Global Health & Medicine. 2021; 3(3):142-148.

DOI: 10.35772/ghm.2021.01000

REVIEW

The use of Japanese long-term care insurance claims in health services research: current status and perspectives

Xueying Jin[1,2,*], Nanako Tamiya[1,2]

[1] Department of Health Services Research, Faculty of Medicine, University of Tsukuba, Tsukuba, Ibaraki, Japan;
[2] Health Services Research & Development Center, University of Tsukuba, Tsukuba, Ibaraki, Japan.

Abstract: This study aims to evaluate the current status and perspectives on the use of Japanese long-term care (LTC) claims databases for research. We conducted a comprehensive literature search of PubMed and the Japan Medical Abstracts Society (Ichushi-Web), focusing on LTC claims data analyses published between 2000 and 2020. We summarized the study characteristics, database characteristics, and the research areas related to health services that were studied. In total, 86 journal articles (12 in Japanese and 74 in English) were included in our review. A particularly remarkable increase in the number of publications from 2016 to 2020 was observed. We extracted more publications with combined databases (n = 64) than those that only used a single source of the LTC claims databases (n = 22). More than half of the studies analyzed healthcare expenditure, healthcare utilization, and quality of care which were relevant to health services research. The most frequently mentioned limitation was the lack of validation in variables stored in the LTC claims databases. In conclusion, the LTC claims databases could serve as important sources of information for the evaluation of healthcare delivery, quality of care, and LTC policy.

***Keywords*:** long-term care claims, administrative data, health services research

Introduction

In 2000, along with the implementation of the long-term care (LTC) insurance system, the Japanese government implemented a standardized electronic LTC claims system with the primary aim of saving money by reducing paper costs and improving the efficiency of access to information on LTC users. Recently, LTC claims have become highly valued by LTC providers, researchers, and policymakers because they offer timely and important information to enhance their decision making.

LTC claims, simply put, are bill records that LTC service providers submit to insurers. They comprise detailed information on the types of LTC services, amount of care granted, and associated payments. Municipal governments, as LTC insurers, have established National Health Insurance Organizations and collected LTC claims aiming to pay the insured cost for their residents after examining the claims. Along with LTC claims, municipal governments also store the care-needs certification survey data (*1*).

To receive LTC insurance services, older people should contact the municipal government and obtain a care-needs level certification after a care-needs assessment. The care-needs certification survey contains 73 items regarding current physical and mental status. The assessment result and primary care physician's statement will be submitted and discussed by the Nursing Care Needs Certification Board that determines and assigns the care-needs level (*2*). Because the primary care physicians' statements are still paper-based, there is much difficulty in providing the necessary data for analysis.

Since LTC claims databases (which we defined as both LTC claims and care-needs certification surveys) reflect real-life LTC provisions and functional changes of care recipients, the data were initially used by the government to grasp the current situation of LTC services and review the LTC system. Ever since, LTC claims have attracted the attention of researchers – especially in health services research (HSR) – because of their extensive information that is useful for evaluating healthcare service delivery, quality, and policy development. Researchers initially accessed these data after the conclusion of joint research (between their university and the municipal government) related to LTC claims database analysis. Subsequently, the Ministry of Health, Labour and Welfare (MHLW) began providing national LTC claims under Article 33 of the Statistics Act (*3,4*). Only researchers who were funded by or undertook joint research with the government were allowed to use this data. Soon after, the MHLW of Japan developed expansive national-level databases named "National LTC Claims Databases (Kaigo DB)" by collecting anonymous LTC claims and care-needs certification surveys, which it publicly released in 2018. The "Kaigo DB" was only available to national or local government agencies, universities, and other quasi-public corporations (*1*). To use these data, study protocols had to be approved by the advisory committee of the MHLW (*1*). Owing to universal health coverage for LTC (*5*) and a well-established payment computing system, Japan became one of the few countries that maintain national-level LTC claims. Despite governments and researchers having great expectations of utilizing the data, little is known about the current status of LTC claims, such as the number of publications, research type, topic, as well as their limitations.

As mentioned above, LTC claims databases record accurate information about the structure (*e.g.*, human resources and organization characteristics), process (*e.g.*, provision of LTC services), and outcome of care services (*e.g.*, changes in the care-needs level, incidence of dementia, and discharge to home), and thus, is of great value in evaluating concerns relevant to HSR.

Therefore, this study aims to not only provide an overview of the current status and perspectives on Japanese LTC claims database analysis by conducting a comprehensive literature review, but also to synthesize current evidence of LTC claims database analysis in HSR.

Comprehensive search of LTC claims-based studies

Search strategy and selection criteria

We conducted a comprehensive literature search of the electronic databases of PubMed and the Japan Medical Abstracts Society (Ichushi-Web), following the methods recommended by the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines (*6*). All searches within titles, keywords, and abstracts covered the period from January 1, 2000 to November 30, 2020. The following search terms were identified: ("long-term care" OR "long-term care insurance") AND ("claim" OR "administrative data" OR "claims" OR "data" OR "database" OR "databases" OR "certification survey") AND ("Japanese" OR "Japan"). We limited the publication language to English and Japanese.

First, duplicated studies were removed from the extracted list. A study was included if it used LTC claims data as the principal source to address its research objectives. Thus, we excluded letters, editorials, conference abstracts, posters, oral presentations, and project reports. We also conducted a manual search to include studies not identified by the automated search.

Data extraction

The authors screened the citations based on the inclusion and exclusion criteria. Data relevant to the study characteristics (publication year, study design, and setting), and data source combinations were decided after a consensus was reached among the authors. For every journal article, we defined the research area according to the subject categories of the SCImago Journal & Country Rank (*7*). For HSR studies, we summarized the detailed information on outcomes, exposures, and main findings.

Description of identified LTC claims-based studies in Japan

Figure 1 depicts the study selection process. The initial combined search retrieved 438 journal articles. After removing the duplicates, 435 articles were assessed for eligibility, of which 78 full texts were included in this review. Eight articles were identified through manual searches.

Publication characteristics

The first study using LTC claims was published in 2006, and the number of publications increased significantly from 2016 (Figure 2). Among the total publications, 86% were written in English and the most common journal was *Geriatrics & Gerontology International* (10.5%), followed by *BMC Geriatrics* (7.0%). The five most commonly researched areas were geriatrics and gerontology (36.0%), medicine (miscellaneous) (33.7%), health policy (17.4%), public health, environmental, and occupational health (10.5%), and psychiatry and mental health (9.3%) (Table 1).

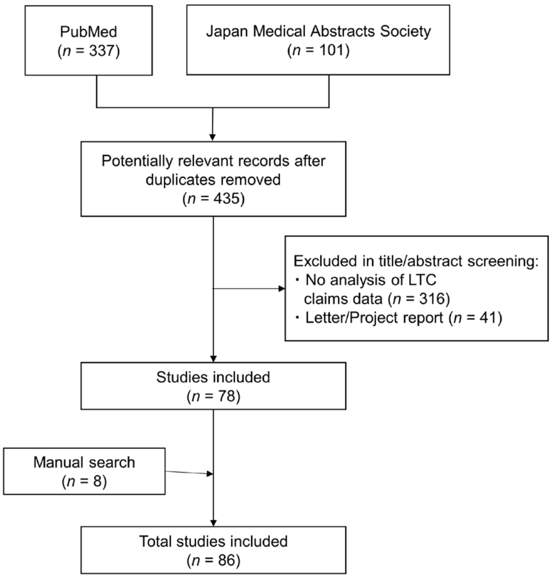

Figure 1. Study selection process.

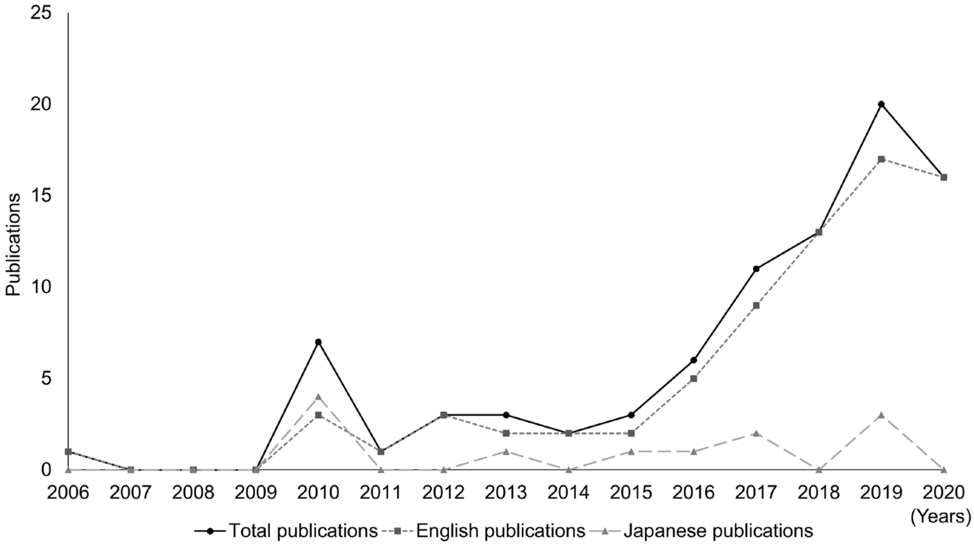

Figure 2. Frequency of publications using LTC claims data.

Table 1. Publication characteristics (*n* = 86)

	n	%
Language		
English	74	86.0
Japanese	12	14.0
Journal		
Geriatr Gerontol Int	9	10.5
BMC Geriatr	6	7.0
BMC Health Serv Res	4	4.7
Journal of Health and Welfare Statistics	4	4.7
PLoS One	4	4.7
J Am Med Dir Assoc	3	3.5
J Gerontol A Biol Sci Med Sci	3	3.5
Others	53	61.6
Research area[a]		
Geriatrics and gerontology	31	36.0
Medicine (miscellaneous)	29	33.7
Health policy	15	17.4
Public health, environmental and occupational health	9	10.5
Psychiatry and mental health	8	9.3
Epidemiology	7	8.1
Multidisciplinary	4	4.7
Others	13	15.1

[a]Multiple choices possible.

Database characteristics

Table 2 provides an overview of database characteristics. The most frequently used data were LTC claims (55.8%), and 48.8% of the total studies used the care-needs certification survey. Judging from the data size, studies that used national-level LTC claims accounted for 16.3% of the total. There was significant use of linkage data (74.4 %) compared to a single source of LTC claims data (25.6%). The most frequent data combinations were medical claims (22.1%) and the Ohsaki Cohort Study (22.1%). Four studies that linked with death records reported a probabilistic matching process for data combination.

Table 2. Database characteristics

	n	%
LTC database components used		
LTC claim	44	51.2
Care-needs certification survey	38	44.2
Both	4	4.7
National level		
Yes	14	16.3
No	72	83.7
Data source combination[a]		
Medical claim	19	22.1
The Ohsaki Cohort	19	22.1
Death records	4	4.7
Survey of institutions and establishments for long-term care	2	2.3
Tsurugaya Project	2	2.3
Other surveys	19	22.1
No database combination	22	25.6

[a]Multiple choices possible

Study characteristics

The most common study design was the cohort study (62.8%), followed by cross-sectional studies (27.9%). Study participants included LTC service users (both home and community, and LTC facility) in 35 studies (40.7%), while 20 studies (23.3%) targeted at-home and community users. Independent people who were not qualified for the LTC insurance system at baseline were included in 27 studies (31.4%). Among all the studies, the most common outcome was the onset of functional disability (20.9%), which is defined as the point at which a participant was certified in the LTC insurance system (Table 3).

The use of LTC claims in HSR

More than half of our examined studies were HSR

Table 3. Study characteristics of empirical (*n* = 85) and methodological (*n* = 1) publications

	n	%
Study design		
Descriptive	4	4.7
Cohort	54	62.8
Case-control	3	3.5
Cross-sectional	24	27.9
Methodological	1	1.2
Study outcomes		
Incidence of functional disability	18	20.9
Health expenditure	13	15.1
Incidence of dementia	13	15.1
Care-needs level change	10	11.6
Long-term care service utilization	7	8.1
Others	25	29.1
Study setting		
Home and community	20	23.3
LTC facility	4	4.7
LTC facility and home and community	35	40.7
Independent people	27	31.4

studies (Supplementary Table S1, *https://www.globalhealthmedicine.com/site/supplementaldata.html?ID=21*). These studies analyzed the healthcare structures (*e.g.* service providers' characteristics, staffing levels), the utilization of LTC services and their impact on health outcomes. Among these HSR studies, the most frequent outcomes were healthcare expenditure (*i.e.*, LTC or medical expenditure or both), LTC service use, and change in the care-needs level.

Discussion of current status and perspectives of LTC claims analysis

This comprehensive review showed that LTC claims were increasingly used in scientific analysis, and this increase was particularly remarkable between 2016 and 2020. Most of the studies were empirical and written in English. Moreover, they focused on a variety of research areas, showing the widespread use of LTC claims. Additionally, more than half of all studies were HSR studies, which examined how LTC beneficiaries gain access to LTC care, how much care costs, and what happens to the beneficiaries after they receive care.

Although there was a notable increase in the number of publications regarding LTC claims database analysis, the total number was far smaller than that of medical claims analysis. One possible reason is that medical researchers commonly prioritize prevention and cure over LTC. However, Japan has the highest aging rate in the world, with one-quarter of its population aged 65 or over. As known to all, older people are more likely to suffer from multiple chronic conditions (*8*). Therefore, medical research studies that can benefit an aging society are in urgent need. This issue was emphasized by the Science Council of Japan in 2014, which claimed that the goal of medicine should switch toward maximizing the quality of life (QOL) for the patient through "community-oriented medical care" that requires close collaborations among public health officials related to medical activities and LTC (*9*). Analyzing linkage data between medical and LTC claims could provide evidence regarding the cooperation between medical and LTC professionals.

Another reason for the large number of publications using medical claims is the involvement of the private sector. The JMDC company has collected medical claims from multiple health insurance associations since 2005, providing the data to healthcare companies, universities, as well as governments. As of 2020, the JMDC claims database includes approximately 7.3 million subjects. The total number of publications has reached 289 since their provision of data (*10*). If such a provision system became available for LTC claims, rapid progress can be made in the LTC research area. Undoubtedly, data provision should be guaranteed by sufficient security and privacy protections.

Most studies using single LTC claims highlighted the lack of information on detailed medical conditions (*11-15*). The reason was the difficulty in investigating the effect of LTC service uses without adjusting for the medical conditions of older people. Linkage data between LTC and medical claims solved this problem and were commonly used in most studies. However, the combination of LTC and medical claims were only available in some municipalities, resulting in the problem of generalizability. Recently, the Japanese government publicly released a nationwide linked database between medical and LTC claims in October 2020; future studies using this data are thus warranted. The other frequently combined data was the Ohsaki Cohort Study data, which is a large population-based prospective study that focuses on psychosocial factors and LTC certification status (*16*). Almost all studies using this combined data treated the incidence of functional disability or dementia as outcomes and examined the association with psychosocial factors such as education level, citrus consumption, and psychological distress (*17-20*). LTC certification survey data were only used to detect the outcomes of studies. For example, the date of obtaining LTC certification was considered as the incident date of functional disability. Because LTC services are only provided after a person becomes certified for LTC, the topics of these studies offer no insights into LTC services.

The most frequent research design was the retrospective cohort study. The care-need levels were most commonly tracked in cohort studies because LTC claims recorded this information in an accurate and timely manner. There were only four descriptive studies, although they were the most common study design in other claims data analysis such as the Japanese national database of health insurance (NDB) (*21*) and Canadian health insurance claims (*22*). In Japan, Matsuda and colleagues published a series of more than 30 Japanese papers focusing on the analysis of linked databases between LTC and medical claims from 2018 to 2020 (*23*). These studies were helpful in grasping the current status of LTC services because they provided rich information in terms of LTC service access, utilization, health outcomes, and quality of care. We excluded them because these papers are comments-oriented which did not satisfy our selection criteria of the original research article.

Like other health administrative databases, the primary advantage of LTC claims databases is the typically large sample that provides high generalizability and statistical stability. Another distinctive advantage over medical claims is the possibility of evaluating the QOL of LTC beneficiaries. The care-needs level of LTC claims is highly correlated with the Barthel Index (*24*), which may because the questionnaire assessing the care-needs level contains many items related to activities of daily living (ADL) and instrumental activities of daily living (IADL). Lawton indicated that the functional health of ADL and IADL is an important aspect of the QOL in frail elders (*25*).

The use of LTC claims databases in HSR has advantages to answering the following questions correctly: What benefits were provided to whom, when, and in what amount? Therefore, it has been widely used in evaluating the quality of care. For instance, studies have examined the effect of demographic factors, financing systems, and organizational structures and processes on health outcomes in terms of functional decline, discharge to home, physician visit frequency, length of hospital stay, and residential care admission. Topics regarding healthcare expenditure and health service utilization were also frequently investigated in HSR studies.

A common limitation of HSR studies using LTC claims was the lack of validation of outcome measures. As Swart *et al.* pointed out, in claims data analysis, a comprehensive validation process that adheres to the official guidelines is recommended to ensure data accuracy (*26,27*). Matsuda *et al.* clarified the validity of Japanese LTC care needs levels by testing their correlation with the Barthel Index (*24*). To better understand the LTC claims information, it is essential that studies be validated.

The present study is not without limitations. The selection of keywords for the research strategy was challenging because there was variation in the translation of LTC claims in English. We restricted our analysis to the most common keywords of "claims data," "databases," and "administrative data." Despite this wide search strategy, we might have failed to extract some relevant publications.

Conclusion

In conclusion, our study analyzed the use of Japanese LTC claims databases in research publications to provide an overview of the current status and perspectives. From 2016 to 2020, we found a particularly remarkable increase in the number of publications, more than half of which were HSR studies providing comprehensive information regarding the quality of care, healthcare expenditure, and LTC service use. Moreover, these HSR studies highlighted useful documents for evidence-based policy regarding LTC.

Funding: This study was supported by a grant-in-aid from the Ministry of Health, Labour and Welfare; Health and Labour Sciences Research Grant, Japan (H30-choju-ippan-007 and H30-iryou-ippan-011).

Conflict of Interest: The authors have no conflicts of interest to disclose.

References

1. Ministry of health, labour, and welfare. 2018. Long-term care claims and long-term care certification survey. *https://www.mhlw.go.jp/content/12301000/000343808.pdf* (accessed December 10, 2020). (in Japanese)
2. Tsutsui T, Muramatsu N. Care-needs certification in the long-term care insurance system of Japan. J Am Geriatr Soc. 2005; 53:522-527.
3. Statistics Act. 2007. *https://www.soumu.go.jp/main_content/000626376.pdf* (accessed December 10, 2020).
4. Ministry of health, labour, and welfare. Provision of questionnaire information under Article 33 of the Statistics Act. *https://www.mhlw.go.jp/toukei/sonota/chousahyo.html* (accessed December 10, 2020). (in Japanese)
5. OECD. Public long-term care financing arrangements in OECD countries. 2011. *https://www.oecd.org/els/health-systems/47884942.pdf* (accessed December 10, 2020).
6. Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. PLoS Med. 2009; 6:e1000097.
7. The SCImago Journal & Country Rank. *https://www.scimagojr.com* (accessed December 10, 2020).
8. Mori T, Hamada S, Yoshie S, Jeon B, Jin X, Takahashi H, Iijima K, Ishizaki T, Tamiya N. The associations of multimorbidity with the sum of annual medical and long-term care expenditures in Japan. BMC Geriatr. 2019; 19:69.
9. Arai H, Ouchi Y, Toba K, Endo T, Shimokado K, Tsubota K, Matsuo S, Mori H, Yumura W, Yokode M, Rakugi H, Ohshima S. Japan as the front-runner of super-aged societies: Perspectives from medicine and medical care in Japan. Geriatr Gerontol Int. 2015; 15:673-687.
10. List of publications using JMDC databases. 2020. *https://info.jmdc.co.jp/jrda* (accessed December 10, 2020).
11. Jin X, Mori T, Sato M, Watanabe T, Noguchi H, Tamiya N. Individual and regional determinants of long-term care expenditure in Japan: evidence from national long-term care claims. Eur J Public Health. 2020; 30:873-878.
12. Jin X, Tamiya N, Jeon B, Kawamura A, Takahashi H, Noguchi H. Resident and facility characteristics associated with care-need level deterioration in long-term care welfare facilities in Japan. Geriatr Gerontol Int.

2018;18:758-766.

13. Morita K, Ono S, Ishimaru M, Matsui H, Naruse T, Yasunaga H. Factors affecting discharge to home of geriatric intermediate care facility residents in Japan. J Am Geriatr Soc. 2018; 66:728-734.
14. Lin HR, Otsubo T, Imanaka Y. Survival analysis of increases in care needs associated with dementia and living alone among older long-term care service users in Japan. BMC Geriatr. 2017; 17:182.
15. Olivares-Tirado P, Tamiya N, Kashiwagi M. Effect of in-home and community-based services on the functional status of elderly in the long-term care insurance system in Japan. BMC health Serv Res. 2012; 12:239.
16. Kuriyama S, Nakaya N, Ohmori-Matsuda K, *et al.* The Ohsaki Cohort 2006 study: Design of study and profile of participants at baseline. J Epidemiol. 2010; 20:253-258.
17. Nurrika D, Zhang S, Tomata Y, Sugawara Y, Tanji F, Tsuji I. Education level and incident functional disability in elderly Japanese: The Ohsaki Cohort 2006 study. PLoS One. 2019; 14:e0213386.
18. Sugiyama K, Tomata Y, Kaiho Y, Honkura K, Sugawara Y, Tsuji I. Association between coffee consumption and incident risk of disabling dementia in elderly Japanese: The Ohsaki Cohort 2006 study. J Alzheimers Dis. 2016; 50:491-500.
19. Tomata Y, Watanabe T, Tanji F, Zhang S, Sugawara Y, Tsuji I. The impact of psychological distress on incident functional disability in elderly Japanese: The Ohsaki Cohort 2006 study. Int J Environ Res Public Health. 2018; 15:2502.
20. Zhang S, Tomata Y, Sugiyama K, Sugawara Y, Tsuji I. Citrus consumption and incident dementia in elderly Japanese: the Ohsaki Cohort 2006 study. Br J Nutr. 2017; 117:1174-1180.
21. Hirose N, Ishimaru M, Morita K, Yasunaga H. A review of studies using the Japanese National Database of Health Insurance Claims and Specific Health Checkups. Annals of Clinical Epidemiology. 2020; 2:13-26.
22. Tricco AC, Pham B, Rawson NS. Manitoba and Saskatchewan administrative health care utilization databases are used differently to answer epidemiologic research questions. J Clin Epidemiol. 2008; 61:192-197.
23. Matsuda S, Fujimoto K, Fujino Y. Current status of medical and long-term care services use among elderly hip fracture patients: analysis of linked data between medical and long-term care claims. Social Insurance Seasonal Report 2020; 18-24. (in Japanese)
24. Matsuda T, Iwagami M, Suzuki T, Jin X, Watanabe T, Tamiya N. Correlation between the Barthel Index and care need levels in the Japanese long-term care insurance system. Geriatr Gerontol Int. 2019; 19:1186-1187.
25. Lawton MP. 1 - A Multidimensional view of quality of life in frail elders. In: The concept and measurement of quality of life in the frail elderly (Birren JE, Rowe JC, Lubben JE, Deutchman DE, eds.). Academic Press, San Diego, 1991; pp. 3-27.
26. Kreis K, Neubauer S, Klora M, Lange A, Zeidler J. Status and perspectives of claims data analyses in Germany-A systematic review. Health policy. 2016; 120:213-226.
27. Swart E, Gothe H, Geyer S, Jaunzeme J, Maier B, Grobe TG, Ihle P. [Good Practice of Secondary Data Analysis (GPS): guidelines and recommendations]. Gesundheitswesen. 2015; 77:120-126.
28. Adomi M, Iwagami M, Kawahara T, Hamada S, Iijima K, Yoshie S, Ishizaki T, Tamiya N. Factors associated with long-term urinary catheterisation and its impact on urinary tract infection among older people in the community: a population-based observational study in a city in Japan. BMJ Open. 2019; 9:e028371.
29. Kuroda N, Hamada S, Sakata N, Jeon B, Iijima K, Yoshie S, Ishizaki T, Jin X, Watanabe T, Tamiya N. Antipsychotic use and related factors among people with dementia aged 75 years or older in Japan: A comprehensive population-based estimation using medical and long-term care data. I Int J Geriatr Psychiatry. 2019; 34:472-479.
30. Hashimoto H, Horiguchi H, Matsuda S. Micro data analysis of medical and long-term care utilization among the elderly in Japan. Int J Environ Res Public Health. 2010; 7:3022-3037.
31. Naruse T, Matsumoto H, Fujisaki-Sakai M, Nagata S. Measurement of special access to home visit nursing services among Japanese disabled elderly people: using GIS and claim data. BMC Health Serv Res. 2017; 17:377.
32. Koike S, Furui Y. Long-term care-service use and increases in care-need level among home-based elderly people in a Japanese urban area. Health Policy. 2013; 110:94-100.
33. Hamada S, Takahashi H, Sakata N, Jeon B, Mori T, Iijima K, Yoshie S, Ishizaki T, Tamiya N. Household income relationship with health services utilization and healthcare expenditures in people aged 75 years or older in Japan: A population-based study using medical and long-term care insurance claims data. J Epidemiol. 2019; 29:377-383.
34. Fu R, Noguchi H. Moral hazard under zero price policy: evidence from Japanese long-term care claims data. Eur J Health Econ. 2019; 20:785-799.
35. Akiyama N, Shiroiwa T, Fukuda T, Murashima S, Hayashida K. Healthcare costs for the elderly in Japan: Analysis of medical care and long-term care claim records. PLoS One. 2018; 13:e0190392.
36. Ishimaru M, Ono S, Morita K, Matsui H, Yasunaga H. Domiciliary dental care among homebound older adults: A nested case-control study in Japan. Geriatr Gerontol Int. 2019; 19:679-683.
37. Mori T, Tamiya N, Jin X, Jeon B, Yoshie S, Iijima K, Ishizaki T. Estimated expenditures for hip fractures using merged healthcare insurance data for individuals aged ≥ 75 years and long-term care insurance claims data in Japan. Arch Osteoporos. 2018; 13:37.
38. Sato M, Tamiya N, Jin X, Watanabe T, Takahashi H, Noguchi H. Impact of a Japanese incentivization program to increase end-of-life care outside of hospitals. J Am Med Dir Assoc. 2021; 22:329-333.
39. Jeon B, Tamiya N, Yoshie S, Iijima K, Ishizaki T. Potentially avoidable hospitalizations, non-potentially avoidable hospitalizations and in-hospital deaths among residents of long-term care facilities. Geriatr Gerontol Int. 2018; 18:1272-1279.
40. Yoshioka Y, Tamiya N, Kashiwagi M, Sato M, Okubo I. Comparison of public and private care management agencies under public long-term care insurance in Japan: a cross-sectional study. Geriatr Gerontol Int. 2010; 10:48-55.
41. Moriyama Y, Tamiya N, Kawamura A, Mayers TD, Noguchi H, Takahashi H. Effect of short-stay service use on stay-at-home duration for elderly with certified care needs: Analysis of long-term care insurance claims data in Japan. PLoS One. 2018; 13:e0203112.
42. Mori H, Ishizaki T, Takahashi R. Association of long-term care needs, approaching death and age with medical

and long-term care expenditures in the last year of life: An analysis of insurance claims data. Geriatr Gerontol Int. 2020; 20:277-284.
43. Kashiwagi M, Tamiya N, Sato M, Yano E. Factors associated with the use of home-visit nursing services covered by the long-term care insurance in rural Japan: a cross-sectional study. BMC Geriatr. 2013; 13:1.
44. Tsuchiya-Ito R, Ishizaki T, Mitsutake S, Hamada S, Yoshie S, Iijima K, Tamiya N. Association of household income with home-based rehabilitation and home help service utilization among long-term home care service users. BMC Geriatr. 2020; 20:314.
45. Tsuboi H, Fujimori K. Effectiveness of hospital discharge support by medical and nursing care workers in reducing readmission rates of patients in long-term care wards: An observation study in Japan. Tohoku J Exp Med. 2020; 251:225-230.
46. Soga Y, Murata F, Maeda M, Fukuda H. The effects of raising the long-term care insurance co-payment rate on the utilization of long-term care services. Geriatr Gerontol Int. 2020; 20:685-690.
47. Lin HR, Imanaka Y. Effects of copayment in long-term care insurance on long-term care and medical care expenditure. J Am Med Dir Assoc. 2020; 21:640-646.
48. Sado M, Ninomiya A, Shikimoto R, Ikeda B, Baba T, Yoshimura K, Mimura M. The estimated cost of dementia in Japan, the most aged society in the world. PLoS One. 2018; 13:e0206508.
49. Ono S, Ishimaru M, Yamana H, Morita K, Ono Y, Matsui H, Yasunaga H. Enhanced oral care and health outcomes among nursing facility residents: Analysis using the national long-term care database in Japan. J Am Med Dir Assoc. 2017; 18:277.e1-277.e5.
50. Tomita N, Yoshimura K, Ikegami N. Impact of home and community-based services on hospitalization and institutionalization among individuals eligible for long-term care insurance in Japan. BMC health Serv Res. 2010; 10:345.
51. Itoh S, Hikichi H, Murayama H, Ishimaru M, Ogata Y, Yasunaga H. Association between advanced care management and progression of care needs level in long-term care recipients: Retrospective cohort study. JMIR Aging. 2018; 1:e11117.
52. Ueshima H, Takahashi H, noguchi H, Kawamura A, matsumoto Y, Moriyama Y, Tamiya N. Lengh of stay at home as an quality indicator of community-based comprehensive care system. Journal of Health and Welfare Statistics. 2017; 64:8-18. (in Japanese)
53. Kawamura A, Tamiya N, izumida I, Ueshima H, Takahashi H, Noguchi H. Long-term care claims data analysis of the current status of transition from tube to oral feeding in long-term care facilities. Journal of Health and Welfare Statistics. 2016; 63:29-36. (in Japanese)
54. Maruta M, Tanaka T, Sagari A, Miyata H, Hotta M, Yoshimitsu K, Han G, Takahashi H, Kawagoe M. Factors related to aggravation of the level of care for elderly individuals with behavioral and psychological symptoms of dementia requiring support. Journal of allied health sciences. 2019; 10:19-26.
55. Miyahara Y, niikura M, simoda Y, teranisi K, naruse Y. Association between Long-term care services use and subsequent independence in activities of daily living. Journal of health and welfare statistics. 2019; 66:27-32. (in Japanese)
56. Horiguchi M, Kokubu K, Mori T. Study on changes in cognitive function of elderly individuals certified for long-term care insurance. Nihon Koshu Eisei Zasshi. 2017; 64:384-390. (in Japanese)
57. Fukuda T, Urakami K. Study on the factors of continued home assistance for needing support level seniors: availability of touch panel-type dementia assessment system (TDAS). Journal of the Yonago Medical Association. 2010; 61:131-141. (in Japanese)
58. Yokozuka M, Nito E, Suzuki K, Asaka H. Effects of home improvements funded by the long-term care insurance program on daily life activities. Rigakuryoho Kagaku. 2010; 25:855-859. (in Japanese)
59. Shimizu U. ADL changes among long-term care recipients. Journal of Health and Welfare Statistics. 2010; 57:19-23. (in Japanese)
60. Sato M, Tamiya N, Ito T, Takahashi H, Noguchi H. Estimation of duration of formal long-term care among frail elderly people in Japanese communities using national long-term care insurance claims records. Nihon Koshu Eisei Zasshi. 2019; 66:287-294. (in Japanese)
61. Kikuzawa S, Sawai M. Community differences in care service resources and service use among the disabled elderly. Japan socio-gerontological society. 2013; 34:482-490. (in Japanese)
62. Olivares-Tirado P, Tamiya N, Kashiwagi M, Kashiwagi K. Predictors of the highest long-term care expenditures in Japan. BMC Health Serv Res. 2011; 11:103.
63. Taniguchi Y, Kitamura A, Ishizaki T, Fujiwara Y, Shinozaki T, Seino S, Mitsutake S, Suzuki H, Yokoyama Y, Abe T, Ikeuchi T, Yokota I, Matsuyama Y, Shinkai S. Association of trajectories of cognitive function with cause-specific mortality and medical and long-term care costs. Geriatr Gerontol Int. 2019; 19:1236-1242.
64. Abe K, Miyawaki A, Kobayashi Y, Watanabe T, Tamiya N. Place of death associated with types of long-term care services near the end-of-life for home-dwelling older people in Japan: a pooled cross-sectional study. BMC Palliat Care. 2020; 19:121.
65. Abe K, Miyawaki A, Kobayashi Y, Noguchi H, Takahashi H, Tamiya N. Receiving the home care service offered by certified care workers prior to a patients' death and the probability of a home death: observational research using an instrumental variable method from Japan. BMJ Open. 2019; 9:e026238.
66. Kato G, Tamiya N, Kashiwagi M, Sato M, Takahashi H. Relationship between home care service use and changes in the care needs level of Japanese elderly. BMC Geriatr. 2009; 9:58.
67. Lin HR, Otsubo T, Imanaka Y. The effects of dementia and long-term care services on the deterioration of care-needs levels of the elderly in Japan. Medicine (Baltimore). 2015; 94:e525.

Received January 4, 2021; Revised April 7, 2021; Accepted April 14, 2021.

*_Address correspondence to_:
Xueying Jin, Department of Health Services Research, Faculty of Medicine, University of Tsukuba, 1-1-1 Tenno-dai, Tsukuba, Ibaraki 305-8575, Japan.
E-mail: kinnsetsuei@md.tsukuba.ac.jp