Chapter 3

Predictors of Care-need Level Deterioration in Long-term care Health Facilities

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Chapter 3

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Long-term care health facilities

A long-term care health facility is a category of LTC-providing institution that is defined by the Long-Term Care Insurance Act. It is designed as an intermediary facility between a hospital and a home or nursing home, and a facility to improve the physical function of the clients, so they are required to be equipped with professional rehabilitation and nursing care providers. The goal of long-term care health facilities is to 'improve the user's function to enable them to go back home' (Japan Association of Geriatric Health Services Facilities, 2015).

Methods

Study population and design

A time-to-event analysis was conducted using a national retrospective cohort. Data were obtained from national long-term care insurance claims and the Survey of Institutions and Establishments for Long-term Care. People who were admitted to long-term care health facilities during fiscal year 2014 were included. The residents included in this analysis had to be 65 years old or more with a care-need level from 1 to 4 (Figure 1).

Outcome

We set the deterioration of the care-need level as the primary outcome. Residents were followed for up to 24 months from admission. The care-need level deterioration time was calculated as the number of months from the beginning of observation, which is the time of admission into the facilities. Only the time from admission to the first care-need level (for example, the time of the change of the care-need level from 1 to 2 or 2 to 4) deterioration was identified.

Independent variable

Additional payments

The LTCI fee items of the LTCI for additional payments appraising individuals' special care and facility initiatives were included to explore the association with care-need level deterioration. **Table 1** presents the items of additional payments and the relevant requirements that were included in the analysis of this study.

Facility characteristics

The facility type (conventional care[1] versus unit care[2]), location (metropolitan city[3] or not) (Jin et al., 2018), and years in business were included. The staffing levels were measured as the number of staff in different specialities and were allocated per 100 users. The proportion of registered nurses (RNs)[4] amongst total nurses (i.e. the sum of the number of registered nurses and certified assistant nurses[5]) and registered dietitians amongst total dietitians (i.e. the sum of the number of registered dietitians[6] and dietitians[7]) were included.

Covariates of resident characteristics

Age, sex, and the care-need level were measured as control variables. These factors have been proved to have an effect on the outcome of functional status (Castle and Ferguson, 2010; Burge, von Gunten, and Berchtold, 2013; Jin et al., 2018) in previous studies.

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[1] Conventional care refers to care for residents in facilities that contains mostly shared rooms and several private rooms.

[2] Unit care refers care to a small number of residents (less than 10) as one living unit. Care staff are assigned to each unit and provide person-centred care. Residential layouts are designed to be all private rooms with a shared living space.

[3] Metropolitan cities: We defined this as cities with a population of more than 500,000 or located in the Tokyo metropolitan area. Besides the Tokyo metropolitan area, this includes the following cities: Sapporo, Sendai, Utsunomiya, Saitama, Chiba, Kawasaki, Yokohama, Sagamihara, Niigata, Shizuoka, Hamamatsu, Nagoya, Kyoto, Osaka, Sakai, Kobe, Okayama, Hiroshima, Matsuyama, Kitakyushu, Fukuoka, Kumamoto, and Kagoshima.

[4] A registered nurse is a nurse who has passed the nursing national examination and provides medical care or medical assistance to patients.

[5] A certified assistant nurse is a nurse who has a license issued by the governor of a prefecture and provides medical care or medical assistance to patients under the direct supervision of doctors and registered nurses.

[6] A registered dietitian is a nutrition expert who has a license issued by the Ministry of Health, Labour and Welfare. The work performed is nutrition education required to get medical treatment for the sick or wounded and nutrition education required to maintain and promote health, which requires a high level of professional knowledge and technique according to clients' physical and nutritional conditions and food service management.

[7] A dietitian is a nutrition expert who has a license issued by the governor of a prefecture. The work performed is nutrition education for clients.

Statistical analysis

Initially, a descriptive analysis was conducted to review the distribution of the outcomes and independent variables. A competing risk [8] regression model was used for the analysis. Deterioration of the care-need level was regarded as a primary outcome of interest. Leaving home, transfer to another facility, hospitalisation, and death were considered as competing events. Subdistribution hazard ratios (SHRs) and the associated 95% confidence intervals (Cis) were reported. The level of statistical significance was checked at 0.05 (two-tailed). All statistical analyses were conducted using Stata version 15.

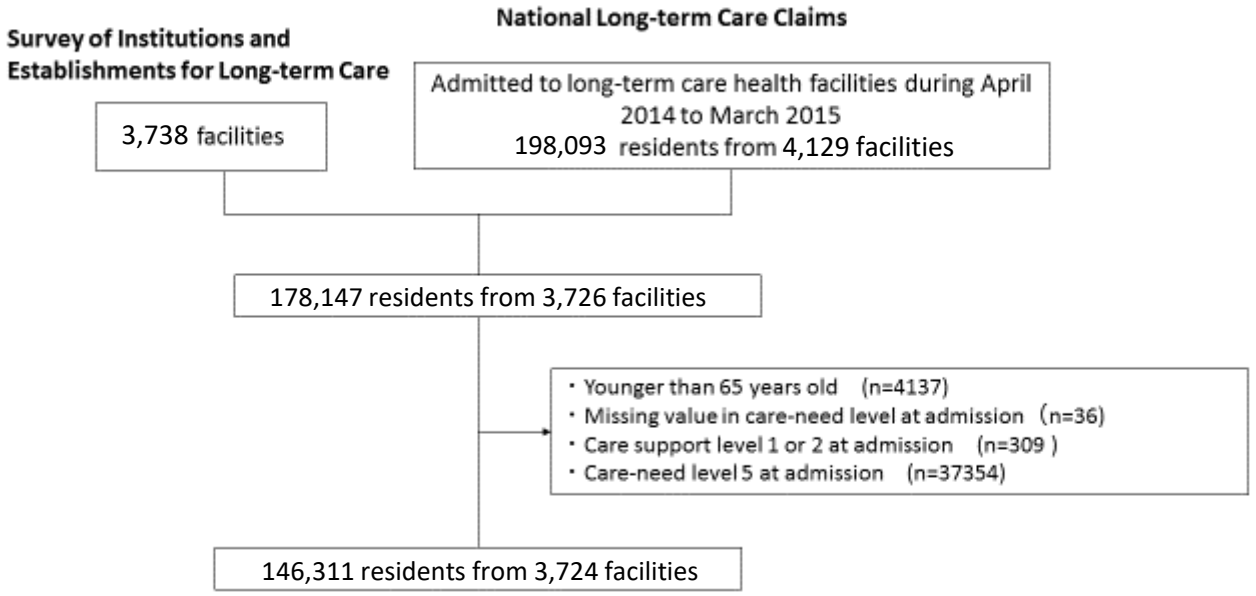
[8] Competing risk occurs when subjects can experience one or more events or outcomes which 'compete' with the outcome of interest. In those cases, the competing risk hinders the observation of the event of interest or modifies the chance that the event occurs. In such cases, a cumulative incidence function is proposed to solve this particular issue by estimating the marginal probability of a certain event as a function of its cause-specific probability and overall survival probability (Noordzij et al., 2013).

Table 1. Items and Requirements for Additional Payments in Long-term Care Health Facilities

Items	Requirements determined by the Ministry of Health, Labour and Welfare of Japan
Additional payments for individuals' special care	
Short-term intensive rehabilitation programme	Provide intensive rehabilitation by physical therapists based on doctors' instructions within three months of admission.
Intensive rehabilitation programme for dementia	Provide intensive rehabilitation by physical therapists based on doctors' instructions within three months of admission for residents with dementia
Instructions for pre-post admission	Visit the home and creation of a detailed care plan regarding goals, such as resuming home life, within 30 days before admission or within 7 days after admission.
Therapeutic meals	Provide the following therapeutic meals based on dietitians' instructions: diabetic diet, kidney disease diet, liver disease diet, stomach ulcer diet, anaemic diet, pancreatic disease diet, hypercholesterolemia diet, and gout diet.
Emergency care and treatment	Provide medication, injections, and medical treatment for residents who require emergency treatment.
Medical treatment for a specified disease	Provide medication, examination, injections, and treatment for residents who have specific diseases, such as pneumonia, urinary tract infections, and herpes zoster.
Oral feeding support	Create a plan for clients under tube feeding to promote oral intake in cooperation with multiple relevant professionals and implement the plan by registered dietitians.
Dementia care	Provide special services to residents with dementia.
Oral hygiene management	Provide oral care at least four times a month in facilities that are eligible for an 'oral hygiene management system', which is one of the facility-initiative based items for additional payment (see below).
Additional payments for facility initiatives	
Support for resuming home life	The following requirements will be calculated using a certain formula: (i) home-life resumption rate, (ii) bed turnover rate, (iii) proportion giving instructions pre-post admission, (iv) proportion giving instructions before and after leaving, etc.
Sufficient night-shift staff	Having nursing staff or care workers at night of more than a 20:1 resident-to-staff ratio.
Sufficient nursing care	Having one care worker or nurse for every four residents, especially in facilities with high medical needs.
Oral hygiene management system	Dentists or dental hygienists give technical suggestions to nursing care staff about oral cavity care more than once a month.
Strengthening of the services provision system	The proportion of certified care workers amongst care workers is more than 50%.
Nutrition management	A full-time registered dietitian to create and manage nutrition plans for malnourished residents.
Improvements in working conditions	Implementation of detailed plans regarding the improvement of working conditions for care workers.

Source: Abe (2015) (translated by the authors).

Figure 1. Flow Diagram of the Participant Selection Process (long-term care health facilities)



Source: Compiled from Japan's LTCI claims by the authors.

Results

As described in the previous section, the endpoints of this competing risk model were care-need deterioration, leaving home, hospitalisation or death, and transfer to another facility. **Table 2** gives the characteristics of the residents by the endpoints of this study. Amongst the total residents enrolled in this study, 32,754 (22.4%) residents reached the endpoints for care-need level deterioration, 33,940 (23.2%) were discharged to go home, 36,144 (24.7%) were hospitalised or died, and 23,375 (16.0%) were transferred to other facilities. The rate of the residents ending with care-need-level deterioration increased with age, and females had a relatively higher rate than males. Additionally, the rate of care-need deterioration decreased with a higher baseline care-need level.

Table 3 shows the distribution of additional payments for facility initiatives and facility characteristics. The majority of the facilities provided conventional care. The mean of the proportion of private rooms was 26.4%, and most (86.4%) of facilities provided 24-hour care systems.

In the multivariable analysis, a higher age, being female, and a lower care-need level were associated with deterioration in the care-need level. Subsequently, residents who were required to make additional payments regarding the LTCI items of 'specific emergency care and treatment', 'medical expense for specified disease', 'dementia care', and 'oral feeding support' were more likely to end up with care-need level deterioration. In contrast, residents who were provided with the LTCI services of 'special care of short-term intensive rehabilitation', 'intensive rehabilitation for dementia', 'instructions pre-post admission', and 'therapeutic meals' were associated with lower care-need level deterioration.

At the facility level, a higher proportion of registered nurses amongst the nursing staff, a higher proportion of certified care workers amongst the care workers, and a larger number of physical therapists (PTs) per 100 residents were associated with a lower likelihood of care-need level deterioration. Facility initiatives, which are defined by the LTCI as 'support for resuming home life', 'sufficient night-shift staff', 'nutrition management', 'oral hygiene management system', 'strengthening of the services provision system', and 'improvements in working conditions' were associated with less deterioration in the care-need level (**Table 4**).

Discussion

The uniqueness of the study is that the factors related to less deterioration in the care-need level were analysed using national-level long-term care claims, with data on all beneficiaries of the LTCI in Japan. Amongst the LTCI fee items categorised as individuals' special care, the following items were associated with less deterioration in the care-need level: short-term intensive rehabilitation, short-term intensive rehabilitation for dementia, home visits for guidance pre-post admission, and therapeutic meals. Amongst the fee items of the facility initiatives, support for resuming home life, sufficient night-shift staff, nutrition management, and strengthening of the services provision system were negatively associated with the care-need level deterioration.

We also analysed the relationships between staffing levels and care-need level deterioration, and we found that a higher percentage of RNs amongst the total number of nurses and a higher number of PTs per 100 residents were negatively related with care-need level deterioration.

Residents whose LTCI claims had payment requests for 'special care of short-term intensive rehabilitation' and 'intensive rehabilitation for dementia' were less likely to deteriorate in their care-need level. A systematic review reported that rehabilitation specifically designed for geriatric patients had the potential to improve outcomes related to function (Bachmann et al., 2010). Recently, an interventional study on the effect of intensive rehabilitation programmes for dementia in long-term care health facilities was conducted. The results showed that the intervention group had a significantly higher Hasegawa dementia rating scale-revised score[9] and a lower Dementia Behaviour Disturbance scale score compared with the control group.

Residents whose LTCI claims included the cost for instructions pre-post admission to their facility had less deterioration in their care-need level. The fee schedule of the LTCI says that instructions must include detailed care plans regarding the improvement of daily functions or the expected functional status when they would leave the facility. Therefore, it may be more effective to have goals and detailed care plans that focus on functional status.

Residents provided with therapeutic meals were less likely to experience care-need level deterioration. There are relatively broad kinds of therapeutic meals, including diabetic, kidney disease, liver disease, stomach ulcer, anaemic, pancreatic disease, hypercholesterolemia, and gout diets. The effects of specific diet therapy on individuals' functional status have been well documented (Lieber, 2003; Evert et al., 2014; Rysz et al., 2017). However, due to the lack of information regarding diseases, this study is unable to identify whether therapeutic meals have an effect on the prevention of the deterioration of the care-need level.

Residents who were provided with the following special care items were more likely to experience care-need level deterioration: emergency care and treatment, medical treatment for specified diseases, oral hygiene management, oral feeding support, and dementia care. The explanation behind this positive association could be that these care items were provided to residents who had more complicated chronic conditions that were related to a higher risk in the deterioration of their physical conditions. Hence, high-risk residents are more likely to deteriorate in their care-need level.

Amongst the items of additional payment for facility initiatives, the 'support for resuming home life' had the strongest association with less care-need level deterioration. Facilities can be approved to receive reimbursement of this LTCI-fee item if they meet the requirements regulated by the LTCI using an index. This index consists of several factors, including the rate of residents that leave to go home (i.e. those who are discharged and go home) and the bed turnover rate. Thus, we can interpret the result that facilities with a higher rate of residents that leave to go

[9] The revised Hasegawa's dementia scale is a test to measure cognitive function comprising nine simple questions with a maximum score of 30.

home (i.e. those who are discharged to go home) may provide more services focusing on residents' functional performance.

Residents in the facilities that are approved to receive the additional payment item of 'sufficient night-shift staff' were less likely to deteriorate in their care-need level. This finding is consistent with a previous study reporting that night shifts were meaningful because they helped to established closer relationships between the nursing staff and residents (Gustafsson et al. 2009).

Facilities that were reimbursed for the additional payments of 'nutrition management' were less likely to have residents whose care-need level deteriorated. One of the requirements of this fee item is assigning full-time dietitians. Considering the outcome of an earlier study that showed that full-time dietitians had a higher score for evidence-based knowledge than part-time dietitians (Byham-Gray et al., 2005), the finding can be interpreted that the knowledge of the full-time dietitians contributes to the prevention of the deterioration of the care-need level.

The residents of facilities that satisfied the requirements of 'oral hygiene management systems' were less likely to deteriorate in their care-need level. Previous studies showed that oral care helped residents to maintain or improve their oral health and function, and a better oral condition contributed to the intake of better nutrition and eventually the improvement of general health. (Naito et al., 2010). The significant effects of oral care on the prevention of pneumonia in nursing homes have also been well documented in earlier studies (Yoneyama et al., 2002).

Satisfying the requirement of 'strengthening of the services provision system' was also negatively associated with care-need level deterioration. One of the most important requirements of this additional payment item is the proportion of certified care workers amongst care workers, which should be more than 60%. Certified care workers require a national qualification and are considered to be experts in the area of long-term care. They are required to have a higher level of professional knowledge and technique regarding the support and care of the daily living of people who need care: both older people and disabled people (The Japan Association of Certified Care Workers, 2007). It is plausible for higher-qualified care workers to enhance the quality of care.

A higher proportion of RNs amongst the nursing staff was associated with lower care-need level deterioration. Our result is consistent with the findings of a previous study (Jin et al., 2018). A possible explanation is that RNs serve as leaders and role models in the supervision of licensed practical nurses, and this contributes to the improvement of the quality of the provided care.

A higher number of PTs was also considered to be a factor in preventing deterioration in the care-need level. The impact of physical therapy on residents' outcomes in nursing homes has been well documented in previous studies (Chiodo et al., 1992) Another study indicated that with increased PT and occupational therapist services, residents experienced less decline in their physical, psychosocial, and cognitive status (Przybylski et al., 1996).

Table 2. Participants' Characteristics and Additional Payments for Individuals' Special Care by Outcome Status in Long-term Care Health Facilities

C	Deteriorated (=32,754)		Discharge home (n=33,940)		Hospitalised/Died (n=36,144)		Transferred to other facility (n=23,375)		End of observation (n=20,098)		Total (n=146,311)	
	n	%	n	%	n	%	n	%	n	%	n	%
Age (years)												
65–74	2,514	19.4	3,700	28.6	2,560	19.8	2,155	16.6	2,021	15.6	12,950	100
75–84	11,220	21.6	12,971	25.0	11,977	23.1	8,516	16.4	7,217	13.9	51,901	100
85–94	16,419	23.0	15,547	21.8	18,343	25.7	11,371	15.9	9,662	13.5	71,342	100
≥95	2,601	25.7	1,722	17.0	3,264	32.3	1,333	13.2	1,198	11.8	10,118	100
Sex												
Male	9,016	19.4	11,091	23.8	14,870	32.0	6,688	14.4	4,849	10.4	46,514	100
Female	23,738	23.8	22,849	22.9	21,274	21.3	16,687	16.7	15,249	15.3	99,797	100
Care-need level												
1	8,580	37.6	6,143	26.9	3,497	15.3	2,627	11.5	1,995	8.7	22,842	100
2	10,679	30.3	9,404	26.6	6,911	19.6	3,909	11.1	4,393	12.4	35,296	100
3	8,963	21.4	9,382	22.4	10,630	25.3	7,055	16.8	5,939	14.2	41,969	100
4	4,532	9.8	9,011	19.5	15,106	32.7	9,784	21.2	7,771	16.8	46,204	100
Additional payments for individuals' special care												
Short-term intensive rehabilitation	24,219	21.5	29,529	26.2	26,785	23.8	17,870	15.9	14,165	12.6	112,568	100

Short-term intensive rehabilitation for dementia	7,447	21.4	9,539	27.4	7,774	22.4	5,946	17.1	4,047	11.6	34,753	100
Instructions for pre-post admission	2,076	17.8	5,508	47.2	1,944	16.7	1,337	11.5	806	6.9	11,671	100
Oral feeding support	4,272	35.4	1,762	14.6	3,085	25.5	1,200	9.9	1,756	14.5	12,075	100
Oral hygiene management	3,581	24.6	3,567	24.5	3,044	20.9	2,344	16.1	2,018	13.9	14,554	100
Therapeutic meals	10,111	21.4	10,801	22.9	12,838	27.2	6,993	14.8	6,464	13.7	47,207	100
Dementia care	6,192	29.4	3,004	14.3	5,452	25.9	3,554	16.9	2,850	13.5	21,052	100
Emergency treatment	1,579	25.5	456	7.4	3,398	55.0	263	4.3	485	7.8	6,181	100
Medical expense for specified disease	7,805	31.9	2,942	12.0	7,563	30.9	2,281	9.3	3,855	15.8	24,446	100

Note: The denominators of the percentage of each item are the total numbers of residents who belong to the specific demographic group, e.g. in the row for 'Age 65–74', the denominator is 12,950.
Source: Compiled from Japan's LTCI claims by the authors.

Table 3. Additional Payments for Facility Initiatives and Baseline Characteristics of Long-term Care Health Facilities (n=3,724)

		n	%
Additional payments for facility initiatives			
	Nutrition management	3,514	94.4
	Assignment for night shift	3,266	87.7
	Improvements in working conditions	2,857	76.7
	Strengthening services provision system	2,427	65.17
	Oral hygiene management system	2,117	56.85
	Support for returning home	1,371	36.82
	Maintenance of the medical treatment system	77	2.07
Facility characteristics			
Facility type	Conventional	3,345	89.82
	Unit	379	10.18
Location	Central city of metropolitan area	735	19.74
Capacity	<100 beds	1,847	49.6
	>=100 beds	1,877	50.4
	24-hour nursing care	3,216	86.36
		Mean	SD
Years in business		14.44	6.86
Staffing level	Doctors per 100 users	1.53	2.25
	Dentists per 100 users	0.02	0.82
	Registered nurses per 100 users	6.79	10.13
	LPNs per 100 users	7.17	12.88
	RN/(RN + LPN) (%)	48.53	24.39
	Caregivers per 100 users	38.73	57.78
	Certified care workers/caregivers	0.62	0.22
	Physical therapists per 100 users	2.36	4.74
	Occupational therapists per 100 users	1.71	2.82
	Speech therapists per 100 users	0.30	1.08
	Dietitians per 100 users	0.37	1.19
	Registered dietitians per 100 users	1.47	2.62
	Registered dietitians/dietitians (%)	85.68	30.19

LPN = licensed practical nurse, RN = registered nurse.
Note: Part-time employee hours were converted to the numbers equivalent to full-time staff using the calculation method designated by the LTCI fee schedule.
Source: Compiled from Japan's LTCI claims by the authors.

Table 4. Multivariable Competing-risk Cox Proportional Hazards Regression Analysis for Care-need Level Deterioration in Long-term Care Health Facilities

	Subdistribution hazard ratio	95% confidence interval		P-value
Individual level				
Additional payment for individuals' special care				
Short-term intensive rehabilitation	0.92	0.89	0.94	<0.001
Short-term intensive rehabilitation for dementia	0.92	0.89	0.94	<0.001
Instructions for pre-post admission	0.81	0.77	0.85	<0.001
Therapeutic meals	0.92	0.90	0.95	<0.001
Oral feeding support	2.04	1.98	2.11	<0.001
Oral hygiene management	1.15	1.11	1.19	<0.001
Dementia care	1.50	1.46	1.55	<0.001
Emergency treatment	1.12	1.07	1.18	<0.001
Medical expense for specified disease	1.80	1.75	1.85	<0.001
Facility level				
Additional payments for facility initiatives				
Support for returning home	0.85	0.83	0.87	<0.001
Assignment for night shift	0.93	0.90	0.97	<0.001
Nutrition management	0.90	0.84	0.97	0.005
Oral hygiene management system	0.93	0.90	0.95	<0.001
Strengthening services provision system	0.95	0.92	0.98	0.002
Improvements in working conditions	0.98	0.95	1.01	0.121
Maintenance of medical treatment system	1.28	1.16	1.41	<0.001
Facility characteristics				
Service type				
Unit (ref.: conventional)	1.00	0.96	1.04	0.995
Central city of metropolitan area (ref.: no)	1.02	0.99	1.05	0.149
Years in business	1.00	1.00	1.00	0.613
Staffing level				
Doctors per 100 users	1.01	1.00	1.02	0.058
RN/(RN + LPN)	0.998	0.997	0.998	<0.001
Certified care workers per 100 users	0.89	0.83	0.96	0.003
Physical therapy staff per 100 users	0.99	0.98	1.00	0.002
Registered dietitians/dietitians	1.00	1.00	1.00	0.367

LPN = licensed practical nurse, RN = registered nurse.
Note: Estimates additionally adjusted for age, sex, and care-need level.
Source: Compiled from Japan's LTCI claims by the authors.