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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

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For increasing medical care demand by aging population, the Japanese government is shifting to home medical care for treatments that do not necessarily require hospitalization. It is therefore essential to identify factors involved in improving the quality and outcomes of home medical care. This study examined the effect of hospital discharge support in long-term care wards on readmission rates. We used medical insurance and the Long-Term Care Insurance data of patients aged ≥ 65. Participants were patients who discharged between April 2012 and March 2016 from long-term care wards that did not require 24-hour monitoring and had no specific incurable diseases. Participants were divided into two groups according to hospital discharge support, defined by medical fee incentives for discharge planning and coordination of medical and nursing services after discharge. We explored the association between hospital discharge support and risk-adjusted readmission based on patient characteristics for one year beginning the month after patient discharge. This study involved a total of 10,998 patients: 2,563 patients with hospital discharge support and 8,435 patients without relevant support. In the group with hospital discharge support, there was a significant reduction in readmission rates. When examined by patients' characteristics, this association was significant in groups with age ≥ 85, care needs levels 1 to 2 (conditions requiring partial care for daily living), dementia or fracture. Our results suggest that hospital discharge support by medical and nursing care workers is effective in reducing readmission rates. Moreover, patients' age, care needs, and underlying disease should be considered.

Keywords: hospital discharge planning; hospital discharge support; Japan; long-term care; readmission
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Introduction

Demand for hospitalization, including long-term care, is expected to increase by aging (Schneider and Guralnik 1990; Lagergren et al. 2018). Reduction of readmission is essential to improve the quality of care and reduce costs (Rackow 2009). Readmission is known to result from complex interactions among patients, hospitals, and communities (Joynt and Jha 2012). For example, short-term readmissions of 30 days or less are reduced by physician follow-up (Jackson et al. 2015; Riverin et al. 2018), but increased by poor communication between health care workers (Pesko et al. 2018). For studies with a more extended evaluation period for readmission, comprehensive discharge planning and follow-up care at home have been reported to be effective in reducing readmissions. (Naylor et al. 1999). The Japanese government is planning to shift from providing medical care at hospitals, including long-term care wards, to home medical care as a community-based integrated care system by 2025. At that time, most baby boomers will be aged 75 and older (Miyata et al. 2015; Iwagami and Tamiya 2019). In Japan, long-term care wards covered by medical insurance are divided into three categories according to patients' diseases and required medical services. Specifically, Category 1 of long-term care wards not requiring 24-hour monitoring and without specific incurable diseases have been targeted for conversion to non-medical care facilities and home medical care. Long-term care wards in Japan are equivalent to skilled nursing facilities in other countries. They are staffed with doctors

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and nurses who can provide certain types of medical care, such as treating infectious diseases (Igarashi et al. 2018; Werner et al. 2019). In Japan, medical insurance pays for the incentive for discharge planning and coordination of medical and nursing services after discharge.

In this study, we aimed to examine the effect of hospital discharge support by medical and nursing care workers in Category 1 of long-term care wards on readmission.

Method

The ethics committee of the Tohoku University Graduate School of Medicine approved this study. It did not require informed consent from patients.

Study design and participants

This study analyzed medical insurance, and the Long-Term Care Insurance (LTCI) data collected from a public institution in a prefecture in Japan. We utilized medical insurance data for patients aged 65 and older, including the National Healthcare Insurance (NHI) and the medical care system for the elderly in the later life stage. In Japan, the NHI is public insurance provided by municipalities available to self-employed people and retirees. Also, the medical care system for the elderly in the later life stage is insurance for all people aged 75 and older. Employees of large companies have employee health insurance (Hashimoto et al. 2010), and are not included in this dataset. The LTCI data consist of all people aged 65 and older.

Data are collected retrospectively. The medical insurance data include unique identifiers, age, sex, using services per month, diseases, deaths. The LTCI data include unique identifiers, the level of needs for nursing care certification, using services per month. We prepared the panel data using the unique identifier and the month information. Using this panel data, we analyzed patients discharged from Category 1 of long-term care wards between April 2012 and March 2016. Also, we prepared data for the 12 months following the month of discharge. To exclude discharges due to death, we excluded patients whose data included information about death at the month of discharge. This dataset included 10,998 people.

Medical insurance and the LTCI system in Japan

Medical insurance covers inpatient care, including long-term care wards, outpatient care, and home medical care. Payment for long-term care wards is based on three levels of therapeutic activity and the Activities of Daily Living (ADL) of the patients (Igarashi et al. 2018). In addition to the basic payment for medical care, incentives for staffing and collaboration are paid when they meet the criteria determined by the Japanese government. The incentive for hospital discharge support is paid when medical and nursing care workers conduct discharge planning and coordination of medical and nursing services after discharge.

The LTCI is available to those who meet the criteria for patients aged 65 and older or for patients aged 40-64 with diseases such as cancer and neurodegenerative diseases. There are seven levels of needs for nursing care certification (Support levels 1 (less severe) to 2 (more severe) and care needs levels 1 (less severe) to 5 (more severe)), assessed by items related to the ADL. Those with Support levels 1 to 2 can perform ADL but need assistance to perform Instrumental Activities of Daily Living (IADL). Care needs levels 1 to 2 require partial care for ADL, while levels 3 to 5 require full assistance for ADL. The LTCI system in Japan covers long-term care welfare facilities, long-term care health facilities, integrated facilities for medical and long-term care, medical long-term care sanatoriums. The LTCI system in Japan does not provide cash benefits and no benefit for family caregivers (Iwagami and Tamiya 2019).

Primary outcome

The primary outcome was 12-month readmission, referring to the duration of the long-term observational study (Heyes et al. 2015; Leitão et al. 2017).

Covariate adjustment

Risk adjustment for readmissions was based on patients' characteristics. Patient's characteristics included age in 10-year increments (65-74, 75-84, the oldest group is 85 and older), sex, medical care after discharge (home medical care, outpatient care), needs for nursing care certification (Not certified or Support levels 1 to 2, Care needs levels 1 to 2, and Care needs levels 3 to 5), diseases (cancer, diabetes mellitus, dementia, heart failure, stroke, pneumonia, fracture) (Coleman et al. 2004; Jackson et al. 2015; Riverin et al. 2018; Sakata et al. 2018; Ma et al. 2019).

Statistical analysis

We divided participants into two groups according to hospital discharge support defined by medical fee incentives for discharge planning and coordination of medical and nursing services after discharge.

We first examined patients' characteristics in each group and then evaluated the association between hospital discharge support and 12-month readmission with a multivariable logistic regression model adjusted by patients' characteristics. Risk-adjusted readmission rates were estimated using the predicted probabilities of the results and the covariates (a method known as predictive margin) (Williams 2012). The standard deviation was calculated using the delta method and used to calculate the 95% confidence interval.

Finally, we evaluated the association between hospital discharge support and 12-month readmission by patient's age, needs for nursing care certification, and diseases.

The statistical significance level was $P < 0.05$, and we used JMP Pro (version 14.1.0) for statistical analysis.

Results

Patients' characteristics

Our sample included 10,998 patients, mean age was

85.5 years, and 7,727 (70.3%) were women. Participants were categorized into 2,563 (23.3%) in the group with hospital discharge support and 8,435 (76.7%) in the group without hospital discharge support.

Patients with hospital discharge support were older, had more home medical and outpatient care after discharge, more nursing care needs. We also found that patients with hospital discharge support were more likely to have cancer, heart failure and fracture, and less likely to have dementia (Table 1).

Association between hospital discharge support and 12-month readmission

The overall 12-month readmission rates were 52.3% (5,750/10,998), 53.1% (4,482/8,435) for patients without hospital discharge support and 49.5% (1,268/2,563) for patients with hospital discharge support. Patients with hospital discharge support had significantly lower readmission rates (adjusted 12-month readmission rates 53.1% (95% CI 52.0% to 54.1%) *vs.* 49.6% (95% CI 47.7% to 51.5%); adjusted OR 0.86, 95% CI 0.79 to 0.95; P = 0.002; Table 2).

Association between hospital discharge support and 12-month readmission by age/needs for nursing care certification/diseases

By patients' age, the association was significant in the group of patients aged 85 and older (adjusted OR 0.85, 95% CI 0.75 to 0.96; P = 0.01) and not in other younger groups (Table 3). By patients' needs for nursing care certification, the association was significant in the group of care needs levels 1 to 2 (adjusted OR 0.79, 95% CI 0.65 to 0.96; P = 0.02) and not in other groups (Table 4). By patients' diseases, the association was significant in patients with dementia (adjusted OR 0.78, 95% CI 0.65 to 0.94; P = 0.01)

Table 1. Characteristics of patients by hospital discharge support.

	Hospital Discharge Support		P
	Yes (n = 2,563)	No (n = 8,435)	
Age-yr	85.8 ± 6.2	85.4 ± 6.5	0.02
Female, No. (%)	1,792 (69.9)	5,935 (70.4)	0.67
Medical care after discharge, No. (%)			
Home medical care	361 (14.1)	960 (11.4)	< 0.001
Outpatient care	2,165 (84.5)	6,701 (79.4)	< 0.001
Needs for nursing care certification, No. (%)			< 0.001
Not certified or Support levels 1 to 2	735 (28.7)	3,204 (38.0)	
Care needs levels 1 to 2	636 (24.8)	1,649 (19.6)	
Care needs levels 3 to 5	1,192 (46.5)	3,582 (42.5)	
Diseases, No. (%)			
Cancer	311 (12.1)	778 (9.2)	< 0.001
Diabetes mellitus	613 (23.9)	1,947 (23.1)	0.38
Dementia	602 (23.5)	2,206 (26.2)	0.006
Heart failure	863 (33.7)	2,714 (32.2)	< 0.001
Stroke	1,040 (40.6)	3,309 (39.2)	0.22
Pneumonia	275 (10.7)	874 (10.4)	0.59
Fracture	842 (32.9)	2,316 (27.5)	< 0.001

Plus-minus values are means ± SD. Needs for nursing care certification were assessed by items related to the Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL). P values are calculated using the $\chi 2$ test for categorical variables and Student's t-test for continuous variables.

Table 2. Adjusted 12-month readmission rates of patients by hospital discharge support.

	Crude readmission rates, % (95% CI)	Crude OR (95% CI)	P	Adjusted readmission rates*, % (95% CI)	Adjusted OR* (95% CI)	P
Hospital discharge support						
No (n = 8,435)	53.1 (52.1-54.2)	Reference		53.1 (52.0-54.1)	Reference	
Yes (n = 2,563)	49.5 (47.5-51.4)	0.86 (0.79-0.94)	0.001	49.6 (47.7-51.5)	0.86 (0.79-0.95)	0.002

OR, odds ratio.
*Adjusted for patient's age, sex, medical care after discharge (home medical care, outpatient care), needs for nursing care certification, diseases.

Table 3. Association between hospital discharge support and 12-month readmission by patients' age.

	Adjusted readmission rates*, % (95% CI)		Adjusted OR* (95% CI)		P
	Hospital discharge support		Hospital discharge support		
	No	Yes	No	Yes	
Patients' age, years					
65-74 (n = 324)	57.4 (51.6-63.2)	57.5 (45.3-69.6)	Ref	1.00 (0.55-1.84)	0.99
75-84 (n = 4,440)	53.5 (51.8-55.1)	50.1 (47.1-53.2)	Ref	0.87 (0.75-1.01)	0.06
≥ 85 (n = 6,234)	52.7 (51.3-54.0)	48.7 (46.2-51.2)	Ref	0.85 (0.75-0.96)	0.01

OR, odds ratio.
*Adjusted for patient's sex, medical care after discharge (home medical care, outpatient care), needs for nursing care certification, diseases.

Table 4. Association between hospital discharge support and 12-month readmission by needs for nursing care certification of patients.

	Adjusted readmission rates*, % (95% CI)		Adjusted OR* (95% CI)		P
	Hospital discharge support		Hospital discharge support		
	No	Yes	No	Yes	
Needs for nursing care certification					
Not certified or Support levels 1 to 2 (n = 3,939)	58.3 (56.6-60.0)	54.4 (50.8-58.0)	Ref	0.85 (0.72-1.00)	0.05
Care needs levels 1 to 2 (n = 2,285)	50.1 (47.7-52.5)	44.6 (40.8-48.4)	Ref	0.79 (0.65-0.96)	0.02
Care needs levels 3 to 5 (n = 4,774)	50.3 (48.7-51.9)	47.9 (45.1-50.7)	Ref	0.90 (0.79-1.03)	0.14

OR, odds ratio. Needs for nursing care certification were assessed by items related to the Activities of Daily Living.
*Adjusted for patient's age, sex, medical care after discharge (home medical care, outpatient care), diseases.

Table 5. Number of patients by hospital discharge support and patients' disease.

	Hospital Discharge Support		All
	No	Yes	
Diseases, No. (%)			
Cancer	778 (71.4)	311 (28.6)	1,089 (100.0)
Diabetes mellitus	1,947 (76.1)	613 (23.9)	2,560 (100.0)
Dementia	2,206 (78.6)	602 (21.4)	2,808 (100.0)
Heart failure	2,714 (75.9)	863 (24.1)	3,577 (100.0)
Stroke	3,309 (76.1)	1,040 (23.9)	4,349 (100.0)
Pneumonia	874 (76.1)	275 (23.9)	1,149 (100.0)
Fracture	2,316 (73.3)	842 (26.7)	3,158 (100.0)

or fracture (adjusted OR 0.84, 95% CI 0.72 to 0.99; P = 0.04) and not in other diseases (Fig.1, Table 5).

Discussion

We show that hospital discharge support by medical and nursing care workers in long-term care wards effectively reduces readmission rates. Despite not being statistically significant, discharge support was more effective for older patients. Our results also suggest that association between hospital discharge support and reduced readmission is not linear with care needs level of patients, because we found significant association in the group of Care needs levels 1 to 2, but not significant in groups with more severe or mild care needs levels. Also, we found a significant association in patients with dementia and fracture, but not in other diseases. These results suggest that hospital discharge support such as discharge planning, is effective in reducing readmission rates, as shown in existing studies (Naylor et al. 1999). On the other hand, studies show that a single intervention is limited, and multiple interventions are needed to reduce readmission (Kripalani et al. 2014). This finding suggests that hospital discharge support in this study alone does not mitigate readmission in patients of all backgrounds.

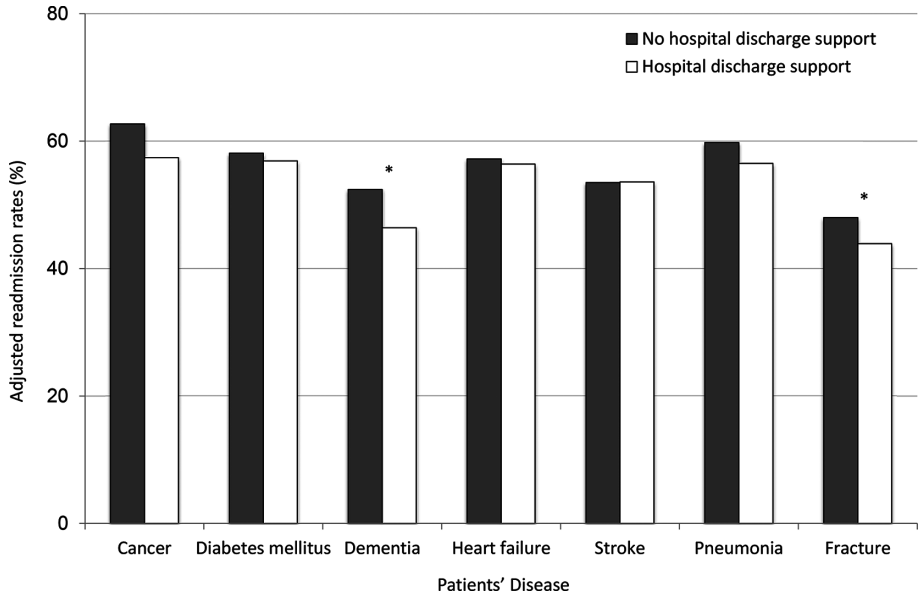

Fig. 1. Association between hospital discharge support and 12-month readmission by patients' disease.
*P < 0.05, significant. Adjusted for patient's age, sex, medical care after discharge (home medical care, outpatient care), needs for nursing care certification.

There are several explanations for the association between hospital discharge support in long-term care wards and reduced readmission. First, more elderly patients are more likely to have multiple diseases, and personalized care has been reported to reduce adverse events and unplanned care (Yarnall et al. 2017). Therefore, in the analysis by age group of patients, the effectiveness of hospital discharge support may be found in the older patient group. Second, patients with multiple chronic diseases are more likely to have hospital readmission (Glynn et al. 2011) and a loss of physical functioning (Bayliss et al. 2004). This study, therefore, suggests that hospital discharge support from medical and nursing care workers was beneficial. Also, it has been reported that readmission rates are lower in patients discharged to nursing homes than to patient's homes (Camberg et al. 1997; Werner et al. 2019). There was a significant association between hospital discharge support and reduced readmission in the group of Care needs levels 1 to 2 but not in the group with more severe care needs. In Japan, admission to some types of nursing homes is limited to patients with Care needs levels 3 or more, who require full assistance with ADL. This may be a bias in readmission for this group. Third, the association between hospital discharge support and reduced readmission varied by underlying disease. Multidisciplinary interventions have been reported as potentially effective in reducing readmission in patients with dementia (Ma et al. 2019). Also, comorbidity status and discharge planning are factors associated with readmission for patients with fractures (Heyes et al. 2015). Hospital discharge support in this study included multidisciplinary interventions and coordination of medical services after discharge, which may have been effective for patients with dementia and fractures. On the other hand, primary care interventions for patients with diabetes and heart failure have been reported to increase both readmission and patient satisfaction (Weinberger et al. 1996). This study focused only on readmission, patients with some diseases may not be properly evaluated. Future research on hospital discharge support for each disease is expected.

This study has other limitations. First, this study used medical insurance and LTCI data, which do not include clinical symptoms or clinical test results. We are therefore unable to distinguish between scheduled or unscheduled readmission. Second, this study used data from a prefecture in Japan, and thus there may be a selection bias. In Japan, regional differences in healthcare resources, costs, and outcomes may have affected the results of this study (Tsugawa et al. 2015; Hara et al. 2017).

In summary, hospital discharge support by medical and nursing care workers in long-term care wards reduces readmission rates. It is also important to consider patients' age, care needs, and underlying disease.

Conflict of Interest

The authors declare no conflict of interest.

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