博士論文

Evaluation on appropriate delivery of formal long-term care services in Japan

（適正な公的介護サービスの提供に関する評価）

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ABSTRACT

Objectives: The main aims of the present study were to examine appropriate delivery of formal long-term care services in Japan, evaluate the effect of home help services on older people with mild disabilities (Study 1), and investigate supplier-induced demand for the long-term care services (Study 2).

Methods: A pseudo panel data analysis of cross-sectional repeated data derived from the Comprehensive Survey of People's Living Conditions was used in Study 1. Propensity score-matching difference-in-difference analysis was employed to compare physical functional independence between service users and non-users before and after policy reform. Study 2 used the Survey of Long-term Care Benefit Expenditures and the Survey of Institutions and Establishments for Long-term Care. The author employed a three-part model using individual-level panel data to evaluate supplier-induced demand by taking into account the incentives of care managers.

Results: In Study 1, the use of home help services was significantly and negatively associated with functional independence, and the association was significantly attenuated after the 2006 policy amendment. In Study 2, the elderly who used an in-home care management office providing both care management and day care services were more likely to use day care services, and the effects of the revision of the LTCI

fees were significantly different between the elderly who used a joint office with day care services and those who used a non-joint office.

Conclusion: The results of this study suggest that inappropriate services were delivered even though care managers were required to serve the best interests of the care recipients.

Key words: Long-term care, home help service, disuse syndrome, supplier-induced demand

INTRODUCTION

1. Background

An increase in the number of older people in need of care has become a common concern of public healthcare in developed countries, and the problem is becoming greater in middle income countries, such as China and India, where the rate of population ageing is accelerating. Japan has the largest proportion of elderly population in the world [1]. Persons aged 65 or older comprised 17.4 percent of Japan's population in 2000 and 23.0 percent in 2010 [2] and are estimated to reach 30 percent in 2030 [3]. Thus, Japan has the world's lowest Potential Support Ratio, defined as the number of people aged 20 to 64 divided by the number of people aged 65 and over [1]. Meanwhile, household demographics have been changing: the average number of household members has been declining, and the numbers of single-member (due to the trend towards nuclear families) and husband-and-wife (with more aging caregivers) households made up of elderly persons have been increasing [4]. In 2000, Japan introduced formal care provision through a social insurance scheme in 2000 to meet the increasing demands for care [5, 6].

The principle of Long-Term Care Insurance (LTCI) is not only to provide personal care for the elderly requiring long-term care but "to maintain dignity and an

independent daily life routine according to each person's own level of abilities" [6, 7]. The characteristics of LTCI are as follows: care recipients can choose their preferred types of service and providers, care managers support care recipients' choices of suitable services and providers, diverse providers including for-profit firms are allowed to offer in-home services, and care recipients pay a 10 percent co-payment for long-term care services regardless of their income [5, 6, 8].

After the introduction of the LTCI system, utilization and provision of LTCI services have been rapidly expanding. The number of beneficiaries and LTCI service users rapidly increased by 2.3 and 2.6 times from 2000 to 2013, much greater than the growth of populations aged 65 and older (1.4 times), and the expenditure of LTCI also increased (3.63 and 9.17 trillion yen in 2000 and 2013) [9]. The number of organizations providing long-term care services has been increasing. In 2000, for example, there were 13,138 organizations providing home help services, which increased to 34,992 in 2014. The number of organizations providing day care services also has been increasing since the introduction of LTCI (from 8,198 in 2000 to 42,145 in 2014) [10].

One of the aims of LTCI is to respond to the rapidly increasing demand for LTCI services, and it has achieved partially this. On the other hand, the increased cost

for long-term care services is threatening the sustainability of the LTCI system and is a major concern of the government. More importantly, increased utilization and provision of LTI services has not necessarily led to improving outcomes of care recipients and family caregivers or providing services that are consistent with their needs, because the Japan's LTCI was implemented simultaneously across the country without clinical trials (or randomized clinical trials) or evidence of the effectiveness of LTCI services [11-20]. To manage long-term care costs while improving the quality of long-term care services, long-term care resources must be used appropriately. In other words, an inappropriate service, which is defined as "service that is not expected to benefit the patient", must be reduced [21-23].

Health systems must be designed to meet the needs of care recipients, and to assure that they can receive the necessary information and the care based on the best scientific knowledge [23]. In Japan's LTCI system, several schemes have been introduced to delivery appropriate long-term care: people who require long-term care are certified on the basis of certification reviews, the amount of LTCI services that can be received is limited in accordance with the care level, care recipients can choose their preferred types of service and providers, and care managers support care recipients' choices of suitable services and providers (care management system). Nevertheless,

although reducing the inappropriate use of long-term care services is a major issue to be solved and a major concern of Japanese policy makers, few studies of it have been conducted. The author focuses on the two types of inappropriate use of long-term care services: the inappropriate use of home help services and the supplier-induced demand for long-term care services.

Japan's LTCI system is more generous than Germany's system in that it covers beneficiaries with milder disabilities and less-professional services such as home help services including housekeeping aids [5, 24]. After much debate in 2006, a policy amendment was made to LTCI on the basis of the claim that formal care services for mildly disabled elderly people may prohibit their functional independence and simply consume costs unnecessarily. However, the effect of home help services on functional status had not been systematically examined, and the above amendment was solely based on theoretical discussion [13]. Therefore, it is necessary to investigate the effect of home help services on functional change in frail elderly with mild disabilities and to clarify the impact of the 2006 policy amendment of LTCI.

The care management system is one of the key elements for the appropriate use of LTCI services [6, 25]. Care managers must possess practical experience in a medical or welfare related occupation, have passed an examination, and have completed a

training program. They consult with care recipients and their families and support their choice of suitable services and providers by creating a care plan. Care recipients can choose and contract with the care managers without a co-payment. The care management system was started partially based on Japan's LTCI system by Germany. However, the quality and the role of care managers or the care management system have not been discussed enough. In addition, some care managers might have incentives to induce unnecessary demand for their firm's services against the interests of care recipients [26-28]. This induced demand is likely to increase the cost of inappropriate long-term care services [29], but the existence and magnitude of supplier-induced demand are still controversial subjects [26-28]. If supplier induced demand exists under the LTCI system, the care management system is not necessarily achieving its intended purpose and should be reconsidered.

2. Aims of the present study and structure of this thesis

The main aims of the present study were to examine appropriate delivery of formal long-term care services in Japan, evaluate the effect of home help services on older people with mild disabilities (Study 1), and investigate the supplier-induced demand for the LTCI services (Study 2).

The structure of this thesis is as follows:

2) In Chapter 1, the author evaluates the effect of home help services on functional change in older people with mild disabilities by using appropriate statistical analysis of service utilization (Study 1).

3) In Chapter 2, the author investigates supplier-induced demand for the long-term care services (Study 2).

CHAPTER 1

Negative impact of home help services on older people with mild disability; a natural experiment evaluation of policy change in the Japanese public long-term care system (Study 1)

1.1. Introduction

Japan's Long-Term Care Insurance (LTCI) is more generous than in other countries such as Germany, in that it covers beneficiaries with milder disabilities and less professional care services such as home help, including housekeeping [5, 24]. In 2006, a debate on the policy revealed that formal care services for mildly disabled old people may actually reduce their functional independence and were too costly [13, 29]. The government then decided to restrict eligibility for home help services mainly for fiscal reasons, without evidence of the functional impact of such a policy change.

One of the few studies that investigated the impact of the policy change was carried out by Ishibashi et al, who performed a longitudinal analysis of administrative claims data [13]. Their results did not support the claim that home help services lead to functional decline. However, their study was confined to a single local area and was limited in generalizability. Additionally, they relied on naïve logistic regression to adjust for beneficiaries' functional conditions, and failed to account for endogenous problems of selective service use, which might obscure the functional impact of home help services.

The current study set out to overcome these limitations by use of the natural experimental setting of the 2006 policy change, and appropriate statistical analysis of

service utilization, to evaluate the effect of home help services on functional change in older people with mild disabilities.

1.2. Methods

1.2.1. Study population

Approval for use of data in the Comprehensive Survey of People's Living Conditions (CSPLC) was obtained from the Ministry of Health, Labour and Welfare in Japan [4]. Every 3 years, the CSPLC conducts clustered-sampling of about a million sample unit areas from 47 prefectures nationwide in Japan, and all households and their members living in the sample unit areas are invited to participate. The survey comprises self-administered questionnaires on sociodemographic and health conditions of the household members. In a subsample of households, a supplemental questionnaire on long-term care utilization is included in homes with any member in receipt of formal long-term care. Anonymous secondary data are approved for research use by the governmental agency, and ethical considerations waived.

In the 2004 and 2007 surveys, a total of 220,836 and 230,596 households, respectively, completed the questionnaires (response rate: 79.8% and 80.1%). Of these, the long-term care survey was provided to subsamples of 5,804 and 5,495 individuals, with response rates of 84.9% and 89.1%, respectively. The datasets for these surveys were merged using unique identifiers for households and individuals.

The study sample was then restricted to subjects aged 65 years and older, and who were expected to be able to maintain functional independence with careful observation and simple support, as is defined as LTCI eligibility category of Care Level 1 (*Yokaigo 1*) or less[29, 30]. This group included the main users of housekeeping services, and would likely be most vulnerable to the possibility of induced dependency as a result of use of home help services.

Older Japanese men often have very limited housekeeping skills because of the traditional gender roles, and they may already be dependent on informal provision of housekeeping services from family members, which would confound analysis of formal service provision, thus the study was restricted to female beneficiaries.

1.2.2. Treatment variables

The treatment variable was dichotomous regarding whether the care recipient received home help services or not. In the questionnaire, home help services comprised cooking, cleaning, shopping, and/or washing clothes by home-visit care staff in the previous 1 month.

1.2.3. Outcome variables

Functional independence was the outcome variable, and was scored 1 to 4 according to the level of activities of daily living. A score of 1 indicated "slightly disabled, but able to go out independently"; 2 and over indicated any need of assistance in daily living. A score of 1 was defined as functional independence.

1.2.4. Statistical analysis

Propensity score-matching difference-in-difference (DD) estimations were employed to examine the effect of a home help service on care recipients' functional independence, following a previous study that accounted for bias because of selective use of the service [6]. A logistic regression model for each survey year was fitted to obtain a propensity score for the use of home help services, regressed on the recipient's characteristics (age, marital status, etiology of functional disability, and LTCI eligibility status in the previous year), and the characteristics of their primary caregiver and household (e.g., gender and relationship with the recipient, house ownership, and residential location). The C-statistic for the model was 0.76 and 0.74 in 2004 and 2007, respectively. One-to-one matching was performed within a caliper of 0.25 SDs [31-33], and without replacement [33, 34]. Matched pairs were used to obtain the DD estimate of

home help service use and the dummy variable of pre-post amendment status as shown below:

$$Y = \alpha_1 * X_1 + \alpha_2 * X_2 + \alpha_3 * X_1 * X_2 + \alpha_3 * X_3 + \varepsilon,$$

where X_1 refers to the home help service dummy, X_2 refers to the year dummy, X_3 refers to a vector of a care recipient, primary caregiver, and household characteristics. In this model, α_1 indicates the difference in outcomes between home help use and non-use groups; α_2 indicates the overall time trend of outcomes; and α_3 represents DD estimates, which are considered to be the impact of the LTCI reform of 2006. We performed conditional logistic regression analysis that accounted for the matched pairing [34]. All analyses were performed using Stata 12.0 (Stata Corp, College Station, TX, USA).

1.3. Results

Among 2,438 and 2,116 observations in 2004 and 2007, respectively, of care recipients and primary caregivers who satisfied the inclusion criteria, 450 and 534 observations were excluded because of missing values of the key variables. The remaining 1,983 and 1,582 eligible observations were categorized into a home help service use group and non-use group for each year.

Table 1-1 presents the descriptive statistics of unmatched home help service users and non-users for each year. Care recipients who used the home help service were more likely to be younger than non-users. The primary caregivers for users of home help services were less likely to be living with the care recipient, and less likely to be a daughter/daughter-in-law of the care recipient. **Table 1-2** shows the baseline characteristics after propensity score-matching. The two groups were balanced in terms of the characteristics of the care recipients, their caregivers, and household characteristics.

Table 1-3 shows the result of propensity score-matching DD estimation for functional independence. The odds ratio for the use of home help services was 0.554 (95% confidence interval (CI), 0.416 to 0.738; $P < 0.001$) in 2004, and 0.821 in 2007. The interaction with the pre-post amendment dummy showed a significant association (odds ratio, 1.483; 95% confidence interval (CI), 1.002 to 2.197; $P = 0.049$); that is, the negative impact of using home help services on functional independence was significantly attenuated after the 2006 reform.

Table 1-1 Characteristics of participants before propensity score matching in 2004 and 2007.

	2004			2007		
	Home help users N=623	Non-users N=1,360	P-value	Home help users N=542	Non-users N=1,040	P-value
Care recipient						
Age (mean±SD, years)	81.1±6.3	82.5±6.7	< 0.001	81.5±6.6	83.2±6.8	< 0.001
Marital status	20.4%	24.4%	0.048	25.5%	26.1%	0.797
Cause of disability						
Stroke	15.4%	15.2%	0.880	15.1%	14.3%	0.668
Joint Disorder	31.3%	27.2%	0.061	36.0%	31.8%	0.096
Dementia	8.7%	8.3%	0.789	13.5%	15.6%	0.263
Fracture	18.5%	17.5%	0.604	21.6%	18.9%	0.194
Aging	30.5%	35.5%	0.029	29.3%	33.8%	0.075
LTCI eligibility 1 year ago						
Mild (care level 1 or less)	96.2%	95.7%	0.669	93.7%	93.2%	0.713
Moderate to severe (care level 2 or more)	3.9%	4.3%		6.4%	6.8%	
Functional independence	45.3%	47.2%	0.421	45.4%	45.0%	0.883
Primary caregiver and household						
Number of people living together	2.0±1.5	3.3±1.8	< 0.001	2.0±1.4	3.1±1.6	< 0.001
Living with care recipient	30.8%	69.9%	< 0.001	32.3%	65.3%	< 0.001
Primary caregiver						
Spouse	6.7%	11.0%	< 0.001	11.1%	10.1%	< 0.001
Daughter	13.3%	19.3%		13.7%	20.1%	
Son	10.3%	10.9%		9.6%	14.8%	
Daughter-in-law	11.9%	34.1%		12.6%	30.1%	
Other	57.8%	24.6%		53.1%	24.9%	
Home ownership	80.7%	90.6%	< 0.001	79.5%	90.1%	< 0.001

Table 1-2 Characteristics of participants after propensity score matching in 2004 and 2007.

	2004			2007		
	Home help users N=515	Non-users N=515	P-value	Home help users N=485	Non-users N=485	P-value
Care recipient						
Age (mean±SD, years)	81.0±6.5	81.6±6.5	0.134	81.5±6.7	81.8±6.9	0.531
Marital status	24.7%	26.2%	0.567	27.2%	30.1%	0.320
Cause of disability						
Stroke	15.9%	15.9%	1.000	14.9%	14.6%	0.668
Joint Disorder	31.5%	31.1%	0.839	36.5%	35.5%	0.738
Dementia	10.3%	8.4%	0.284	13.4%	14.4%	0.643
Fracture	20.0%	16.3%	0.125	22.1%	18.1%	0.128
Aging	32.4%	33.0%	0.842	29.9%	32.6%	0.368
LTCI eligibility 1 year ago						
Mild (care level 1 or less)	95.3%	96.7%	0.265	92.8%	94.0%	0.438
Moderate to severe (care level 2 or more)	4.7%	3.3%		7.2%	6.0%	
Functional independence	42.3%	55.2%	< 0.001	44.1%	48.5%	0.176
Primary caregiver and household						
Number of people living together	2.2±1.6	2.3±1.6	0.199	2.1±1.4	2.2±1.3	0.172
Living with care recipient	37.3%	35.3%	0.517	36.1%	38.1%	0.506
Primary caregiver						
Spouse	8.2%	6.8%	0.935	12.4%	14.4%	0.690
Daughter	15.9%	16.3%		15.3%	14.9%	
Son	11.7%	11.7%		10.7%	12.4%	
Daughter-in-law	14.4%	15.4%		14.0%	14.6%	
Other	49.9%	49.9%		47.6%	43.7%	
Home ownership	80.6%	84.3%	0.120	81.0%	85.4%	0.071

Table 1-3 Difference-in-difference estimates of home help services by conditional logistic regression analysis

	Odds ratio	P-value	95% CI	
Use of home help services	0.554	< 0.001	0.416	0.738
Use of home help services * year dummy	1.483	0.049	1.002	2.120
Age	0.962	0.016	0.932	0.994
Marital status	1.264	0.368	0.759	2.106
Cause of disability				
Stroke	0.500	0.007	0.302	0.827
Joint Disorder	0.847	0.374	0.588	1.221
Dementia	0.291	0.000	0.161	0.528
Fracture	0.842	0.468	0.530	1.339
Aging	0.847	0.407	0.572	1.255
LTCI eligibility 1 year ago (1= Moderate to severe)	0.454	0.039	0.214	0.961
Number of people living together	1.029	0.881	0.705	1.503
Living with care recipient	1.462	0.407	0.596	3.588
Primary caregiver				
Spouse	reference			
Daughter	2.926	0.068	0.924	9.266
Son	3.841	0.004	1.527	9.659
Daughter-in-law	3.198	0.031	1.111	9.205
Other	1.924	0.126	0.833	4.443

CI, confidence interval.

1.4. Discussion

The result suggested revealed that use of a home help service was associated with the functional independence of female care recipients with mild disability, and that the negative association between use of home help service and the functional independence was reduced after policy amendment by the LTCI in 2006. As far as we know, this is the first study to empirically test the impact of home help services for mildly disabled older people on their functional independence using a large nationwide population-based dataset.

Before the 2006 policy amendment, an 11-month observational study by Kato et al. showed that use of more types of care services, including home help services, was significantly associated with an increase in care needs of users whose level of disability had been mild at baseline [12]. In contrast, Ishibashi et al. reported that the risk of decline in functional status was lower in users of home help services than in users of community-based daycare services in the post-amendment years between 2007 and 2009 [13]. Unfortunately, these studies were conducted in a single local municipality, and either before or after the policy reform in 2006, and did not investigate the impact of the policy change. Furthermore, these analyses relied on naïve regression analysis, and did not fully account for endogenous selection of service use that would seriously

bias the results. In our study, we carefully addressed the endogenicity problem by use of appropriate statistical techniques, and confirmed a negative effect of home help service use before 2006, and attenuation of the impact after policy amendment. Thus our results are not necessarily inconsistent with those of the previous studies.

Disuse syndrome induced by physical inactivity is a major risk factor for a reduction in muscle volume, or sarcopenia, and subsequent functional decline and mortality among older persons [35-37]. Physical frailty also causes cognitive impairment, and *vice versa* [38]. Recent cohort studies revealed that participation in daily household chores, including housework, cooking, and shopping, is an independent predictor of lower mortality [39], and of a lower risk of cognitive decline [40]. These previous findings and the current study suggest that current provision of home help services for mildly disabled older persons under Japan's LTCI may interfere with their active participation in daily activities and reduce their functional independence.

A strength of this study was that it included nationally representative data and the use of a propensity score-matching method to minimize selection bias. However, the study has several limitations that require consideration. First, we did not take into account service use as a substitute for home help services, e.g., community-based day care [11, 14, 16]. We conducted an *ad hoc* analysis and found that day care service use

increased after the amendment (data not shown). When we adjusted for day care services in our DD model, however, the outcomes of the DD analysis remained marginally significant. Second, the CSPLC is not a panel data set. Therefore, the comparability of the 2004 and 2007 surveys is questionable, even though the two surveys employed the same sampling method. The two groups differed in the care recipients' characteristics (age and etiology of functional disability) and the characteristics of their primary caregiver and household (number of people living together) (**Appendix 1**). The author compared the change in the functional independence between care recipients with similar characteristics; however, there may have been systematic differences in baseline characteristics between the 2004 and 2007 surveys. A future study using a panel data set is required to confirm these results. Third, the author could not fully preclude reverse causation, or the possibility that improved functional status led to less use of home help services, because of the study design. The author also attempted to use instrumental variable methods to address reverse causation; however, proper instruments could not be found. Fourth, as the use of home help services was dichotomous, the author could not investigate the relationship between the extent of home help services used and its effect on functional independence. Finally, care should be exercised in concluding that service restriction is beneficial because the

effects of home help service reduction on the wellbeing and earning capacity of caregivers was not investigated. Previous studies indicated that formal care substitutes for informal home care [41], and introduction of Japan's LTCI led to improved labor participation by female caregivers [6]. Whether restriction of home help services increases the burden of caregiving among family caregivers needs to be investigated in future studies.

In conclusion, our results suggested that a formal home help service for mildly disabled older persons was associated with their functional independence, and this was attenuated after a reduction in the availability of home help services after the 2006 policy amendment. The results suggested that formal care for mildly disabled older persons needs to be carefully designed not to interfere with their independence. Further studies are required to examine the effects of home help services on the wellbeing of care recipients and their carers.

CHAPTER 2

Supplier-induced demand for long-term care services in Japan (Study 2)

2.1. Introduction

Since the introduction of the Long-Term Care Insurance (LTCI) system, long-term care services have been provided by diverse providers including for-profit firms [5, 6] and care recipients have been able to choose their preferred types of service and providers. To support their choice of suitable services and providers, nearly all care recipients request a "care manager," who is a specialist with a medical or welfare related background, to create a care plan, i.e., a schedule of service provision [5, 6, 25].

Thus, care managers, who are employed in an in-home care management office (*Kyotaku Kaigo Shien Zigyosho*), are required to serve the best interests of the care recipients, i.e., they should serve as agents of care recipients. Meanwhile, the firms that own the in-home care management office often provide long-term care services such as home help services or day care services. Therefore, care managers (or the in-office care management office) might have an incentive to provide services supplied by their own facilities against the interests of the care recipients to gain profits. That is, they might violate their roles as agents of care recipients[26].

This agency problem has been discussed in health economics and is known as the "supplier(physician)-induced demand hypothesis"[42]. McGuire (2000) defined supplier-induced demand as follows: "Physician-induced demand exists when the

physician influences a patient's demand for care against the physician's interpretation of the best interest of the patient" [42]. Many studies have investigated the existence of the supplier-induced demand by analyzing the effect of competition or the fee reduction on service utilization in healthcare. Nevertheless, the existence and magnitude of supplier-induced demand are still controversial [43-50]. This is because many studies may have failed to distinguish between the supplier-initiated demand and the recipient-initiated demand [26, 45].

On the other hand, only a few studies have examined the supplier-induced demand for the LTCI services [26-28]. These studies investigated the association between care provider density and service utilization or expenditure. Yuda (2005) and Noguchi and Shimizutani (2009) employed a two- (or three-) part model to decompose service utilization into probability of receiving services, i.e. the recipient-initiated demand, and expenditure on services, i.e. the supplier-initiated demand [51, 52], and found weak evidence that the supplier-induced demand existed [26, 28]. However, these studies may have failed to distinguish the supplier-induced from the recipient-initiated demand, since care managers could influence not only expenditure on services but also the probability of receiving services through creating the care plan.

The current study attempts to overcome these limitations by using the natural experimental setting of the revision of LTCI fees in 2012 and to investigate the supplier-induced demand for the long-term care services by taking into account the incentive of care managers, i.e., whether the firms in which care managers were employed provided long-term care services or not.

2.2. Methods

The revision of LTCI fees in 2012

In April 2012, the Japanese Ministry of Health, Labour and Welfare revised the LTCI fee schedule for providing day care services. A day care service for the LTCI eligibility of Care Level 1 for 6-8 hours at a regular-sized facility had been equivalent to 677 units per day before the revision of the LTCI fees. After fees were revised, a day care service for the LTCI eligibility of Care Level 1 for 5-7 and 7-9 hours became equivalent to 602 and 690 units per day. The mean delivery time for a day care service was 6.2 hours before the revision of the LTCI fees in 2012 [53]. Thus, the payment for providing day care services declined by 10% for the mean delivery time under this new fee schedule.

2.2.1. Data Source

The primary data source for care recipients was the Survey of Long-term Care Benefit Expenditures [54]. This survey covers all claims of long-term care benefit expenditure and a benefit management sheet assessed every month by Prefectural National Health Insurance Organizations under the supervision of the All-Japan Federation of National Health Insurance Organizations. The annual number of recipients with insured claims was 5.2 million in 2011 and 5.4 million in 2012. The author chose data from April 2011

to March 2013 because the LTCI fees were revised in April 2012, thereby, the author could conduct a panel data analysis, as described later.

Details of the in-home care management offices' status were obtained from the Survey of Institutions and Establishments for Long-term Care [10]. This survey comprises questionnaires on organizations and management entities filled in by managers of organizations providing home-based services, in-home care management, etc. Of the 33,517 organizations providing in-home care management in Japan, 28,628 respond to the survey (response rate: 85.8%).

These anonymous secondary data are approved for research use by the governmental agency, and ethical considerations waived.

*2.2.2. Study population (**Figure 2-1**)*

The author selected those who were aged 65 and older, LTCI eligible for Care Levels 1 to 3, and not institutionalized in April 2011 (N=3,799,257). The author excluded elderly who were institutionalized or hospitalized between April 2011 and March 2013. The author further excluded the elderly who changed their LTCI eligibility category to Support Level 1 to 2 or Care Level 4 to 5, did not request a care manager to draw up a care plan, or could not be tracked (due to the death of the care recipient or the change of

residence to a different municipality) up to March 2013. Then, the author also excluded the elderly who changed in-home care management offices providing the care plan in order to better determine the impact of supply side factors. Finally, the author merged these datasets and the in-home care management offices' datasets by using the offices' unique identification numbers. The final dataset for the study analyses contained 366,776 care recipients.

2.2.3. Explanatory variables

The explanatory variable was dichotomous regarding whether the firms that owned the in-home care management office provided day care services or not in the same prefecture. The in-home care management offices proving day care services were defined as "joint offices with day care services (joint office)" or "non-joint offices without day care services (non-joint office)".

The author included the care recipient's characteristics (age, sex, and the LTCI eligibility) and the in-home care management offices' characteristics (private non-profit providers, public non-profit providers, and for-profit providers) as covariates.

2.2.4. Dependent variables

There were four outcome variables for the day care service utilization. First, the use of day care services was dichotomous regarding whether the care recipient received day care services or not at least one day per month. Second, the author used the number of days care recipients received day care services per month. Third, the author calculated the average daily expenditure on the basis of the basic fees for the day care services per month. Finally, the average daily expenditure on the bonus fees for the additional services was calculated. These bonus fees were charged if bathing services, services related to improving functional or nutrition status, etc., were used.

The author also used monthly total expenditure on long-term care services to evaluate the substitution of the day care services.

2.2.5. Statistical analysis

The author employed a three-part model using individual-level panel data to evaluate supplier-induced demand of in-home care management offices in response to the revision of the LTCI fees in 2012. The author compared the difference in outcome variables for the day care service uses before and after the revision of the LTCI fees for joint and non-joint office users. A random effect regression model or fixed effect

regression model was used to control for unmeasured variables, such as the characteristics of the caregiver and household (e.g., sex, relationship with the recipient, and house ownership). The author assumed that these unmeasured variables were time-invariant.

The following model was constructed for the estimation:

(1) First part: use of day care services (N=366,676)

$$Y^{(utilization)}{}_{i,t} = \alpha_0 + \alpha_1 X_{1i,t} + \alpha_2 X_{2i,t} + \alpha_3 X_{3i,t} + \alpha_4 X_{2i,t} * X_{3i,t} + \alpha_5 X_{4i} + u_i + \varepsilon_{i,t}$$

(2) Second to fourth parts: the number of days care recipients received day care services per month (second part), average daily expenditure on the basic fees for the day care services per month (third part), and average daily expenditure on the bonus fees for the additional services (fourth part) for those who used day care services for 24 consecutive months (N=177,247).

$$Y^{(days)}{}_{i,t} = \beta_0 + \beta_1 X_{1i,t} + \beta_2 X_{2i,t} + \beta_3 X_{3i,t} + \beta_4 X_{2i,t} * X_{3i,t} + \beta_5 X_{4i} + u_i + \varepsilon_{i,t}$$

$$Y^{(basic\ fee)}{}_{i,t} = \gamma_0 + \gamma_1 X_{1i,t} + \gamma_2 X_{2i,t} + \gamma_3 X_{3i,t} + \gamma_4 X_{2i,t} * X_{3i,t} + \gamma_5 X_{4i} + u_i + \varepsilon_{i,t}$$

$$Y^{(bonus\ fee)}{}_{i,t} = \delta_0 + \delta_1 X_{1i,t} + \delta_2 X_{2i,t} + \delta_3 X_{3i,t} + \delta_4 X_{2i,t} * X_{3i,t} + \delta_5 X_{4i} + u_i + \varepsilon_{i,t}$$

where X_1 refers to a vector of a care recipient; X_2 refers to joint office dummy that takes 1 if care recipients use an in-home care management office proving day care services (joint office) and 0 otherwise (non-joint office); X_3 refers to the revision of fees dummy

1 if after the revision of the LTCI fees in 2012 and 0 otherwise; and X_4 refers to the month dummy. In this model, α_2, β_2, γ_2, δ_2 indicates the difference in outcomes between joint and non-joint office users; α_3, β_3, γ_3, δ_3 indicates the impact of the revision of the LTCI fees in 2012, which is regarded as a mixture of recipient-initiated and physician-initiated utilization ; and α_4, β_4, γ_4, δ_4 represents the differential impact of the revision of the LTCI fees between joint and non-joint office users, which are considered as inducements by joint offices, i.e., supplier-induced demand, because non-joint offices have no incentive to increase the utilization of services against a care recipient's interests. The author conducted a Hausman test for model specification between the random effect model and the fixed effect model.

The author also conducted the analysis using monthly total expenditure on long-term care services as the outcome in a random effect model and fixed effect model to examine whether the impact of the revision of the LTCI fees on long-term care service utilization differed in the two groups.

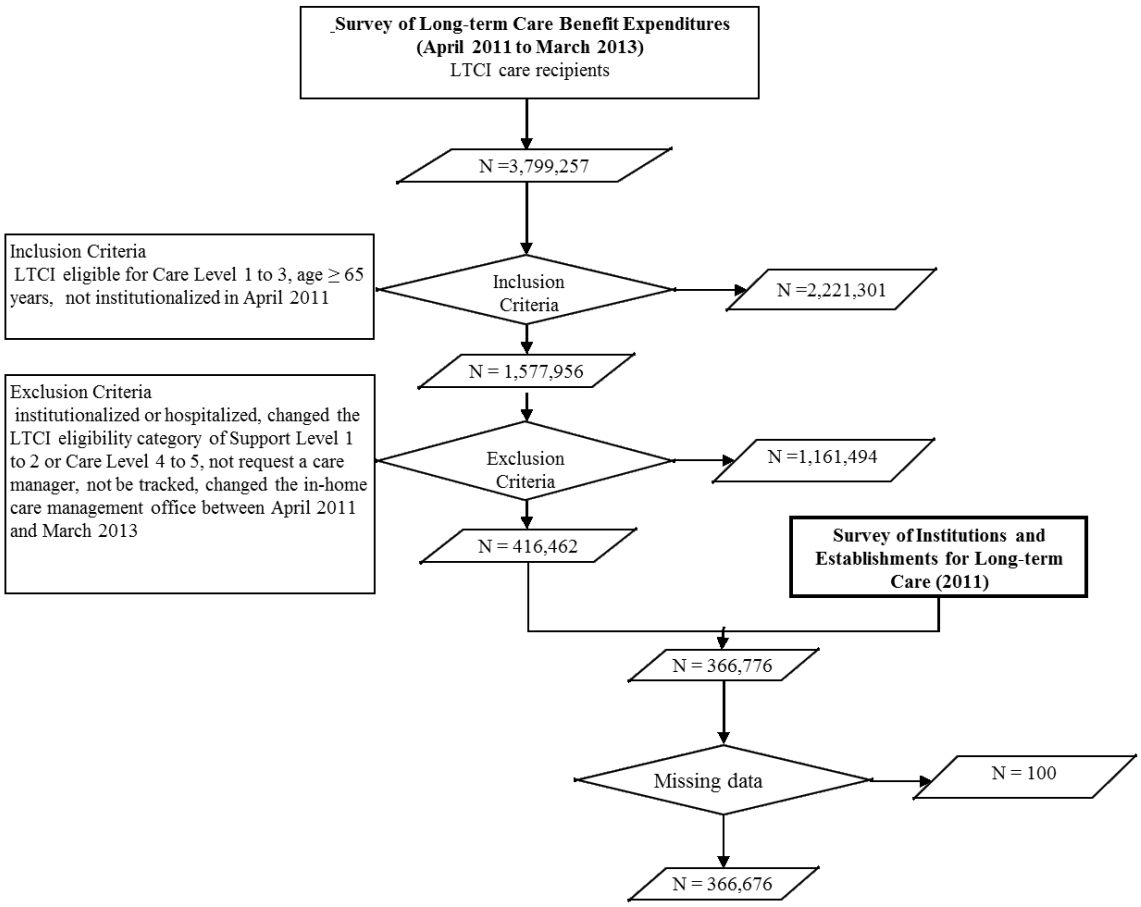
2.2.6. Sensitivity analysis

Since the distribution of the number of days care recipients received day care services per month and monthly total expenditure on long-term care services was right-skewed,

the author log-transformed these values. Then, the author repeated the analysis using log-transformed values as the outcome.

Since the demand inducement will occur more frequently as supplier density increases [55], the author also included in the model the density of day care service facilities and the in-home care management offices' characteristics (private non-profit providers, public non-profit providers, or for-profit providers). The density of day care service facilities was calculated as the number of facilities per 1000 people aged 65 and over in each city. This variable was categorized into a median. The median density of day care service facilities was 0.85 per 1,000 people aged 65 and over.

Figure 2-1 Subject selection



2.3. Results

Table 2-1 presents the descriptive statistics of joint and non-joint office users in April 2011. Care recipients who used the non-joint offices were more likely to be younger, be female, and have the LTCI eligibility of Care Level 3 than joint-office office users. The two groups differed in the probability of using day care services (43.1% vs. 63.6%, P<0.01) and monthly total expenditure on long-term care services (7507 units/month vs. 8066 units/month, P<0.01). When restricted to day care service users, the number of days care recipients received day care services and average daily expenditure on the bonus fees for the additional services were higher for joint office users than non-joint office users, and average daily expenditure on the basic fees for the day care services was lower for non-joint office users. Distributions of the number of days care recipients received day care services per month, average daily expenditure on the basic fees for the day care services per month, average daily expenditure on the bonus fees for the additional services, and monthly total expenditure on long-term care services are shown in **Appendix 2**, **3**, **4** and **5**.

Figure 2-1, **2-2**, **2-3**, and **2-4** show trends in the probability of using day care services, the number of days care recipients received day care services, average daily expenditure on the basic fees for the day care services per month, and average daily

expenditure on the bonus fees for the additional services around the time of revision of the LTCI fees in April 2012.

Table 2-2 shows the estimation results of the first part. The left and right columns show the results of the random and fixed effects models. The Hausman test verified the endogeneity of the explanatory variables ($P < 0.01$) and supported the use of the fixed effect model. The use of joint offices and the revision of the LTCI fees were significantly and positively associated with the use of day care services. Moreover, the interaction between the use of joint offices and the revision of fees dummy, in which the author is most interested, showed a significant association (coefficient, -0.010; $P<0.01$), indicating that the difference in home help services use between joint and non-joint office users was significantly attenuated after the revision of the LTCI fees.

The estimation results of the second, third, and fourth parts are given in **Table 2-3, 2-4, 2-5**. The revision of the LTCI fees was significantly and positively associated with the number of days care recipients received day care services and average daily expenditure on the bonus fees, and the interaction with the use of the joint office dummy showed a significant and negative association. Meanwhile, the revision of the LTCI fees was significantly and negatively associated with average daily expenditure

on the bonus fees for the additional services, and the interaction with the use of joint office dummy showed a significant and negative association.

Conversely, the interaction between the use of joint offices and the revision of fees dummy was significantly and positively associated with monthly total expenditure on long-term care services (**Table 2-6**).

Sensitivity analysis

The author repeated the analyses using log-transformed values as the outcome, and found the similar results (**Appendix 6, 7, 8, and 9**). When the density of day care service facilities or the in-home care management offices' characteristics were added to the model, the coefficient of the interaction between the use of joint offices and the revision of fees dummy showed a similar value (data not shown). In addition, the interaction between the use of joint offices, the revision of fees dummy, and the density of day care service facilities dummy was not significantly associated with the outcome.

Table 2-1 Characteristics of care recipients in April 2011

	Non-joint office user N=133,395	Joint office user N=233,281	P value
Age (mean±SD, years)	81.7±7.4	82.5±7.3	P < 0.01
Sex (females, %)	68.9%	66.4%	P < 0.01
LTCI eligibility (%)			
Care Level 1	41.4%	44.3%	P < 0.01
Care Level 2	40.4%	39.2%	
Care Level 3	18.3%	16.5%	
Use of day care services (%)	43.1%	63.6%	P < 0.01
Monthly expenditure on long-term care services (mean±SD, units/month)	7507±5878	8066±5830	P < 0.01
Day care services user	(N=57,473)	(N=148,248)	
The number of days (mean±SD, days/month)	9.5±5.2	9.8±5.3	P < 0.01
Average daily expenditure on the basic fees (mean±SD, units/day)	747.9±132.8	740.2±121.9	P < 0.01
Average daily expenditure on the bonus fees (mean±SD, units/day)	58.6±27.1	62.2±26.4	P < 0.01

1 unit = 10 – 11.26 JPY (differs with regions and services)

*: Chi-square test for categorical variables and t-test for continuous variables.

Figure 2- 2 Trends in the probability of using day care services

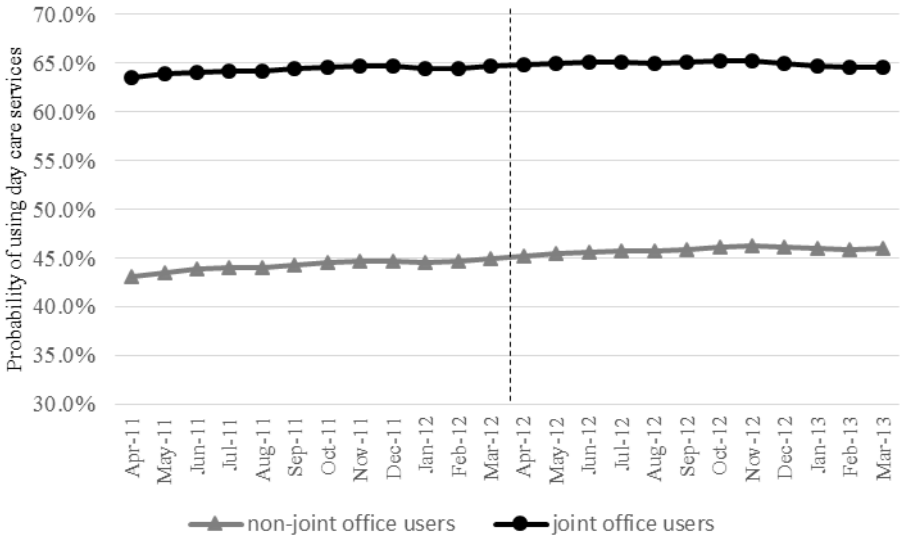


Figure 2- 3 Trends in the number of days care recipients received day care services

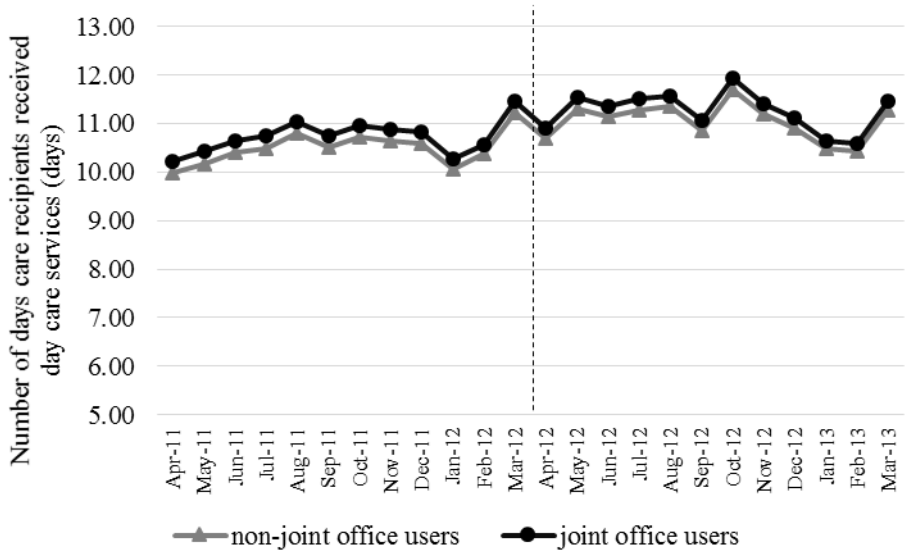


Figure 2-4 Trends in average daily expenditure on the basic fees for the day care services per month

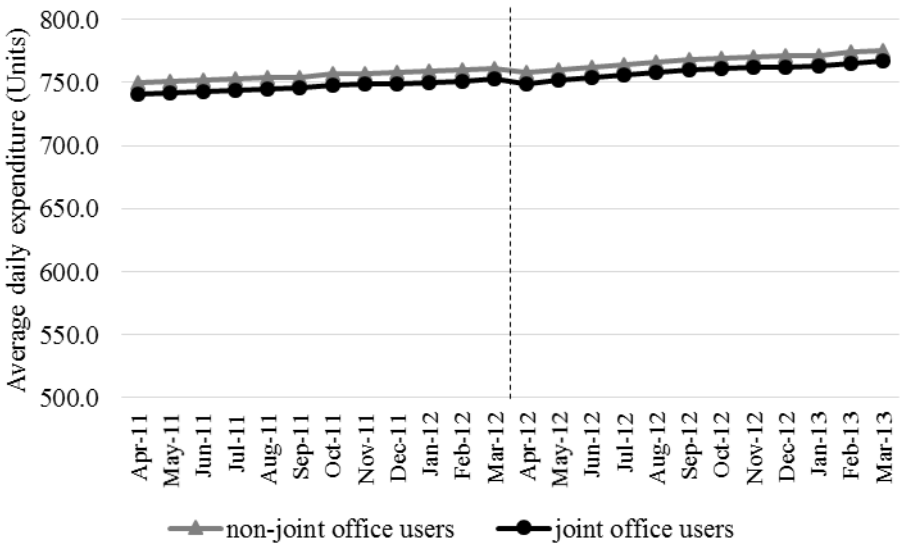


Figure 2-5 Trends in average daily expenditure on the bonus fees for the additional services

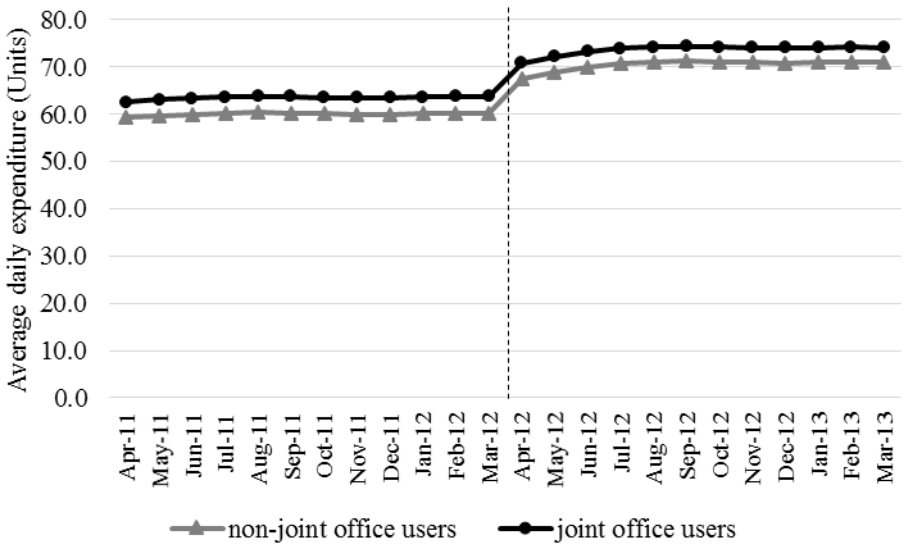


Table 2-2 Determinants of day care services use: First-part (linear model)

	Random effect model		Fixed effect model	
	Coefficient.	P value	Coefficient	P value
Sex (female=1)	0.057	P<0.01	omitted	
Age	0.005	P<0.01	0.000	0.67
LTCI eligibility				
Care Level 1	reference		reference	
Care Level 2	0.003	P<0.01	0.003	P<0.01
Care Level 3	-0.002	P<0.01	-0.002	P<0.01
Joint office dummy	0.196	P<0.01	omitted	
Revision of fees dummy	0.011	P<0.01	0.016	P<0.01
Joint office dummy* Revision of fees dummy	-0.010	P<0.01	-0.010	P<0.01
Number of observations	8800224		8800224	

*Adjusted for month

* Hausman test: chi2 (16) =1758.91: P value<0.01

Table 2-3 Determinants of the number of days: Second-part (linear model)

	Random effect model		Fixed effect model	
	Coefficient	P value	Coefficient	P value
Sex (female=1)	0.640	P<0.01	omitted	
Age	0.021	P<0.01	-0.006	0.07
LTCI eligibility				
Care Level 1	reference		reference	
Care Level 2	0.454	P<0.01	0.441	P<0.01
Care Level 3	0.936	P<0.01	0.891	P<0.01
Joint office dummy	0.229	P<0.01	omitted	
Revision of fees dummy	0.490	P<0.01	0.519	P<0.01
Joint office dummy* Revision of fees dummy	-0.040	P<0.01	-0.039	P<0.01
Number of observations	4253928		4253928	

*Adjusted for month

* Hausman test: chi2 (16) = 1261.46: P value<0.01

Table 2-4 Determinants of average daily expenditure on the basic fees: Third-part (linear model)

	Random effect model		Fixed effect model	
	Coefficient	P value	Coefficient	P value
Sex (female=1)	14.415	P<0.01	omitted	
Age	0.724	P<0.01	-0.080	0.22
LTCI eligibility				
Care Level 1	reference		reference	
Care Level 2	112.096	P<0.01	112.048	P<0.01
Care Level 3	232.764	P<0.01	232.485	P<0.01
Joint office dummy	-4.221	P<0.01	omitted	
Revision of fees dummy	-1.583	P<0.01	-0.764	P<0.01
Joint office dummy* Revision of fees dummy	-0.492	P<0.01	-0.492	P<0.01
Number of observations	4253928		4253928	

*Adjusted for month

* Hausman test: chi2 (16) = 321.97: P value<0.01

Table 2-5 Determinants of average daily expenditure on the bonus fees: Fourth-part (linear model)

	Random effect model		Fixed effect model	
	Coefficient	P value	Coefficient	P value
Sex (female=1)	-2.843	P<0.01	omitted	
Age	0.053	P<0.01	0.007	0.79
LTCI eligibility				
Care Level 1				
Care Level 2	1.057	P<0.01	0.857	P<0.01
Care Level 3	1.640	P<0.01	1.339	P<0.01
Joint office dummy	3.522	P<0.01	omitted	
Revision of fees dummy	10.261	P<0.01	10.325	P<0.01
Joint office dummy* Revision of fees dummy	-0.323	P<0.01	-0.321	P<0.01
Number of observations	4253928		4253928	

*Adjusted for month

* Hausman test: chi2 (16) = 567.99: P value<0.01

Table 2-6 Determinants of monthly total expenditure on long-term care services (linear model)

	Random effect model		Fixed effect model	
	Coefficient	P value	Coefficient	P value
Sex (female=1)	330.1	P<0.01	omitted	
Age	58.8	P<0.01	-2.4	0.30
LTCI eligibility				
Care Level 1				
Care Level 2	1767.1	P<0.01	1744.9	P<0.01
Care Level 3	4196.8	P<0.01	4124.3	P<0.01
Joint office dummy	665.5	P<0.01	omitted	
Revision of fees dummy	626.5	P<0.01	691.0	P<0.01
Joint office dummy* Revision of fees dummy	136.0	P<0.01	136.4	P<0.01
Number of observations	4253928		4253928	

*Adjusted for month

* Hausman test: chi2 (16) = 9684.77: P value<0.01

2.4. Discussion

The author revealed that the elderly who used a joint in-home care management office with day care services were more likely to use day care services and that the effects of the revision of the LTCI fees were significant different between the elderlies who used the non-joint offices and the joint offices. These results suggested the joint offices influenced care recipients demand for long-term care against their interests. As far as we know, this is the first study to empirically test the supplier-induced demand for the LTCI services using a large nationwide population-based dataset.

Using prefectural level panel data, Yuda indicated that supplier density affected probability of receiving several types of services but did not influence most types of services' expenditure [28]. Moreover, using household-level data, Noguchi and Shimizutani reported that supplier density was not positively correlated with probability to use care or care expenditure [26]. On the other hand, Yuda showed that day care service density was positively correlated with probability to use day care services and care expenditure and found the existence of supplier-induced demand for day care services [28]. My findings are consistent with the result obtained by Yuda. Unfortunately, these studies were conducted in a single local municipality or by using prefecture level data and did not take into account the role of care managers.

On the other hand, a joint in-home care management office with day care services negatively affected utilization of day care services after the revision of LTCI fees. Previous studies indicated that the reduction of the payment leads to use of other high-margin medical care or drugs [46, 56]. In the field of medical care, separating the prescribing and dispensing of drugs in Taiwan, which is similar to the situation in the care management system in LTCI, reduced drug expenditure [50]. However, the separation policy was less effective at reducing total health expenditure [50]. Consistent with these studies [46, 50, 56], the present study indicated that monthly total expenditure on LTCI services was higher for joint office users than non-joint office users and that the difference in total expenditure became larger after the revision of fees. This study suggested that joint offices switched from providing day care services that reduced the fees to other high-margin services.

A strength of this study was that it included nationally representative data and use of care manager's roles in the analyses to distinguish between the supplier-initiated demand and the recipient-initiated demand. However, the study has several limitations that require careful discussion. First, the author did not include detailed information on family caregivers and households. In addition, the in-home care management offices' status derived from the Survey of Institutions and Establishments for Long-term Care

were not panel dataset. However, the author assumed that these unmeasured variables such as household income, gender and relationship with the care recipients and the in-home care management offices' status were time-invariant and used a fixed effect regression model to control for unmeasured confounders. Second, the actual delivery time for a day care service could not be revealed in this study. Moreover, the author could not fully investigate what kind of LTCI services are used for substitutions of day care services. A future study using a simultaneous equation model is required to confirm our results. Finally, the clinical effectiveness of induced demand was not evaluated in the present study. Labelle emphasized the importance of considering clinical effectiveness in analyses of supplier-induced demand, especially for considering its policy implications [57]. The author conducted an *ad hoc* analysis and found that use of joint offices was not associated with the deterioration of care-needs levels (data not shown).

The present findings have important policy implications. First, firms that provide both care management and day care services might induce demand against the interests of the care recipients. Separating the care management and LTCI service provision may be effective in improving care arrangements. Second, it is assumed that little information asymmetry exists between care managers and care recipients or their

family [26] , but the present study suggests that information asymmetry exists even in the LTCI services. To improve appropriate LTCI services use, a system that monitors the quality of care plans (standardization of care plan) should be established.

In conclusion, the author found the existence of supplier-induced demand in the Japanese LTCI. The results indicate that separating the care management and LTCI services provision could be effective in promoting appropriate use of long-term care services. Further studies are required to examine the effects of supplier-induced demand on other services' utilization and the wellbeing of care recipients.

CONCLUSIONS

To investigate appropriate delivery of formal long-term care services, the author evaluated the effect of home help services on functional change in older people with mild disabilities and investigated the supplier-induced demand for the long-term care services.

The main findings of the present doctoral research are as follows:

1) Home help services for mildly disabled older persons was associated with their functional independence, and this was attenuated after a reduction in the availability of home help services after the 2006 policy amendment.

2) Firms that provide both care management and day care services might induce demand against the interests of the care recipients.

Recent studies showed that when health care providers provide the information about appropriate care, and this care is fully discussed with patients, health care improved at reduced costs [58]. In the Japan's LTCI system, care recipients and their families can receive the information about appropriate care services from care managers. Kashiwagi et al. reported that the nonmedical care management agencies were failing to grasp the actual need for visiting nurses and that the care management

system may not have been working effectively [59]. My finding also indicated that some care managers do not have the information about the inappropriate services such as home help services for mildly disabled older persons, even though these services are easy to understand. In addition, some care managers have incentives to distort the information about appropriate long-term care services in order to gain profits.

To reduce inappropriate LTCI services use, it is necessary to clarify the effect of the long-term care services and the effective combinations of services on care recipients and family caregivers and to establish a standardization of care plans on the basis of the effect. In addition, it is required to provide the information about appropriate long-term care services not only to care recipients and their families but also to care managers or service providers. The author indicated that information asymmetry exists even in the LTCI services. If care recipients and their families use the information of the quality of LTCI services, they can choose suitable care managers and service providers [60, 61]. Moreover, several studies have reported that Nursing Home Compare, which is public reporting of nursing home quality, improved both unreported and reported care [62, 63]. The information of LTCI services providers is available from the Ministry of Health, Labour and Welfare in Japan, however, this include only structural indicators. To encourage the care recipients and their families to select long-

term care providers or care managers, and to improve long-term care, process and outcome indicators are desired to include in a public reporting.

In addition, further studies are required to evaluate the effect of long-term care services not only based on impairment but also taking into account the goals to be achieved by the beneficiary for daily social participation and to assess the degree to which inappropriate services are delivered in the LTCI system.

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APPENDIX

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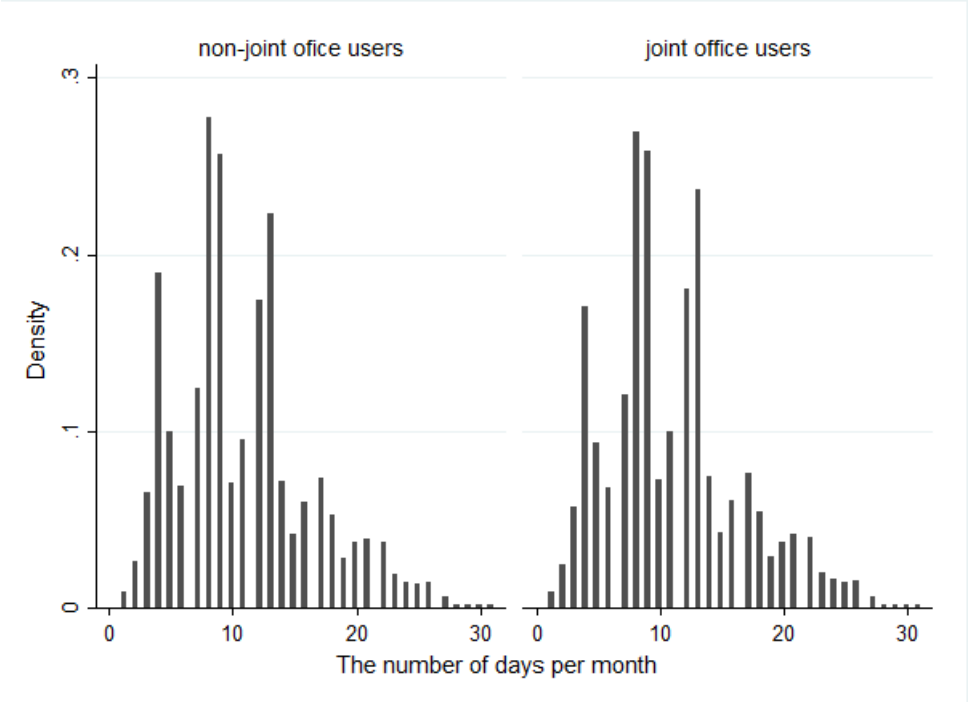
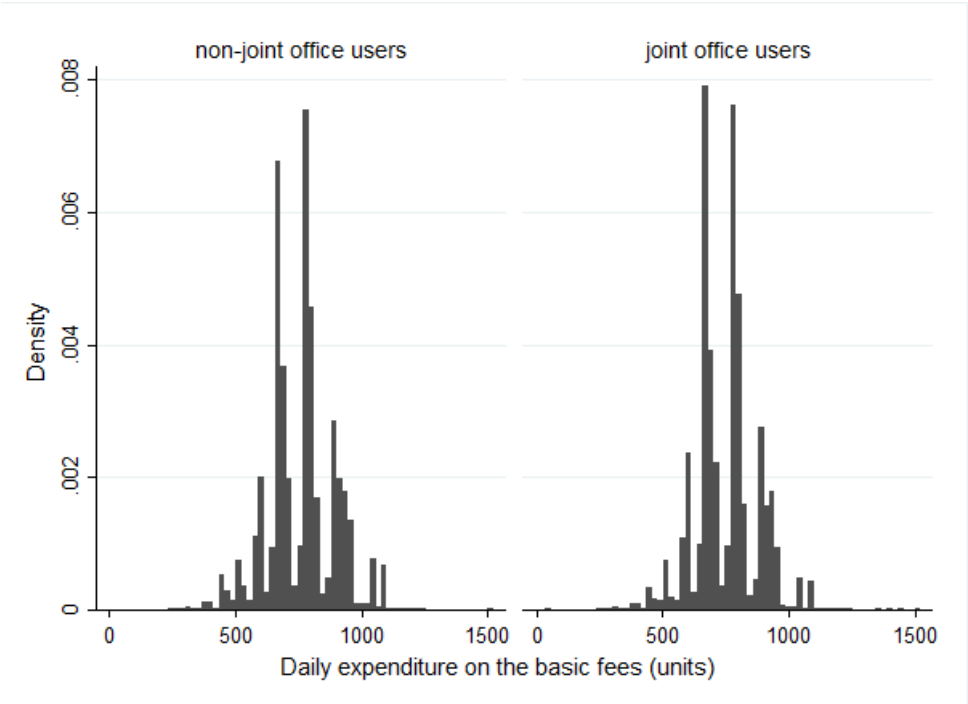
Appendix 1 Characteristics of participants in 2004 and 2007

	2004 N=1,983	2007 N=1,582	P-value
Care recipient			
Age (mean±SD, years)	82.0±6.6	82.6±6.8	0.010
Marital status	23.2%	25.9%	0.061
Cause of disability			
Stroke	15.2%	14.6%	0.602
Joint Disorder	28.5%	33.3%	0.002
Dementia	8.4%	14.9%	< 0.001
Fracture	17.8%	19.8%	0.131
Aging	33.9%	32.2%	0.284
LTCI eligibility 1 year ago			
Mild (care level 1 or less)	95.9%	93.5%	0.001
Moderate to severe (care level 2 or more)	4.1%	6.5%	
Functional independence	46.6%	45.2%	0.384
Primary caregiver and household			
Number of people living together	2.8±1.8	2.7±1.6	0.016
Living with care recipient	42.4%	46.0%	0.031
Primary caregiver			
Spouse	9.7%	10.4%	0.096
Daughter	17.5%	17.9%	
Son	10.7%	13.0%	
Daughter-in-law	27.1%	24.1%	
Other	35.1%	34.6%	
Home ownership	86.5%	87.5%	0.367

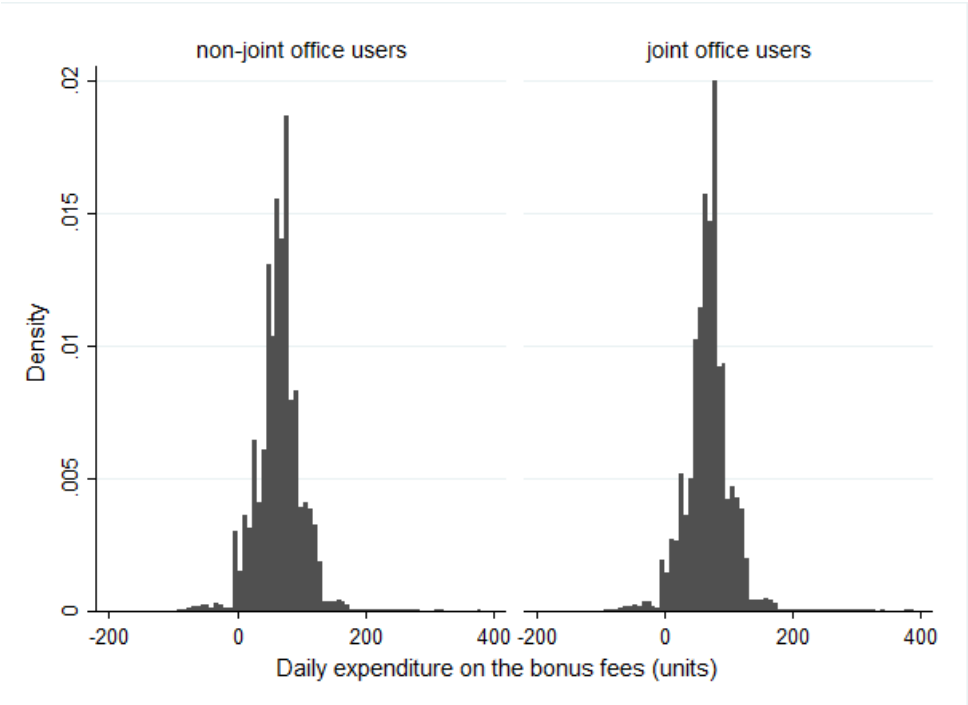
Appendix 2 Distribution of the number of days care recipients received day care services per month



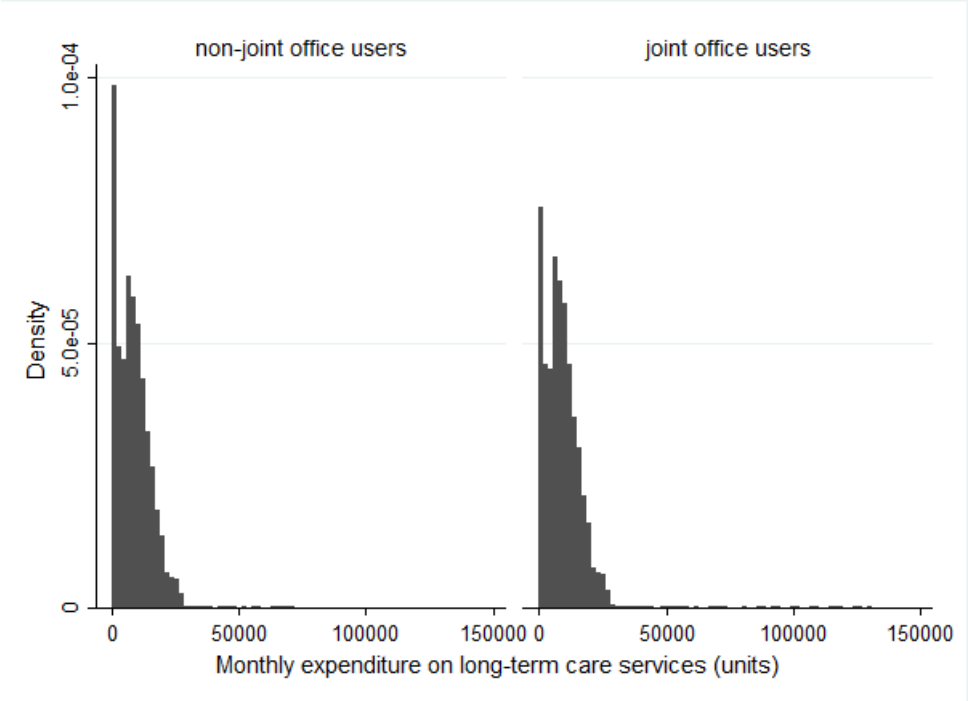
Appendix 3 Distribution of average daily expenditure on the basic fees for the day care services per month



Appendix 4 Distribution of average daily expenditure on the bonus fees for the additional services



Appendix 5 Distribution of monthly total expenditure on long-term care services



Appendix 6 Determinants of the number of days (log transformed): Second-part (linear model)

	Random effect model		Fixed effect model	
	Coefficient.	P value	Coefficient	P value
Sex (female=1)	0.060	P<0.01	omitted	
Age	0.003	P<0.01	0.000	0.268
LTCI eligibility				
Care Level 1	reference		reference	
Care Level 2	0.039	P<0.01	0.037	P<0.01
Care Level 3	0.066	P<0.01	0.061	P<0.01
Joint office dummy	0.026	P<0.01	omitted	
Revision of fees dummy	0.045	P<0.01	0.048	P<0.01
Joint office dummy* Revision of fees dummy	-0.004	P<0.01	-0.004	P<0.01
Number of observations	4253928		4253928	

*Adjusted for month

* Hausman test: chi2 (16) =826.76: P value<0.01

Appendix 7 Determinants of average daily expenditure on the basic fees (log transformed): Third-part (linear model)

	Random effect model		Fixed effect model	
	Coefficient	P value	Coefficient	P value
Sex (female=1)	0.021	P<0.01	omitted	
Age	0.001	P<0.01	-0.000	0.20
LTCI eligibility				
Care Level 1	reference		reference	
Care Level 2	0.156	P<0.01	0.155	P<0.01
Care Level 3	0.299	P<0.01	0.299	P<0.01
Joint office dummy	-0.004	P<0.01	omitted	
Revision of fees dummy	-0.003	P<0.01	-0.001	P<0.01
Joint office dummy* Revision of fees dummy	-0.001	0.08	-0.001	0.08
Number of observations	4253928		4253928	

*Adjusted for month

* Hausman test: chi2 (16) = 390.41: P value<0.01

Appendix 8 Determinants of average daily expenditure on the bonus fees (log transformed): Third-part (linear model)

	Random effect model		Fixed effect model	
	Coefficient	P value	Coefficient	P value
Sex (female=1)	-0.019	P<0.01	omitted	
Age	0.004	P<0.01	-0.000	0.92
LTCI eligibility				
Care Level 1	reference		reference	
Care Level 2	0.009	P<0.01	0.006	P<0.01
Care Level 3	0.008	P<0.01	0.006	P<0.01
Joint office dummy	0.237	P<0.01	omitted	
Revision of fees dummy	0.043	P<0.01	0.045	P<0.01
Joint office dummy* Revision of fees dummy	-0.003	P<0.01	-0.003	P<0.01
Number of observations	4253928		4253928	

*Adjusted for month

* Hausman test: chi2 (16) = 464.17: P value<0.01

* Average daily expenditure on the bonus fees contained negative values, the author added a constant value to the data prior to applying the log transform.

Appendix 9 Determinants of monthly total expenditure on long-term care services (log transformed) (linear model)

	Random effect model		Fixed effect model	
	Coefficient	P value	Coefficient	P value
Sex (female=1)	-0.058	P<0.01	omitted	
Age	0.017	P<0.01	-0.002	0.78
LTCI eligibility				
Care Level 1				
Care Level 2	0.319	P<0.01	0.311	P<0.01
Care Level 3	0.560	P<0.01	0.541	P<0.01
Joint office dummy	0.295	P<0.01	omitted	
Revision of fees dummy	0.158	P<0.01	0.177	P<0.01
Joint office dummy* Revision of fees dummy	0.017	P<0.01	0.017	P<0.01
Number of observations	4253928		4253928	

*Adjusted for month

* Hausman test: chi2 (16) = 4915.51: P value<0.01