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Original article

A decline in activities of daily living due to acute heart failure is an independent risk factor of hospitalization for heart failure and mortality

Kensuke Takabayashi (MD)[a,*], Shouji Kitaguchi (MD)[a], Kotaro Iwatsu (BSc, PhD)[b], Yuko Morikami (MD)[a], Tahei Ichinohe (MD)[a], Takashi Yamamoto (MD)[a], Kotoe Takenaka (MD, PhD)[a], Hiroyuki Takenaka (MD, PhD)[a], Hiroyuki Muranaka (MD, PhD)[a], Ryoko Fujita (MD, PhD)[a], Osamu Nakajima (MD, PhD, FJCC)[c], Ryou Yokoyama (MD)[c], Yuka Terasaki (MD)[d], Hideki Nishio (MD)[e], Miho Masai (MD, PhD)[e], Hitoshi Koito (MD, PhD, FJCC)[f], Miyuki Okuda (MD, PhD)[g], Hirohisa Uwatoko (MD)[h], Yoshihide Kawakami (MD, PhD)[i], Sen Matsumoto (MD, PhD)[j], Tetsuhisa Kitamura (MD, PhD)[k], Ryuji Nohara (MD, PhD, FJCC)[a]

[a] *Department of Cardiology, Hirakata Kohsai Hospital, Osaka, Japan*
[b] *Department of Rehabilitation, Hirakata Kohsai Hospital, Osaka, Japan*
[c] *Department of Cardiology, Hirakata City Hospital, Osaka, Japan*
[d] *Department of Internal Medicine, Arisawa General Hospital, Osaka, Japan*
[e] *Department of Cardiology, Ueyama Hospital, Osaka, Japan*
[f] *Department of Cardiology, Otokoyama Hospital, Kyoto, Japan*
[g] *Department of Respiratory Medicine, Hirakata Kohsai Hospital, Osaka, Japan*
[h] *Department of Cardiology, Yawata Central Hospital, Kyoto, Japan*
[i] *Department of Cardiology, Nakamura Hospital, Osaka, Japan*
[j] *Department of Cardiology, Hoshigaoka Medical Center, Osaka, Japan*
[k] *Department of Social and Environmental Medicine, Graduate School of Medicine, Osaka University, Osaka, Japan*

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ABSTRACT

Background: Although activities of daily living (ADL) are recognized as being pertinent in averting relevant readmission of heart failure (HF) and mortality, little research has been conducted to assess a correlation between a decline in ADL and outcomes in HF patients.
Methods: The Kitakawachi Clinical Background and Outcome of Heart Failure Registry is a prospective, multicenter, community-based cohort of HF patients. We categorized the patients into four types of ADL: independent outdoor walking, independent indoor walking, indoor walking with assistance, and abasia. We defined a decline in ADL (decline ADL) as downgrade of ADL and others (non-decline ADL) as preservation of ADL before discharge compared with admission.
Results: Among 1253 registered patients, 923 were eligible, comprising 98 (10.6%) with decline ADL and 825 (89.4%) with non-decline ADL. Decline ADL exhibited a higher risk of hospitalization for HF and mortality compared with non-decline ADL. A multivariate analysis revealed that decline ADL emerged as an independent risk factor of hospitalization for HF [hazard ratio (HR), 1.42; 95% confidence interval (CI): 1.01–1.96; $p = 0.046$] and mortality (HR, 1.95; 95% CI: 1.23–2.99; $p < 0.01$). Although 66.3% of patients with decline ADL were registered for long-term care insurance, few received daycare services (32.7%) or home-visit medical services (8.2%).
Conclusions: Decline in ADL is a predictor of hospitalization for HF and mortality in HF patients.
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* Corresponding author at: Department of Cardiology, Hirakata Kohsai Hospital, 1-2-1, Fujisakashigashimachi, Hirakata-shi, Osaka 573-0153, Japan.
E-mail address: taka410@gmail.com (K. Takabayashi).

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Introduction

Heart failure (HF) is a common disease among the elderly, with a higher prevalence of HF in older adults and the increasingly aging population [1,2]. A previous study reported that hospitalization exerted harmful effects on activities of daily living (ADL), particularly in super-elderly patients [3]. A study reported a correlation between an increase in the cardiovascular risk factor and a decline in instrumental ADL [4]. Furthermore, previous studies identified risk factors for the reduced ADL function in HF, including older age, female gender, dyspnea, reduced muscle strength, fatigue, and depression [5–8].

A functional deficit is a major risk factor for mortality and institutionalization in elderly patients because of the increased care need and care complexity [9–11]. Furthermore, poor quality of life, poor social engagement, and higher health care service utilization are also reported to be crucial factors for outcomes [9–11]. In addition, prior cohort studies reported that a decline in physical function is positively correlated with a higher risk of mortality [12–14]. Among elderly adults free of baseline HF, instrumental ADL impairment is a potent and independent predictor of the incidence of HF and mortality [15].

ADL is increasingly recognized in averting the readmission for HF and mortality in patients with HF; however, few clinical studies comprehensively investigated a correlation between a decline in ADL due to readmission for HF and outcomes among patients with HF in Japan. Moreover, preceding studies have not comprehensively examined the clinical characteristics and social backgrounds of patients with decline in ADL. In the Kitakawachi Clinical Background and Outcome of Heart Failure (KICKOFF) Registry, 1253 patients with HF were registered between April 2015 and August 2017. Using the database, this study aimed to assess and compare the outcomes and social backgrounds between patients with a decline in ADL and those with a non-decline in ADL.

Methods

Patient data definitions

The KICKOFF Registry is a prospective multicenter community-based cohort of patients with HF in Japan [3]. The participating institutions included 13 hospitals in the north of Kitakawachi and Yawata, which are typical satellite communities in Japan. The participating institutions comprised one cardiovascular center and 12 small- and medium-sized hospitals (<450 beds for acute care), serving as primary and secondary referral medical centers.

Between April 2015 and August 2017, we registered patients diagnosed with HF during hospitalization. The diagnosis of HF was established by the presence of at least two major criteria or one major criterion in conjunction with two minor criteria according to the Framingham criteria [16]. Although the KICKOFF Registry had no exclusion criteria, this study examined only those patients who were discharged home because patients discharged to an institution for the aged or another hospital were provided steady assistance by the staff.

The detailed study design, patient enrollment, and definition of measurements of the KICKOFF Registry are described in the UMIN Clinical Trials Registry (UMIN000016850). The clinical data of all patients were uploaded to the Internet Database System, which were automatically verified for missing or contradictory entries and values not in the normal range. Moreover, additional editing checks were performed at the general office of the registry.

Data were collected, beginning at the initiation of hospitalization and concluding with the patient's discharge, from medical record reviews and through interviews with patients or other family members.

In this study, patients were categorized into the following four types of ADL: (a) independent outdoor walking, (b) independent indoor walking, (c) indoor walking with assistance, or (d) abasia both before admission and at discharge [3]. We defined a decline in ADL as downgrade in the four types of ADL before discharge compared with that at admission (decline ADL) and the other as preservation in the four types of ADL (non-decline ADL). In addition, other co-morbidities were defined as in our previous study [3]. The long-term care insurance was defined by the Ministry of Health, Labour and Welfare of Japan.

Study endpoints

In this study, the collection of follow-up data was primarily conducted via review of hospital records, and additional follow-up information was collected through contact with patients or relatives by telephone or mail. The primary endpoint was the incidence of hospitalization for HF during the follow-up period. Another clinical endpoint comprised the incidence of all-cause mortality during the follow-up period.

Patient confidentiality

The study protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki, and was approved by the ethical committees of the Hirakata Kohsai Hospital (Osaka, Japan). We obtained informed consent from the patients. Notably, the registry did not undergo any protocol-specified alteration of treatment or any other method of outpatient department care. Furthermore, direct patient identifiers, such as name, address, or identification number were not collected to preserve patient confidentiality.

Statistical analysis

The clinical baseline characteristics, social background, and outcomes were compared between patients with decline ADL and those with non-decline ADL in only those who were discharged home. Continuous variables are expressed as mean ± standard deviation, or median and interquartile range, and categorical variables are presented as numbers and percentages. In addition, categorical variables were compared using the χ^2 test when appropriate or the Fisher's exact test otherwise, and continuous variables were compared using the Student's t-test based on distribution. We used the Kaplan–Meier method to estimate the cumulative incidences of clinical events and assessed the differences using a log-rank test. In a sensitivity analysis, we added to compare the outcomes between the groups of patients with independent outdoor waking on admission, long-term care insurance, age, and gender. In addition, we performed a multivariate analysis using a Cox proportional hazard model. The selected covariates were decline in ADL, male gender, age, history of HF, history of coronary artery disease, valvular disease, cardiomyopathy, hypertension, diabetes mellitus, atrial fibrillation, chronic kidney disease, and history of stroke. We performed a logistic regression model for detecting the risk factors in patients with decline ADL by gender. All statistical analyses were performed using JMP version 14 (SAS Institute, Cary, NC, USA). Finally, we considered two-sided $p < 0.05$ as statistically significant.

Results

As of August 2017, we had enrolled 1253 patients from 13 institutions. Among 1118 patients who were discharged, follow-up data were available for 1117 patients (follow-up rate, 99.9%). Of these, 923 patients were discharged home. Of the

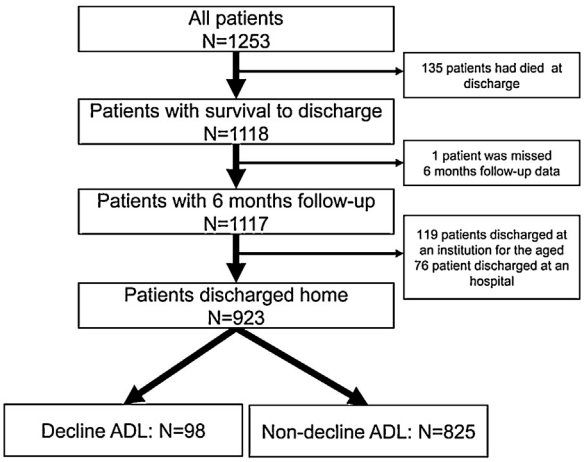

Fig. 1. Flow chart describing the inclusion of the participants in this study. ADL, activities of daily living.

923 patients, 98 patients (10.6%) were in the decline ADL group, and 825 (89.4%) were in the non-decline ADL group (Fig. 1). The median follow-up period was 369 (interquartile range, 213–419) days.

Baseline clinical characteristics of patients and co-morbidities

Table 1 summarizes the demographic and baseline clinical characteristics of all registered patients with HF. Overall, 54.9% were males, and the mean age was 75.7 years. The decline ADL group comprised more females and elderly patients than the non-decline ADL group. We observed no significant difference in the systolic blood pressure and heart rate at admission and at discharge.

Among all patients, 57.3% were enrolled with a history of HF, 68.4% had hypertension, 52.9% had chronic kidney disease (CKD), 42.5% had atrial fibrillation, and 10.2% had a history of stroke (Table 2). Patients in the decline ADL group were more likely to have CKD; however, other co-morbidities exhibited no significant difference in both groups. CKD was associated with a decline ADL among females but not among males. Age was associated with an increased risk of a decline ADL in both genders (Table S1).

Outcomes

Fig. 2 presents the Kaplan–Meier curves for the incidence of clinical events in all patients during the follow-up period. During the follow-up period, 279 patients (30.3%) were hospitalized for HF, 45 (46.4%) patients in the decline ADL group and 234 (28.4%) patients in the non-decline ADL group. We observed a higher risk of hospitalization for HF in the decline ADL group than the non-decline ADL group [hazard ratio (HR), 1.89; 95% confidence interval (CI): 1.35–2.58; $p < 0.001$]. During the study period, 119 patients (12.9%) died, comprising 28 (28.9%) patients in the decline ADL group and 91 (11%) patients in the non-decline ADL group. In addition, the risk of all-cause mortality was higher in the decline ADL group than in the non-decline ADL group (HR, 2.67; 95% CI: 1.71–4.02; $p < 0.001$).

Fig. 3 shows the Kaplan–Meier curves for the incidence of clinical events in subgroups. In patients with independent outdoor walking, during follow-up period there was a higher risk of hospitalization for HF in the decline ADL group than the non-decline ADL group (HR, 2.38; 95% CI: 1.56–3.49; $p < 0.001$) and a higher risk of all-cause mortality (HR, 3.24; 95% CI: 1.70–5.83; $p < 0.001$). Furthermore, in patients not taking long-term care insurance, there was a higher risk of hospitalization for HF in the decline ADL group than the non-decline ADL group (HR, 2.94; 95% CI: 1.74–4.68; $p < 0.001$) and a higher risk of all-cause mortality (HR, 5.68; 95% CI: 2.91–10.35; $p < 0.001$).

In the subgroup of age and gender, the Kaplan–Meier curves for the incidence of clinical events are shown in Fig. 4. A higher risk of hospitalization for heart failure and all-cause mortality during the follow-up period in patients with a decline ADL were consistently observed even in patients stratified by age and gender.

In the multivariate analysis of all patients (Table 3) after adjustment of decline ADL, male gender, age, history of HF, history of coronary artery disease, valvular disease, cardiomyopathy, hypertension, diabetes mellitus, atrial fibrillation, CKD, and history of stroke, decline ADL emerged as an independent risk factor for an augmented risk of hospitalization for HF (HR, 1.42; 95% CI: 1.01–1.96; $p = 0.046$) and mortality (HR, 1.95; 95% CI: 1.23–2.99; $p < 0.01$).

Social background between the decline and non-decline ADL groups

Table 4 outlines the social backgrounds of all patients with HF. Patients with a decline in ADL were less likely to live alone than

Table 1
Baseline clinical characteristics.

N	All patients 923	Decline ADL 98 (10.6%)	Non-decline ADL 825 (89.4%)	*p*-Value
Male gender	507 (54.9%)	35 (35.7%)	472 (57.2%)	<0.01
Age (years)	75.7 ± 11.2	81.7 ± 9.0	75.0 ± 11.3	<0.01
Height (cm)	157.4 ± 10.2	153.6 ± 9.3	157.8 ± 10.2	<0.01
Weight (kg)	55.6 ± 13.2	51.6 ± 11.7	56.0 ± 13.3	<0.01
BMI (kg/m^2)	22.3 ± 4.1	21.8 ± 4.0	22.3 ± 4.1	0.19
On admission				
Systolic blood pressure (mmHg)	143.9 ± 33.2	142.2 ± 34.2	144.1 ± 33.0	0.59
Diastolic blood pressure (mmHg)	83.4 ± 22.9	77.4 ± 21.4	84.1 ± 23.0	<0.01
Heart rate (beats/min)	93.1 ± 29.9	91.3 ± 26.9	93.3 ± 30.3	0.52
On discharge				
Systolic blood pressure (mmHg)	115.7 ± 18.6	118.7 ± 20.8	115.4 ± 18.3	0.1
Diastolic blood pressure (mmHg)	65.9 ± 13.3	65.6 ± 13.6	66.0 ± 13.2	0.79
Heart rate (beats/min)	71.5 ± 13.5	71.7 ± 13.6	71.5 ± 13.5	0.88
LVEF (%)	51.7 ± 17.6	55.2 ± 17.2	51.3 ± 17.6	0.04
BNP (pg/dL)	413.9 ± 913.8	414.2 ± 413.5	413.9 ± 955.9	0.99

Categorial data are presented as number (%). Continuous data are presented as mean ± standard deviation. ADL, activities of daily living; BMI, body mass index; LVEF, left ventricular ejection fraction; BNP, B-type natriuretic peptide.

Table 2
Co-morbidities.

N	All patients 923	Decline ADL 98	Non-decline ADL 825	*p*-Value
History of heart failure	531 (57.3%)	62 (63.3%)	469 (56.9%)	0.22
History of coronary artery disease	267 (28.9%)	28 (28.6%)	239 (29.0%)	0.93
Valvular disease	276 (29.9%)	35 (35.7%)	241 (29.2%)	0.19
Cardiomyopathy	144 (15.6%)	12 (12.2%)	132 (16.0%)	0.32
Hypertension	631 (68.4%)	72 (73.5%)	559 (67.8%)	0.24
Diabetes mellitus	329 (35.6%)	38 (38.8%)	291 (35.3%)	0.46
Dyslipidemia	367 (39.8%)	35 (35.7%)	332 (40.2%)	0.38
Atrial fibrillation	392 (42.5%)	46 (46.9%)	346 (41.9%)	0.35
Chronic kidney disease	488 (52.9%)	61 (62.2%)	427 (51.8%)	0.05
On dialysis	30 (3.2%)	5 (5.1%)	25 (3.0%)	0.49
History of stroke	94 (10.2%)	15 (15.3%)	79 (9.6%)	0.09

Categorial data are presented as number (%). ADL, activities of daily living.

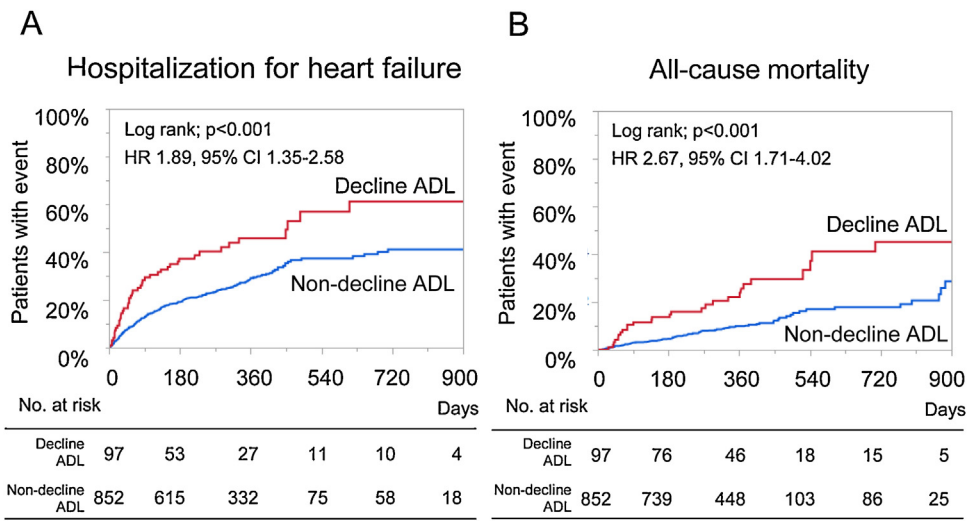

Fig. 2. Kaplan–Meier curves for the hospitalization for HF (A) and the all-cause mortality (B) during the follow-up period in all patients with a decline in ADL and with a non-decline in ADL. In the Kaplan–Meier analysis, overall patients with a decline ADL had higher risk of hospitalization for HF and all-cause mortality than those with a non-decline ADL. ADL, activities of daily living; HF, heart failure; HR, hazard ratio; CI, confidence interval.

those with a non-decline in ADL; however, over one-fourth of patients (27.6%) were living alone. In the decline ADL group, among patients who were either living alone or with a partner, fewer than half (only 47.1%) were provided support by other family members. In addition, the decline ADL group had less control over their drug therapies in themselves than the non-decline ADL group. Furthermore, although 66.3% of patients with a decline in ADL were registered for long-term care insurance, few received daycare services (32.7%) or home-visit medical services (8.2%).

Discussion

The KICKOFF Registry offers unique social background information for patients with HF through the assistance of small- and medium-sized hospitals in Japan. To our knowledge, this is the first study to establish a correlation between decline ADL and outcomes in patients with HF in Japan using a community-based registry. This study demonstrated that patients with a decline in ADL exhibited a higher incidence rate of hospitalization for HF and mortality than those with a non-decline in ADL. These differences were also shown in the subgroup of patients with good ADL levels and without taking long-term care insurance. Furthermore, these differences were independently maintained despite adjustment for differences in baseline characteristics. In this study, we enrolled patients with HF who were older than those reported in previous Japanese registries [17–19], and our registry demonstrated a social background of patients with a decline in ADL.

Poor prognosis with a decline in ADL

Previously, we reported that hospitalization exerted a worsening effect on ADL, particularly in super-elderly patients [3]. In addition, 18.1% of super-elderly patients displayed a change from independently walking before admission to a decline in ADL at discharge. In fact, the rate of a decline in ADL was higher in the super-elderly group than in the non-super-elderly group. Although some studies have reported that a decline in physical function presents a higher risk of mortality [12–14], no study has assessed outcomes in patients with acute HF by easy criteria.

A previous study reported a vicious cycle of exercise intolerance in patients with HF [20]. Bed rest during hospitalization results in skeletal muscle myopathy, which induces fatigue and dyspnea. Patients displaying these symptoms feel unpleasantness toward exercise and are in a depressive mood that reduces their physical activity. Thus, they continue with bed rest and remain exercise-intolerant and less capable of performing their ADL. Reportedly, in

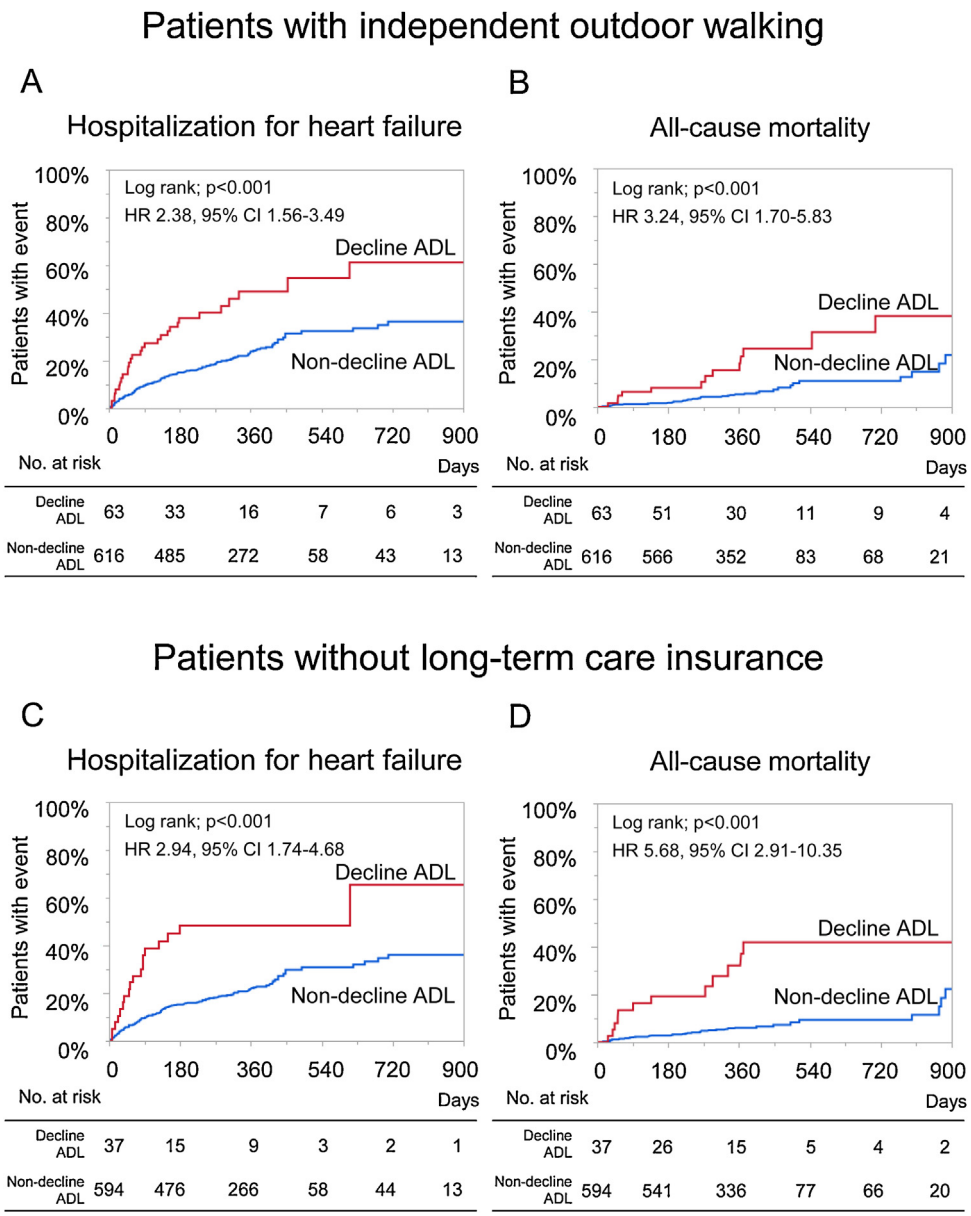

Fig. 3. Kaplan–Meier curves for the hospitalization for HF (A) and the all-cause mortality (B) in the subgroups of patients with independent outdoor walking, and the hospitalization for HF (C) and the all-cause mortality (D) in the subgroups of patients without taking long-term care insurance during the follow-up period. In the Kaplan–Meier analysis, in both subgroups of patients with independent outdoor walking and without taking long-term care insurance, there was a higher risk of hospitalization for HF in the decline ADL group than the non-decline ADL group. ADL, activities of daily living; HF, heart failure; HR, hazard ratio; CI, confidence interval.

several patients with HF, hemodynamic improvement does not acutely result in increased exercise tolerance because the muscles limit their exercise capacity [21]. Such patients could effectively increase their tolerance through cardiac rehabilitation. In this study, we did not have data on the implementation of cardiac rehabilitation during hospital stay and after discharge; however, it is imperative to implement cardiac rehabilitation in the acute phase of a patient's hospital stay and for outpatients to continue their exercise regimen. A decline in ADL during hospital stay causes progressive reduction in muscle alterations [22] and exercise tolerance, thus rendering the continuation of cardiac rehabilitation after discharge challenging. In the elderly society, it is even more imperative that cardiac rehabilitation is introduced in the acute-phase treatment of patients with acute HF. Acute phase rehabilitation is important, but post-acute phase, intermediate phase and chronic phase rehabilitation is also important to reduce readmission. Many studies showed that the positive effects of physical rehabilitation in patients with chronic HF was confirmed [23–25]. Any phases of rehabilitation were effective to significantly increase the physical score, functional independence measure score, quality of life, and oxygen uptake in cardiopulmonary exercise tests [23–26]. Further efforts should be dedicated to preventing a decline in ADL at admission due to HF.

A previous study showed that pre-discharge examination parameters were more useful risk-stratifying information in patients with HF compared to the admission examination parameters [27]. We also showed that ADL on discharge was more important to predict outcomes than ADL on admission. A study reported that there were different risks for incident heart failure between males and females [28]. In this study, we also detected that CKD was associated with a decline ADL among females but not among males and age was associated with an

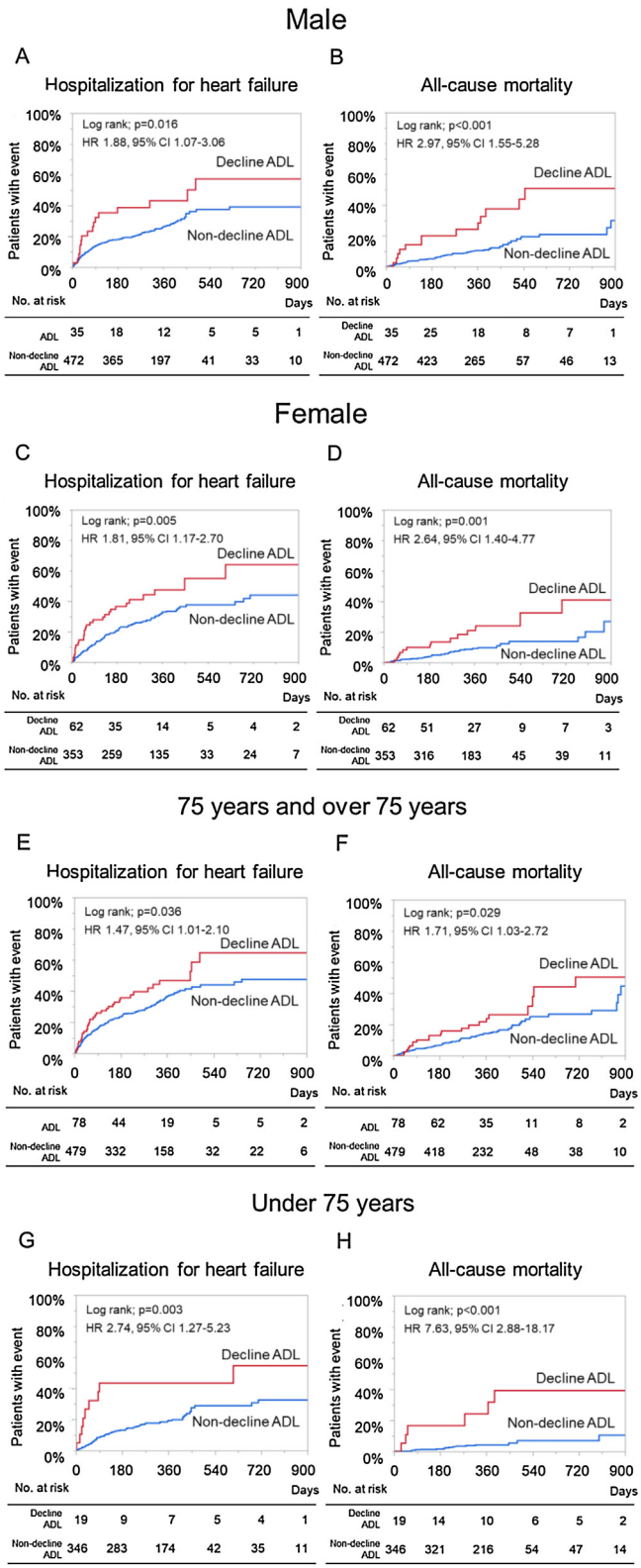

Fig. 4. Kaplan–Meier curves for the hospitalization for HF (A) and the all-cause mortality (B) in the subgroups of patients with gender of male, and the hospitalization for HF (C) and the all-cause mortality (D) in the subgroups of patients with gender of female during the follow-up period. Kaplan–Meier curves for the hospitalization for HF (E) and the all-cause mortality (F) in the subgroups of patients 75 years and over 75 years, and the hospitalization for HF (G) and the all-cause mortality (H) in the subgroups of patients under 75 years during the follow-up period. In the Kaplan–Meier analysis, all of the subgroups in patients stratified by age and gender, there were higher risks of hospitalization for HF and all-cause mortality in the decline ADL group than the non-decline ADL group. ADL, activities of daily living; HF, heart failure; HR, hazard ratio; CI, confidence interval.

increased risk of a decline ADL in both genders. Furthermore, we showed that a decline ADL was consistently higher risk of outcomes in patients stratified by age and gender.

Social background of a decline in ADL

In this study, we enrolled patients with HF who were older than those in previous Japanese registries, and patients with a decline in ADL were older than those with a non-decline in ADL. The KICKOFF Registry provides detailed social data on patients with HF in community-based hospitals. In Japan, the increasing life expectancy has resulted in a large population of elderly patients with HF [29]. In elderly patients, ADL is vital to diet and drug therapy management. Thus, this study focuses on social backgrounds, social support, and physical activity. However, we first reported these situations in a prospective, multicenter, community-based cohort in Japan [3].

Patients with a decline in ADL may require additional support from other persons, including their partners, sons, daughters, or caretakers. However, over one-fourth of patients with a decline in ADL were living alone, over one-third of patients independently managed their diet, and over half independently managed their drug therapy. Further, more patients with a decline in ADL were registered for long-term care insurance than those with non-decline ADL, but only one-third with a decline in ADL received daycare services, and a handful of them received home-visit medical services. This study examined only patients who were discharged home. ADL is a vital factor for patients at home rather than for those at institutions for the aged or hospitals. A study reported that poor socioenvironmental situations, such as poor follow-up visits, no occupation, and no professional support, were potentially useful predictors of hospital readmission in patients with HF [30]. A decline in ADL could affect management in their life, such as the lack of compliance with sodium intake or water restriction and drug adherence. Hence, a need to construct a systematic management system to decrease the rate of hospital readmission is necessary. Furthermore, these systems should comprise necessary elements, including family care and coordinated care in hospitals, and for outpatients, the effective use of home-visit medical services, and daycare and day services.

Limitations

This registry has several limitations. First, the HF diagnosis was physician-defined; thus, a selection or referral bias could be a possibility. Second, we did not have the data to evaluate patients' ADL by more quantitative index such as Barthal index or functional independence measure score. We categorized ADL into only four types, i.e. (a) independent outdoor walking, (b) independent indoor walking, (c) indoor walking with assistance, and (d) abasia, however, this categorization is very simple and crucial in daily living. Thus, clinical physicians and co-medical staff members could easily adapt it for patients with HF in their respective clinical studies. Third, data on social backgrounds were collected through interview surveys; thus, data were not evaluated using strict criteria. Fourth, in this study, we did not have data on the implementation of cardiac rehabilitation during hospital stay and after discharge; however, it is obvious that to a cardiac rehabilitation in the acute phase of a patient's hospital stay and for outpatients to continue their exercise regimen is important. Hence, while this registry had some limitations, it revealed that a decline in ADL correlated with poor outcomes in patients with HF and inadequacy of social support to prevent all-cause mortality or readmission of HF, particularly in the decline ADL group.

Table 3
Predictors of hospitalization for heart failure and mortality during the follow-up period in overall patients – multivariate analysis.

Overall patients	Hospitalization for HF		Mortality	
Variable	Hazard ratio (95% CI)	*p*-Value	Hazard ratio (95% CI)	*p*-Value
Decline ADL	1.42 (1.01–1.96)	0.046	1.95 (1.23–2.99)	<0.01
Male gender	1.11 (0.86–1.43)	0.41	1.54 (1.05–2.28)	0.26
Age (/year)	1.03 (1.01–1.04)	<0.01	1.08 (1.05–1.10)	<0.01
History of heart failure	2.22 (1.68–2.97)	<0.01	1.41 (0.93–2.16)	0.10
History of coronary artery disease	1.60 (1.21–2.12)	<0.01	1.25 (0.81–1.90)	0.30
Valvular disease	1.10 (0.85–1.42)	0.46	1.08 (0.72–1.59)	0.71
Cardiomyopathy	1.11 (0.77–1.55)	0.57	1.28 (0.72–2.14)	0.39
Hypertension	0.83 (0.64–1.07)	0.83	0.67 (0.45–0.99)	0.05
Diabetes mellitus	0.92 (0.70–1.19)	0.52	1.46 (0.97–2.17)	0.07
Dyslipidemia	0.83 (0.64–1.07)	0.15	0.68 (0.45–1.01)	0.05
Atrial fibrillation	1.31 (1.02–1.68)	0.04	0.77 (0.52–1.14)	0.19
Chronic kidney disease	1.34 (1.03–1.75)	0.03	1.44 (0.96–2.20)	0.08
History of stroke	1.51 (1.05–2.11)	0.03	1.53 (0.90–2.47)	0.11

ADL, activities of daily living; CI, confidence interval; HF, heart failure.

Table 4
Social background.

N	All patients 923	Decline ADL 98	Non-decline ADL 825	*p*-Value
Living style				
Alone	311 (33.7%)	27 (27.6%)	284 (34.4%)	<0.01
Only with partner	195 (21.1%)	24 (24.5%)	171 (20.7%)	0.39
Family support (alone or only with partner)	186 (36.8%)	24 (47.1%)	162 (35.6%)	0.24
With son or daughter	403 (43.7%)	44 (44.9%)	359 (43.5%)	0.79
Other	14 (1.5%)	3 (3.1%)	11 (1.3%)	0.23
Dietary manager				
Own	349 (37.8%)	31 (31.6%)	318 (38.6%)	0.18
Partner	309 (33.5%)	21 (21.4%)	288 (31.9%)	<0.01
Son or daughter	168 (18.2%)	31 (31.6%)	137 (16.6%)	<0.01
Other	97 (10.5%)	15 (15.3%)	82 (9.9%)	0.12
Drug therapy monitoring				
Own	752 (81.5%)	65 (66.3%)	687 (83.3%)	<0.01
Partner	59 (6.4%)	11 (11.2%)	48 (5.8%)	0.06
Son or daughter	90 (9.8%)	16 (16.3%)	74 (9.0%)	0.03
Other	22 (2.4%)	6 (6.1%)	16 (1.9%)	0.03
Long-term care insurance	292 (31.6%)	61 (62.2%)	231 (28.0%)	<0.01
Support required 1 (e.g. standing on one foot)	46 (5.0%)	7 (7.1%)	39 (4.7%)	0.32
Support required 2 (e.g. walking; possibly improved)	55 (6.0%)	11 (11.2%)	44 (5.3%)	0.03
Care level 1 (e.g. walking; maintained)	43 (4.7%)	8 (8.2%)	35 (4.2%)	0.11
Care level 2 (e.g. moving, wear/pull off trousers)	83 (9.0%)	18 (18.4%)	65 (7.9%)	<0.01
Care level 3 (e.g. washing face, oral care)	33 (3.6%)	12 (12.2%)	21 (2.5%)	<0.01
Care level 4 (e.g. dietary intake, communication)	15 (1.6%)	3 (3.1%)	12 (1.5%)	0.28
Care level 5 (e.g. swallowing, memorization)	9 (1.0%)	1 (1.0%)	8 (1.0%)	0.96
Unknown	2 (0.2%)	–	–	
Home-visit medical service	48 (5.2%)	8 (8.2%)	40 (4.9%)	0.19
Day service or daycare	127 (13.8%)	32 (32.7%)	95 (11.5%)	<0.01

Categorial data are presented as number (%). ADL, activities of daily living.

Conclusion

A decline in ADL is a predictor of hospitalization for HF and all-cause mortality in patients with acute HF. Because patients with a decline in ADL are at serious risk, they need additional support in maintaining their ability to perform ADL during hospitalization. This study could aid in decision-making for early-phase cardiac rehabilitation and providing social support after discharge to prevent the readmission for HF and all-cause mortality.

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Appendix

The following is a list of the institutions participating in the registry.

Chief investigator: Kitaguchi S, Takabayashi K (Hirakata Kohsai Hospital).

Vice-chief investigator: Nohara R (Hirakata Kohsai Hospital).

Steering Committee: Morikami Y, Fujita R, Haruna Y (Hirakata Kohsai Hospital), Nishio H (Ueyama Hospital), Matsumoto S (Hoshigaoka Medical Center), Nakajima O (Hirakata City Hospital).

Statistical Analysis: Kitamura T (Department of Cardiovascular Medicine Osaka University Graduate School of Medicine).

Coordinator: Kido Y (Hirakata Kohsai Hospital), Ueshima K (Institute for Advancement of Clinical and Translational Science Kyoto University Hospital).

Participating institutions: Department of Cardiology, Hirakata Kohsai Hospital (Kitaguchi S, Nohara R, Takabayashi K, Ozaki M, Haruna Y, Takenaka H, Takenaka K, Fujita R, Yamamoto T, Morikami Y, Ichinohe T Hagihara T, Ogami M, Okazaki Y, Ikuta A); Department of Cardiology, Hirakata City Hospital (Nakajima O, Yokoyama R); Department of Cardiology, Hoshigaoka Medical Center (Matsumoto S); Arisawa General Hospital (Terasaki Y); Osaka Hospital (Okuda M); Komatsu Hospital (Ichibanngase A); Ueyama Hospital (Nishio H, Masai M); Katano Hospital (Kubota J); Fukuda General Hospital (Kubota Y); Nakamura Hospital (Kawakami Y); Yawata Central Hospital (Uwatoko H); Kyoto Yawata Hospital (Iehara K); Otokoyama Hospital (Koito H).

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.jjcc.2018.12.014.

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