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The Role of Spousal Characteristics on the Use of Formal Long-Term Care of Elderly Couples in the United States

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Abstract of the Dissertation

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In the United States, the last decades have witnessed a steady increase in the percent of formal long-term care (nursing home care and paid home health care) uses. Specifically, it is shown that the percent of elderly couples, who use formal long-term care is much lower than that of single-living elderly to use formal long-term care. However, it has not been fully understood what factors determine the use of formal long-term care for elderly couples.

Different from the previous studies, I scrutinize not only own individual factors but also spousal characteristics in terms of spouses health conditions, which may determine the use of formal long-term care of elderly couples. Detailed health conditions of spouse are considered; spouse's health dynamics and diagnosed illness by doctors. In addition, I carefully consider two different cases, according to the identity of the principal decision-maker regarding uses of formal long-term care: (i) An individual who needs long-term care decides formal long-term care uses himself/herself, and (ii) the spouse of the individual decides the individual's formal long-term care utilizations.

Models are estimated using multinomial logit specification using data from the Health and Retirement Study. Results suggest that the age, education level, the individual's health conditions and Activities of Daily Living ("ADL") changes are key factors that strongly affect the decision for utilization of formal long-term care for the elderly couples. When the individual

has more disabilities in daily living, or has illnesses such as cancer, diabetes, stroke, psychological problem, or memory problem, he/she is more likely to use formal long-term care. I have also found that the spouse's health conditions, such as Instrumental Activities of Daily Living ("IADL"), ADL, diabetes, cancer or psychological problems affect the formal long-term care of the individual.

This study shows that the spouse has an important effect on the individual's decision making, regardless of who is ultimately in charge of that decision. However, when the group is classified according to 'decision maker', the role of the spouse in the decisions regarding the individual's utilization of formal long-term care is more clearly understood.

To my lovely parents

Table of Contents

Contents

List of Tables

List of Tables

List of Figures

List of Figures

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Chapter 1

1 The Role of Spouse′s Health Conditions on the Decision of Nursing Home Entry of Elderly Couples in the United States

1.1 Introduction

Between 1980 and 2009, the elderly populations in the United States increased by 42%. Demographers predict that this population, defined as those individuals aged 65 years and above, will reach 71 million, or 20% of the total population, by 2030 (Byrne, Goeree, Hiedemann, and Stern, 2009).

Population aging is an important issue in the United States, since it is highly correlated with an increase in health expenditures, particularly for nursing home care. Nursing home care is the most expensive form of long-term care — both in terms of total costs ($70 billion in 1993) and per resident costs (about $3,200 per month) for the elderly (Freedman, 1996; Lakdawalla and Philipson, 2002) —, and 60% of these costs are covered by the federal and state governments through Medicaid and Medicare (Lakdawalla, 2003).[1] As the population ages, the number of beneficiaries of Medicare and Medicaid in the United States is expected to rise, hence government's share of payments for nursing home care will increase. It is a big burden to both the government and taxpayers.

Over the decades, the government has looked for the ways to curb the huge costs in nursing home care. One of the ways for the government to reduce the costs is by implementing policies to decrease the risk factors leading to nursing home entry. Researchers are able to identify the factors affecting entry into nursing facility and determine which factors are potentially modifiable. By controlling such determining factors, the government can make policies to reduce the risks that require nursing home entry, eventually leading to a decrease in nursing home care costs. The purpose of this research is to better understand the framework for long-term care, which includes nursing home care.

Previous studies have shown that the probability of nursing home entry increases according to a number of factors: greater age, functional difficulties in daily activities, cognitive impair-

[1] In the United States, nursing homes alone account for more than 10% of medical expenditure (Lakdawalla, 2003).

ment, living alone, and being of the Caucasian race (Fisher et al., 2003; Bharucha, Pandav, Shen, Hiroko H., Dodge, and Ganguli, 2004; Gaugler, Duval, Anderson, and Kane, 2007; Nihtila and Martikainen, 2008; Luppa et al., 2010). Many studies consistently report that the married elderly are less likely to enter nursing home, and show that the marital status of the elderly is one of the highly significant factors in the decision for nursing home use, independent of age and individual health concerns (Miller and Weissert, 2000; Kersting, 2001; Martikainen et al., 2009; Miller, 2010).

[Table 1.1 here]

[Table 1.2 here]

Table 1.1 and Table 1.2 show the probability of nursing home entry for the elderly over 65 years old by marital status. The percent of elderly couples[2] who entered the nursing homes, over 65 years old is much lower than the percent of single-living elderly[3]. Specifically, the percent of the elderly couples who enter the nursing homes was estimated at 3% in 1996 and increased to 6% in 2008. On the other hand, the percent of the single-living elderly entering the nursing homes was estimated at 9% in 1996 and increased to 19% in 2008.

As shown in the data and previous studies, the number of elderly couples who enter nursing homes is much lower than that of single-living elderly. However, few studies investigate why fewer elderly couples enter nursing homes as compared to single-living elderly (Nihtila and Martikainen, 2008). In this paper, I have analyzed the key factors that play a role on elderly couples' decisions to enter nursing homes, particularly examining the role that the spouse's health conditions play on this decision. I have examined the effects of both individual factors and household factors, as well as how important a role that changes in Activities of Daily Living ("ADL") play in determining long-term care.

It has been widely known that living with a spouse affects health related behaviors. The demographic literature indicates that unmarried persons have higher morbidity and mortality rate than married persons' (Wilson and Oswald 2005; I. Kohler, H.Kohler, and Skytthe, 2011). The researchers suggest two major factors: 'selection effect'[4] and 'protection effect'[5](Schone and Weinick, 1998). According to selection and protection effects, marriage has a positive effect

[2]Elderly couples consist of married and partnered elderly people.

[3]The single-living elderly include unmarried, divorced, and widowed elderly people.

[4]Selection effects refer to that healthier individuals are more likely to marry and to stay married (Waldron, Hughes, and Brooks, 1996)

[5]Marriage provide a protective benefit by influencing the social, psychological, and physical environments in which individuals live, thereby positively influencing their health (Schone and Weinick, 1998)

on a spouse's health, thus married people have lower morbidity and mortality. However, there are few papers demonstrating relationship between these effects and nursing home entry. The role of spousal effect on nursing home use has not been thoroughly studied. In this paper, I will examine the spousal effect on nursing home entry of elderly couples, and identify the individual and household factors that affect an elderly couple's decision to enter a nursing home. The remainder of this paper consists of the following sections: Section 2 describes nursing home care in the United States; Section 3 presents a conceptual framework that shows the role of spousal effect on nursing home care; Section 4 discusses the model of elderly couple's decision on nursing home entry; Section 5 describes and analyzes the data used in the estimation; Section 6 explains empirical estimation methods and variables used in the estimation; Section 7 discusses estimation results; and Section 8 summarizes the key results of this study and future directions for this research.

1.2 Nursing Home Care in the United States

Medical care in the United States is divided into short-term care and long-term care. Hospitals and clinics function almost as short-term care facilities, and focus on treatment of patients with acute disease. The people who recover from these acute illness, or who have chronic disabilities in activities of daily living associated with old aging need care over short-term care. The people who need care beyond short-term care take into account long-term care (Lakdawalla, 2003).

Long-term care can be classified by care providers, intensity of care, or length of stay in institutions. The widely accepted classification is: informal long-term care versus formal long-term care. Informal long-term care is home-based care provided by unpaid care-givers who can be family members, relatives or friends. It can be almost always provided by a spouse and/or adult children. Formal long-term care consists of paid home health care and nursing home care. Paid home health care is also community-based care and is different from that of informal long-term care as it is provided by licensed health care professionals. Paid home health care is typically paid on an hourly basis. According to the 2012 MetLife Market Survey of Long-Term Care Costs (MetLife Survey), the average cost of paid home health care in 2012 was $21 per hour.

Nursing home care, another type of formal long-term care, provides health care services within an institutional setting. Depending on patients level of health problems, care is provided

at three different levels, custodial, intermediate and skilled nursing care. Nursing home facilities categorize these three levels as assisted living,[6] intermediate care [7] and skilled nursing care[8]respectively (Health Alliance Annual Report, 2006).

Nursing home care is the most expensive care among long-term care services and accounts for majority of long-term care costs (Stone and Benson, 2012). According to the MetLife Survey, the average nursing home cost in 2012 was $248 daily or $90,520 annually. This cost is often too much to bear for millions of people aged 65 and older. Most rely on financial assistance from public and private resources to cover the cost of nursing home care.

The government provides two types of public health insurance programs for the elderly: Medicare and Medicaid. Medicare is the federal health insurance program for people who are 65 or older and certain younger people with disabilities. Medicaid is a federal-state health insurance program for families and individuals with low income and resources. Although most seniors qualify for Medicare, only the impoverished seniors who pass stringent asset and income eligibility criteria qualify for Medicaid. Eligibility criteria for Medicaid vary by state.

In spite of its broadness of these programs, the coverage of nursing home care is limited. While Medicare covers costs up to 100 days in a skilled nursing facility, other types of nursing facilities are not covered. In detail, in a skilled nursing facility, all costs are covered for days 1 through 20, and the patients are required to pay coinsurance payments from days 21 to 100 days. After 100 days, they need to pay all costs from their own resources. On the other hand, Medicaid, which is restricted to those individuals or families who pass the eligibility criteria, reimburses all fees regardless of length of stay in nursing home facilities.

In addition to government health insurance programs, private health insurance may be obtained to cover the cost of nursing home care. The coverage rate and range are different depending on the type of benefits. However, the market for private long term care insurance is very small in the United States. According to the Health and Retirement Study data, only about 10% of the elderly who are 65 years or older have private long term care insurance. Any nursing home expenditure beyond that covered by private and public health insurances must be paid for

[6]It is a housing facility for people with disabilities. This facility provides supervision or assistance with activities of daily living (http://en.wikipedia.org/wiki/Skilled_nursing_facility)

[7]Intermediate care facility is a health care facility for individual who are disabled, elderly, or non-acute ill, usually providing less intensive care than that of skilled nursing facility(http://en.wikipedia.org/wiki/Skilled_nursing_facility), and a licensed practical nurse or a nursing assistant can provide care services.

[8]Skilled nursing facility is a health care facility, provides not only custodial care, but also intensive care, for instance, extensive wound and skin care. It is generally provided by registered nurse.

out of pocket.

According to the CBO report, in 2011 approximately two-thirds of nursing home care costs (approximately 77 billion dollars) were paid by government health insurance programs. While this is already a big expenses for government, the rate of growth of such expenditures is projected to rise at 7.5% annually (Fong, Koh, and Mitchell, 2012).

1.3 Spouse and Nursing home care

Marital status affect the health behaviors of elderly couples. Changed health behaviors accordingly will influence health care use, such as nursing home use. Considering a link of 'protection effect' on nursing home use, a spouse may prevent bad health behaviors, for instance, claim to quit smoking or alcohol use, or they can encourage to take preventive medical examinations, such as cancer screening, or general check-up. Thus, elderly couples may have more possibilities to detect and start cure in early stage of disease, and improve physical health conditions. It may make elderly couples to be less likely to enter a nursing home, compared with single-living elderly.

Secondly, marriage also may improve access to care by increasing resources available to purchase care via 'economies of scale'(Wood, 2007). Couples can save living cost by sharing resources, such as a house and a vehicle, and build resources more quickly than singles, controlling other factors. It will give couples more resources to purchase health care than singles. Additionally, they can be covered by spouse's health insurance even if they do not have their own insurance. Thus couples are more easily to access health care. It allows them to visit doctor's office more often and take preventive medical examination more frequently when they need it. It will give a preventive effect regarding diseases and/or disabilities to couples. Then it will cause couples to enter a nursing home entry less, instead, they receive cares while staying at communities. While 'economies of scale' makes elderly couple to stay at the community for longer periods, the reverse effect is probable. Nursing home care is one of the expensive health cares. If elderly have sufficient wealth and/or income to pay for nursing home care, the chances to use nursing home will be high, as long as nursing home care is not an inferior good. Thus, elderly couples may use nursing home with higher probability than single-living elderly, since elderly couples have more resources to pay nursing home utilization. Hence, the direction of spousal effect in terms of 'economies of scale' on nursing home use is ambiguous. In this study,

I will include household income and household wealth to capture the picture of 'economies of scale' on nursing home entry for elderly couples.

Lastly, 'selection effect' of marriage seems to be not appropriate in this study. Most elderly couples' marital status decided in earlier periods, and generally have sustained stable marital status[9].

Another strand is that marital status also affect nursing home use through informal care. It is argued that since spouses are quite often able to provide enough support for each other to prevent nursing home entry, being without a spouse elevates a person's risk of nursing home entry (Lakdawalla, 2003). According to Health and Retirement Survey, the primary care-givers for couple households are spouses or partners.[10] Elderly couples are more likely to get an informal care from spouses or partners other than from other family members or friends. In this regard, spouse characteristics can be significant factors that make an effect on a long term care; especially, it may affect a nursing home entry. Simply, suppose an elderly man who has physical difficulties and needs a long-term care, has a healthy spouse. His wife can assist his physical difficulties— such as walking, and/or give an emotional support for him. He can stay at home for longer periods and be cared for by a spouse. However, consider that she is no longer to provide an aid because of her aggravated health conditions. Unless other informal care-givers provide a support, he needs to get a formal long term care. Then the probability to enter a nursing home will increase compared with that he has a healthy spouse.

Spouses' health conditions will be worsen by the aging (McCann, Donnelly, and O'Reilly, 2012). Considering the spouses' aggravated health conditions over the years, elderly couples will have more possibilities to enter nursing homes. In this paper, I include both spouse's subjective health variables and objective health variables to analyze the effect of spouses' health conditions on nursing home placement. I will also examine the effect of spouses' each disease and transitions of ADL variables on nursing home entry. Many previous studies analyze the role of own health conditions on nursing home placement, however very few studies show that

[9]Transitions of marital status for entire samples in this study shows only 1.32% of single-living elderly become couples in next period. Mostly single-living elderly stay at same marital status. For elderly couples, 8.60% turns to single-living elderly. However this case mostly comes from death of spouses, instead of divorce(or splitting) because of health issues. Moreover, there are not big differences in marital transitions between healthy couples and unhealthy couples, and may conclude that elderly couples are not affected by selection effect of marriage much.

[10]From wave 5 (2000) to wave 8 (2008)in the HRS, about 80% of people who report to receive care, are cared for by spouses or partners. (The questionnaire includes duplicated answers. That is, the survey allow to choose more than one informal care-givers among spouses(or partners), adult children, relatives, friends, and employees of institutions)

spouse's number of ADLs and IADLs affect a nursing home use (Gaugler et al., 2007). It does not suggest a sufficient information about the role of spouse's health condition on a nursing home entry. By including detailed information of spouses' health conditions, this study will broaden our understanding what will govern the elderly couples' nursing home entry.

1.4 Model

This study extends the empirical approaches in the work of Anderson (1968), Greene and Ondrich (1990), Kersting (2001), and Miller (2010). They propose the three fundamental factors associated with the decision of health care utilization — the predisposing factors, enabling factors and need factors. Predisposition factors usually include demographic concepts such as age, ethnicity, gender, social characteristics, and beliefs about health services. The enabling factors examine ability to access services. It includes socio-economic factors — such as social support, income and wealth. It can be expected that elderly couples would be more likely to acquire an informal care (Lo Sosso and Johnson, 2002), social and emotional support from their spouses. However, there may exist negative consequences of care-giving, associated with the care-giver's relationship with the elder person (Basu and Rosenman, 2009). Some studies find that female care-givers of dementia were more distressed, and younger care-givers were more resentful of their role (Glaser et al., 1991, Fitting et al., 1986). Additionally, spouse care-givers report more depressive symptom, greater financial and physical burden, and lower levels of psychological well-being (Pinquart et al., 2011). Thus, it also can be predictable that a spouse is reluctant to provide an informal care due to the negative side of care-giving.

The need factors are associated with health — such as own health status, functional dependence, and chronic diseases. The increasing dependency from ill health would give more uses of health care utilization, including a nursing home care.

The classic model of Anderson does not take into account the role of spouses' interaction on the decision of health care utilization. Recent studies have analyzed the effect of spouses' characteristics on health care utilization (Miller 2010, Gaugler et al., 2007), however these studies have not systematically considered the analysis of spouse's health conditions. Hence I extend the model of previous studies by analyzing spouses' effect in terms of spouses' health conditions, based on household framework — considering household wealth and household income. Moreover I will analyze the effect of each disease on nursing home care, instead considering

the effect of total number of chronic diseases. It will allow for understanding how each disease plays a role on the decision of nursing home entry. Furthermore, I consider the changes of six ADLs separately over the years, instead of using static ADL variables. By considering changes of ADLs over the years, the trend of ADLs can be reflected in the model and analyzed its effect on the long-term care decision. The details of the extended model are described in following conceptual framework and empirical model will be described in section 6.

Conceptual Framework

Conceptual framework is consistent with that of Houtven and Norton (2004). I apply their framework to couple's household by considering the role of a spouse in terms of spouse's health conditions. The role of informal care from children is not included in this framework.[11]

Each individual makes a decision on long-term care among three choices every wave — no long-term care, paid home health care, and nursing home care. The choice of 'no long-term care' includes the possibility to receive an informal care. This study does not reflect informal care explicitly. It is assumed that there are two individuals in the household – a respondent[12] and his/her spouse. A respondent chooses the type of long-term care, j, at every wave, t. Here, j can have three values — such as $j = 0$ for *no long − term care*, $j = 1$ for *nursing home care*, *or* $j = 2$ for *paid home health care*. Each choice gives an utility to a respondent, U_{rjt}.

$$\begin{aligned} U_{rjt} \;=\; & U_{rjt}\;\left(\,\alpha\, C_{Ht},\;\; L_{rt},\;\; h_{rt}(\,M_{rjt}),\;\; \gamma\, h_{st}(\,M_{sjt})\,\right) \\ & \textit{subject to} \quad Y_{rt} \;=\; p_m\, M_{rjt} \;+\; p_c C_{rt} \\ & \textit{where}\; j \;=\; 0,\, 1,\, 2 \quad \textit{and}\;\; t = 3,\, ...,\, 9 \end{aligned} \tag{1}$$

The subscript r implies a respondent, s means his/her spouse, and H is a household. C_{Ht} is a household consumption, and α is the share of a respondent in a household consumption (Becker, 1981). L_{rt} is a leisure of a respondent, h_{rt} is a health of a respondent, and respondent's health status is a function of a respondent's medical care, (M_{rjt}). h_{st} is a health of a spouse, and

[11] Children are also potential care-givers to the elderly couples, however generally primary care-givers of elderly couples are spouses. In this study, I mainly focus on the interaction of elderly couples. I include the number of children, who are potential care-givers, however it does not give a sufficient information about the informal care from children. The future study will be extended to include the role of children as another potential care-givers.

[12] In this research, a respondent means a potential demander for long-term care who would need a formal long-term care – nursing home care and/or paid home health care due to the factors.

it is also a function of his/her medical care, (M_{sjt}). γ represents the degree of a respondent's altruism on his/her spouse's health. If a respondent does not receive an utility from his/her spouse's health, γ will be zero.

Based on above utility function, a respondent considers utilities for each choice of j. When an individual decides to choose one of j's, from the revealed preference viewpoint, it is clear that this is a constrained utility maximizing decision, otherwise the individual would have chosen alternatives (Basu and Rosenman, 2009). For instance, if a respondent decides to enter a nursing home, it means that $U_{r1t} = Max\,[\,U_{r0t},\ U_{r1t},\ U_{r2t}\,]$.

1.5 Data

The data are obtained from the Health and Retirement Study (HRS) and RAND HRS. The HRS is a biennial longitudinal household survey data set for the study of retirement and health among the elderly in the United States. It has surveyed since 1992 and tracked every two years. It contains extensive information about respondents' demographic information, health, wealth, income, social security, family structure, and employment history. Almost 22,000 Americans are included in the survey. Respondents are categorized into five cohorts;

- The Study of Assets and Health Dynamics Among the Oldest Old (AHEAD) birth cohort. This cohort was born before 1924. They were first interviewed in 1998, and subsequently biennially.

- The Children of Depression (CODA) cohort was born 1924 to 1930. They were first interviewed in 1998, and subsequently every two years.

- Initial HRS cohort was born 1931 to 1941. They were first interviewed in 1992, and subsequently every two years.

- The War Baby (WB) cohort was born 1942 to 1947. They were first interviewed in 1998, and subsequently every two years.

- The Early Baby Boomer (EBB) cohort was born 1948 to 1953. They were first interviewed in 2004, and subsequently every two years.

At interview, respondents were asked their marital status — whether they are married, partnered, divorced, widow, or unmarried. If a respondent is married or partnered, he or she is considered as a couple household. The survey interviewed the spouses of couple households' respondents on the same subjects as respondents. Different from respondents, spouses were interviewed regardless of ages. The RAND HRS is a user-friendly version of a subset of the HRS. It contains cleaned and processed variables with consistent and intuitive naming conventions, model-based imputations, and spousal counterparts of most individual-level variables.[13] The HRS contains several files, 'core' interview files, 'exit' interview files, and restricted data. The RAND HRS data file includes only 'core' interview files.

Sample Selection

This study contains all cohorts of HRS, except the EBB cohort, and includes only core interview files. I restrict my sample to couple households' respondents whose age is 65 or older at the first interview and interviewed from wave 3 (1996) to wave 9 (2008), inclusive of their spouses. Wave 1 and wave 2 are excluded. The reason is that one of main variables, the use of special health facility, is not available in 1992. Second, one of main explanatory variable, 'Activities of daily living', has been consistent only from wave 3 onwards. Third, the detailed information about nursing home care was collected since wave 3. When the respondent answers to live in a nursing home at the time of interview, he/she was also asked when he/she moved to a nursing home. Based on these data, the days of stays in a nursing home were calculated since the last interview in which the respondent lived in a nursing home. The days of stays is necessary to disentangle long stays from short stays in a nursing home. In this study, I employ long stays in a nursing home, and I define that staying over 100 days consecutively in a nursing home is long stays.[14]

I also exclude single-living elderly, since my research concentrates on the role of spouse's

[13] See the RAND HRS data documentation, 2010

[14] Generally long stays in a nursing home involve stays of consecutive 30 days or longer in a nursing home (Friedman et al., 2005). Sometimes it is classified by stays of consecutive 90 days in a nursing home. Korbin et al.(1988) shows that among short stayers who returned to the community, over two-thirds lived in a nursing home for less than 3 months. Kasper (2005; 2010) uses 90 days of stays or longer in a nursing home as a criterion of long stays. In this study, over 100 consecutive days in a nursing home are employed as a definition of long stays. I add more days to eliminate the effect of Medicare. I check the robustness regarding consecutive 30 days or longer stays, and over consecutive 90 days of stays in a nursing home. The result shows that the criterion of over 100 days are robust. [Results available upon request]

health conditions in the nursing home entry. I keep only couple households at wave 3 (1996) and remain couples at following waves. Additional couple households in later waves were also included.

In HRS, respondents live in the community at the first interview. At following waves, the survey collect the information on the uses of formal long term cares. They report whether they receive a paid home health care, a nursing home care, or other residential cares. Regarding nursing home care utilization, two types of questions are asked; whether a respondent lives in a nursing home at the time of interview, and whether a respondent use a nursing home during previous two years. In this study, the latter data is used for utilization of nursing home care, since it is consistent with measurement scales of other formal long term care data. Paid home health care and special facility care are inquired about its utilization during previous two years.

Lastly, the analytical sample is limited to respondents who stay in a community and do not take a nursing home care at wave 3 (1996). Additionally, I consider only the periods up to first entry of nursing home. The framework of the second or later entries will be different from the first entry, because the second or later entries come along with exits from nursing homes. Moreover, a nursing home is more likely to be a last resort to the long stayers in a nursing home. That is, the exit ratio of long stayers from a nursing home to a community are very low, once they enter a nursing home.

[Table 1.3 here]

Table 1.3 summarizes final sample observations. The initial pooled sample has 132,629 observations. Sample is selected based on aforementioned criteria. The final sample includes 42,251 pooled observations, in other words, 12,672 individuals. Specifically, there are 4,726 observations at wave 3, 6,210; observations at wave 4; 6,064 observations at wave 5; 6,158 observations at wave 6; 6,316 observations at wave 7; 6,440 observations at wave 8, and 6,337 observations at wave 9.

Variables

Dependent Variable

The dependent variable in the model is the choice of formal long term cares of elderly couples. It is constituted contingent on the use of nursing home facility, paid home health care, and

special health facility. The HRS asks whether a respondent reports any use of nursing home care (overnight stay), paid home health care, and/or special health facility in the reference period[15]. Special health facility involves special facilities used, but not already asked, such as an adult day care center, a social worker, an outpatient rehabilitation program, or transportation or meals services for the elderly or disabled.

I generate the choice variable by assigning three values, 0, 1 and 2.[16]

- 0: If a respondent reports no uses in any formal long term cares – nursing home care, home health care, and special health facility
- 1: If a respondent enters a nursing home and stays over 100 days since the last interview that the respondent has lived in a nursing home
- 2: If a respondent reports the use of paid home health care and/or special health facility

Each respondent makes a decision on the formal long term cares in every wave, which can be depicted in Figure 1. A respondent lives in a community at an initial wave. In the next wave, he/she can make a choice about the long term care among three options — staying in the community (without a formal long term care), a nursing home care, or a paid home health care. If he determines to utilize a nursing home care, his data is ended at this point. However if he chooses to take either paid home health care or staying in the community without a formal long term care, he can repeat the decision process again at following waves until he enters to a nursing home. In this paper, the data is restricted until the first entry of a nursing home.

[Figure 1 here]

[Table 1.4 here]

Table 1.4 indicates nursing home utilization of elderly couples, who are 65 years old and over for periods until the first entry to a nursing home. In 1998, 2.91% of elderly couples enter a nursing home, and it rises to 4.12% in 2008. The pattern is similar as shown in table 1.2, which includes all entries of nursing homes.

[15]From wave 3(1998) to wave 9(2008), the reference period is previous 2 years for nursing home care, paid home health care, and special health facility.

[16]When a respondent answers to receive 'nursing home care and paid home health care', or 'nursing home care and special health facility', or 'nursing home care, paid home health care, and special health facility', I assign '1'. We don't know the exact time of a specific formal long term care that was used during a reference period. Therefore, I assume that if a respondent answers that he uses a nursing home care in the reference period, his final choice is a nursing home care, regardless of using other community-based formal long term cares. Nursing home care is an institutional care by trained professionals. Once he enters a nursing home, there's no necessity to choose another formal long term care, particularly community-based formal long term care.

Explanatory Variables

The key independent variables in this study are spouse's health conditions. The HRS collects data of not only respondents' own health conditions, but also spouses' health conditions. Commonly, data of health conditions contain subjective and objective health status. For subjective health status, self-reported health status is collected in every wave, with a scale from 1 (excellent) to 5 (poor). Each individual also reports activities of daily living (ADLs), and instrumental activities of daily living (IADLs). ADLs indexes consist of 6 activities — walking across a room, bathing, dressing, eating, transferring in and out of bed, and using a toilet. RAND-HRS recode raw data of ADLs about difficulty as yes/no dummy variables, where 1 means 'some difficulty', and 0 means 'no'. Based on recoded ADLs, the changes of ADLs with respect to time are generated for each ADL. Changes of ADLs comprise of three possible changes — increasing in limitation of a ADL, decreasing in limitation of a ADL, or no changes, that is, same as before. I recode these data as yes/no dummy variables, which is 0 for 'same as before or decreasing in limitation of a ADL' and 1 for 'increasing in limitation of a ADL'. The increasing in limitation of a ADL is concerned, since people enter a nursing home when they have more disabilities or aggravated health conditions.

Instrumental activities of daily living (IADLs) consist of six variables — using the phone, taking medications, managing money, shopping for groceries, preparing meals, and using a map. These also recode raw variables showing the difficulty with instrumental activities of daily living — yes/no dummy variables, where 1 means 'some difficulty' and 0 means 'no'. RAND-HRS constructs a variable of number of IADLs by summing up the IADLs that a respondent reports. The value range is 0-3 (using a phone, managing money, and taking medication) and 0-5 (using a phone, managing money, taking medication, shopping for groceries, and preparing meals).

Objective health data — such as doctors-diagnosed diseases was also surveyed in every wave. Doctors-diagnosed diseases include high blood pressure, stroke, diabetes, cancer, lung disease, heart disease, arthritis, psychological problems, and cognitive impairment. I recode variables for doctors-diagnosed diseases as yes/no dummy variables, where 1 means yes to the question regarding whether or not a doctor has told that respondent had these diseases.

Household-level variables — household wealth and household income — are controlled. As described earlier, elderly couples will make a decision based on household-level resources, instead of personal resources. Household wealth is measured in nominal dollars. Household

wealth data is negatively-skewed, thus I use quartiles of household wealth in the estimation. Household income is also measured in nominal dollars and negatively-skewed. The quartiles of household income is used in the estimation, as well.

Demographic characteristics — respondent's age, gender, ethnicity, region, whether a respondent lives in a city, and levels of education — are included. Goda et al. (2012) find that elderly women incur higher medical spending on nursing home care than elderly men. By including a gender of elderly couples, I will analyze the gender differentials of elderly couples in the choice of long-term cares. Previous studies also report the role of racial differentials — such that older African Americans are less likely to use nursing homes than similar Caucasians, with the lower institutionalization replaced by a higher use of paid home care (Wallace et al., 1997). Region and urban area is also controlled in order to take into account the differentials of living areas. For example, if a respondent lives in a city, he/she would have more chance to easily gain access to medical care, in comparison with a respondent who lives in the rural area, provided other factors are fixed. Levels of education could be associated with the health literacy. A more educated person could search a health-related information readily, and accordingly he/she could have more accessibility to formal long-term cares.

As enabling factors, private long-term care health insurance and Medicaid are also contained.

[Table 1.5 here]

[Table 1.6 here]

Table 1.5 summarizes the definitions and measurements of explanatory variables. The variables are mostly dummy variables or categorical variables. Table 1.6 shows descriptive statistics of these variables in my data. The respondents' average age is about 76 and the gender is almost 50% of men and 50% of women. About 29% of the respondents have education at the college level or above. Majority races in the sample are white. Only 13% of the respondents reply to have a private long-term care insurance, and 5% of the respondents are covered by Medicaid. It is relatively very low percent, though the cost of nursing home are expensive. For health conditions, respondents report they are fair or poor health with 32%. Difficulty in dressing is the most reported difficulty among six ADLs, and, in sequence, difficulty in bathing, difficulty in walking across a room, difficulty in using a toilet, difficulty in transferring in and out of bed, and difficulty in eating are reported. A high percent of respondents have an arthritis and a high blood pressure. The health conditions for spouses display similar patterns as the ones of respondents.

1.6 Empirical model

To analyze the effect of spouses' health conditions and determinants on nursing home entry, I consider the reduced form of models for long-term cares. Three types of long-term care decision — no formal long-term care (including the possibility of an informal care), paid home health care, and nursing home care – are estimated with multinomial logit model that predicts the probability of using nursing home care and paid home health care over the years.

The choice of long-term cares is a function of demographic and income characteristics, D_{rt}, health, h_{rt}, spouse's health, h_{st} and other consumption goods of household, $C_{Ht}\prime$.

$$M_{rjt} \;=\; f(D_{rt},\; h_{rt},\; h_{st},\; C_{Ht}\prime,\; \varepsilon_{rjt}) \;\; where \; j \;=\; 0,\, 1,\, 2 \;\; and \;\; t = 3,\, ...,\, 9 \qquad (2)$$

As mentioned earlier, M_{rjt} have three types of long-term cares. One of them is our concern, nursing home care. D_{rt} includes demographic and income/wealth characteristics. It can be applied to the prepositions and access to health care variables in Anderson's model. I include age, gender, race, region, location, education level as preposition variables, and number of children are also contained as an access to health care variables with household income and household wealth. h_{rt} is affected by respondent's health conditions. Not only subjective health conditions, but also objective health conditions are included, and the changes of ADLs are also taken into account. As for h_{st}, subjective health conditions, and objective health conditions of spouses are considered. The effects of spouses' each diseases, subjective health status, changes of ADLs, and IADLs on the decision of long-term care for a respondent, M_{rjt}, are analyzed. Private long-term care health insurance availability and Medicaid availability (Houtven and Norton, 2004) are incorporated with other consumption goods, $C_{Ht}\prime$.

By the definition of function, $f(\bullet)$, the empirical models are different. This study represents competing risk over the events (choices) — $f(\bullet)$ is assumed logit, and accordingly multinomial logit model is conveyed to analyze the effect of determinants.[17] I briefly explain multinomial logit model with panel data.

[17]Competing risk model can be estimated by three representative models — stratified Cox model, Latent survivor time approach, and Multinomial logit

Multinomial logit model starts from additive random utility. The additive random utility is:

$$U_{rjt} = V_{rjt} + \varepsilon_{rjt} \quad for\ all\ \ j,\ t \tag{3}$$

$$= \alpha_j + \beta_j' X_{rt} + \varepsilon_{rjt} \quad for\ all\ \ j,\ t \tag{4}$$

A respondent decides to use a nursing home if it gives the highest utility, in comparison with the utilities of alternatives, that is, $U_{r1t} = Max\,[\,U_{r0t},\ U_{r1t},\ U_{r2t}\,]$. In this case, the level of utility does not matter. Thus, the probability for a respondent to choose an *i* type of long-term cares is followed as:

$$(P_{rit}|V) = Prob([U_{rit} \geq U_{rjt}\,|\,V],\quad for\ all\ j \neq i) \tag{5}$$

$$= Prob([U_{rit} - U_{rjt} \geq 0\,|\,V],\quad for\ all\ j \neq i) \tag{6}$$

$$= Prob([\varepsilon_{rjt} - \varepsilon_{rit} \leq V_{rit} - V_{rjt}\,|\,V],\quad for\ all\ j \neq i) \tag{7}$$

If ε_{rjt} follows type I extreme value distributions, and independent over r, j, and t, then, the choice probabilities are:

$$(P_{rit}|V) = \frac{e^{V_{rit}}}{\sum_j e^{V_{rjt}}} \quad for\ all\ j \neq i,\ t \tag{8}$$

This probability is estimated using log likelihood functions. To specify the likelihood, define $d_{rjt} = 1$ if a respondent experiences a j at t, otherwise, $d_{rjt} = 0$. The likelihood function for unit r is:

$$L_r = P_{r1t}^{d_{r1t}} \bullet P_{r2t}^{d_{r2t}} \bullet .... \bullet P_{rJt}^{d_{rJt}} \tag{9}$$

Then the likelihood function for the entire sample is:

$$L = \prod_{r=1}^{N} (P_{r1t}^{d_{r1t}} \bullet P_{r2t}^{d_{r2t}} \bullet .... \bullet P_{rJt}^{d_{rJt}}) \tag{10}$$

Thus the log-likelihood function is:

$$lnL = \sum_{r=1}^{N} \sum_{j=1}^{J} d_{rjt} ln(P_{rjt})) \quad (11)$$

$$= \sum_{r=1}^{N} \sum_{j=1}^{J} d_{rjt} ln(\frac{e^{\alpha_j + X_{rt}\beta_j}}{\sum_j e^{\alpha_j + X_{rt}\beta_j}}) \quad (12)$$

Multinomial logit model of a respondent's choice on the type of long-term cares, including nursing home care, is estimated. This estimation assumed that a decision maker is a respondent. However, in the real world, the persons who need a nursing home care sometimes cannot make a decision because of severe health problems. For instance, if a respondent has a cognitive problem or a dementia, he/she cannot make his/her own decision. In this case, family will make a decision whether to give an informal care, use a paid home health care, or send them to a nursing home (Lopez et al., 2012; Haley et al., 2002; Hopp 2000). To fill in the gap between the model and real world, I allow for a spouse to make a decision on long-term cares for a respondent. Therefore, the equation of (2) can be rewritten as:

$$M_{rjt} = f(D_{rt},\ D_{st},\ h_{st},\ h_{rt},\ C_{Ht}\prime,\ \varepsilon_{sjt}) \ \ where\ j = 0,\ 1,\ 2 \ \ and \ \ t = 3,\ ...,\ 9 \quad (13)$$

The choice of long-term care is still of a respondent's, M_{rjt}, however it is decided by the spouse of the respondent. D_{st} is demographic and income/wealth characteristics of spouse, and D_{rt} is for the respondent's. $C_{Ht}\prime$ is other consumptions of household as well. The health contains respondent's health, h_{rt}, and spouse's health, h_{st}. Spouse chooses a type of long-term care for the respondent considering her/his own factors, the respondent's factors, and household factors.

A spouse makes a decision on long-term care for the respondent, by comparing her utilities that she could have received when she chooses one of long-term cares – no formal long-term care, paid home health care, and nursing home care. She will choose i, which give the maximum utility among three choices, that is, $U_{sit} = Max\ [\ U_{s0t},\ U_{s1t},\ U_{s2t}\ ]\ where\ i = 0, 1,\ or\ 2.$

Then, the equation (5) is rewritten as:

$$(P_{rit}|V) = Prob([U_{sit} \geq U_{sjt} \mid V], \quad for\ all\ j \neq i) \quad (14)$$

$$= Prob([U_{sit} - U_{sjt} \geq 0 \mid V], \quad for\ all\ j \neq i) \quad (15)$$

$$= Prob([\varepsilon_{sjt} - \varepsilon_{sit} \leq V_{sit} - V_{sjt} \mid V], \quad for\ all\ j \neq i) \quad (16)$$

If ε_{sjt} follows type I extreme value distribution, and independent over s, j, and t, then the choice probabilities is rewritten as:

$$(P_{rit}|V) = \frac{e^{V_{sit}}}{\sum_j e^{V_{sjt}}} \quad for\ all\ j \neq i,\ t \tag{17}$$

And then, the likelihood function and the log-likelihood function for the entire sample of spouses(NS) are given as follows:

$$L = \prod_{s=1}^{NS} (P_{s1t}^{d_{r1t}} \bullet P_{s2t}^{d_{r2t}} \bullet .... \bullet P_{sJt}^{d_{rJt}}) \tag{18}$$

$$lnL = \sum_{s=1}^{NS} \sum_{j=1}^{J} d_{rjt} ln(P_{sjt})) \tag{19}$$

$$= \sum_{s=1}^{NS} \sum_{j=1}^{J} d_{rjt}\ ln(\frac{e^{\mu_j + X_{st}\gamma_j}}{\sum_j e^{\mu_j + X_{st}\gamma_j}}) \tag{20}$$

The parameters in equations (12) and (20) are estimated by multinomial logit models. However, it is an issue to identify two groups. This identification is implemented based on whether the decision of long-term care is made by a respondent him/herself (group one) or his/her spouse (group two). Burton et al. (1997) defined high-level care-givers as having a spouse with an ADL impairment, and moderate-level care-givers as having a spouse with one or more IADL impairments. It gives a glimpse about a spouse's decision for a respondent's long-term care. When the spouse is more likely to become a high-level care-giver, his/her impact on the respondent's uses of long-term care increases, thus a spouse is more likely to be a decision-maker on a respondent's use on long-term cares.

I employ the number of ADLs as a criterion between the groups. I assume that more ADLs of respondents, higher-level of caregives, resulting in higher probability for spouses to intervene respondents' long-term care decisions. In general, persons who require substantial assistance in performing at least two of six ADLs for at least 90 days qualify for insurance payouts, is considered as "benefit-triggers" (Fong et al.,2012). I separate groups, based on the "benefit-triggers". Firstly, I conduct an analysis with 2 ADLs, and then will do with 3 ADLs of a respondent. This means, in the analysis, for 0-1 ADL group, a respondent makes a decision on long term cares, and in 2-6 ADLs group, a spouse chooses a type of long-term cares for the respondent. Accordingly, for 0-2 ADLs groups, a respondent decide his/her long-term care. On

the other hand, 3-6 ADLs group, a spouse makes a decision on respondent's using of nursing home. The empirical results are shown in the next section.

1.7 Empirical Results

This section discusses the estimated parameters, which is a marginal effect on the first entry of a nursing home. This section consists of two parts according to who is a decision-maker.

Decision-maker: A respondent

Table 1.7 summarizes the results obtained by estimating the parameters of explanatory variables on the first entry of nursing home. Table 1.7 shows the calculated predicted probabilities, based on multinomial logit model.

[Table 1.7 here]

The results indicate that higher age of a respondent is associated with higher use of nursing home care. When a respondent adds one year on his/her age, the predicted probability of the first entry of nursing home is increased by 0.17%. It is consistent with previous findings, providing that getting an old is a risk factor to enter a nursing home (Lin et al., 2012). The gender and race differentials of elderly couples in nursing home care are not found. It is shown that a respondent who lives in south states is less likely to enter a nursing home with 0.74%. The regional differentials in utilization are due to variations in the supply of long-term care options: number of nursing home beds, number of available slots for alternative long-term care services, or both (Borrayo et al., 2002; Coughlin et al., 1990; Dwyer, Barton, and Vogel, 1994; Egleston, Rudberg, and Brody, 1999; Rudberg, Sager, and Zhang, 1996). Borrayo et al (2002) reports that the negative correlation between region and long-term care services was strongest in Florida, where nursing home bed supply was below the state median of beds per 1,000 Medicaid-eligible population aged 65 and older. The effect of living in an urban area can be explained under the same framework. Urban area provides nursing home care with ease accessibility than a rural area, thus a respondent who lives in the urban area is more likely to use a nursing home care. The education level has a positive effect on nursing home care. The respondent who is educated more than the high school, is more likely to enter the nursing home with probability of from 0.07% to 1.18%. The children are potential care-givers to elderly couples.

Thus they would impact the parents' decision on formal long term care. The number of children could be a good proxy to measure the role of children as informal care-givers. However it is found that the number of children do not affect a decision of respondent's nursing home care in this study. This may be due to the fact that the proxy does not have a sufficient information of children's informal care-giving. The children would consider their consumption, transfers for formal care, and allocation of time to informal care, market work, and leisure when they decide whether to give an informal care to their parents.

The private long-term care insurance does not affect nursing home entry. Medicaid affect nursing home entry positively. If a respondent has Medicaid, he/she is more likely to nursing home entry with increased probability by 1.60%, when compared with persons who do not have Medicaid.

A respondent health conditions are highly significant to nursing home care. When a respondent has more disabilities in activities of daily living, or have illnesses in diabetes, stroke, psychological problem, or memory problem, he/she is more likely to enter nursing home, when other factors except the health condition of a respondent are fixed. When a respondent has a increasing limitation in walking and in using a toilet, the probability of a nursing home use will be increased by around 2%. Increasing limitations in dressing and bathing gives rise to an around 1% increases of entering a nursing home. Broadly it is noted that bathing and walking are the first losing ADLs for the elderly, and eating is the last (Fong et al., 2012; Dunlop et al., 1997; Jagger et al., 2001; Kingston et al., 2012). My empirical results show similar patterns with those in previous studies, whereas my study suggests that limitation in using a toilet is a critical factor in determining a nursing home entry with a limitation of walking.

Although nursing home is the most expensive medical care, the results show that wealthy people are less likely to enter a nursing home. This is because of the complexity of the eligibility of Medicaid. If a person is eligible to Medicaid, the price of nursing home is close to zero. Thus, persons have an incentive to spend down their wealth to be eligible Medicaid (De Nardi et al., 2011). Besides, people prefers to live in a community, rather than enter a nursing home, so that a wealthy person would be less likely to enter a nursing home as long as they are cared for by trained professionals in a community.

A spouse health conditions affect the choice on nursing home entry. If a spouse has a diabetes, a respondent enters a nursing home with increased probability by 0.77%. When a spouse has a psychological problem, the probability for a respondent to choose a nursing home care is

increased by 0.72%. Additionally, the more IADLs of a spouse, the probability for a respondent to enter a nursing home is increased. If a spouse's IADLs rise by 1 more, then the probability of respondent's entering a nursing home is increased by 0.39%. However, a spouse's difficulty in walking gives a negative effect on the decision of a respondent. That is, if a spouse has a limitation on walking, the respondent is less likely to enter the nursing home. It can be due to the mixed effects between couples. A respondent is also a potential informal caregiver to a spouse, thus he/she would be less likely to enter a nursing home to help his/her spouse's difficulty in the walking.

Overall, spouse gives a protective effect on a choice of respondent's nursing home entry. Deterioration of spouse's health leads to a higher utilization of nursing home care. Thus, the nursing home entry of a respondent is affected by not only his/her own health conditions but also spouse's health conditions, and spouse's health conditions have a protective effect.

Decision-maker: A Respondent vs A Spouse

As delineated earlier, when a respondent has a high level of limitations or severe diseases, a decision of long term cares would be conveyed by family members, generally a spouse for the elderly couples. I assume that the number of respondent's ADLs represent the inability for a respondent to decide on long-term cares. Two groups are classified as follows:

- 0-1 ADL group (group 1): A decision-maker is a respondent. The predicted probabilities of parameters on the decision of nursing home care is estimated based on equation (12).

- 2-6 ADLs group (group 2): The decision on nursing home care is determined by a spouse. The predicted probabilities of parameters on nursing home care is estimated by equation (20).

I change the criteria of classification into 0-2 ADLs group in which a respondent makes a decision, and 3-6 ADLs group where the spouse makes a decision for the respondent. The equations of (12), and (20) are estimated. The results are shown in tables as follow:

[Table 1.8 here]

[Table 1.9 here]

Table 1.8 indicates the marginal effects of variables. It also provides the predicted probability of parameters. The results mostly are consistent with the Table 1.7. However some results are changed. For group 1 (a decision- maker is a respondent), there is a race difference in using a nursing home. If a respondent is white, then he/she tends to use a nursing home more by 0.93%, in comparison with other ethnicity groups. Regarding spouse health conditions, a respondent who has a spouse has more limitation in IADLs, a psychological problem, or a diabetes, is more likely to enter a nursing home, since he/she cannot expect an informal care from a spouse.

Regarding Group 2 (a decision-maker is a spouse), I find that different results. The number of children affects a decision of a spouse for the respondent. If the elderly couple has more children, a spouse makes a decision for the respondent to stay in the community for longer periods. It is understandable, since adult children could also give an informal care to the respondent, including financial aid to their parents. The spouse age is also significant. When a spouse is getting older, she/he tends to send the respondent to a nursing home with increased probability by 0.39% with respect to a year increase in her/his age. When she/he is getting old, her/his health conditions could aggravate, when compared with her/his younger ages, which makes her/him to decide for the respondent to use a nursing home with more probability, provided other factors are fixed. Spouse makes a decision for the respondent to be less likely to enter a nursing home when the household is wealthy. It is ascribed to mingled effect of wealth on the nursing home — an incentive to spend down wealth to be eligible Medicaid, and the preferences of people who prefers to stay in the community, instead of being institutionalization.

Table 1.9 shows the similar results to those reported in Table 1.8. Table 1.9 also suggests the marginal effect of variables, and the information of the predicted probabilities. For group 1 (decision-maker: a respondent), age is positive effect in decision of a nursing home entry, while there are no differentials in gender, and race. The results show that the changes of ADLs are affective variables in the decision of a nursing home entry. Spouse's psychological problem is related to a respondent's decision on nursing home positively. For group 2 (decision-maker: the spouse of the respondent), if a respondent is older, the spouse makes a decision for the respondent to enter a nursing home. Changes of spouse's ADLs in bathing, and transferring in and out of a bed does also make a positive effect on a spouse's decision for the respondent's nursing home entry. Spouse's cancer is correlated with a spouse's decision on the respondent's

nursing home entry negatively. When the spouse has a cancer, a respondent is less likely to enter a nursing home due to a medical expense incumbent on the spouse's cancer.

In sum, a spouse affect a respondent's decision of nursing home entry, regardless of who is the decision-maker. Though the results are not same in all cases, spouse's psychological problem is significant in all cases with positive effect on a respondent's nursing home entry. Additionally, when the group is classified according to the decision maker, the role of spouse on a decision of nursing home entry is more obvious.

1.8 Conclusion

The data indicates that elderly couples enter a nursing home with relatively low probability when compared with single-living elderly. Previous literatures show that the marital status is a highly significant factor in the decision of nursing home entry. However, few studies investigate why elderly couples use nursing home with lower probability in comparison with single-living elderly (Nihtila and Martikainen, 2008). In this paper, I analyze the key factors that play a role on elderly couples, decisions to enter a nursing home, and particularly examine the role of spouse in terms of spouses health conditions on nursing home uses. I include information on health conditions, by considering subjective health and objective health status. Moreover, I consider the changes of each ADL on the model. Household framework is also considered in the analysis, since the elderly couple makes a decision based on household incom and household wealth.

I set up the conceptual framework and estimate empirical model that is based on multinomial logit with panel data, HRS. Firstly, I analyze the whole sample assuming that a respondent makes a decision of formal long-term care. Subsequently, I try to fill up the gap between a model and a real world, since, a decision of formal long-term care including a nursing home care is sometimes decided by a family, particularly, a spouse. So I contrive a model when a respondent is a decision-maker and when a spouse is a decision-maker in using a respondent's formal long-term care. The criteria of classification is the number of ADLs. I identify these number of ADLs by employing the concept of 'benefit-trigger'.

In all cases, the results show that increasing limitation in respondents' ADLs leads to an increase of the probability of nursing home entry. The increasing limitation in walking and using a toilet mostly increases the probability to enter the nursing home. And the limitation in eating

is rarely significant in the decision of nursing home in all cases. It is consistent with previous studies, which suggest that needing help with the limitation in eating is the least prevalent ADL limitations (Fong et al., 2012).

Stroke is a highly significant in determining a nursing home use for a respondent in all cases. Some cases indicates that diabetes, heart problem, psychological problem, and memory problems of a respondent increase the probability of nursing home entry.

Spouse health conditions affect a respondent's nursing home entry. In all cases, spouse's psychological problems increase the probability of a respondent's nursing home entry. It is consistent with the fact that the distress of care-givers increases to enter a nursing home care. When a spouse has a psychological problem, she/he feels more pessimistic on conditions that she/he faced, and thus experiences more mental distress. It makes a respondent to use a nursing home care. Spouse's IADLs is also a significant factor in all cases. When a spouse has more IADLs, the respondent is more likely to enter a nursing home. After controlling a decision maker, spouse age is also of importance. When a respondent decides his/her own nursing home entry, a spouse age is not significant. However it affects positively a respondent's nursing home entry in a case that a spouse decides a respondent's nursing home use. It can be elucidated based on finding that a respondent's health conditions are the most important factor in deciding a nursing home entry when a respondent makes his/her own decision on the formal long-term care.[18] Spouse's characteristics may be the second important factor when a respondent makes a decision of formal long-term care uses. However, when a spouse makes a decision of respondent's nursing home entry, she/he considers her/his own personal factors more.

A spouse is a potential informal care-giver. The HRS data indicates that over 80% of care-givers are spouses for elderly couples. The results also display that spouses' health conditions affect the respondent's choices on formal long-term cares. Thus it is accepted that spouses are likely to be altruistic, who receives an utility from a husband/wife's health conditions — that is, good health of husband/wife gives an utility to a wife/husband. However, this study also shows that when the spouse makes a decision of respondent's formal long term cares, she/he considers her/his own personal factors more, when compared with the case in which a respondent decides his/her own decision of long term care. Spouses are generally found to be altruistic in this study, whereas the degree of altruistic could be lessened when the spouse makes a decision on the respondent's formal long-term care.

[18]Refer to Table 7, Table 8, and Table 9

This study has examined the role of the spouses' health conditions on respondents' decisions of formal long-term cares. It represents significant effects of spouses' health characteristics on respondents' decisions of formal long-term cares. However, these effects sometimes are mixed, since it is due to the interaction between couples, so that the effects could be both directions. It is also shown that specific disease makes an effect on the respondent nursing home entry, while it is not understood why the disease makes an effect. Additionally, though a number of adult children are included, the framework of this study is limited. Therefore, the future study focus on studying how the characteristic of adult children makes an effect on the role of spouse on the decision of respondent's nursing home care by incorporating such characteristic into the empirical model. Moreover, my future work will refine the model by considering who is a decision maker for respondent's nursing home entry. Furthermore, the effect of a specific disease will be considered with the medical perspective.

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Figure 1: The first entry to a nursing home

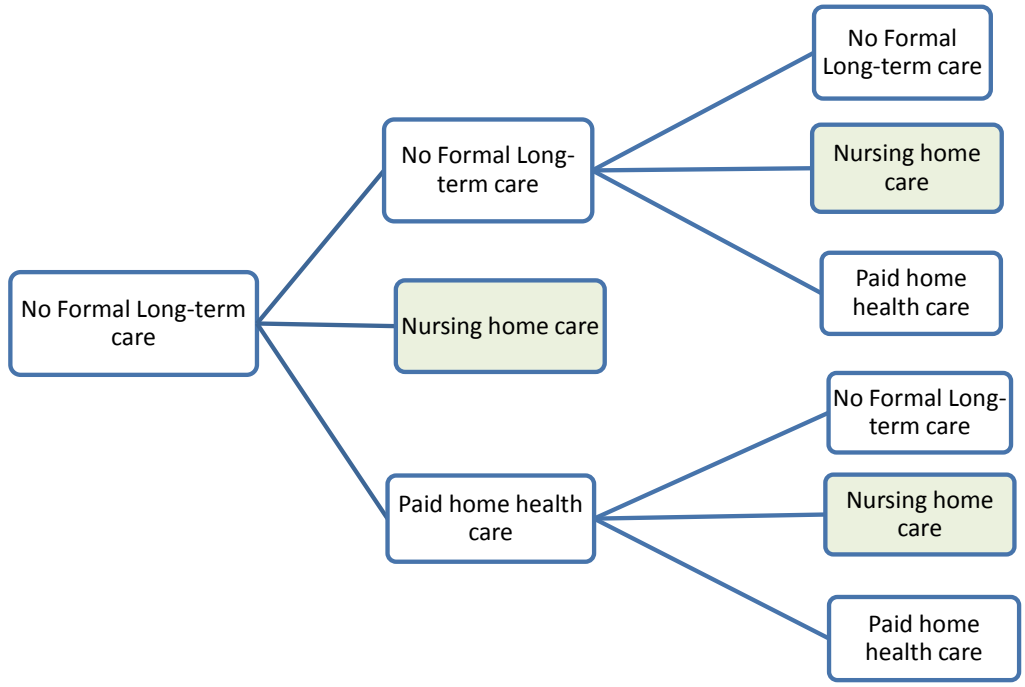

Table 1.1: Percent of nursing home entries during previous 2 years(65 years or older) Single-living elderly

Year	1996	1998	2000	2002	2004	2006	2008
Percent	0.09	0.11	0.12	0.15	0.15	0.17	0.19
N(Number of Obs.)	3,458	4,108	3,763	3,423	3,048	2,708	2,394

Table 1.2: Percent of nursing home entries during previous 2 years (65 years or older) Couple respondents

Year	1996	1998	2000	2002	2004	2006	2008
Percent	0.03	0.03	0.03	0.05	0.04	0.06	0.06
N(Number of Obs.)	4,859	5,409	4,515	3,735	3,163	2,624	2,137

Table 1.3: Final sample observations

Initial Sample	132,629
Respondent's age$<$65	58,170
Single-living elderly	12,821
Nursing home stays $\leq$ 100days	2,106
Not the first entry of Nursing home	869
Receiving nursing home care at wave 3	123
Total Observations	42,251 (12,672 respondents)

Table 1.4: Nursing home care utilization for elderly couples 65 years old and over

LTC/Year	1996	1998	2000	2002	2004	2006	2008
No LTC	88.32	83.97	86.48	84.56	83.32	81.08	81.14
Nursing home	N/A	2.91	2.66	3.69	3.18	5.14	4.12
N(Number of Obs.)	4,726	5,402	4,429	3,628	3,021	2,490	1,988

[1] The data keeps until the first entry to a nursing home. Therefore, the percent of nursing home use means, the first entry to a nursing home.

[2] Nursing home care in 1996 is dropped as explained in the sample selection.

Table 1.5: Explanatory variables

Variable	Descriptives and Measurements
Respondent's	
Age	65 years old and over, Years
Gender	0 : Male, 1: Female
Race/Ethinicity	0: Others , 1: Caucasians
Region (States)	0: Other states, 1: South states
Location (urban)	0: Other areas, 1: Living in an urban
Levels of education	
Less than high school	0: Others, 1: Yes
High school graduation	0: Others, 1: Yes
Some college	0: Others, 1: Yes
College graduation or above	0: Others, 1: Yes
Health Insurance	
Long term care health insurance	0: No, 1: Yes
Medicaid	0: No, 1: Yes
Health Status	0: Excellent/Very good/Good, 1: Fair/Poor
ADL changes	
$\triangle$ in *walking difficulty*	0: Same as before, decreasing limitation of walking, 1: Increasing limitation of walking
$\triangle$ in *dressing difficulty*	0: Same as before, decreasing limitation of dressing, 1: Increasing limitation of dressing
$\triangle$ in *bathing difficulty*	0: Same as before, decreasing limitation of bathing, 1: Increasing limitation of bathing
$\triangle$ in *eating difficulty*	0: Same as before, decreasing limitation of eating, 1: Increasing limitation of eating
$\triangle$ in *'in and out Bed' difficulty*	0: Same as before, decreasing limitation of 'in and out Bed', 1: Increasing limitation of 'in and out Bed'
$\triangle$ in *difficulty using a toilet*	0: Same as before, decreasing limitation of using a toilet, 1: Increasing limitation of using a toilet
Number of IADLs	0: Min, 5: Max
Disease	
High blood pressure	0: No, 1: Yes
Diabetes	0: No, 1: Yes
Cancer	0: No, 1: Yes
Lung	0: No, 1: Yes
Heart	0: No, 1: Yes
Stroke	0: No, 1: Yes
Psychological problem	0: No, 1: Yes
Arthritis	0: No, 1: Yes
Memory problem	0: No, 1: Yes

Table 1.5 continued

Variable	Descriptives and Measurements
Spouse's	
Age	all age range
Levels of education	
Less than high school	0: Others, 1: Yes
High school graduation	0: Others, 1: Yes
Some college	0: Others, 1: Yes
College graduation or above	0: Others, 1: Yes
Health Status	0: Excellent/Very good/Good, 1: Fair/Poor
ADL changes	
△ in *walking difficulty*	0: Same as before, decreasing limitation of walking, 1: Increasing limitation of walking
△ in *dressing difficulty*	0: Same as before, decreasing limitation of dressing, 1: Increasing limitation of dressing
△ in *bathing difficulty*	0: Same as before, decreasing limitation of bathing, 1: Increasing limitation of bathing
△ in *eating difficulty*	0: Same as before, decreasing limitation of eating, 1: Increasing limitation of eating
△ in *'in and out Bed' difficulty*	0: Same as before, decreasing limitation of 'in and out Bed', 1: Increasing limitation of 'in and out Bed'
△ in *difficulty using a toilet*	0: Same as before, decreasing limitation of using a toilet, 1: Increasing limitation of using a toilet
Number of IADLs	
Disease	
High blood pressure	0: No, 1: Yes
Diabetes	0: No, 1: Yes
Cancer	0: No, 1: Yes
Lung	0: No, 1: Yes
Heart	0: No, 1: Yes
Stroke	0: No, 1: Yes
Psychological problem	0: No, 1: Yes
Arthritis	0: No, 1: Yes
Memory problem	0: No, 1: Yes
Household's	
Number of Children	
Household wealth	Including primary housing
Household income	Generated by summing up respondent's income and spouse's income

Table 1.6: Descriptive Statistics

Variable	Descriptive Statistics
Respondent's	
Age	76.15 (5.86)
Gender	Male: 51.20% (5.68), Female: 48.80%
Race/Ethinicity	Others: 15.77%, White : 84.23%
Region (States)	Other states : 60.75%,South states: 39.25%
Location (urban)	Other areas: 55.84%, Urban areas: 44.16%
Levels of education	
Less than high school	37.96%
High school graduation	32.19%
Some college	15.95%
College graduation or above	13.91%
Health Insurance	
Long term care health insurance	13.21%
Medicaid	5.24%
Health Status	Excellent/Very good/Good: 67.88%, Fair/Poor: 32.12%
ADL Changes	
Limitation in walking	7.59%
Limitation in dressing	11.56%
Limitation in bathing	8.16%
Limitation in eating	4.17%
Limitation in 'in and out bed'	6.17%
Limitation in using a toilet	6.19%
Number of IADLs	0.38 (1.01)
Disease	
High blood pressure	55.91%
Diabetes	17.88%
Cancer	17.70%
Lung	10.47%
Heart	32.52%
Stroke	10.14%
Psychological problem	10.96%
Arthritis	60.57%
Memory problem	3.72%

Table 1.6 continued

Variable	Descriptives Statistics
Spouse's	
Age	74.29 (7.74)
Less than high school 27.49%	
High school graduation 36.19%	
Some college	19.44%
College graduation or above	16.88%
Health Status	Excellent/Very good/Good: 68.36%, Fair/Poor: 31.64%
ADL Changes	
Limitation in walking difficulty	7.84%
Limitation in dressing difficulty	11.45%
Limitation in bathing difficulty	8.22%
Limitation in eating difficulty	4.21%
Limitation in 'in and out of bed' difficulty	6.62%
Limitation in difficulty using a toilet	6.78%
Number of IADLs	0.37 (1.01)
Disease	
High blood pressure	55.12%
Diabetes	16.84%
Cancer	16.42%
Lung	10.12%
Heart	29.51%
Stroke	9.11%
Psychological problem	12.79%
Arthritis	62.22%
Memory problem	3.44%
Household's	
Number of Children	3.43 (2.31)
Household wealth	$498143.9 (1024552)
Household income	$46514.18 (61325.59)

Note[1]: Pooled sample from wave 3 to wave 9.
Note[2]: The value in the parenthesis represents a standard deviation.

Table 1.7: The Marginal Effect: Full Sample, A decision-maker: Respondent

Variable	Nursing home care
Respondent's	
Age	.0017***
Gender	.0013
Race/Ethinicity	.0051
Region (States)	-.0074**
Location (urban)	.0056*
Less than high school	—-
High school graduation	.0073*
Some college	.0118**
College graduation or above	.0082
Long term care health insurance	-.0038
Medicaid	.0160***
Health Status	.0027
$\triangle$ in walking difficulty	.0184***
$\triangle$ in dressing difficulty	.0098***
$\triangle$ in bathing difficulty	.0116***
$\triangle$ in eating difficulty	-.0046
$\triangle$ in 'in and out of bed' difficulty	.0077
$\triangle$ in difficulty using a toilet	.0198***
Number of IADLs	.0097***
High blood pressure	-.0040
Diabetes	.0084**
Cancer	-.0023
Lung	.0039
Heart	-.0001
Stroke	.0105***
Psychological problem	.0090**
Arthritis	.0007
Memory problem	.0092**

Table 1.7 continued

Variable	Nursing home care
Spouse's	
Age	.0002
Less than high school	—
High school graduation	—
Some college	—
College graduation or above	—
Health Status	-.0071
△ in walking difficulty	-.0071***
△ in dressing difficulty	.0015
△ in bathing difficulty	.0124**
△ in eating difficulty	.0054
△ in 'in and out of bed' difficulty	.0027
△ in difficulty using a toilet	.0011
Number of IADLs	.0039**
High blood pressure	.0023
Diabetes	.0077**
Cancer	-.0027
Lung	-.0009
Heart	-.0008
Stroke	.0025
Psychological problem	.0072*
Arthritis	.0002
Memory problem	-.0022
Household's	
Number of Children	-.0009
Total household wealth	
Over 90 percentile	-.0135
75 percentile-90 percentile	-.0105
50 percentile-75 percentile	-.0227***
25 percentile-50 percentile	-.0166**
10 percentile-25 percentile	-.0076
Below 10 percentile	—-
Total household income	
Over 90 percentile	.0121
75 percentile-90 percentile	.0053
50 percentile-75 percentile	.0096
25 percentile-50 percentile	.0011
10 percentile-25 percentile	-.0152
Below 10 percentile	—

Note[1]:*,**,*** represents statistical significance with 10%, 5%, and 1%, respectively.

Table 1.8: ADL2: The Marginal Effect— Decision maker: respondent vs Decision maker: spouse

Variables	Nursing home care(R)	Nursing home care(S)
Respondent's		
Age	.0015***	.0039
Gender	.0007	-.0223
Race/Ethinicity	.0093*	-.0327
Region (States)	-.0014	-.0738***
Location (urban)	.0041	.0075
Less than high school	—	—
High school graduation	-.0033	.1133***
Some college	.0039	.1060***
College graduation or above	.0007	.0897**
Long term care health insurance	.0009	-.0384
Medicaid	.0084	.0717*
Health Status	.0024	-.0435
$\triangle$ in walking difficulty	.0164***	.0585**
$\triangle$ in dressing difficulty	.0087*	.0186
$\triangle$ in bathing difficulty	.0112*	.0198
$\triangle$ in eating difficulty	.0150	-.0604*
$\triangle$ in 'in and out of bed' difficulty	.0074	.0267
$\triangle$ in difficulty using a toilet	.0166***	.0785***
Number of IADLs	.0065***	.0317***
High blood pressure	-.0005	-.0332
Diabetes	.0070***	.0193
Cancer	.0008	-.0490
Lung	.0028	-.0009
Heart	.0019	-.0136
Stroke	.0097***	.0326
Psychological problem	-.0014	.0854***
Arthritis	.0009	-.0251
Memory problem	.0027	.0527**

Table 1.8 continued

Variables	Nursing home care(R)	Nursing home care(S)
Spouse's		
Age	-.00009	.0039*
Less than high school	—	—
High school graduation	—	.0221
Some college	—	.0419
College graduation or above	—	.0358
Health Status	-.0059	-.0184
△ in walking difficulty	-.0071	-.2351
△ in dressing difficulty	-.0069	.0905**
△ in bathing difficulty	.0064	.0733
△ in eating difficulty	.0075	.0074
△ in 'in and out of bed' difficulty	-.0064	.0643
△ in difficulty using a toilet	.0018	.0388
Number of IADLs	.0035***	-.0010
High blood pressure	.0036	-.0251
Diabetes	.0074***	-.0034
Cancer	.0032	-.0925***
Lung	-.0050	.0405
Heart	-.0039	.0132
Stroke	-.0021	.0672*
Psychological problem	.0064**	.0246
Arthritis	.0015	.0049
Memory problem	.0047	-.0862

Table 1.8 continued

Variables	Nursing home care(R)	Nursing home care(S)
Household's		
Number of Children	-.00009	-.0119**
Total household wealth		
Over 90 percentile	-.0138*	-.0359
75 percentile-90 percentile	-.0117*	-.0248
50 percentile-75 percentile	-.0207***	-.0861
25 percentile-50 percentile	-.0125**	-.0927*
10 percentile-25 percentile	-.0067	-.0478
Below 10 percentile	—	—
Total household income		
Over 90 percentile	.0081	.0279
75 percentile-90 percentile	.0069	-.0698
50 percentile-75 percentile	.0074	-.0013
25 percentile-50 percentile	-.0016	-.0183
10 percentile-25 percentile	-.0025	-.1592
Below 10 percentile	—	—

Note[1]:*,**,*** represents statistical significance with 10%, 5%, and 1%, respectively.
Note[2]: Two sub-samples are estimated—
A respondent makes a decision in the first group, and a spouse makes a decision of a respondent's formal long-term care in the second group.
R stands for a decision maker is a respondent and S represents a decision maker is a spouse.
Note[3]: The criteria of classification of sub-samples is 2 ADLs of respondent. When a respondent has 0-1 ADL, I assume that a respondent makes a decision of his/her formal long-term care. Otherwise, a spouse makes a decision for a respondent.

Table 1.9: ADL 3: The Marginal Effect— Decision maker: respondent vs Decision maker: spouse

Variables	Nursing home care(R)	Nursing home care(S)
Respondent's		
Age	.0015***	.0085**
Gender	-.0018	.0306
Race/Ethinicity	.0064	-.0128
Region (States)	-.0018	-.1113***
Location (urban)	.0049*	-.0047
Less than high school	—	—
High school graduation	-.0030	.1752***
Some college	.0044	.1409**
College graduation or above	.0002	.2145***
Long term care health insurance	.0018	-.1038
Medicaid	.0053	.1420***
Health Status	.0011	-.0195
$\triangle$ in walking difficulty	.0164***	.0764**
$\triangle$ in dressing difficulty	.0081**	.0606
$\triangle$ in bathing difficulty	.0141***	-.0089
$\triangle$ in eating difficulty	-.0013	-.0894**
$\triangle$ in 'in and out of bed' difficulty	.0119*	.0120
$\triangle$ in difficulty using a toilet	.0169***	.0758**
Number of IADLs	.0070***	.0281**
High blood pressure	-.0020	-.0282
Diabetes	.0067**	.0194
Cancer	.00003	-.0747
Lung	.0036	.0119
Heart	.0023	-.0249
Stroke	.0108***	.0268
Psychological problem	-.0011	.1191***
Arthritis	.0015	-.0388
Memory problem	.0068	.0900**

Table 1.9 continued

Variables	Nursing home care(R)	Nursing home care(S)
Spouse's		
Age	.0001	.0008
Less than high school	—	—
High school graduation	—	.0452
Some college	—	.0545
College graduation or above	—	.0348
Health Status	-.0071	-.0234
△ in walking difficulty	-.0107	-.3809
△ in dressing difficulty	-.0002	.0169
△ in bathing difficulty	.0048	.1527**
△ in eating difficulty	.0028	.1301
△ in 'in and out of bed' difficulty	-.0100	.1593**
△ in difficulty using a toilet	.0026	.0440
Number of IADLs	.0040***	.0172
High blood pressure	.0038	-.0571
Diabetes	.0078***	-.0265
Cancer	.0032	-.1453***
Lung	.0002	-.0366
Heart	-.0021	.0205
Stroke	-.0023	.0909*
Psychological problem	.0067**	.0498
Arthritis	.0004	.0175
Memory problem	.0049	-.1484

Table 1.9 continued

Variables	Nursing home care(R)	Nursing home care(S)
Household's		
Number of Children	-.0001	-.0160**
Total household wealth		
Over 90 percentile	-.0124	-.0358
75 percentile-90 percentile	-.0082	-.0997
50 percentile-75 percentile	-.0191***	-.1323**
25 percentile-50 percentile	-.0125**	-.1342**
10 percentile-25 percentile	-.0044	-.0720
Below 10 percentile	—	—
Total household income		
Over 90 percentile	.0051	0.1150
75 percentile-90 percentile	.0034	.4101
50 percentile-75 percentile	.0068	.0445
25 percentile-50 percentile	-.0043	.0501
10 percentile-25 percentile	-.0048	0.388
Below 10 percentile	—	—

Note[1]:∗,∗∗,∗ ∗ ∗ represents statistical significance with 10%, 5%, and 1%, respectively.
Note[2]: Two sub-samples are estimated—
A respondent makes a decision in the first group, and a spouse makes a decision of a respondent's formal long-term care in the second group.
R stands for a decision maker is a respondent and S represents a decision maker is a spouse.

Chapter 2

2 The Role of Spouse′s Characteristics on the Decision of Paid Home Health Care of Elderly Couples in the United States

2.1 Introduction

In general, home health care has been rapidly expanding due to demographic changes and fiscal restraint (Donna Goodridge et al., 2012). In the United States, the number of home health care has been increased in accordance with an aging population[19] and increasing of life expectancy[20]. More than $72.2 billion was spent on home health care during 2009 and about 8.28 million of older Americans, aged 65 and above, received care from more than 33,000 home health care providers during 2010 (Shang et al., 2014). These older adults who need home health care mostly live in the community, and receive help with their daily activities from informal care-givers and/or paid care-givers (Kadushin, 2004).

[Table 2.1 here]

According to the Health and Retirement Study, the paid home health care[21] has been increasing over the years. Table 2.1 shows the percent of older adults over 65 years old who use paid home health care over the years. In 1996, the paid home health care was used by 11.68% of older adults over 65 years old before entering to a nursing home, and the use of paid home health care was increased to 14.74% in 2008. This number is expected to increase due to the increase of population of older people as well as improved technology and treatment that may prevent many chronic conditions from previously fatal illnesses (Kadushin, 2004). Additionally most older adults prefer to receive home health care while remaining at home or in their communities rather than in institution (Chen and Thompson, 2010; Eckert, Morgan, and Swamy, 2004; Langa, Chernew, Kabeto, and Katz, 2001; Mollica, 2003). It will also cause

[19]The number of elderly population has rapidly increased from 3.1 million in 1900 to 43.1 million in 2012, but also the elderly population itself is older than before. In 2012, the number of 65-74 age group was more than 10 times larger than in 1900; the 75-84 group was 17 times larger and the group of aged 85 years and above was 48 times larger (U.S. Department of health and human services, 2012; 2013).

[20]In 2011, it is expected for individuals who reached 65 years old to live 19.2 years more. The life expectancy of a child who was born in 2011 was increasing by almost 30 years(78.7 years old) than the person who was born in 1900 (U.S. Department of health and human services, 2012; 2013).

[21]Home health care consists of informal care provided by informal care-givers such as spouses, adult children, relatives or friends, and formal home health care provided by trained paid care-givers. In this chapter, paid home health care is defined as the formal home health care provided by paid care-givers.

to increase the need for paid home health care substantially over next several decades (Li and Jensen, 2011; Chen and Thompson, 2010; Fox-Grage, Folkemer, Burwel, and Horahan, 2000; Fox-Grage, Folkemer, and Lewis, 2003).

U.S. government has paid significant portion of the costs for formal long-term care – nursing home care and paid home health care through Medicare and Medicaid. Government spent around $90 million, which is 60% of total cost for nursing home care and $63 million, 81% of total cost for paid home health care in 2012. These government payments would be enlarged as the population of older adults, who are potential demander for long-term care, increases. According to Center for Medicare and Medicaid Services (2012; 2013), the government's coverage for long-term care is projected to increase up to $139 million for nursing home care, and $108 million for home health care in 2020.[22] Therefore, implementation of effective policy on long-term care is important to both individuals and government.

The government has discussed how to build an effective system for formal long-term care. One of discussions was how to sustain older adults to remain at homes or in the communities for longer periods before institutionalized. Nursing home care is the most expensive form of long-term care, and mostly is paid by the government through social welfare program. Thus the government has looked for the ways to decrease the cost for nursing home care. One of routes to decreasing the cost is to delay the entrance of disabled older adults to nursing facilities, through home health care that allows them to stay longer in communities or homes.

Researchers have analyzed the effect of the use of paid home health care on nursing home uses; in particulary, they studied whether receiving paid home health care reduces the uses of nursing home care. Some studies reported that an older adult who receives paid home health care enters a nursing home with less probability (G. Mitchell, Salmon, Polivka, and Soberon-Ferrer, 2006), other studies suggested opposite results (Jette, Tennstedt, and Crawford, 1995). However, the relationship between the use of paid home health care and the use of nursing home is still undetermined (Chen et al., 2014). Therefore it would be appropriate to develop a model based on considering both the use of home health care and nursing home care utilization as a continuum decision for long-term care. The model will be able to provide a more precise picture of long-term care choices when the choice set contains all possible ranges of alternatives on long-term care, whereas most of previous models (Gaugler, Duval, Anderson, and Kane, 2007) imposed restrictions on choice sets. This paper does not impose any assump-

[22] Assuming that the growth of government's coverage rates for paid home health care and nursing home care, 60% and 81% are constant.

tions or prior restrictions among choices for long-term care such as the hierarchy of choices. An individual will choose the one that maximize his/her utility among long-term care choices, given budget constraint.

Chapter 1 reviewed and analyzed how individual's factors, household factors, and spouse's factors make an effect on nursing home entry. In this chapter, I will analyze the risk factors that determine the use of paid home health care. Through this analysis, we can examine the factors that make a significant effect on the use of paid home health care. As a result, we can figure out which characteristics affect the individual's choices on formal long-term care for elderly couples in the United States through analysis presented in chapter 1 and this chapter. By integrating of formal long-term care in the analysis, this paper will provide policy makers valuable information such as risk factors, which increase the formal long-term care utilization.

Previous studies suggested that the likelihood of using paid home health care is increasing with living alone, availability of health insurance, physical impairment, functional difficulties in daily activities, and care-giver's need (Herlitz, 1997; Ozawa and Tseng, 1999; Kadushin, 2004).

Previous studies actively discussed risk factors for utilization of paid home health care, however these studies have limitations. First, the effect of spouse's characteristics in terms of spouse's health conditions on using paid home health care has not been thoroughly analyzed. Second, an interaction between spouses while elderly couple determines the type of long-term care has not been considered in the model. Third, previous studies have not covered all possible choices of long-term care in one picture. Mostly these studies focused on the risk factors for each type of formal long-term care separately. Thus, this chapter will provide a more comprehensive model by overcoming the aforementioned restrictions.

Regarding an influence of a spouse on paid home health care, spouse's characteristics would affect the choice of paid home health care. Considering primary care-givers for elderly couples are mostly spouses, spouse's characteristics that affect care-giving would make an effect on the choice of paid home health care. Moreover, paid home health care is a continuous care by staying at home or community, so that the spouse's effect on paid home health care might be more stronger than the effect on nursing home entry.

There are many indicators representing spouse's characteristics. The major indicator considered in this chapter is spouse's health conditions. In particular, this chapter will provide the effect of spouse's health conditions on the use of paid home health care. Assuming all condi-

tions are same, the person who has a healthy spouse is more likely to receive an aid from the spouse at home than the person who has an unhealthy spouse.

It is shown that secondary care-givers were less inclined to offer assistance or help if the primary care-giver is a spouse (Stolz, Uden, and Williman, 2004). Thus the role of spouses as primary care-givers would be an important factor. For instance, if spouse's health conditions are aggravated, it is hard to expect to receive an assistance or help from him/her. For this case, the need of a help from other secondary care-givers such as adult children, friends, and/or paid care-givers is increasing, and the demand for paid home health care would be increasing, as well.

Second, when an individual makes a decision on using paid home health care, the principal decision-maker is mostly assumed by himself/herself. If the individual is already receiving an informal care from his/her spouse, the influence of the spouse in decision making process will exist. For instance, consider a case in which an individual who has severe functional difficulties or physical impairment receives care only from his/her spouse. As an individual's functional dependency in daily activities increases, the care-giving burden of the spouse would be raised. This increased intensity of care-giving would induce a spouse to play a leading role on the decision of paid home health care.

In general, most of studies assume that decision maker in elderly couples is either an individual who use long-term care or the other family members (Kats et al., 2000; Miller, 2010; Li et al., 2011; Kietzman et al., 2013) . In these studies, it is typically assumed that the choice for using long-term care including paid home health care is determined by an individual. Even though some studies consider a spouse as the principal decision-maker (Lopez et al., 2012; Reckrey et al., 2013), these studies consider some specific groups defined by having same diseases and the decision is conveyed only by the spouse (Cho et al., 2011). However, this study presumes that both individuals of couple household could be a decision-maker, and does not have limitations by focusing on a specific group having a certain disease.

Lastly, it has been still controversial whether paid home health care and nursing home care are complement or substitute choices. In this study, I assume that paid home health care and nursing home care are exclusive choices,[23] and I do not impose a sequential ordering on the decision between paid home health care and nursing home care. Older adults who need long-

[23]This assumption should be tested for multinomial logit model, since assumption of independence of irrelevant alternatives("IIA") needs to be satisfied in multinomial logit model. The tested result shows that IIA is holding [Results available upon request].

term care have a same weight on paid home health care and nursing home care when they make a decision on formal long-term care.

In this paper I will extend previous studies on paid home health care in three ways by including spouse's health conditions, the principal decision-makers on formal long-term care, and all ranges of possible choices of long-term care. The remainder of this paper consists of the following sections. Section 2 and 3 explain empirical estimation methods and discuss estimation results; and Section 4 summarizes the key results of this study.

2.2 Multinomial logit approach

2.2.1 Data and Variables

The data was obtained from the Health and Retirement Study (HRS), which provides surveys every two years since 1992. Compared with cross-sectional data, panel data enables researchers to observe not only static relationship but also dynamic relationship among variables since same individuals are tracked during the survey periods. Unobserved heterogeneity can also be considered in panel analysis. Different from cross-sectional data and time-series data, the panel data provides more information such as dynamics of variables, so that it allows researchers to acquire an efficient estimator. This paper is based on longitudinal data, the HRS from wave 3 (1998) to wave 9 (2008).

As mentioned in chapter 1, the HRS includes five cohorts – AHEAD cohort, CODA cohort, initial HRS cohort, WB cohort, and EBB cohort. HRS provides individual's information such as demographic characteristics, health, wealth, income, social security, family structure, and employment history.

Sample Selection

The sampling data-sets are same as those in chapter 1. Couple households' respondents in AHEAD cohort, CODA cohort, initial HRS cohort, and WB cohort's are selected. The data-set in this chapter includes only core interview files in the HRS. I restrict my sample to couple households' respondents who aged 65 or older and interviewed from wave 3 (1996) to wave 9

(2008), inclusive of their spouses' information. The analytical sample is limited to respondents who stay in a community and do not take a nursing home care at wave 3 (1996), as well. Additionally, I consider only the periods up to the first entry to a nursing home, and staying at least 100 days at nursing home facilities.

Variables

Dependent Variable

As in chapter 1, all possible choices on long-term care will be a dependent variable. An individual who needs long-term care takes into account three choices on long-term care such as 'no formal long-term care(including the possibility of informal care),' 'paid home health care provided by paid caregivers at home or in the community,' and 'the use of nursing home care provided by institute employees.' Just as the dependent variable in chapter 1, three numbers are assigned for these three choices.

- 0: If a respondent reports no uses in any formal long term cares – nursing home care, home health care, and special health facility
- 1: If a respondent enters a nursing home and stays over 100 days since the last interview that the respondent has lived in a nursing home
- 2: If a respondent reports the use of paid home health care and/or special health facility

The purpose of this chapter is to analyze the key factor in determining the use of paid home health care before the first entry of long-term nursing home stays. Particularly spouse's health conditions will be examined in detail. This study will show how spouse's health conditions affect the uses of paid home health care before entering to a nursing home. This chapter focuses on the case in which a respondent receives paid home health care. As mentioned earlier, including the choice of nursing home care will provide the integrated picture of long-term care choices.

Independent Variable

In order to indicate health dynamics of respondents, I consider the following variables — respondent's ADL, IADL, and health status. Specifically, the ADL variables are represented by a dummy variable to consider the three changes of limitation over the time for each ADL variable ; 0 for decreasing limitation and no changing in limitation in a specific ADL variable, and 1 for increasing limitation in a specific ADL variable. By recoding the changes of each ADL using aforementioned dummy variables, the marginal effects of each new difficulty in ADLs will be analyzed. This study will provide the likelihood of using paid home health care and nursing home entry when a respondent experiences difficulties in ADLs. This study may provide an insight into marginal effect of aggravated ADLs on the choice of formal long-term care.

IADL is evaluated through the variables of six instrumental activities in daily living. If a respondent answers to have some difficulty, IADL variable is assigned to 1; otherwise, IADL variable is set to 0 for no difficulty. RAND-HRS provides the data for number of IADLs by summing up all reported IADLs by a respondent. There are two types of measurement scales such as, 0-3 (using a phone, managing money, and taking medication) and 0-5 (using a phone, managing money, taking medication, shopping for groceries, and preparing meals). This study adopts the latter scale in the analysis.

Self-reported health status is also contained in independent variables. The range of scale is from 1(Poor) to 5(Excellent). Same as in the chapter 1, I generate a dummy variable by assigning 0 for a respondent who has excellent, very good, or good health status. The data for a respondent who reports fair or poor health status is assigned by 1 in self-reported health status.

Nine diseases diagnosed by doctors are included; high blood pressure, stroke, diabetes, cancer, lung disease, heart disease, arthritis, psychological problems, and cognitive impairment. Most previous studies include the total number of reported diseases of a respondent. It does not provide how each disease have an effect on formal long-term care. In this chapter, quantitative results for the effect of each disease on paid home health care will be presented.

Additionally, individuals' demographic characteristics – respondent's age, gender, location where a respondent lives, levels of education – are controlled in the analysis. Household variables such as household income and household wealth are considered, instead of respondent's income and wealth. The elderly couple will make a decision based on household resources when they reach the status in which they need a formal long-term care.

Lastly, I include independent variables that indicate the spouse's health condition (e.g. health dynamics, and nine diagnosed diseases) and spouse's characteristics (e.g. age, and education level).

2.2.2 Empirical Model: Multinomial logit with panel data

Multinomial logit with panel data is used to analyze the effect of determinants on paid home health care. The empirical estimation is conducted separately according to the principal decision-maker.

Decision-maker: A respondent

A respondent decides a type of long-term care among three choices by himself/herself. As mentioned in chapter 1, the utility function of an individual who needs long-term care potentially consists of deterministic part and error term, which cannot be observed by researcher.

$$U_{rjt} = V_{rjt} + \varepsilon_{rjt} \quad for\ all\ \ j,\ t \tag{21}$$

$$= \alpha_j + \beta_j' X_{rt} + \varepsilon_{rjt} \quad for\ all\ \ j,\ t \tag{22}$$

where $X_{rt} = f\ (\ predisposing\ factors,\ need\ factors,\ enabling\ factors\ )$

A respondent uses a paid home health care if it gives the highest utility compared with the utilities of alternatives, that is, $U_{r2t} = Max\,[\,U_{r0t},\ U_{r1t},\ U_{r2t}\,]$. In this case, the level of utility does not matter. Thus, the probability for the respondent to choose a paid home health care is given as follows:

$$(P_{r2t}|V) = Prob([U_{r2t} \geq U_{rjt}\,|\,V],\quad for\ all\ j \neq 2) \tag{23}$$

$$= Prob([U_{r2t} - U_{rjt} \geq 0\,|\,V],\quad for\ all\ j \neq 2) \tag{24}$$

$$= Prob([\varepsilon_{rjt} - \varepsilon_{r2t} \leq V_{r2t} - V_{rjt}\,|\,V],\quad for\ all\ j \neq 2) \tag{25}$$

If ε_{rjt} follows type I extreme value distributions, and independent over r, j, and t, then, the choice probabilities are:

$$(P_{r2t}|V) = \frac{e^{V_{r2t}}}{\sum_j e^{V_{rjt}}} \quad for\ all\ j \neq 2,\ t \tag{26}$$

This probability is estimated using log likelihood functions. To specify the likelihood, define $d_{r2t} = 1$ if a respondent chooses a 2(paid home health care) at t, otherwise, $d_{rjt} = 0$. The likelihood function for unit r is:

$$L_r = P_{r1t}^{d_{r1t}} \bullet P_{r2t}^{d_{r2t}} \bullet .... \bullet P_{rJt}^{d_{rJt}} \tag{27}$$

Then the likelihood function for the entire sample is:

$$L = \prod_{r=1}^{N} (P_{r1t}^{d_{r1t}} \bullet P_{r2t}^{d_{r2t}} \bullet .... \bullet P_{rJt}^{d_{rJt}}) \tag{28}$$

Thus the log-likelihood function is:

$$lnL = \sum_{r=1}^{N} \sum_{j=1}^{J} d_{rjt} ln(P_{r2t})) \tag{29}$$

$$= \sum_{r=1}^{N} \sum_{j=1}^{J} d_{rjt} ln(\frac{e^{\alpha_2 + X_{rt}\beta_2}}{\sum_j e^{\alpha_j + X_{rt}\beta_j}}) \tag{30}$$

The parameters β_2 are estimated.

Decision-maker: A spouse

As discussed earlier, the spouse of the respondent sometimes plays a leading role in decision-making process for long-term care uses. In this case, the above equations can be rewritten as:

$$U_{sjt} = V_{sjt} + \varepsilon_{sjt} \quad for\ all\ j,\ t \tag{31}$$

$$= \mu_j + \gamma_j' X_{st} + \varepsilon_{sjt} \quad for\ all\ j,\ t \tag{32}$$

where $X_{st} = f$ (*predisposing factors, need factors of the respondent, enabling factors*)

A spouse decides to use a paid home health care for the respondent if the choice of paid home health care gives the highest utility to the spouse, in comparison with the utilities when the spouse chooses alternatives, that is, $U_{s2t} = Max\,[\,U_{s0t},\ U_{s1t},\ U_{s2t}\,]$. In this case, the level of utility does not matter. Thus, the probability for the spouse to choose a paid home health care for the respondent is written as:

$$
\begin{aligned}
(P_{s2t}|V) &= Prob([U_{s2t} \geq U_{sjt} \mid V], \quad for\ all\ j \neq 2) && (33)\\
&= Prob([U_{s2t} - U_{sjt} \geq 0 \mid V], \quad for\ all\ j \neq 2) && (34)\\
&= Prob([\varepsilon_{sjt} - \varepsilon_{s2t} \leq V_{s2t} - V_{sjt} \mid V], \quad for\ all\ j \neq 2) && (35)
\end{aligned}
$$

If ε_{sjt} follows type I extreme value distributions, and independent over s, j, and t, then the choice probabilities are:

$$(P_{s2t}|V) = \frac{e^{V_{s2t}}}{\sum_j e^{V_{sjt}}} \quad for\ all\ j \neq 2,\ t \tag{36}$$

This probability is estimated using log likelihood functions. To specify the likelihood, define $d_{r2t} = 1$ if the spouse chooses a 2 (paid home health care) for the respondent at t, otherwise, $d_{rjt} = 0$. The likelihood function for unit s is:

$$L_s = P_{s1t}^{d_{r1t}} \bullet P_{s2t}^{d_{r2t}} \bullet .... \bullet P_{sJt}^{d_{rJt}} \tag{37}$$

Then the likelihood function for the entire sample of spouses(NS) is:

$$L = \prod_{s=1}^{NS} (P_{s1t}^{d_{r1t}} \bullet P_{s2t}^{d_{r2t}} \bullet .... \bullet P_{sJt}^{d_{rJt}}) \tag{38}$$

Thus the log-likelihood function is:

$$
\begin{aligned}
lnL &= \sum_{s=1}^{NS} \sum_{j=1}^{J} d_{rjt} ln(P_{s2t})) && (39)\\
&= \sum_{s=1}^{NS} \sum_{j=1}^{J} d_{rjt} ln(\frac{e^{\mu_2 + X_{st}\gamma_2}}{\sum_j e^{\mu_j + X_{st}\gamma_j}}) && (40)
\end{aligned}
$$

The parameters γ_2 are estimated.

To estimate the parameters, β_2, and γ_2, we need to identify two groups. Same as in chapter 1, I use the number of ADLs as for a criterion. As a respondent has more difficulties in daily living, the spouse of the respondent will experience higher physical and psychological burdens in care-giving. It would result in higher probability for spouses to intervene the decision of the respondent for using long term care.

Firstly, I conduct an analysis consecutively with considering groups categorized based on number of ADLs. This means, in the analysis for 0-1 ADL group, a respondent makes a decision on long-term care including paid home health care, while in 2-6 ADLs group the spouse chooses a type of long-term cares for the respondent. And then, the cut-off point for these two groups is changed to 3 ADLs. For 0-2 ADLs groups, a respondent decides his/her long-term care. On the other hand, 3-6 ADLs group, the spouse makes a decision on the respondent's using of paid home health care. The empirical results are shown in the next section.

2.2.3 Results and Discussion

This section provides the estimated parameters, which is marginal effect on the use of paid home health care before the first entry to a nursing home. The results consist of two parts according to the principal decision maker.

Decision-maker: A respondent

[Table 2.2 here]

Table 2.2 displays the results obtained by estimating the parameters of explanatory variables. Specifically, table 2.2 shows the calculated predicted probabilities from multinomial logit model based on full samplings with assuming that the principal decision-maker is a respondent.

Age has a positive effect on the use of a paid home health care. The predicted probability of a respondent in next 10 years to use a paid home health care is increased by 1.3%. As the seniors are getting older, the risk to use a paid home health care rises because of weakening of health conditions. Different from the results of nursing home entry, regional differentials are

not found in using paid home health care. This is due to the fact that the use of paid home health care is more easily accessible irrespective of regions.

Higher education level is associated with higher use of paid home health care. The respondent who is educated more than the high school, is more likely to use paid home health care, by the the amount of 2% to 6%, than one who does not graduate from high school. Cutler and Muney (2007) shows that education affects an individual's health in such a way that higher levels of education provides more resources to the individual. Higher education may allow one to access the information of long-term care with more easiness and to easily use the care due to resources related to education level.

Medicaid affects paid home health care positively. The results show that if a respondent has a Medicaid, the use of paid home health care will be increased by 4.55%.

The health conditions of a respondent are one of significant factors in using paid home health care. When an individual has fair or poor health status, he/she is more likely to use paid home health care by around 5%, when compared with the person who has excellent or very good or good health status. When individual's abilities in ADL such as dressing, bathing, eating, and/or using a toilet are aggravated, the possibility to use paid home health care increases by a range from 2.55% to 6.24%. The difficulty in IADL makes an effect on the use of paid home health care positively as well. Diseases diagnosed by doctors are also major effect to raise the probability of using paid home health care. Particularly, when an individual has cancer, heart problem, stroke, and/or arthritis, the individual is more likely to use paid home health care.

Spouse's health conditions are also key factors affecting the probability to use paid home health care. When a spouse has a difficulty in walking, the respondent is more likely to use paid home health care. Additionally when a spouse has a illness in high-blood pressure, diabetes, cancer, psychological problem, or arthritis, the respondent is more likely to use paid home health care.

Individual's and spouse's health conditions are significant factors for the respondent to choose paid home health care, whereas the effect of household income and wealth are insignificant.

Decision-maker: A respondent vs A spouse

As mentioned earlier, two sub-samples are taken into account. In the first group a respondent makes a decision by himself/herself, while in the other group the spouse of the respondent is

the principal decision-maker. The identification criteria are based on the number of respondent's ADLs. The criteria are 2 ADLs and 3 ADLs. That is, for 0-1 ADLs group (0-2 ADLs group), a respondent decides formal long-term care, including paid home health care. On the other hand, for 2-6 ADLs group (3-6 ADLs group), the spouse makes a decision on the type of formal long-term cares for the respondent, including using of paid home health care.

[Table 2.3 here]

[Table 2.4 here]

Tables 2.3 and 2.4 suggest the predicted probabilities of explanatory variables in choosing the use of paid home health care. The criterion in table 2.3 is 2 ADLs of a respondent whereas it is 3 ADLs for table 2.4.

The overall results in table 2.3 and 2.4 are similar to those presented in table 2.2. However when the groups are categorized by the principal decision-maker, some marginal effects are changed.

For group 1 (where the principal decision-maker is a respondent), it is shown in table 2.3 that white people are more likely to use paid home health care than other races. Regarding health conditions of the respondent, the marginal effect of difficulties in ADLs has been changed. Only difficulties in dressing and using a toilet are significant effects. The psychological problem of a respondent plays an additional role on using paid home health care. The spouse's health conditions may be an important factor for the choice of paid home health care. Among spouse's health conditions, spouse's diabetes, cancer and arthritis are only significant factors that affect positively the use of paid home health care.

For group 2 (the principal decision-maker is the spouse of the respondent), the results shown in table 2.3 are similar to those presented in table 2.2. However there are some differences. When a respondent has difficulties in eating, and using a toilet, the spouse of the respondent chooses to use paid home health care for the respondent. In other words, the respondent has these difficulties, the spouse is more likely to choose paid home health care rather than the care provided by the spouse at home. Only cancer has a positive effect on the choice of paid home health care in this case. Regarding spouse's health conditions, when the spouse has a difficulty in walking, the probability of the respondent to receive paid home health care is increased by 13%.

Table 2.4 shows the marginal effect of explanatory variables when the criterion to separate the group is 3 ADLs of the respondent. Although some changes in the predicted probability of

using paid home health care are made, the overall results are similar to those shown in table 2.2. For group 1(the principal decision-maker is a respondent), a respondent who has difficulties in ADLs is more likely to use paid home health care. The results for spousal effect report similar patterns as well.

In group 2, I found different results when compared with previous results reported in table 2.2. Especially, the household wealth have a positive effect on paid home health care. If respondent's household has higher wealth, the spouse of the respondent is more likely to choose paid home health care for the respondent. It is different from the results of the effect on nursing home entry. Higher wealth affect negatively the nursing home entry. This implies that the role of wealth on formal long-term care is dependent on the types of formal long-term care.

The limitation of the method used in this study is that the use of paid home health care is repeated choices. In the case of nursing home care, we focus on the first entry to a nursing home, so that we can evade the econometric problem of repeated choices in multinomial logit model with panel data. Nursing home entry is ended up at the first entry, thus it is not a repeated choice. However, the uses of paid home health care is repeated choices for the decision-maker of long-term care. It could make the error term of paid home health care correlated over the waves(time). To overcome this restriction, I employ a hazard model for analysis of paid home health care. By comparing the results of multinomial logit with those of hazard model, we can obtain robust estimators.The details of hazard model and its results are described in the following section.

2.3 Hazard model

2.3.1 Data and Variables

Data and Sample Selection

The HRS is used to consider hazard model. All cohorts except EBB cohort are included in the analysis. Respondents who aged 65 and above in couple households are selected. The spouses of the selected respondents are also contained in the estimation. The data from wave 3 (1996) to wave 9 (2008) are included. Wave 1 (1992) and Wave 2(1994) are not included because special health facility, which is a type of paid home health care, is not collected. I con-

sider the respondents who stays at home or in the community at wave 3. Additionally, periods up to the first entry to a nursing home, staying at least 100 days at nursing home facilities are considered. Thus the use of paid home health care in this study means the utilization of paid home health care before the first entry to a nursing home for long stays.

Variables

Dependent Variable

The dependent variable of hazard model is the time from baseline to the date of event happening. For instance, in a hazard model for nursing home placement, a dependent variable could be the time of dwelling at communities from baseline to the date of being institutionalization (Freedman, 1996). According to previous studies in hazard model, the dependent variable for paid home health care would be the time of dwelling at communities without any formal long-term care from baseline to the date of using a paid home health care. However, the HRS did not interview respondents about the exact date of using a paid home health care, but it provides an information whether a respondent used a paid home health care during previous 2 years. Thus we are not able to use the measurement of time from baseline to the date of using a paid home health care as for a dependent variable. In this study, the dependent variable is the age from baseline to the age when the respondent uses home health care. Based on this variable, we can calculate the duration of staying at home for the respondent before using a paid home health care.

Independent Variable

Based on Anderson's health care behavioral model[24] the independent variables of hazard model are described as follows.

Predisposing factors

Demographic characteristics of respondents are included as for predisposing factors. Gender,

[24]See Anderson, 1968; and Bradley et al., 2002

race, region where a respondent lives, and levels of education are analyzed. Dummy variables are generated for gender, race, region, and levels of education. The effect of gender on home health care is inconsistent. Some researchers found positive effect of female on paid home health care, however others found insignificant results (Kats et al., 2000). This paper will estimate the effect of gender for elderly couples on paid home health care. Previous studies also report that the level of education is positively related to the use of paid home health care. Education on paid home health care will also examined in this paper, and the respondents' dwelling area is controlled.

Need factors

As for need factors, health conditions are included. These health-related variables make a critical effect on the use of paid home health care. In the HRS, health dynamics of a respondent — ADL, IADL, and health status of a respondent — are surveyed every two years. In particular, I focus on the marginal effects of aggravated ADLs separately. The changes of ADLs are one of the most significant factors in decision of nursing home entry as presented in section 2. I will examine the results obtained from hazard model in order to investigate whether the results are similar to those of multinomial logit model or not. I generate the changes of ADLs by generating values same as before — 0 for 'same as a previous wave or improved limitation of a ADL,' and 1 for 'aggravated limitation of a ADL.' Unlike previous studies, this study analyzes the marginal effects of aggravated limitations of each ADL.

IADL is a measure of abilities in six areas of instrumental activities in daily living – using the phone, taking medications, managing money, shopping for groceries, preparing meals, and using a map. If a respondent has a difficulty in IADL, the value of that IADL is denoted as 1. The HRS and RAND/HRS provide information for each IADL variable. Based on this, calculated total number of IADLs for each individual is available. There are two types of calculated IADL variables in RAND/HRS data, one of which is based on a scale of 0-3 (using a phone, managing money, and taking medication) while the other is based on a scale of 0-5 (using a phone, managing money, taking medication, shopping for groceries, and preparing meals). This study use the scale of 0-5 range.

Health status are also considered in this study. Five categories for health status are classified based on a dummy variable — 0 for excellent/very good/good and 1 for fair/poor. As for objective health data, diseases diagnosed by doctors are contained as well. Same as before, all

nine diseases are included to analyze its effect on the use of paid home health care.

Enabling factors

The insurance that covers long-term care costs belongs to enabling factors. Broadly, the long-term care health insurance consists of private insurance and government insurance. Medicare and Medicaid belongs to government insurance. In this study, private long-term care health insurance and Medicaid are included as enabling factors. Both variables are recoded with dummy variable, defined as 0 for not holding the insurance and 1 for holding the insurance.

As mentioned earlier, when a respondent has a difficulty in physical activities, the primary informal care-giver is the spouse of the respondent who lives together. The change of spouse's characteristics makes an effect on informal care provided by the spouse, and consequently, the choice of formal long-term care. Spouse's variables such as — spouse's age, spouse's education levels, and health conditions are reflected to analyze the spouse's role in the use of paid home health care. Spouse's health conditions are measured in a similar manner to the estimation of health conditions for a respondent, and then reflected in the model.

2.3.2 Empirical Model: Hazard model

Duration based hazard model is used to estimate determinants that affect the use of paid home health care. Before entering a nursing home, a respondent could experience repeated choices on the use of paid home health care. In this case, hazard model will be more appropriate.

The duration from staying at home without formal long-term care to using paid home health care was estimated in this study. We estimate the risk factors of using paid home health care. In this work, some individuals in the data are censored because of death. This censored case is considered in the analysis. The model is able to consider a case in which a respondent could die before using a paid home health care.

The HRS includes the information of deceased respondents over the years. The spouse of the respondent has answered whether his/her significant spouse are died during previous 2 years. Another possibility of censoring is the entry to a nursing home. However, this possibility can be excluded, since the selected data is limited to the first entry to a nursing home. That is, in the selected data a respondent can use a paid home health care before entering a nursing home,

however a respondent cannot use a paid home health care after the first entry to a nursing home. The use of a paid home health care occurs prior to the nursing home entry. Thus respondents staying in the community without formal long-term care face the risks; using paid home health care and death.

A respondent faces two competing risks before entering a nursing home; using a paid home health care and death. These two competing risk is assumed to be unrelated. A death of a respondent happens randomly, independent of using paid home health care. The Cox- proportional hazard regressions will be estimated separately.

The Cox- proportional hazard model is generally represented in the following form:

$$h(t;X) \;=\; h_0(t)\, exp(\beta' X) \tag{41}$$

β is the parameters to be estimated, and X represents independent variables. The Cox- proportional hazard regression estimates the parameters, whereas the baseline hazard, h_0, is not estimated directly. In hazard model, we also evaluate the parameters by categorizing two cases according to the principal decision-maker.

Decision-maker: A respondent

As mentioned, a respondent faces two risks such as using a paid home health care and death. To consider these competing risks, the general Cox- proportional hazard regression can be rewritten as follows:

$$h_r^{C\ to\ P}\ (t;X_r) \;=\; h_0(t)^{\,C\ to\ P}\ exp(\ \delta^{\,C\ to\ P\,\prime}\, X_r) \tag{42}$$

$$h_r^{C\ to\ D}\ (t;X_r) \;=\; h_0(t)^{\,C\ to\ D}\ exp(\ \delta^{\,C\ to\ D\,\prime}\, X_r) \tag{43}$$

where P indicates paid home health care, *C represents staying at home or community*, *D means Death*, *r indicates a respondent* .

$h_r^{C\ to\ P}\ (t;X_r)$ represents the hazard rate of a respondent for transition from staying at home or community to using a paid home health care. $h_r^{C\ to\ D}\ (t;X_r)$ is the hazard rate of a respondent for transition to death from staying at home or community. Equations (42) and (43) are estimated separately. In this study, we focus on the estimated parameters from the equation

(42).

Decision-maker: A spouse

In this analysis, we also consider the case where the spouse of the respondent plays a leading role on the use of paid home health care. The equations (42) and (43) can be rewritten as:

$$h_r^{C\ to\ P}\ (t;X_s) \;=\; h_0(t)^{\,C\ to\ P}\ exp(\ \omega^{\,C\ to\ P\prime}\, X_s) \tag{44}$$

$$h_r^{C\ to\ D}\ (t;X_r) \;=\; h_0(t)^{\,C\ to\ D}\ exp(\ \omega^{\,C\ to\ D\prime}\, X_r) \tag{45}$$

where P represents paid home health care, C indicates staying at home or community, D means Death, s represents the spouse of the respondent.

$h_r^{C\ to\ P}\ (t;X_s)$ is the hazard rate of a respondent for transition from staying at home or community to using paid home health care. Here, it should be noted that the decision of using a paid home health care is made by a spouse. The person who receives paid home health care is still the respondent, however the decision will be made by the spouse. $h_r^{C\ to\ D}\ (t;X_r)$ is the also hazard rate of a respondent for transition to death from staying at home or community. Here, note that $h_r^{C\ to\ D}\ (t;X_r)$ is irrespective of spouse's characteristics. The death of a respondent will be decided by his/her health status and/or other characteristics, so that the independent variables in equation (45) consists of only respondent's characteristics, X_r. Equation (45) is similar to equation (43), except differently estimated parameters. The parameters of equation (43) are obtained from the group 1, where a respondent decides the type of long-term care. The parameters of equation (45) are acquired from the risk of death for the group 2 , where a respondent has a high dependency on his/her spouse who is thus a decision maker. Equations (44) and (45) are estimated separately.

As described earlier, I employ the number of ADLs for identifying these two groups. The criteria are 2 ADLs and 3 ADLs. That is, for 0-1 ADLs group (0-2 ADLs group), a respondent decides his/her paid home health care. On the other hand, in 2-6 ADLs group (3-6 ADLs group), the spouse makes a decision on respondent's use of paid home health care. The empirical results are provided in the next section.

2.3.3 Results and Discussion

Table 2.5 and 2.6 show hazard ratio of using paid home health care before the first entry to a nursing home. According to the principal decision-maker, the results will be presented separately.

Decision-maker: A respondent

[Table 2.5 here]

Table 2.5 presents hazard ratio for each explanatory variable. The results are almost similar to those obtained from multinomial logit model. It is interestingly found that the number of children affects the use of paid home health care. When a respondent has more children, he/she is less likely to use paid home health care. It supports that children also play a role in the choice of parent's formal long-term care.

As stated above, I analyze the effect of spousal role on the choice of paid home health care according to the principal decision-maker. The results are shown as below:

Decision-maker: A respondent vs A spouse

[Table 2.6 here]

Table 2.6 provides two sub-samples according to the principal decision-maker. The first column shows the results when a respondent makes a decision on paid home care by himself/herself. The second column suggests the results when the spouse of the respondent plays a main role in the decision of respondent's paid home health care.

Group 1 has similar results to those suggested in table 2.5. The respondent's health conditions are highly significant factors in determining the use of paid home health care. Spouse's health conditions also affect the respondent's use of paid home health care. When the spouse has a psychological problem, the respondent is more likely to use paid home health care. Additionally, spouse's difficulty in using a toilet causes the respondent to use paid home health care. Medicaid also plays a positive role in using the paid home health care.

Group 2 considers the case in which the spouse makes a decision on paid home health care for the respondent. Interestingly, if the respondent is a female, then her husband is more likely to

decide to use paid home health care for her. It is consistent with the fact that wife is more likely to be an informal care-giver when a husband has health problems, whereas husband rarely provides the wife with informal care at home. Additionally, household wealth and income makes the spouse of the respondent to use more paid home health care for the respondent. This group exhibits severe difficulties in comparison with group 1, so that the burden of care-giving by the spouse will be high. Therefore, if the spouse has more resources such as household income and wealth, she/he is more likely to purchase paid home health care for the respondent.

[Table 2.7 here]

In table 2.7, the criteria is changing from 2 ADLs to 3 ADLs of a respondent. As shown similarly in table 2.6, the principal decision-maker is a respondent in the first column, and the second one shows the results when the spouse of the respondent is the principal decision-maker.

The results presented in table 2.7 are similar to those provided in table 2.6. This indicates that there are common factors that affect the use of paid home health care, while race is a significant, uncommon factor that makes an effect on the use of the paid home health care for group 2 in table 2.7. If a respondent's race is white, the spouse makes the respondent to use more paid home health care.

2.4 Conclusion

Along with an aging population and increasing of life expectancy, the needs for paid home health care is increasing. According to Shang et al. (2014), about 8.28 million of older Americans, aged 65 and above, received care from more than 33,000 home health care providers during 2010. The demand for home health care in the next several decades is expected to increase due to increasing older population as well as improved technology and medical treatment.

It has been discussed the risk factors that affect home health care. Previous studies found living alone, availability of health insurance, physical impairment, functional difficulties in activities of daily living, and care-giver's need increase the possibility to use paid home health care (Herlitz, 1997; Ozawa and Tseng, 1999; Kadushin, 2004). This chapter extends previous studies by considering the effect of spouse's characteristics on using paid home health care, an interaction between spouses in the decision-making process of long-term care, and by including all possible choices on the type of long-term care in the model. In this chapter, it is

studied how the paid home health care is affected by following factors - individual's factors, household factors, and spouse's factors, based on multinomial logit model and hazard model. Despite slight differences between results obtained from these two models, these two models predict similar effect of aforementioned factors on the use of paid home health care.

In using of paid home health care, the individual's health conditions and education level are important parameters in the decision. Additionally spouse's psychological problem affects paid home health care in all cases. Household wealth and income make a positive effect in some cases, and Medicaid positively affects the use of paid home health care.

According to the principal decision-maker, we find the different results: private long-term care health insurance was not significant in the full sample, however when we categorize the sample into sub-samples to figure out the principal decision-maker, it affects positively paid home health care uses. If a respondent has a private long-term care health insurance, he is more likely to use paid home health care with increased probability by 12%-18%. Additionally respondent's psychological problem does not affect the use of paid home health care in the full sample, while it turns to be a significant effect on paid home health care use when we separate the sample to recognize the principal decision-maker. The predicted probability to use a paid home health care is increased by 2.04% if a respondent has a psychological problem.

As mentioned in section 2, I employed multinomial logit for the analysis of paid home health care uses. However, it could be problematic in the perspective of the framework in the choice of paid home health care. Different from choosing nursing home care, the use of paid home health care is repeated choices for a respondent. To overcome this restriction, hazard model for analysis of paid home health care is employed.

The results from hazard model are almost similar to those obtained from multinomial logit model, while respondent's high blood pressure, and lung problem have a positive effect on using paid home health care. Moreover, the results obtained from the hazard model report that the number of children affects negatively the use of paid home health care of the respondent. When the respondent has more children, he/she is less likely to use a paid home health care service.

This chapter analyzes the risk factors in the use of paid home health care. The results suggest that the use of paid home health care is also affected by not only individual factors, but also spouse's factors, as well as household factors.

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Table 2.1: Paid home health care utilization for elderly couples 65 years old and over

LTC/Year	1996	1998	2000	2002	2004	2006	2008
No LTC	88.32	83.97	86.48	84.56	83.32	81.08	81.14
Paid home care	11.68	13.12	10.86	11.74	13.51	13.78	14.74
N(Number of Obs.)	4,726	5,402	4,429	3,628	3,021	2,490	1,988

[1] The data keeps until the first entry to a nursing home. Paid home health care is tracked before the first entry to a nursing home.

Table 2.2: The Marginal Effect: Full Sample, Decision maker: Respondent

Variable	Paid home health care
Respondent's	
Age	.0013*
Gender	-.0043
Race/Ethinicity	.0144
Region (States)	-.0004
Location (urban)	.0090
Less than high school	—
High school graduation	.0278***
Some college	.0299***
College graduation or above	.0606***
Long term care health insurance	.0062
Medicaid	.0455***
Health Status	.0475***
$\triangle$ in walking difficulty	.0148
$\triangle$ in dressing difficulty	.0255**
$\triangle$ in bathing difficulty	.0387***
$\triangle$ in eating difficulty	.0421**
$\triangle$ in 'in and out of bed' difficulty	.0089
$\triangle$ in difficulty using a toilet	.0624***
Number of IADLs	.0252***
High blood pressure	.0048
Diabetes	-.0034
Cancer	.0223***
Lung	.0101
Heart	.0342***
Stroke	.0409***
Psychological problem	.0057
Arthritis	.0384***
Memory problem	-.0128

Table 2.2 continued

Variable	Paid home health care
Spouse's	
Age	.0007
Health Status	-.0058
△ in walking difficulty	.0265*
△ in dressing difficulty	-.0108
△ in bathing difficulty	-.0091
△ in eating difficulty	-.0138
△ in 'in and out of bed' difficulty	-.0142
△ in difficulty using a toilet	.0246
Number of IADL	.0056
High blood pressure	-.0110
Diabetes	.0184**
Cancer	.0184**
Lung	-.0080
Heart	.0054
Stroke	-.0025
Psychological problem	.0155*
Arthritis	.0125*
Memory problem	-.0098
Household's	
Number of Children	-.0021
Total household wealth	
Over 90 percentile	-.0120
75 percentile-90 percentile	-.0110
50 percentile-75 percentile	.0042
25 percentile-50 percentile	.0109
10 percentile-25 percentile	.0135
Below 10 percentile	—-
Total household income	
Over 90 percentile	-.0113
75 percentile-90 percentile	-.0158
50 percentile-75 percentile	-.0268
25 percentile-50 percentile	-.0155
10 percentile-25 percentile	-.0012
Below 10 percentile	—

Note[1]:∗,∗∗,∗ ∗ ∗ represents statistical significance with 10%, 5%, and 1%, respectively.

Table 2.3: ADL2: The Marginal Effect— Decision maker: respondent vs Decision maker: spouse

Variables	Paid home health care(R)	Paid home health care(S)
Respondent's		
Age	.0010	.0023
Gender	-.0017	-.0620
Race/Ethinicity	.0156	.0254
Region (States)	-.0010	.0058
Location (urban)	.0051	.0480
Less than high school	—	—
High school graduation	.0327***	-.0089
Some college	.0358***	-.0475
College graduation or above	.0621***	.0582
Long term care health insurance	.0002	.1216**
Medicaid	.0479***	.0529
Health Status	.0430***	.0668
△ in walking difficulty	.0108	-.0240
△ in dressing difficulty	.0292**	-.0106
△ in bathing difficulty	.0308	.0446
△ in eating difficulty	.0229	.0742**
△ in 'in and out of bed' difficulty	.0038	-.0235
△ in difficulty using a toilet	.0559***	.0733**
Number of IADLs	.0205***	.0403***
High blood pressure	.0009	.0467
Diabetes	-.0024	-.0136
Cancer	.0178***	.0956***
Lung	.0105	.0150
Heart	.0371***	-.0062
Stroke	.0538***	-.0433
Psychological problem	.0204**	-.0672*
Arthritis	.0393***	.0211
Memory problem	-.0130	-.0421

Table 2.3 continued

Variables	Paid home health care(R)	Paid home health care(S)
Spouse's		
Age	.0007	.0004
Less than high school	—	—
High school graduation	—	-.0531
Some college	—	.0214
College graduation or above	—	-.0111
Health Status	-.0037	-.0200
△ in walking difficulty	.0185	.1302*
△ in dressing difficulty	-.0012	-.1037
△ in bathing difficulty	-.0201	.0312
△ in eating difficulty	-.0008	-.1796
△ in 'in and out of bed' difficulty	-.00008	-.0707
△ in difficulty using a toilet	.0202	.0648
Number of IADLs	.0047	.0056
High blood pressure	-.0133**	.0343
Diabetes	.0219***	.0099
Cancer	.0195***	.0301
Lung	-.0057	-.0301
Heart	.0066	-.0233
Stroke	-.0044	.0056
Psychological problem	.0129	.0289
Arthritis	.0115*	.0271
Memory problem	-.0157	.0500

Table 2.3 continued

Variables	Paid home health care(R)	Paid home health care(S)
Household's		
Number of Children	-.0022	-.0005
Total household wealth		
Over 90 percentile	-.0288	.0867
75 percentile-90 percentile	-.0299	.1065
50 percentile-75 percentile	-.0157	.1341*
25 percentile-50 percentile	-.0128	.1859***
10 percentile-25 percentile	-.0025	.1220
Below 10 percentile	—	—
Total household income		
Over 90 percentile	-.0126	-.0032
75 percentile-90 percentile	-.0251	.1118
50 percentile-75 percentile	-.0321	.0391
25 percentile-50 percentile	-.0158	.0148
10 percentile-25 percentile	-.0199	.1340
Below 10 percentile	—	—

Note[1]:∗,∗∗,∗ ∗ ∗ represents statistical significance with 10%, 5%, and 1%, respectively.
Note[2]: Two sub-samples are estimated—
A respondent makes a decision in the first group, and a spouse makes a decision of a respondent's formal long-term care in the second group.
R stands for a decision maker is a respondent and S represents a decision maker is a spouse.
Note[3]: The criteria of classification of sub-samples is 2 ADLs of respondent. When a respondent has 0-1 ADL, I assume that a respondent makes a decision of his/her formal long-term care. Otherwise, a spouse makes a decision for a respondent.

Table 2.4: ADL 3: The Marginal Effect— Decision maker: respondent vs Decision maker: spouse

Variables	Paid home health care(R)	Paid home health care(S)
Respondent's		
Age	.0011	.0031
Gender	-.0055	-.0332
Race/Ethinicity	.0138	.0167
Region (States)	-.0022	.0433
Location (urban)	.0063	.0453
Less than high school	—	—
High school graduation	.0310***	-.0318
Some college	.0323***	-.0765
College graduation or above	.0592***	.1585**
Long term care health insurance	.0017	.1858***
Medicaid	.0472***	.0221
Health Status	.0474***	-.0328
△ in walking difficulty	.0167	-.0324
△ in dressing difficulty	.0289**	-.0363
△ in bathing difficulty	.0457***	.0387
△ in eating difficulty	.0394	.0884**
△ in 'in and out of bed' difficulty	.0069	-.0062
△ in difficulty using a toilet	.0591***	.0509
Number of IADLs	.0200***	.0421***
High blood pressure	.0048	-.0058
Diabetes	-.0043	-.0130
Cancer	.0176***	.1612***
Lung	.0068	.0505
Heart	.0355***	.0063
Stroke	.0479***	-.0591
Psychological problem	.0109	-.0207
Arthritis	.0379***	.0373
Memory problem	-.0210	.0247

Table 2.4 continued

Variables	Paid home health care(R)	Paid home health care(S)
Spouse's		
Age	.0008	.0019
Less than high school	—	—
High school graduation	—	-.0333
Some college	—	.0110
College graduation or above	—	.0752
Health Status	-.00009	-.0754
△ in walking difficulty	.0216	.1279
△ in dressing difficulty	-.0058	-.0688
△ in bathing difficulty	-.0111	-.0330
△ in eating difficulty	.0025	-.4260*
△ in 'in and out of bed' difficulty	-.0035	-.1864
△ in difficulty using a toilet	.0201	.1043
Number of IADLs	.0041	.0076
High blood pressure	-.0118*	.0513
Diabetes	.0192***	.0262
Cancer	.0164**	.0563
Lung	-.0126	.0867
Heart	.0046	.0090
Stroke	-.0054	-.0101
Psychological problem	.0120	.0966*
Arthritis	.0133**	.0076
Memory problem	-.0009	-.2401

Table 2.4 continued

Variables	Paid home health care(R)	Paid home health care(S)
Household's		
Number of Children	-.0022	.0028
Total household wealth		
Over 90 percentile	-.0191	.0593
75 percentile-90 percentile	-.0192	.0381
50 percentile-75 percentile	-.0065	.1269
25 percentile-50 percentile	-.0023	.2281**
10 percentile-25 percentile	.0059	.1531*
Below 10 percentile	—	—
Total household income		
Over 90 percentile	-.0087	-.5047
75 percentile-90 percentile	-.0188	-.3338
50 percentile-75 percentile	-.0293	-.3935
25 percentile-50 percentile	-.0129	-.4263
10 percentile-25 percentile	-.0124	-.2791
Below 10 percentile	—	—

Note[1]:∗,∗∗,∗ ∗ ∗ represents statistical significance with 10%, 5%, and 1%, respectively.
Note[2]: Two sub-samples are estimated—
A respondent makes a decision in the first group, and a spouse makes a decision of a respondent's formal long-term care in the second group.
R stands for a decision maker is a respondent and S represents a decision maker is a spouse.

Table 2.5: Cox-proportional hazard model: Full sample, Decision-maker: respondent

Variable	Paid home health care: Hazard ratio
Respondent's	
Gender	.9924
Race/Ethinicity	1.174
Region (States)	.0014
Location (urban)	1.067
Less than high school	—
High school graduation	1.3873***
Some college	1.3199**
College graduation or above	1.8292***
Long term care health insurance	1.0071
Medicaid	1.5868***
Health Status	1.5038***
$\triangle$ in walking difficulty	1.0022
$\triangle$ in dressing difficulty	1.4392***
$\triangle$ in bathing difficulty	1.4090**
$\triangle$ in eating difficulty	1.3954*
$\triangle$ in 'in and out of bed' difficulty	1.1376
$\triangle$ in difficulty using a toilet	1.5146***
Number of IADLs	1.0192
High blood pressure	1.1431*
Diabetes	1.0321
Cancer	1.2244**
Lung	1.2686**
Heart	1.3255***
Stroke	1.5514***
Psychological problem	1.0911
Arthritis	1.3428***
Memory problem	.9579

Table 2.5 continued

Variable	Paid home health care
Spouse's	
Age	.9960
Less than high school	—
High school graduation	—
Some college	—
College graduation or above	—
Health Status	1.0942
△ in walking difficulty	.9622
△ in dressing difficulty	.9879
△ in bathing difficulty	.8663
△ in eating difficulty	.7665
△ in 'in and out of bed' difficulty	.8746
△ in difficulty using a toilet	1.4170**
Number of IADL	.9336
High blood pressure	.8963
Diabetes	1.1035
Cancer	1.1370
Lung	.7842*
Heart	1.006
Stroke	.9361
Psychological problem	1.2362**
Arthritis	1.0419
Memory problem	1.0635
Household's	
Number of Children	.9706*
Total household wealth	
Over 90 percentile	.9518
75 percentile-90 percentile	1.041
50 percentile-75 percentile	1.1394
25 percentile-50 percentile	1.2739
10 percentile-25 percentile	1.1221
Below 10 percentile	—-
Total household income	
Over 90 percentile	1.3119
75 percentile-90 percentile	1.1726
50 percentile-75 percentile	1.0549
25 percentile-50 percentile	1.2965
10 percentile-25 percentile	1.3845
Below 10 percentile	—

Note[1]:*,**,*** represents statistical significance with 10%, 5%, and 1%, respectively.

Table 2.6: ADL 2: Cox-proportional hazard model,
Decision-maker: respondent vs Decision-maker: spouse

Variable	Paid home health care(R)	Paid home health care(S)
Respondent's		
Gender	.9545	2.0010***
Race/Ethinicity	1.2518	1.1110
Region (States)	1.0294	.8251
Location (urban)	1.0594	1.1096
Less than high school	—	—
High school graduation	1.4504***	1.4521
Some college	1.3763***	1.3292
College graduation or above	1.9273***	1.8229
Long term care health insurance	.9359	1.8895**
Medicaid	1.0308*	1.1239***
Health Status	1.4405***	1.0711
$\triangle$ in walking difficulty	1.1199	.7405
$\triangle$ in dressing difficulty	1.4343***	.7472
$\triangle$ in bathing difficulty	1.5794***	.9017
$\triangle$ in eating difficulty	1.5849	1.1778
$\triangle$ in 'in and out of bed' difficulty	1.3210	.7260
$\triangle$ in difficulty using a toilet	1.8506***	1.2716
Number of IADLs	1.0308	1.3076
High blood pressure	1.1568*	2.0861***
Diabetes	1.0186	.8662
Cancer	1.2023**	1.4781
Lung	1.2481**	1.4507
Heart	1.3822***	.8349
Stroke	1.7004***	.6489*
Psychological problem	.99238	1.3113
Arthritis	1.3125***	.4862***
Memory problem	.9929	.9902

Table 2.6 continued

Variable	Paid home health care(R)	Paid home health care(S)
Spouse's		
Age	.9953	.9370**
Health Status	1.1572	.8532
△ in walking difficulty	1.0257	.7042
△ in dressing difficulty	.9674	.6152
△ in bathing difficulty	.7909	2.0313
△ in eating difficulty	.9069	.1634
△ in 'in and out of bed' difficulty	.8418	.6512
△ in difficulty using a toilet	1.4060*	2.4533
Number of IADLs	.9150	1.0751
High blood pressure	.9090	1.0286
Diabetes	1.0959	.9928
Cancer	1.1261	.7456
Lung	.7132*	1.0150
Heart	1.0169	1.1914
Stroke	.8282	1.1297
Psychological problem	1.2170*	1.1913*
Arthritis	1.0831	1.0358
Memory problem	1.3035	.2572*
Household's		
Number of Children	.9662**	1.0638
Total household wealth		
Over 90 percentile	.6889	2.4975
75 percentile-90 percentile	.7682	1.4988
50 percentile-75 percentile	.8023	3.3100*
25 percentile-50 percentile	.9018	4.7022**
10 percentile-25 percentile	.8211	3.0323
Below 10 percentile	—-	–
Total household income		
Over 90 percentile	1.3300	1.41e+07**
75 percentile-90 percentile	1.1531	3.37e+07**
50 percentile-75 percentile	.9925	4.96e+07**
25 percentile-50 percentile	1.2883	2.92e+07**
10 percentile-25 percentile	1.1355	3.08e+07**
Below 10 percentile	—	–

$Note^1$:∗,∗∗,∗ ∗ ∗ represents statistical significance with 10%, 5%, and 1%, respectively.
$Note^2$: Two sub-samples are estimated—
A respondent makes a decision in the first group, and a spouse makes a decision of a respondent's formal long-term care in the second group.
R stands for a decision maker is a respondent and S represents a decision maker is a spouse.

Table 2.7: ADL 3: Cox-proportional hazard model,
Decision-maker; respondent vs Decision-maker: spouse

Variable	Paid home health care(R)	Paid home health care(S)
Respondent's		
Gender	.9758	4.6875***
Race/Ethinicity	1.2377	2.7720*
Region (States)	1.0059	.8442
Location (urban)	1.0679	.5457
Less than high school	—	—
High school graduation	1.4430***	2.2640*
Some college	1.4093***	.6942
College graduation or above	1.9435***	.3070*
Long term care health insurance	.9595	3.6804***
Medicaid	.9960***	.5339
Health Status	1.4843***	.4232
$\triangle$ in walking difficulty	1.0875	1.6238
$\triangle$ in dressing difficulty	1.4928***	.5149*
$\triangle$ in bathing difficulty	1.5613***	.9454
$\triangle$ in eating difficulty	1.5904**	.9958
$\triangle$ in 'in and out of bed' difficulty	1.2168	.9205
$\triangle$ in difficulty using a toilet	1.6009***	1.6543
Number of IADLs	.9960	1.0753
High blood pressure	1.1617*	3.9559***
Diabetes	1.0286	.8083
Cancer	1.2062**	2.0332*
Lung	1.2396**	1.6300
Heart	1.3384***	.5695
Stroke	1.6466***	.5986
Psychological problem	1.0298	.9656
Arthritis	1.3136***	.3812**
Memory problem	1.0986	1.4311

Table 2.7 continued

Variable	Paid home health care(R)	Paid home health care(S)
Spouse's		
Age	.9968	.9147**
Health Status	1.1175	.5811
△ in walking difficulty	.9420	.6025
△ in dressing difficulty	1.0011	.9911
△ in bathing difficulty	.8815	.6833
△ in eating difficulty	.7910	.0736
△ in 'in and out of bed' difficulty	.8684	1.8422
△ in difficulty using a toilet	1.4134**	5.6950**
Number of IADLs	.9386	1.2664
High blood pressure	.9007	1.6212
Diabetes	1.1269	.8747
Cancer	1.1344	.3338
Lung	.7541**	.8985
Heart	1.0116	.8962
Stroke	.8590	1.0153
Psychological problem	1.2307**	1.5443
Arthritis	1.0568	1.3683
Memory problem	1.1560	.2316
Household's		
Number of Children	.9628**	1.1129
Total household wealth		
Over 90 percentile	.7319	2.39e+09***
75 percentile-90 percentile	.8096	1.61e+09***
50 percentile-75 percentile	.8599	1.94e+09***
25 percentile-50 percentile	.9925	3.43e+09***
10 percentile-25 percentile	.8724	3.92e+09***
Below 10 percentile	—-	—
Total household income		
Over 90 percentile	1.3630	4.32e+07***
75 percentile-90 percentile	1.1773	8.42e+07***
50 percentile-75 percentile	1.0498	7.34e+07***
25 percentile-50 percentile	1.2923	2.59e+07***
10 percentile-25 percentile	1.3110	3.19e+07***
Below 10 percentile	—	

Note[1]:∗,∗∗,∗ ∗ ∗ represents statistical significance with 10%, 5%, and 1%, respectively.
Note[2]: Two sub-samples are estimated—
A respondent makes a decision in the first group, and a spouse makes a decision of a respondent's formal long-term care in the second group.
R stands for a decision maker is a respondent and S represents a decision maker is a spouse.

Chapter 3

3 Discussion and Conclusion

This chapter summarizes and discusses the key findings of this work as presented in Chapter 1 and 2. Chapter 1 describes the key factors that play a role in nursing home entry. In particular, we estimate the predicted probabilities of key factors on nursing home entry through marginal effects depicted by multinomial logit model. Chapter 2 demonstrates the predicted probability of significant factors that affect paid home health care uses. For this analysis, we employ not only multinomial logit model with panel data but also Cox-proportional hazard model as described in Chapter 2. In this work, we demonstrate how the aforementioned factors play a critical role on each type of formal long-term cares – nursing home care and paid home health care.

The likelihood of nursing home entry** vs **The likelihood of paid home health care

This chapter will combine the results obtained from both Chapter 1 and 2. I will discuss how an individual who needs formal long-term care would behave if he/she has a specific risk factor, which affects nursing home entry and/or paid home health care use. I will analyze the percentage points in which the predicted probability will be changed according to the factor. The likelihood of entering to a nursing facility is compared with that of using paid home health care when an individual encounters a specific risk factor.

[Table 3.1 here]

Table 3.1 shows both the percent of the first entry to a nursing home and the percent of receiving paid home health care over the years. As mentioned, this study tracks individuals' choices up to the first entry to a nursing home if they enter a nursing home, otherwise their choices on long-term care are all included in the study. Thus, a nursing home entry is happened at most once for an individual in the data, while paid home health care could occur several times. As shown in figure 1, every person in the data faces three types of choices on long-term care – no formal long-term care, nursing home care, and paid home health care. The person will choose one of these types, and this decision-making process will end up with the final decision on entering to a nursing home. If the person decide not to enter a nursing home,

his/her decision-making process will continue at the end of time in the data. Table 3.1 displays the decision-making process for the individuals over the years. In table 3.1, 2.91% of people firstly entered a nursing home, and 13.12% received paid home health care in 1998. In the next wave(in 2000), 2.66% of people firstly entered a nursing home, and 10.86% chose to receive paid home health care. This 2.66% of people entered nursing homes firstly, thus they were not counted in the percent of nursing home entry in 1998. This people are newly admitted to a nursing home. However, 10.86% of people include the people who use paid home health care in 2000 firstly, and who has used paid home health care both in 1998 and 2000.

To compare the likelihood of nursing home entry with that of paid home health care when an individual has a risk factor, we consider a benchmark for such a comparison. From table 1.4 and 2.1, the average probabilities of first entry to a nursing home and paid home health care uses before the first entry to a nursing home, are calculated as 3.60% and 12.77%. I will use these probabilities in order to make comparison of the likelihood of nursing home entry with that of paid home health care uses when there is a risk factor. I will discuss the results according to the key factors such as individual's own characteristics, spousal characteristics, and household factors.

Individual's own health conditions

In this paper, own characteristics consist of demographic characteristics and own health conditions. Seniors usually tend to experience short-term or long-term physical difficulties or physical impairments. It is reported that majority of seniors have high blood pressure, heart problem, and arthritis. I particularly discuss how seniors' health problem affect their decisions on formal long-term care in this chapter using the predicted probabilities.

[Table 3.2 here]

Table 3.2 indicates the marginal effects of seniors' own health conditions on nursing home entry and paid home health care. When an individual's difficulty in walking is increased, so does the likelihood of entering to a nursing home by the amount of 1.84%. However the increasing difficulty in walking does not critically affect the decision on using paid home health care.

When an individual experiences increased limitation in dressing, bathing, and using a toilet, the probabilities of entering a nursing home and paid home health care are both increased.

However we can not conclude which type of formal long-term care is more likely to be chosen based on comparison of marginal effect as shown in table 3.2. Thus I will compare the likelihood of choosing nursing home care with that of choosing paid home health care by considering the people's choices in the sample. Table 3.2 shows that as the limitation in dressing increased, so does not only the probability of nursing home entry by 0.98% but also that of paid home health care by 2.55%. From these percentage points and the average probabilities of entering a nursing home and receiving paid home health care, I calculate the likelihoods of choosing nursing home care and/or paid home health care. On average, 3.60% of people in the sample enter a nursing home and 12.77% of people choose to receive paid home health care. Thus, 0.035% (that is 0.98% of 3.60%) of people are likely to enter a nursing home, and 0.032% (that is 2.55% of 12.77%) of people are likely to choose paid home health care when an individual's limitation in dressing is increased. These calculated likelihoods imply that the person, who has increased limitation in dressing, tends to use both a nursing home and paid home health care, while he/she is more likely to use a nursing home with very slightly higher probability than paid home health care. Increased limitation in bathing raises the predicted probability of nursing home entry by 1.16%, and the probability of paid home health care by 3.87%. Likewise, when an individual has increased limitation in bathing, the likelihoods of nursing home entry and paid home health care are increased by 0.041% and 0.494%, respectively. Thus increasing limitation in bathing leads to the choice of paid home health care with higher probability when compared with nursing home entry. When an individual's limitation in using a toilet is increased, so do the probabilities of nursing home entry and paid home health care by 1.98% and 6.24%, respectively. Increased limitation in using a toilet will make a person choose to use paid home health care with higher probability (0.796%) when compared with nursing home entry (0.07%).

When an individual experiences increased difficulty in eating, the probability of using paid home health care is increased by 4.21%; On the other hand, the increased difficulty in eating does not affect the nursing home entry.

Regarding the diseases diagnosed by doctors, when an individual has a stroke, the probabilities to enter a nursing home and receive paid home health care are increased by 1.05% and 4.09%, respectively when compared with a person who does not have a stroke. For a person who has a stroke, possibility of using home health care before the first entry to a nursing home is computed as 0.052%, and the likelihood of entering to a nursing home is evaluated as

0.037%. Thus when a person has a stroke, he/she is more likely to receive paid home health care by 0.053%. Diabetes, psychological problem and memory problem increase the predicted probability to enter a nursing home by 0.84%, 0.90%, and 0.92%, respectively, while cancer, heart problem, and arthritis are predicted to increase the probability to use paid home health care by 2.23%, 3.42%, and 3.84%, respectively. These observations indicate that the health conditions of an individual make a critical effect on using paid home health care rather than nursing home entry.

Table 3.2 suggests that if an individual has an increased limitation in bathing, increased limitation in using a toilet, cancer, heart problem, arthritis, and/or stroke, he/she is more likely to receive paid home health care. However, when the individual has a diabetes, psychological problem, and memory problem, he/she is more likely to choose nursing home entry.

[Table 3.3 here]

Table 3.3 shows the likelihoods of a respondent about the choice of formal long-term care when the individual experiences health problems. In particular, this table presents how the aforementioned factors make a marginal effect on using paid home health care and nursing home entry. The likelihoods to choose either of paid home health care and nursing home entry are calculated so as to provide an insight into how an individual make a decision on using either of two types of formal long-term cares.

[Table 3.4 here]

[Table 3.5 here]

Table 3.4 shows the marginal effects by the principal decision-maker. The first and second column show the marginal effects when a respondent makes a decision. The third and fourth column indicate the results when the spouse of the respondent makes a decision for the respondent. Based on marginal effects, and average probabilities of entering a nursing home, and paid home health care uses, we compute the likelihoods of choosing either of two types of formal long-term cares as a function of marginal effects as shown in table 3.5.

Regarding the role of individual health conditions, an increased limitation in dressing, and using a toilet, as well as stroke increase both nursing home entry and paid home health care uses when a respondent is the principal decision-maker on formal long-term care. It is shown that these factors result in higher probability to use paid home health care than nursing home entry. When a spouse is the principal decision-maker, increased limitation in eating and using a toilet makes an effect on both formal cares. The increased limitation of using toilet for a spouse,

who is a decision-maker, leads to using formal long-term cares with higher probability, when compared with the case in which a respondent being a decision-maker has a same increased limitation. However the person is still more likely to use paid home health care than nursing home care, if the person has a difficulty in using toilet even though the principal decision-maker is changed.

When the criterion changes from 2 ADLs to 3 ADLs, the results are shown in table 3.6 and 3.7.

[Table 3.6 here]

[Table 3.7 here]

When the respondent is the principal decision-maker, increased difficulties in bathing is added as a factor to increase marginal effects on both types of formal long-term care. When an individual has a difficulty in bathing, he/she is more likely to receive paid home health care by 0.58%. Stroke also increases the uses of both formal long-term cares. When the spouse makes a decision for the respondent, increased difficulty in eating results in the increase of both formal long-term cares. Interestingly, when the respondent has a difficulty in eating, the spouse of the respondent is more likely to choose a paid home health care rather than nursing home care. This can be elucidated based on the property of sub-samples. For a group in which the spouse makes a decision, the respondent already has more than 3 ADLs. It is expected that their difficulties would be adjusted before, thus the new increased difficulty in eating would give rise to the negative effect on nursing home care. Moreover, the difficulty of eating is the last to aggravate among six ADLs. Therefore, this difficulty results in a negative effect on nursing home entry. However, it affects positively paid home health care when a spouse make a decision. When a person has a difficulty in eating, the spouse of the person is more likely to decide to use paid home health care with increased probability of 1.12%.

Spouse's health conditions

Spouse's characteristics considered in this paper are demographic characteristics and health conditions. This section will analyze how the health conditions of the respondent's spouse affects the decision of using formal long-term cares. Table 3.2 shows the marginal effect of spouse's health condition on using either types of formal long term cares such as paid home health care and nursing home care, while table 3.3 presents the role of spouse's health condition

on the likelihoods of using either types of formal long-term cares. Spouse's diabetes increases the probabilities to receive formal long-term care. Spouse's diabetes increases the nursing home entry by 0.77% and paid home health care by 1.84% when compared with an individual whose spouse does not have a diabetes. Unlike the individual's own health conditions, only diabetes affect both types of formal long-term care. The individual is more probable to receive a paid home health care than to enter a nursing home when his/her spouse has a diabetes.[25]

Increasing bathing difficulty of spouse, spouse's psychological problem, and increasing of spouse's IADL result in an increase of probability of nursing home entry, while these factors do not make a critical effect on using a paid home health care. On the other hand, increasing difficulty in dressing, spouse's cancer, and spouse's arthritis leads to an increase of probability of using a paid home health care by 2.65%, 1.84%, and 1.25%, respectively, when compared with the person whose spouse does not have those difficulty or diseases.

[Table 3.4 here]

[Table 3.5 here]

The marginal effects of spouse's health conditions on nursing home and paid home health care according to the principal decision-maker are presented in table 3.4. The significant factors in spouse's health conditions, affecting both types of long-term care are shown in table 3.5. As mentioned earlier, the numbers in table 3.5 are calculated in order to compare the likelihood of nursing home entry with that of using a paid home health care. Table 3.5 shows that when the spouse of an individual has a diabetes, the individual is more likely to enter a nursing home and to use paid home health care. However, the person whose spouse has diabetes, he/she is more likely to use paid home health care by 3.57% than entering a nursing home. Spouse's cancer also a key factor that affects both types of formal long-term care. However these effects are different in the viewpoint of the type of formal long-term care. When a spouse has a cancer, the individual is less likely to enter a nursing home by 0.33%, and more likely to receive paid home health care by 0.01%. This is due to the fact that nursing home care is the most expensive form of long-term care, and the treatment of cancer is also costly. Thus, the person whose spouse has a cancer, he/she is less likely to enter a nursing home.

[Table 3.6 here]

[Table 3.7 here]

Table 3.6 and 3.7 show the results when the criterion changes from 2 ADLs to 3 ADLs. The

[25] Refer to table 3.3

results are similar to those as presented in table 3.4 and 3.5. The spouse's diabetes increases the predicted probabilities of entering a nursing home and using a paid home health care for the respondent. The respondent is more likely to use paid home health care by 0.24%, and nursing home care by 0.02%, when compared with one whose spouse does not have a diabetes. Cancer also affect negatively nursing home care, and positively paid home health care.

Household factors

Household wealth makes a negative effect on nursing home entry. Table 3.2 shows the effect of wealth on nursing home entry. It is predicted that the people belonging to a group of 50th percentile to 75th percentile of wealth will enter a nursing home with less probability of 2.27%, when compared with those who has below 10 percentile wealth. It implies that the wealth of a person reduces the probability for him/her to enter a nursing home.

[Table 3.4 here]

[Table 3.5 here]

Table 3.4 displays the marginal effect of household factors on both types of formal long-term cares according to the principal decision-maker. The factors that make the marginal effects on formal long-term care are extracted, and the probability to enter a nursing home and to receive paid home health care are calculated. Table 3.5 shows that wealth makes a negative effect on nursing home entry but a positive effect on paid home health care. An increase in wealth from 25% to 50% (or 50% to 75%) reduces the probability for a person to enter a nursing home by 0.75% (or 0.33%), while it increases the probability to use a paid home health care by 1.71% (or 2.37%), when compared with the person whose wealth is lower than 10%.

[Table 3.6 here]

[Table 3.7 here]

Table 3.6 and 3.7 show the results when the criterion changes from 2 ADLs to 3 ADLs. The results found in table 3.6 and 3.7 are similar to those provided in table 3.4 and 3.5. Wealth makes a negative effect on nursing home entry but a positive effect on paid home health care, which is consistent with previous finding.

This chapter summarizes and concludes the findings of chapter 1 and 2. It is found that the choices of long-term cares are affected by not only the individual's health condition but

also the spouse's health condition. In particular, as suggested in previous studies, the individual's health conditions such as individual's walking difficulty, dressing difficulty, and number of chronic diseases are significant factors that play a critical role in the decision of nursing home care. This study suggests that the choice of long-term care is affected by increased difficulties in ADLs such as increased difficulty in using a toilet, and that the choice of nursing home entry is highly dependent on the individual's health condition such as stroke, diabetes, memory problem, and psychological problem. On the other hands, the individual, who suffers from cancer, heart problem, stroke, and arthritis, is more likely to use a paid home health care. Additionally increased difficulty in eating leads to an increase in a probability to using a paid home health care.

This study demonstrates that the choice of formal long-term care is affected by spouse's health conditions such as diabetes, cancer, arthritis, and stroke. It is shown that when a spouse suffers from aforementioned health problems, the individual is more likely to receive both nursing home care and paid home health care. Household wealth is also a key factor in making an effect on the decision of formal long-term care. Specifically, the household wealth makes a negative effect on nursing home entry but a positive effect on a paid home health care.

Despite previous studies discussing the choice of long-term cares, there are no efforts that have been made to analyze the role of a spouse on the choice of long-term cares. This study suggests the critical role of spouse's characteristics on the decision of formal long-term cares for the elderly couples. Elderly couple will make a decision on long-term cares based on their own individuals' factors, and their spouse's factors. This study suggests that the choice of long-term cares for elderly couples are governed by key factors such as both individual's and spouse's characteristics such as health conditions and household wealth. This implies that researchers and policy-makers have to concentrate on these key factors for understanding the choice of long-term cares for the elderly couples, for further predictions on long-term care services and establishment of a law or policy related to long-term care services for the elder.

Table 3.1: Long term care utilization for elderly couples 65 years old and over

LTC/Year	1996	1998	2000	2002	2004	2006	2008	Avg.Prob.
No LTC	88.32	83.97	86.48	84.56	83.32	81.08	81.14	–
Nursing home	N/A	2.91	2.66	3.69	3.18	5.14	4.12	3.60
Paid home care	11.68	13.12	10.86	11.74	13.51	13.78	14.74	12.77
N(Number of Obs.)	4,726	5,402	4,429	3,628	3,021	2,490	1,988	–

Note[1]: The data keeps until the first entry of nursing home. Therefore, the percent of nursing home use means, the first entry of nursing home. Paid home health care is also followed before the first entry of nursing home.
Note[2]: Nursing home care in 1996 is dropped as explained in the sample selection.

Table 3.2: The Marginal Effect: Full Sample, A decision-maker: Respondent

Variable	Nursing home care	Paid home health care
Respondent's		
Age	.0017***	.0013*
Gender	.0013	-.0043
Race/Ethinicity	.0051	.0144
Region (States)	-.0074**	-.0004
Location (urban)	.0056*	.0090
Less than high school	—-	—
High school graduation	.0073*	.0278***
Some college	.0118**	.0299***
College graduation or above	.0082	.0606***
Long term care health insurance	-.0038	.0062
Medicaid	.0160***	.0455***
Health Status	.0027	.0475***
$\triangle$ in walking difficulty	.0184***	.0148
$\triangle$ in dressing difficulty	.0098***	.0255**
$\triangle$ in bathing difficulty	.0116***	.0387***
$\triangle$ in eating difficulty	-.0046	.0421**
$\triangle$ in 'in and out of bed' difficulty	.0077	.0089
$\triangle$ in difficulty using a toilet	.0198***	.0624***
Number of IADLs	.0097***	.0252***
High blood pressure	-.0040	.0048
Diabetes	.0084**	-.0034
Cancer	-.0023	.0223***
Lung	.0039	.0101
Heart	-.0001	.0342***
Stroke	.0105***	.0409***
Psychological problem	.0090**	.0057
Arthritis	.0007	.0384***
Memory problem	.0092**	-.0128

Table 3.2 continued

Variable	Nursing home care	Paid home health care
Spouse's		
Age	.0002	.0007
Health Status	-.0071	-.0058
△ in walking difficulty	-.0071***	.0265*
△ in dressing difficulty	.0015	-.0108
△ in bathing difficulty	.0124**	-.0091
△ in eating difficulty	.0054	-.0138
△ in 'in and out of bed' difficulty	.0027	-.0142
△ in difficulty using a toilet	.0011	.0246
Number of IADLs	.0039**	.0056
High blood pressure	.0023	-.0110
Diabetes	.0077**	.0184**
Cancer	-.0027	.0184**
Lung	-.0009	-.0080
Heart	-.0008	.0054
Stroke	.0025	-.0025
Psychological problem	.0072*	-.0025
Arthritis	.0002	.0125*
Memory problem	-.0022	-.0098
Household's		
Number of Children	-.0009	-.0021
Total household wealth		
Over 90 percentile	-.0135	-.0120
75 percentile-90 percentile	-.0105	-.0110
50 percentile-75 percentile	-.0227***	.0042
25 percentile-50 percentile	-.0166**	.0109
10 percentile-25 percentile	-.0076	.0135
Below 10 percentile	—-	—-
Total household income		
Over 90 percentile	.0121	-.0113
75 percentile-90 percentile	.0053	-.0158
50 percentile-75 percentile	.0096	-.0268
25 percentile-50 percentile	.0011	-.0155
10 percentile-25 percentile	-.0152	-.0012
Below 10 percentile	—	—

Note[1]:∗,∗∗,∗ ∗ ∗ represents statistical significance with 10%, 5%, and 1%, respectively.

Table 3.3: The Likelihood of nursing home entry *vs* The Likelihood of paid home health care, Full Sample, A decision-maker: Respondent

Variable	Nursing home care	Paid home health care
Respondent's health conditions		
$\triangle$ in dressing difficulty	.0352***	.0325**
$\triangle$ in bathing difficulty	.0417***	.4941***
$\triangle$ in difficulty using a toilet	.0712***	.7968***
Stroke	.0378***	.5222***
Spouse's		
$\triangle$ in walking difficulty	-.0071***	.0265*
Diabetes	.0077**	.0184**

$Note^1$:*,**,*** represents statistical significance with 10%, 5%, and 1%, respectively.
$Note^2$: The likelihood of nursing home entry = marginal probability of a factor X average probability to enter a nursing home(0.036)
$Note^3$: The likelihood of receiving paid home health care = marginal probability of a factor X average probability to receiving paid home health care (0.1277)
$Note^4$: The numbers in the table are percentage points.
$Note^5$: Only significant factors of both types of formal long-term cares are calculated and presented.

Table 3.4: ADL2: The Marginal Effect— Decision maker: respondent vs Decision maker: spouse

Variables	Nursing home care(R)	Paid home health care(R)	Nursing home care(S)	Paid home health care(S)
Respondent's				
Age	.0015***	.0010	.0039	.0023
Gender	.0007	-.0017	-.0223	-.0620
Race/Ethinicity	.0093*	.0156	-.0327	.0254
Region (States)	-.0014	-.0010	-.0738***	.0058
Location (urban)	.0041	.0051	.0075	.0480
Less than high school	—	—	—	—
High school graduation	-.0033	.0327***	.1133***	-.0089
Some college	.0039	.0358***	.1060***	-.0475
College graduation or above	.0007	.0621***	.0897**	.0582
Long term care health insurance	.0009	.0002	-.0384	.1216**
Medicaid	.0084	.0479***	.0717*	.0529
Health Status	.0024	.0430***	-.0435	.0668
△ in walking difficulty	.0164***	.0108	.0585**	-.0240
△ in dressing difficulty	.0087*	.0292**	.0186	-.0106
△ in bathing difficulty	.0112*	.0308	.0198	.0446
△ in eating difficulty	.0150	.0229	-.0604*	.0742**
△ in 'in and out of bed' difficulty	.0074	.0038	.0267	-.0235
△ in difficulty using a toilet	.0166***	.0559***	.0785***	.0733**
Number of IADLs	.0065***	.0205***	.0317***	.0403***
High blood pressure	-.0005	.0009	-.0332	.0467
Diabetes	.0070***	-.0024	.0193	-.0136
Cancer	.0008	.0178***	-.0490	.0956***
Lung	.0028	.0105	-.0009	.0150
Heart	.0019	.0371***	-.0136	-.0062
Stroke	.0097***	.0538***	.0326	-.0433
Psychological problem	-.0014	.0204**	.0854***	-.0672*
Arthritis	.0009	.0393***	-.0251	.0211
Memory problem	.0027	-.0130	.0527**	-.0421

Table 3.4 continued

Variables	Nursing home care(R)	Paid home health care(R)	Nursing home care(S)	Paid home health care(S)
Spouse's				
Age	-.00009	.0007	.0039*	.0004
Less than high school	—	—	—	—
High school graduation	—	—	.0221	-.0531
Some college	—	—	.0419	.0214
College graduation or above	—	—	.0358	-.0111
Health Status	-.0059	-.0037	-.0184	-.0200
△ in walking difficulty	-.0071	.0185	-.2351	.1302*
△ in dressing difficulty	-.0069	-.0012	.0905**	-.1037
△ in bathing difficulty	.0064	-.0201	.0733	.0312
△ in eating difficulty	.0075	-.0008	.0074	-.1796
△ in 'in and out of bed' difficulty	-.0064	-.00008	.0643	-.0707
△ in difficulty using a toilet	.0018	.0202	.0388	.0648
Number of IADLs	.0035***	.0047	-.0010	.0056
High blood pressure	.0036	-.0133**	-.0251	.0343
Diabetes	.0074***	.0219***	-.0034	.0099
Cancer	.0032	.0195***	-.0925***	.0301
Lung	-.0050	-.0057	.0405	-.0301
Heart	-.0039	.0066	.0132	-.0233
Stroke	-.0021	-.0044	.0672*	.0056
Psychological problem	.0064**	.0129	.0246	.0289
Arthritis	.0015	.0115*	.0049	.0271
Memory problem	.0047	-.0157	-.0862	.0500

Table 3.4 continued

Variables	Nursing home care(R)	Paid home health care(R)	Nursing home care(S)	Paid home health care(S)
Household's				
Number of Children	-.00009	-.0022	-.0119**	-.0005
Total household wealth				
Over 90 percentile	-.0138*	-.0288	-.0359	.0867
75 percentile-90 percentile	-.0117*	-.0299	-.0248	.1065
50 percentile-75 percentile	-.0207***	-.0157	-.0861	.1341*
25 percentile-50 percentile	-.0125**	-.0128	-.0927*	.1859***
10 percentile-25 percentile	-.0067	-.0025	-.0478	.1220
Below 10 percentile	—	—	—	—
Total household income				
Over 90 percentile	.0081	-.0126	.0279	-.0032
75 percentile-90 percentile	.0069	-.0251	-.0698	.1118
50 percentile-75 percentile	.0074	-.0321	-.0013	.0391
25 percentile-50 percentile	-.0016	-.0158	-.0183	.0148
10 percentile-25 percentile	-.0025	-.0199	-.1592	.1340
Below 10 percentile	—	—	—	—

Note[1]:*,**,*** represents statistical significance with 10%, 5%, and 1%, respectively.

Note[2]: Two sub-samples are estimated—

A respondent makes a decision in the first group, and a spouse makes a decision of a respondent's formal long-term care in the second group.

R stands for a decision maker is a respondent and S represents a decision maker is a spouse.

Note[3]: The criteria of classification of sub-samples is 2 ADLs of respondent. When a respondent has 0-1 ADL, I assume that a respondent makes a decision of his/her formal long-term care. Otherwise, a spouse makes a decision for a respondent.

Table 3.5: ADL2: The Likelihood of nursing home entry *vs* The Likelihood of paid home health care

Variables	Nursing home care(R)	Paid home health care(R)	Nursing home care(S)	Paid home health care(S)
Respondent's health conditions				
△ in dressing difficulty	.0112*	.3728**		
△ in eating difficulty		-.2174*	.9475**	
△ in difficulty using a toilet	.0597***	.7138***	.2826***	.9360**
Stroke	.0349***	.6870***		
Psychological problem		.2605**	.3074***	-.8581*
Spouse's health conditions				
Diabetes	.2490***	3.5704***		
Cancer		.0195***	-.3330***	
Household's				
Total household wealth				
50 percentile-75 percentile	-.0745***			1.7124*
25 percentile-50 percentile	-.0450**		-.3337*	2.3739***

Note[1]:∗,∗∗,∗ ∗ ∗ represents statistical significance with 10%, 5%, and 1%, respectively.
Note[2]: Two sub-samples are estimated —
R stands for a decision maker is a respondent and S represents a decision maker is a spouse.
Note[3]: The criteria of classification of sub-samples is 2 ADLs of respondent. When a respondent has 0-1 ADL, I assume that a respondent makes a decision of his/her formal long-term care. Otherwise, a spouse makes a decision for a respondent.
Note[4]: The likelihood of nursing home entry = marginal probability of a factor X average probability to enter a nursing home(0.036)
Note[5]: The likelihood of receiving paid home health care = marginal probability of a factor X average probability to receiving paid home health care (0.1277)
Note[6]: The numbers in the table are percentage points.
Note[7]: Only significant factors of both types of formal long-term cares are calculated and presented.

Table 3.6: ADL 3: The Marginal Effect— Decision maker: respondent vs Decision maker: spouse

Variables	Nursing home care(R)	Paid home health care(R)	Nursing home care(S)	Paid home health care(S)
Respondent's				
Age	.0015***	.0011	.0085**	.0031
Gender	-.0018	-.0055	.0306	-.0332
Race/Ethinicity	.0064	.0138	-.0128	.0167
Region (States)	-.0018	-.0022	-.1113***	.0433
Location (urban)	.0049*	.0063	-.0047	.0453
Less than high school	—	—	—	—
High school graduation	-.0030	.0310***	.1752***	-.0318
Some college	.0044	.0323***	.1409**	-.0765
College graduation or above	.0002	.0592***	.2145***	.1585**
Long term care health insurance	.0018	.0017	-.1038	.1858***
Medicaid	.0053	.0472***	.1420***	.0221
Health Status	.0011	.0474***	-.0195	-.0328
△ in walking difficulty	.0164***	.0167	.0764**	-.0324
△ in dressing difficulty	.0081**	.0289**	.0606	-.0363
△ in bathing difficulty	.0141***	.0457***	-.0089	.0387
△ in eating difficulty	-.0013	.0394	-.0894**	.0884**
△ in 'in and out of bed' difficulty	.0119*	.0069	.0120	-.0062
△ in difficulty using a toilet	.0169***	.0591***	.0758**	.0509
Number of IADLs	.0070***	.0200***	.0281**	.0421***
High blood pressure	-.0020	.0048	-.0282	-.0058
Diabetes	.0067**	-.0043	.0194	-.0130
Cancer	.00003	.0176***	-.0747	.1612***
Lung	.0036	.0068	.0119	.0505
Heart	.0023	.0355***	-.0249	.0063
Stroke	.0108***	.0479***	.0268	-.0591
Psychological problem	-.0011	.0109	.1191***	-.0207
Arthritis	.0015	.0379***	-.0388	.0373
Memory problem	.0068	-.0210	.0900**	.0247

Table 3.6 continued

Variables	Nursing home care(R)	Paid home health care(R)	Nursing home care(S)	Paid home health care(S)
Spouse's				
Age	.0001	.0008	.0008	.0019
Less than high school	—	—	—	—
High school graduation	—	—	.0452	-.0333
Some college	—	—	.0545	.0110
College graduation or above	—	—	.0348	.0752
Health Status	-.0071	-.00009	-.0234	-.0754
△ in walking difficulty	-.0107	.0216	-.3809	.1279
△ in dressing difficulty	-.0002	-.0058	.0169	-.0688
△ in bathing difficulty	.0048	-.0111	.1527**	-.0330
△ in eating difficulty	.0028	.0025	.1301	-.4260
△ in 'in and out of bed' difficulty	-.0100	-.0035	.1593**	-.1864
△ in difficulty using a toilet	.0026	.0201	.0440	.1043
Number of IADLs	.0040***	.0041	.0172	.0076
High blood pressure	.0038	-.0118*	-.0571	.0513
Diabetes	.0078***	.0192***	-.0265	.0262
Cancer	.0032	.0164**	-.1453***	.0563
Lung	.0002	-.0126	-.0366	.0867
Heart	-.0021	.0046	.0205	.0090
Stroke	-.0023	-.0054	.0909*	-.0101
Psychological problem	.0067**	.0120	.0498	.0966*
Arthritis	.0004	.0133**	.0175	.0076
Memory problem	.0049	-.0009	-.1484	-.2401

Table 3.6 continued

Variables	Nursing home care(R)	Paid home health care(R)	Nursing home care(S)	Paid home health care(S)
Household's				
Number of Children	-.0001	-.0022	-.0160**	.0028
Total household wealth				
Over 90 percentile	-.0124	-.0191	-.0358	.0593
75 percentile-90 percentile	-.0082	-.0192	-.0997	.0381
50 percentile-75 percentile	-.0191***	-.0065	-.1323**	.1269
25 percentile-50 percentile	-.0125**	-.0023	-.1342**	.2281**
10 percentile-25 percentile	-.0044	.0059	-.0720	.1531*
Below 10 percentile	—	—	—	—
Total household income				
Over 90 percentile	.0051	-.0087	0.1150	-.5047
75 percentile-90 percentile	.0034	-.0188	.4101	-.3338
50 percentile-75 percentile	.0068	-.0293	.0445	-.3935
25 percentile-50 percentile	-.0043	-.0129	.0501	-.4263
10 percentile-25 percentile	-.0048	-.0124	0.388	-.2791
Below 10 percentile	—	—	—	—

Note[1]:∗,∗∗,∗ ∗ ∗ represents statistical significance with 10%, 5%, and 1%, respectively.

Note[2]: Two sub-samples are estimated—

A respondent makes a decision in the first group, and a spouse makes a decision of a respondent's formal long-term care in the second group.

R stands for a decision maker is a respondent and S represents a decision maker is a spouse.

Table 3.7: ADL 3: The Likelihood of nursing home entry *vs* The Likelihood of paid home health care

Variables	Nursing home care(R)	Paid home health care(R)	Nursing home care(S)	Paid home health care(S)
Respondent's				
△ in dressing difficulty	.0291**	.3690**		
△ in bathing difficulty	.0507***	.5835***		
△ in eating difficulty			-.3218**	1.1288**
△ in difficulty using a toilet	.0608***	.7547***	.2728**	
Stroke	.0388***	.6116***		
Spouse's				
Diabetes	.0280***	.2451***		
Cancer		2.0942**	-.5230***	
Household's				
Total household wealth				
50 percentile-75 percentile	-.0687***		-1.6894**	
25 percentile-50 percentile	-.0450**		-.4831**	2.9128**

Note[1]:∗,∗∗,∗ ∗ ∗ represents statistical significance with 10%, 5%, and 1%, respectively.
Note[2]: Two sub-samples are estimated—
R stands for a decision maker is a respondent and S represents a decision maker is a spouse.
Note[3]: The criteria of classification of sub-samples is 2 ADLs of respondent. When a respondent has 0-1 ADL, I assume that a respondent makes a decision of his/her formal long-term care. Otherwise, a spouse makes a decision for a respondent.
Note[4]: The likelihood of nursing home entry = marginal probability of a factor X average probability to enter a nursing home(0.036)
Note[5]: The likelihood of receiving paid home health care = marginal probability of a factor X average probability to receiving paid home health care (0.1277)
Note[6]: The numbers in the table are percentage points.
Note[7]: Only significant factors of both types of formal long-term cares are calculated and presented.

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