unmet needs (this questionnaire was only available in the 2017 data). 64.5% of the respondents answered that it was because there were limitations of how much family could help, and 17% answered that they lacked hours supported by the Personal Assistance Service program.

<insert table 7 about here>

Then who relies more on informal care provided by the family? Table 8 shows a linear probability model of the determinants of family care dependency. We see that those with severe disability, that are married males, married elderly, homeowners, with greater household size are more likely to rely on family care.

<insert table 8 about here>

The 2011 and 2014 surveys ask questions about whether the disabled are willing to use "outside" care-givers. One can take this as a measure of demand for external care (vis-a-vis family care) or a measure of opportunity costs for family care. We have coded answers for this question as 0 for no need for care, 1, no need for outside care, 2, will use if free, and 3, will use even if it is not free. According to our linear probability model of which the results are summarized in table 9, we find that those with severe disabilities, females, higher household income leads to have them demand more external care, and married men and those with better subjective health demand it less.

<insert table 9 about here>

Why do the females with disability receive less care? We argue that this is because females are in general care-givers within a household, and even if you are disabled you cannot break away from that role. More time care-giving would also mean less time to attend to oneself.

We have extensive evidence in the literature that all over the world it is the females that provide care in the households be it the person in need of care is healthy or ailing, and young or old (Allen 1994; Sharma et al. 2013; Stanfors et al. 2019; Kan et al. 2011).

There could be several reasons why women take up the role as care-givers. The first is the opportunity cost argument. Care-giving by family member has opportunity costs. Greater the opportunity cost, greater demand for outside help. The opportunity cost framework can give insight to the difference between male and females in unmet needs in general and demand for external care. Because of the gender pay gap, if we compare a disabled married male and a disabled married female, the opportunity cost of care of a disabled married male (by his female spouse) would be lower than the opportunity cost of care of a disabled married female by his male spouse. Naturally the disabled married male would have less demand for external care.

The second line of reasoning is that driven by gender norms (Swinkels et al. 2019), females feel more responsible to take up the care-giving role than males (Hong and Coogle 2016; Glauber 2017) and men are less socialized into the care-giving role than women (Allen et al. 1999; Miller 1990)

In case of the disabled that requires actual care, anotherreason why females have greater unmet needs for personal assistance and relies less on other household members could be because females may be less expressive of their needs or that other household members have less concern for their expression of need for care.

It could also be that because most of the professional care-givers are females (Lim and Lee 2016), the disabled that are males and older are not preferred by the professional care-takers (Kim and Song 2019), and household members have to chip in. Taken care by household members, the elderly males would claim less needs for personal assistance than their female counterparts that are taken care for by the professionals since the personal assistants may not be attending to the detailed needs as we have seen in Table 7.

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Table 1. summary statistics for the variables

Variables	Mean	SD	MAX	MIN
UC1 (absolute unmet needs)	0.08	0.27	0	1
UC2 (some unmet needs)	0.16	0.36	0	1
UC_TOTAL(UC1+UC2) Overall unmet needs	0.24	0.42	0	1
Sex (female=1)	0.44	0.5	0	1
Age	59.9	17.6	0	106
Marital status (Married=1)	0.57	0.5	0	1
Educational status (high school and above=1)	0.39	0.49	0	1
In employment (yes=1)	0.36	0.48	0	1
Monthly Income (10,000KRW)	220.1	232.2	0	9998
Household type (living alone=1)	0.18	0.39	0	1
ADL (need at least one of 12 ADLs=1)	0.31	0.46	0	1
IADL (need at least one of 8 ADLs=1)	0.48	0.5	0	1
Subjective health status (ok, good, very good=1)	0.44	0.5	0	1
Chronic disease of more than 3 months (CD=1)	0.76	0.43	0	1
Type of disability:			0	1
physical	0.84	0.37		
mental	0.1	0.3		
internal organs	0.06	0.24		
Disability duration (years)	8.65	6.18	0	29
Disability grade:			0	1
1	0.07	0.25		
2	0.13	0.34		
3	0.17	0.38		
4,5,6	0.6	0.49		
Household size (persons)	2.64	1.33	1	10
Home ownership (owner=1)	0.63	0.48	0	1

Table 2. comparison between those with unmet needs and no unmet needs

Variables	UC_TOTAL(UC1+UC2), or those with overall unmet needs		Those without unmet needs	
	(N=4,580)		(N=14,788)	
	Mean	SD	Mean	SD
Sex (female=1)	0.54	0.5	0.4	0.49
Age	61.2	20.2	59.5	16.7
Marital status (Married=1)	0.41	0.49	0.62	0.49
Educational status (high school and above=1)	0.31	0.46	0.41	0.49
In employment (yes=1)	0.16	0.37	0.42	0.49
Monthly Income (10,000KRW)	185	200	230.9	240.3
Household type (living alone=1)	0.27	0.44	0.16	0.36
ADL (need at least one of 12 ADLs=1)	0.66	0.47	0.2	0.4
IADL (need at least one of 8 ADLs=1)	0.9	0.3	0.35	0.48
Subjective health status (ok, good, very good=1)	0.3	0.46	0.48	0.5
Chronic disease of more than 3 months (CD=1)	0.82	0.39	0.74	0.44
Type of disability:				
physical	0.78	0.41	0.85	0.36
mental	0.16	0.37	0.09	0.3
internal organs	0.05	0.23	0.06	0.24
Disability duration (years)	8.5	6.66	8.69	6.03
Disability grade:				
1	0.15	0.36	0.04	0.2
2	0.21	0.4	0.11	0.31
3	0.2	0.4	0.16	0.34
4,5,6	0.39	0.49	0.66	0.47
Household size (persons)	2.49	1.38	2.69	1.32
Home ownership (owner=1)	0.58	0.49	0.65	0.48

Table 3. determinants of unmet needs for personal assistance (linear probability model)

	UC1	UC2	UC_total
disability grade = 1, 2, 3	-0.050***	0.074***	0.024***
	(0.005)	(0.006)	(0.007)
age 18 - 64	0.031***	-0.031	0
	(0.007)	(0.021)	(0.022)
age65+	0.021***	-0.046**	-0.025
	(0.007)	(0.021)	(0.022)
female	0.027***	0.011**	0.038***
	(0.004)	(0.005)	(0.006)
married	0.004	-0.020***	-0.016**
	(0.005)	(0.007)	(0.007)
edu_highover	0.008*	0.001	0.009
	(0.004)	(0.005)	(0.006)
health_good	0.013***	-0.052***	-0.039***
	(0.004)	(0.005)	(0.006)
Chronic disease	0.002	-0.005	-0.004
	(0.005)	(0.006)	(0.006)
physical disability	0.043***	-0.024*	0.02
	(0.007)	(0.012)	(0.013)
internal disability (organ)	0.087***	-0.076***	0.011
	(0.010)	(0.014)	(0.016)
disability years	0.002***	-0.002***	0
	(0.000)	(0.000)	(0.000)
ADL_needhelp	0.007	0.194***	0.201***
	(0.007)	(0.008)	(0.009)
IADL_needhelp	0.118***	0.158***	0.276***
	(0.007)	(0.006)	(0.008)
household income (ln)	-0.012***	-0.001	-0.013***
	(0.003)	(0.004)	(0.004)
employment	0.022***	-0.031***	-0.009
	(0.005)	(0.005)	(0.006)
home owner	-0.007*	0	-0.007
	(0.004)	(0.005)	(0.006)
live alone	0.131***	-0.020**	0.111***
	(0.009)	(0.009)	(0.011)
household size	-0.006***	0.002	-0.004
	(0.002)	(0.002)	(0.003)
Constant	-0.013	0.122***	0.109***
	(0.017)	(0.029)	(0.031)
Observations	19,368	19,368	19,368
Adjusted R2	0.102	0.26	0.283
F test	33.33	138.89	206.49
Prob > F	0	0	0
year FE	YES	YES	YES
region FE	YES	YES	YES

Table 4. severity of unmet needs analysis

	unmet needs severity (OLS)	unmet needs severity 1 (ordered logit)	unmet needs severity 2 (ordered logit)
disability grade = 1, 2, 3	-0.026**	1.01	1.56***
	(0.011)	(0.047)	(0.085)
age 18 - 64	0.031	0.95	0.9
	(0.024)	(0.094)	(0.096)
age65+	-0.003	0.80**	0.73***
	(0.025)	(0.083)	(0.083)
female	0.065***	1.33***	1.22***
	(0.009)	(0.055)	(0.059)
married	-0.012	0.85***	0.78***
	(0.011)	(0.044)	(0.046)
edu_highover	0.016*	1.05	0.98
	(0.009)	(0.049)	(0.053)
health_good	-0.026***	0.79***	0.53***
	(0.009)	(0.037)	(0.030)
Chronic disease	-0.002	1	0.97
	(0.010)	(0.057)	(0.065)
physical disability	0.063***	1.12*	1
	(0.017)	(0.074)	(0.073)
internal disability (organ)	0.098***	1.28**	0.71***
	(0.023)	(0.132)	(0.085)
disability years	0.002***	1.01*	0.99***
	(0.001)	(0.003)	(0.004)
ADL_needhelp	0.209***	2.11***	2.07***
	(0.015)	(0.097)	(0.106)
IADL_needhelp	0.394***	11.38***	1.95***
	(0.014)	(0.713)	(0.230)
household income (ln)	-0.024***	0.90***	0.87***
	(0.006)	(0.027)	(0.032)
employment	0.012	0.96	0.73***
	(0.010)	(0.052)	(0.050)
home owner	-0.014	0.96	1.04
	(0.009)	(0.040)	(0.052)
live alone	0.242***	2.61***	1.51***
	(0.017)	(0.193)	(0.142)
household size	-0.009***	0.96**	1
	(0.004)	(0.020)	(0.023)
Observations	19,368	19,368	7,860
Log Likelihood		-10642.7	-7783.7
LR chi2	156.09 (F-test)	5766.49	1014.85
Prob > chi2	0 (prob>F)	0	0
adjr2	0.22	0.21	0.06
Year FE	YES	YES	YES
Region FE	YES	YES	YES

Table 5. unmet needs for personal assistance (elderly vs. younger)

By Age	65+			18-64		
	UC1	UC2	UC_total	UC1	UC2	UC_total
disability grade = 1, 2, 3	-0.063***	0.090***	0.026**	-0.038***	0.052***	0.014
	(0.008)	(0.010)	(0.011)	(0.008)	(0.008)	(0.009)
female	0.029***	0.008	0.037***	0.024***	0.009	0.033***
	(0.007)	(0.008)	(0.010)	(0.005)	(0.007)	(0.007)
married	-0.001	-0.025**	-0.026*	0.004	-0.020**	-0.016*
	(0.009)	(0.012)	(0.014)	(0.006)	(0.008)	(0.009)
edu_highover	0.013*	0.001	0.014	0.003	-0.002	0.001
	(0.008)	(0.010)	(0.011)	(0.005)	(0.006)	(0.007)
health_good	0.021***	-0.054***	-0.033***	0.006	-0.045***	-0.040***
	(0.007)	(0.007)	(0.009)	(0.005)	(0.006)	(0.008)
Chronic disease	0.001	-0.015	-0.014	0.004	-0.006	-0.002
	(0.011)	(0.011)	(0.014)	(0.005)	(0.006)	(0.007)
physical disability	0.031	-0.062	-0.031	0.064***	-0.025*	0.038**
	(0.020)	(0.043)	(0.045)	(0.009)	(0.014)	(0.015)
internal disability (organ)	0.106***	-0.131***	-0.025	0.088***	-0.065***	0.023
	(0.025)	(0.046)	(0.048)	(0.012)	(0.016)	(0.018)
disability years	0.002***	-0.001*	0.001	0.002***	-0.002***	0
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
ADL_needhelp	0.003	0.202***	0.204***	0.017	0.186***	0.203***
	(0.011)	(0.010)	(0.013)	(0.011)	(0.012)	(0.015)
IADL_needhelp	0.111***	0.153***	0.264***	0.128***	0.168***	0.296***
	(0.010)	(0.007)	(0.011)	(0.010)	(0.009)	(0.012)
household income (ln)	-0.018***	-0.002	-0.019***	-0.005	0.003	-0.002
	(0.005)	(0.006)	(0.007)	(0.004)	(0.005)	(0.005)
employment	0.024***	-0.027***	-0.003	0.020***	-0.038***	-0.018**
	(0.008)	(0.007)	(0.009)	(0.006)	(0.006)	(0.008)
home owner	0	0.007	0.006	-0.017***	-0.007	-0.024***
	(0.007)	(0.008)	(0.010)	(0.005)	(0.006)	(0.007)
live alone	0.144***	-0.019	0.125***	0.100***	-0.028**	0.072***
	(0.013)	(0.015)	(0.017)	(0.012)	(0.011)	(0.014)
household size	-0.007***	0.001	-0.006	-0.005**	0.001	-0.004
	(0.003)	(0.004)	(0.005)	-0.032	0.096***	0.064**
Constant	0.054	0.117**	0.171***	(0.021)	(0.028)	(0.031)
	(0.033)	(0.055)	(0.060)		(0.029)	
Observations	8,948	8,948	8,948	9,830	9,830	9,830
Adjusted R2	0.107	0.233	0.258	0.091	0.28	0.31
F test	20.31	71.82	108.54	14.17	61.36	94.09
Prob > F	0	0	0	0	0	0
year FE	YES	YES	YES	YES	YES	YES
region FE	YES	YES	YES	YES	YES	YES

Table 6. unmet needs for personal assistance (female vs. male)

By Sex	Females			Males		
	UC1	UC2	UC_total	UC1	UC2	UC_total
disability grade = 1, 2, 3	-0.071***	0.085***	0.015	-0.031***	0.067***	0.035***
	(0.009)	(0.011)	(0.012)	(0.007)	(0.008)	(0.009)
age 18 - 64	0.024**	-0.04	-0.016	0.043***	-0.031	0.011
	(0.012)	(0.034)	(0.034)	(0.008)	(0.027)	(0.028)
age65+	0.006	-0.05	-0.044	0.041***	-0.045	-0.004
	(0.012)	(0.034)	(0.035)	(0.009)	(0.028)	(0.029)
married	0.013*	-0.016*	-0.003	-0.012*	-0.021**	-0.033***
	(0.007)	(0.010)	(0.011)	(0.007)	(0.009)	(0.010)
edu_highover	0.016*	0.014	0.030***	0.001	-0.005	-0.004
	(0.008)	(0.010)	(0.011)	(0.005)	(0.006)	(0.007)
health_good	0.001	-0.066***	-0.065***	0.021***	-0.043***	-0.022***
	(0.007)	(0.008)	(0.009)	(0.005)	(0.006)	(0.007)
Chronic disease	0.001	-0.004	-0.004	0.005	-0.004	0.001
	(0.009)	(0.011)	(0.012)	(0.005)	(0.006)	(0.008)
physical disability	0.042***	-0.035*	0.007	0.051***	-0.016	0.034**
	(0.011)	(0.019)	(0.020)	(0.008)	(0.016)	(0.017)
internal disability (organ)	0.078***	-0.096***	-0.018	0.097***	-0.064***	0.033
	(0.016)	(0.022)	(0.025)	(0.013)	(0.018)	(0.021)
disability years	0.003***	-0.002**	0.001	0.001***	-0.002***	-0.001
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
ADL_needhelp	-0.016	0.194***	0.179***	0.024**	0.192***	0.216***
	(0.012)	(0.012)	(0.014)	(0.009)	(0.011)	(0.013)
IADL_needhelp	0.157***	0.179***	0.336***	0.087***	0.142***	0.229***
	(0.011)	(0.009)	(0.012)	(0.009)	(0.007)	(0.010)
household income (ln)	-0.022***	0.003	-0.020***	-0.003	-0.005	-0.008
	(0.005)	(0.006)	(0.007)	(0.003)	(0.005)	(0.005)
employment	0.020**	-0.032***	-0.012	0.020***	-0.032***	-0.011
	(0.008)	(0.007)	(0.009)	(0.006)	(0.006)	(0.008)
home owner	-0.011	0.009	-0.002	-0.005	-0.004	-0.009
	(0.007)	(0.008)	(0.009)	(0.005)	(0.007)	(0.007)
live alone	0.142***	-0.036***	0.106***	0.103***	0.003	0.106***
	(0.012)	(0.013)	(0.015)	(0.012)	(0.013)	(0.015)
household size	-0.006**	-0.002	-0.008*	-0.005**	0.004	0
	(0.003)	(0.004)	(0.005)	(0.002)	(0.003)	(0.003)
Constant	0.054	0.117**	0.171***	-0.032	0.096***	0.064**
	(0.033)	(0.055)	(0.060)	(0.021)	(0.028)	(0.031)
Observations	8,492	8,492	8,492	10,876	10,876	10,876
Adjusted R2	0.124	0.253	0.287	0.069	0.263	0.268
F test	22.57	74.09	114.49	12.64	68.92	93.96
Prob > F	0	0	0	0	0	0
year FE	YES	YES	YES	YES	YES	YES
region FE	YES	YES	YES	YES	YES	YES

Table 7. Why is there unmet needs for personal assistance?

reason for unmet needs	frequency	%	cumulative %
severity of disability	89	8.90	8.90
limitations of family help	645	64.50	73.40
insufficient PAS hours	170	17.00	90.40
personal assistants not able to provide needed help	30	3.00	93.40
emergency	18	1.80	95.20
for external activities (independent living)	46	4.60	99.80
others ( )	2	0.20	100.00
total	1,000	100.00	100.00

Table 8. Determinants of family reliance on care (linear probability model)

family care =1	TOTAL	by age		by sex	
		65+	18-64	female	male
disability grade = 1, 2, 3	0.027***	0.005	0.040***	0.029***	0.017**
	(0.007)	(0.011)	(0.009)	(0.011)	(0.008)
age 18 - 64	-0.126***			-0.144***	-0.112***
	(0.014)			(0.023)	(0.018)
age65+	-0.105***			-0.128***	-0.086***
	(0.015)			(0.023)	(0.019)
female	-0.035***	-0.048***	-0.015**		
	(0.005)	(0.009)	(0.007)		
married	0.015**	0.032**	0.005	-0.004	0.030***
	(0.007)	(0.013)	(0.008)	(0.010)	(0.009)
edu_highover	-0.018***	-0.030***	-0.011	-0.033***	-0.01
	(0.006)	(0.010)	(0.007)	(0.010)	(0.007)
health_good	-0.008	-0.016**	-0.004	-0.004	-0.009
	(0.005)	(0.008)	(0.007)	(0.008)	(0.007)
Chronic disease	-0.002	0.02	-0.013*	-0.004	-0.006
	(0.006)	(0.013)	(0.007)	(0.011)	(0.007)
physical disability	-0.133***	0.003	-0.135***	-0.139***	-0.130***
	(0.011)	(0.041)	(0.013)	(0.017)	(0.014)
internal disability (organ)	-0.105***	0.048	-0.115***	-0.123***	-0.091***
	(0.014)	(0.044)	(0.016)	(0.021)	(0.017)
disability years	-0.001*	-0.001	0	-0.001	0
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
ADL_needhelp	0.082***	0.068***	0.102***	0.048***	0.123***
	(0.009)	(0.012)	(0.013)	(0.013)	(0.011)
IADL_needhelp	0.546***	0.540***	0.543***	0.497***	0.586***
	(0.008)	(0.010)	(0.012)	(0.011)	(0.010)
household income (ln)	0	-0.006	0.005	0.001	-0.002
	(0.004)	(0.007)	(0.005)	(0.007)	(0.005)
employment	-0.023***	-0.025***	-0.019***	-0.024***	-0.011
	(0.005)	(0.009)	(0.007)	(0.009)	(0.007)
home owner	0.022***	0.022**	0.023***	0.031***	0.012*
	(0.005)	(0.009)	(0.007)	(0.009)	(0.007)
live alone	-0.212***	-0.226***	-0.161***	-0.217***	-0.193***
	(0.010)	(0.016)	(0.013)	(0.014)	(0.014)
household size	0.006**	0.016***	0.004	0.016***	-0.001
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)
Constant	0.321***	0.098*	0.148***	0.331***	0.290***
	(0.026)	(0.056)	(0.029)	(0.043)	(0.032)
Observations	19,368	8,948	9,830	8,492	10,876
Adjusted R2	0.522	0.456	0.554	0.452	0.586
F test	701.24	280.57	309.66	258.97	500.35
Prob > F	0	0	0	0	0
year FE	YES	YES	YES	YES	YES
region FE	YES	YES	YES	YES	YES

Table 9. Determinants of demand for external care (linear probability model)

need external care=0, 1, 2, 3	TOTAL	by age		by sex	
		65+	18-64	female	male
disability grade = 1, 2, 3	0.160***	0.180***	0.138***	0.180***	0.151***
	(0.014)	(0.022)	(0.017)	(0.022)	(0.017)
age 18 - 64	-0.085**			-0.039	-0.121**
	(0.038)			(0.060)	(0.048)
age65+	-0.039			0.018	-0.075
	(0.038)			(0.060)	(0.050)
female	0.044***	0.044**	0.035***		
	(0.011)	(0.019)	(0.013)		
married	-0.028**	-0.032	-0.024	-0.001	-0.047***
	(0.013)	(0.024)	(0.016)	(0.020)	(0.018)
edu_highover	0.001	0.007	0	0.024	-0.01
	(0.011)	(0.022)	(0.013)	(0.021)	(0.013)
health_good	-0.078***	-0.112***	-0.051***	-0.101***	-0.066***
	(0.011)	(0.018)	(0.013)	(0.018)	(0.013)
Chronic disease	0.007	0.017	0.012	0.008	0.011
	(0.011)	(0.024)	(0.013)	(0.021)	(0.013)
physical disability	-0.053**	0.016	-0.076***	-0.05	-0.056*
	(0.023)	(0.079)	(0.026)	(0.035)	(0.031)
internal disability (organ)	-0.090***	-0.024	-0.120***	-0.109**	-0.081**
	(0.029)	(0.086)	(0.032)	(0.045)	(0.038)
disability years	-0.002*	-0.004**	0	-0.002	-0.002*
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
ADL_needhelp	0.592***	0.612***	0.560***	0.587***	0.591***
	(0.018)	(0.025)	(0.026)	(0.026)	(0.024)
IADL_needhelp	1.028***	1.061***	0.998***	1.091***	0.978***
	(0.015)	(0.021)	(0.021)	(0.023)	(0.019)
household income (ln)	0.032***	0.042***	0.024***	0.041***	0.022**
	(0.008)	(0.014)	(0.009)	(0.013)	(0.009)
employment	-0.095***	-0.117***	-0.101***	-0.132***	-0.076***
	(0.011)	(0.019)	(0.014)	(0.018)	(0.014)
home owner	-0.020*	-0.01	-0.030**	-0.014	-0.022
	(0.011)	(0.018)	(0.013)	(0.017)	(0.013)
live alone	0.038*	0.073**	-0.023	0.043	0.035
	(0.020)	(0.032)	(0.025)	(0.029)	(0.027)
household size	-0.009*	-0.014*	-0.008	-0.015*	-0.005
	(0.005)	(0.008)	(0.006)	(0.008)	(0.006)
Constant	0.321***	0.098*	0.148***	0.331***	0.290***
	(0.026)	(0.056)	(0.029)	(0.043)	(0.032)
Observations	12,817	5,624	6,769	5,609	7,208
Adjusted R2	0.673	0.642	0.685	0.652	0.687
F test	795.4	384.69	369.26	379.4	431.34
Prob > F	0	0	0	0	0
year FE	YES	YES	YES	YES	YES
region FE	YES	YES	YES	YES	YES