



BMJ Open Impairment in activities of daily living and readmission in older patients with heart failure: a cohort study

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ABSTRACT

Objectives This study aims to investigate the prevalence of impairment of activities of daily living (ADLs) in older patients with heart failure (HF), and to examine the impact of ADL impairment on readmission after discharge.

Design and settings A prospective cohort study was conducted in patients aged ≥ 65 years with HF admitted to a tertiary hospital in Vietnam from August 2016 to June 2017. Difficulties with six ADLs were assessed by a questionnaire. Participants were classified into two categories (with and without ADL impairment). The associations of ADL impairment with 3-month readmission were examined using logistic regression models.

Results There were 180 participants (mean age 80.6 ± 8.2 , 50% female) and 26.1% were classified as having ADL impairment. The most common impaired activity was bathing (21.1%), followed by transferring (20.0%), toileting (12.2%), dressing (8.9%), eating (3.3%), and continence (2.8%). During 3-month follow-up, 32.8% of the participants were readmitted to hospitals (55.3% in participants with ADL impairment, 24.8% in those without ADL impairment, $p < 0.001$). ADL impairment significantly increased the risk of 3-month readmission (adjusted OR 2.75, 95% CI 1.25 to 6.05, $p = 0.01$).

Conclusions In summary, ADL impairment was common in older hospitalised patients with HF and was associated with increased readmission. These findings suggest further studies on ADL assessment and intervention during transition care for older patients with HF after discharge to prevent readmission.

INTRODUCTION

Heart failure (HF) is a complex chronic syndrome and a leading cause of morbidity, mortality and hospitalisation in older people worldwide.¹ The management of HF in older people is complex as it often coexists with cognitive impairment, polypharmacy, frailty and significant decrease in functional capacity. The decreased functional capacity, high rate of comorbidities and generally poor prognosis all contribute to the impairment of activities of daily living (ADLs) in 22%–44% of patients at the time of diagnosis of HF.¹ In older patients with HF, the presence of ADL impairment was

Strengths and limitations of this study

- This is the first study of activities of daily living impairment in older hospitalised patients with heart failure in Vietnam.
- This study adds to the evidence of this topic in Asian population.
- This study was conducted in elderly patients at only one hospital, which may not be representative for all older patients with HF in Vietnam.
- We focused on all-cause admission as it was difficult to obtain reasons for readmission from elderly patients via phone calls.

shown to be associated with increased risk of rehospitalisation.^{2–4}

The prevalence of HF in Western countries has been known to be increasing for some time, and recent statistics from Southeast Asian countries have shown similar increasing trends.^{5 6} Prevalence of HF in older people was 10%–12% and accounted for 15% of all hospital admissions in Vietnam, which represents a huge economic burden.^{7 8} Although there have been advances in the treatment, HF still carries a poor prognosis with a 30-day readmission rate of 8% in Vietnam.⁷ However, there is limited evidence on ADL impairment in older hospitalised patients with HF in Vietnam. It is important to understand the prevalence of ADL impairment and its impact on outcomes in older patients with HF to help guide management of this complex disease to improve both quality of life and survivability.

Therefore, this study aims to investigate the prevalence of ADL impairment in older hospitalised patients with HF in Vietnam, and to examine the impact of ADL impairment on readmission after discharge.

METHODS

Participants

A prospective cohort study was conducted in patients aged 65 years or older with chronic HF admitted to Thong Nhat Hospital in Ho

Chi Minh City (Cardiology Department and Interventional Cardiology Department) from August 2016 to June 2017.

Patients who were 65 years or older and diagnosed with chronic HF were included. HF were defined based on clinical notes of HF diagnoses in patients' medical records. Consecutive patients with HF admitted to the study wards during the study period were invited to participate in the study. Patients were excluded if they were dying, receiving intensive care, having newly diagnosed acute HF or were unable to provide consent. Oral informed consent was obtained from all participants.

Patient and public involvement: patients or the public were not involved in the design, or conduct, or reporting or dissemination plans of our research.

Sample size calculation

Sample size was calculated for the first aim of this study (to identify the prevalence of ADL impairment in older patients with HF). The sample size was determined using a single population proportion formula: $n = Z_{1-\alpha/2}^2 * [p*(1-p)/d^2]$, with n = the required sample size, $Z_{1-\alpha/2} = 1.96$ (with $\alpha = 0.05$ and 95% confidence interval), p = prevalence of ADL impairment in older patients with HF, and d = precision (assumed as 7%). We used the study conducted by Skalska *et al* in 2014 as reference.⁹ In this study, Skalska *et al* found that ADL impairment was present in 32.9% in patients aged 65 years or older with HF.⁹ Therefore, the sample size for this study was estimated to be at least 173 participants.

Data collection

Data was collected from patient interviews and medical records. Information obtained from medical records included: demographic characteristics, medical history, comorbidities, reasons for admission, blood pressure measurements, blood test results and echocardiography.

All participants were followed up for 3 months after discharge. Participants were contacted via telephone calls (to the phone numbers provided) to obtain information about their readmission. Readmission was defined as any readmission during the 3-month period after discharge and was treated as a binary variable (yes/no). Details of reasons for readmission and date of readmission were not obtained.

ADL impairment definition

The ADLs include six activities that are fundamental for independent life at home: bathing, using the toilet, transferring, dressing, eating and continence.^{10 11} Participants were asked to identify whether they have any difficulty performing these activities on their own. The response options were binary (Yes/No). ADL impairment was defined as having difficulty in performing at least one of the above activities.

Covariates

Coronary heart disease, stroke, dyslipidaemia, peripheral vascular disease, diabetes mellitus and chronic obstructive pulmonary disease were identified based on documented information from participants' medical records. Hypertension was defined as systolic blood pressure >140 mm Hg, diastolic blood pressure >90 mm Hg, or current use of

antihypertensive medications. Estimated glomerular filtration rate (eGFR) was calculated from the serum creatinine level at baseline. Chronic kidney disease (CKD) was defined as an eGFR of less than 60 mL/min. Anaemia was defined as serum haemoglobin <12 g/dL in women or <13 g/dL in men. Resting left ventricular ejection fraction (EF) was documented from transthoracic echocardiograms performed during hospitalisation and preserved EF was defined as EF \geq 50%.

STATISTICAL ANALYSIS

Analysis of the data was performed using SPSS for Windows V.24.0 (IBM Corp.). Continuous variables are presented as means \pm SD, and categorical variables as frequencies and percentages. Comparisons between groups (participants with and without ADL impairment, male and female) were assessed using the χ^2 test or Fisher's exact test for categorical variables and Student's t-test or Mann-Whitney test for continuous variables.

To investigate the impact of ADL impairment on readmission, we first conducted univariate logistic regression of ADL impairment on 3-month readmission. We also performed univariate logistic regression of other factors that can be associated with 3-month readmission. The relationship between ADL impairment with readmission was then examined by multivariate logistic regression, adjusting to age, sex and those variables that had a p value <0.05 on univariate analyses.

All variables were examined for interaction and multicollinearity. Results were presented as odds ratios (ORs) and 95% confidence intervals (CIs).

RESULTS

There were 180 participants. Their mean age was 80.6 \pm 8.2, 50% were women, and 26.1% were classified as having ADL impairment. The most common comorbidity was hypertension (88.9%), followed by coronary heart disease (78.3%), anaemia (72.8%) and type 2 diabetes (30.6%). A history of hospitalisation in the past year was present in 66.1% of the participants. Overall, participants with ADL impairment were significantly older, had higher rate of hospitalisation in the past year, and higher prevalence of stroke (table 1).

The prevalence of impairment in each domains of ADLs among 180 participants is presented in figure 1. The activity that was most commonly impaired was bathing (21.1%), followed by transferring (20.0%), toileting (12.2%), dressing (8.9%), eating (3.3%) and continence (2.8%). There was no significant difference between men and women.

During the 3-month follow-up, 32.8% (59/180) of the participants were readmitted to hospitals (55.3% in participants with ADL impairment, 24.8% in those without ADL impairment, $p < 0.001$).

On univariate logistic regression, ADL impairment was significantly associated with increased likelihood of readmission (unadjusted OR 3.75, 95% CI 1.87 to 7.53). This association was examined further in multivariate logistic regression, adjusted to age, sex and the variables that had significant

Table 1 Participant characteristics

Characteristics	All (N=180)	Participants with ADL impairment (N=47)	Participants without ADL impairment (N=133)	P value
Age, years	80.6±8.2	83.2±9.2	79.7±7.7	0.01
Female	90 (50)	25 (53.1)	65 (48.8)	0.61
Reasons for this admission:				
Shortness of breath	140 (77.8)	38 (80.9)	102 (76.7)	0.56
Fatigue	22 (12.2)	4 (8.5)	18 (13.5)	0.45
Chest pain	14 (7.8)	4 (8.5)	10 (7.5)	0.76
Other	4 (2.2)	1 (2.1)	3 (2.3)	1.0
NYHA classification:				
II	27 (15.0)	1 (2.1)	26 (19.5)	<0.001
III	139 (77.2)	37 (78.7)	102 (76.7)	
IV	14 (7.8)	9 (19.1)	5 (3.8)	
EF %	41.9±10.2	40.64±10.4	42.3±10.1	0.35
Preserved EF (EF ≥50%)	40 (22.2)	11 (23.4)	29 (21.8)	0.82
Duration of hospitalisation, days	16.3±42.7	10.7±5.8	12.8±7.4	0.06
History of hospitalisation in the past year	119 (66.1)	43 (91.5)	76 (57.1)	<0.001
Comorbidities:				
Hypertension	160 (88.9)	38 (80.9)	122 (91.7)	0.04
Coronary heart disease	141 (78.3)	40 (85.1)	101 (75.9)	0.19
Anaemia	131 (72.8)	35 (74.5)	96 (72.2)	0.76
Diabetes	55 (30.6)	13 (27.7)	42 (31.6)	0.61
Chronic kidney disease	37 (20.6)	13 (27.7)	24 (18.0)	0.16
Dyslipidaemia	36 (20)	5 (10.6)	31 (23.3)	0.07
Stroke	28 (15.6)	17 (36.2)	11 (8.3)	<0.001
COPD	15 (8.3)	6 (12.8)	9 (6.8)	0.20
Peripheral vascular disease	15 (8.3)	3 (6.4)	12 (9.0)	0.57
Total number of comorbidities	4.51±1.14	4.83±1.15	4.39±1.12	0.02

Continuous data are presented as mean±SD; categorical data are shown as n (%). ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; EF, ejection fraction; NYHA, New York Heart Association.

relationship with readmission on univariate analyses (table 2). After adjusting to age, sex, history of hospitalisation in the past year, total number of comorbidities, anaemia and CKD, the impact of ADL impairment on 3-month readmission was still significant (adjusted OR 2.75, 95% CI 1.25 to 6.05, $p=0.01$).

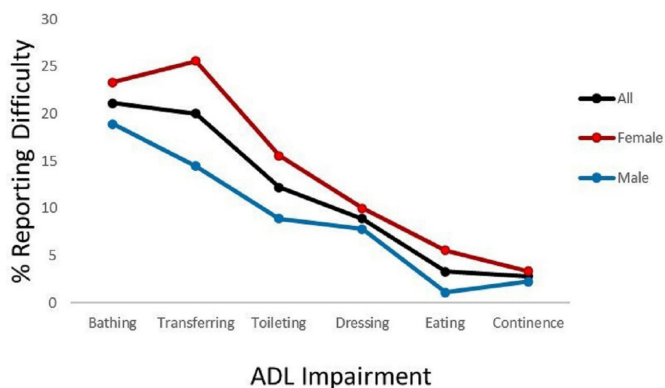


Figure 1 Prevalence of impairment in activities of daily living among older patients with HF.

Among the ADL domains, only bathing impairment and transferring impairment were significantly associated with 3-month readmission on univariate analyses (figure 2). After adjusting to age, sex, history of hospitalisation in the past year, total number of comorbidities, anaemia and CKD, only bathing impairment remained significantly associated with increased risk of 3-month readmission (adjusted OR 2.71, 95% CI 1.18 to 6.25, $p=0.02$).

DISCUSSION

In this study in 180 older patients with HF, we found that more than 26% of the participants had ADL impairment and it increased the likelihood of 3-month readmission to hospitals by approximately three times.

Our findings are compatible with some previous studies in other countries. In a study conducted by Skalska *et al* in Poland in 4795 older patients hospitalised with HF (mean age 73.8±6.5), 32.9% of the participants had ADL impairment.⁹ In another study in 581 patients aged 75 years or older and hospitalised due to HF in Spain, 50% of the

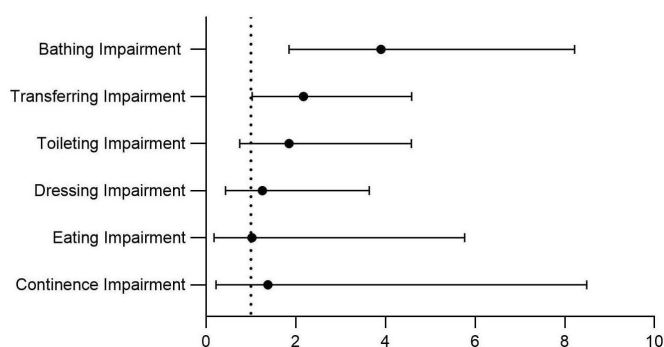
Table 2 Univariate analysis of potential predictor factors for 3-month readmission

Factors	Unadjusted OR (95% CI)	P value
ADL impairment	3.75 (1.87 to 7.53)	<0.001
Bathing impairment	3.90 (1.85 to 8.22)	<0.001
Transferring impairment	2.17 (1.03 to 4.58)	0.04
Toileting impairment	1.85 (0.75 to 4.58)	0.18
Dressing impairment	1.26 (0.43 to 3.64)	0.67
Eating impairment	1.03 (0.18 to 5.77)	0.98
Incontinence	1.38 (0.22 to 8.49)	0.73
Age	1.04 (1.00 to 1.08)	0.06
Female	1.05 (0.56 to 1.96)	0.87
Total number of comorbidities	1.68 (1.25 to 2.26)	0.001
History of hospitalisation in the past year	3.07 (1.45 to 6.50)	0.003
Anaemia	2.74 (1.23 to 6.13)	0.01
Hypertension	3.05 (0.86 to 10.86)	0.09
Coronary heart disease	1.31 (0.60 to 2.87)	0.49
Diabetes	1.26 (0.65 to 2.46)	0.50
Chronic kidney disease	3.63 (1.72 to 7.67)	0.001
Stroke	1.68 (0.74 to 3.82)	0.22
Dyslipidaemia	0.91 (0.41 to 2.01)	0.81
Peripheral vascular disease	1.03 (0.34 to 3.16)	0.96
Chronic obstructive pulmonary disease	1.03 (0.34 to 3.16)	0.96

ADL, activities of daily living.

participants had ADL impairment.¹² In studies in community settings, the prevalence of ADL impairment in older patients with HF was lower, from 11% to 17% in studies from the USA.^{13 14}

We also found that among the ADL domains, bathing and transferring were the most common impaired activities, and only bathing impairment was independently associated with significantly higher risk of readmission. The significance of bathing disability over other essential ADL domains was consistent with previous findings, in which ADLs impairment tend to proceed in a hierarchical pattern.^{9 15 16} Although bathing disability is generally not

**Figure 2** Unadjusted ORs (95% CI) of ADL items on 3-month readmission.

preceded by any other impairments, it serves as one of the crucial stages within the disability cascade, predisposing the patients to reduced function across other essential ADL domains and increasing requirement for prolonged care services.^{15 17} The development of bathing function is multifactorial, attributable to both endogenous and environmental risk factors. As HF is known to alter the functionality of contractile units in skeletal muscle, it is common for patients with this chronic condition to suffer from muscle weakness, thus impairing their physical activity level and ability to maintain balance.¹⁸ Such limitations were significant predisposing factors and were found to increase the risk of persistent bathing and transferring disability.^{19 20} In addition, the likelihood of bathing impairment is further exacerbated by prolonged hospitalisation,²⁰ which often happened in patients with HF. In fact, in this study, two-thirds of the participants had a history of hospitalisation in the past 12 months. Older hospitalised patients are usually at increased risk of functional impairment due to immobility and the impacts of malnutrition, comorbidities and polypharmacy. As current practice focuses on disease-based models of care, more attention should be given to other aspects of health in older patients such as functional activities. A thorough posthospitalisation care plan coupled with an exercise regime could be a viable strategy to circumvent the burden of bathing and other ADL disability in patients with HF. Environmental modification and intervention such as installation of bath aids (including shower seat, grab bars, etc.) could be considered to help improving ADL functions in older patients.²¹

This study has several limitations. It was conducted on elderly patients at only one hospital, which may not be representative for all older patients with HF in Vietnam. In addition, compliance to medications for HF treatment, which may have an impact on readmission rate, was not evaluated in the participants during the follow-up time. Readmission information was obtained by conducting phone calls to participants and details of reasons for readmission could not fully achieved from the elderly participants. However, to our best knowledge, this is the first study examining the prevalence of ADL impairment and its negative impact on readmission in older hospitalised patients with HF in Vietnam. The evidence from this study suggests that routine assessment of ADLs should be performed in older hospitalised patients with HF. Further studies are needed to evaluate the effectiveness of interventions in improving ADL functions in older patients with HF to prevent adverse outcomes in this population.

CONCLUSION

In summary, in this study, we found that ADL impairment was common in older hospitalised patients with HF and was associated with increased readmission. These findings suggest further studies on ADL assessment and intervention during transition care for older patients with HF after discharge.

Contributors TVN and TNN conceived the study. TVN and HTD led ethics application, recruiting and data acquisition. TVN, TNN, HTD, MJB, HHH were involved in data analysis, result interpretation, drafting the manuscript and revising it critically for important intellectual content. All authors read and approved the final manuscript.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Ethics approval The study was approved by the ethics committees of the University of Medicine and Pharmacy in Ho Chi Minh City, Vietnam (Reference Number (292/DHYD-HD).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement The study data are available from the corresponding author upon reasonable request.

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REFERENCES

- Butrous H, Hummel SL. Heart failure in older adults. *Can J Cardiol* 2016;32:1140–7.
- Kitamura M, Izawa KP, Yaekura M, et al. Relationship among activities of daily living, nutritional status, and 90 day readmission in elderly patients with heart failure. *Int J Environ Res Public Health* 2019;16:ijerph16245068. doi:10.3390/ijerph16245068
- Kitamura M, Izawa KP, Taniue H, et al. Relationship between activities of daily living and readmission within 90 days in hospitalized elderly patients with heart failure. *Biomed Res Int* 2017;2017:7420738 doi:10.1155/2017/7420738
- Dunlay SM, Manemann SM, Chamberlain AM, et al. Activities of daily living and outcomes in heart failure. *Circ Heart Fail* 2015;8:261–7.
- Harkness K, Heckman GA, McKelvie RS. The older patient with heart failure: high risk for frailty and cognitive impairment. *Expert Rev Cardiovasc Ther* 2012;10:779–95.
- Yancy CW, Jessup M, Bozkurt B, et al. 2017 ACC/AHA/HFSA Focused Update of the 2013 ACCF/AHA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Failure Society of America. *J Card Fail* 2017;23:628–51.
- Do TNP, Do QH, Cowie MR, et al. Effect of the Optimize Heart Failure Care Program on clinical and patient outcomes - The pilot implementation in Vietnam. *Int J Cardiol Heart Vasc* 2019;22:169–73.
- Reyes EB, Ha J-W, Firdaus I, et al. Heart failure across Asia: same healthcare burden but differences in organization of care. *Int J Cardiol* 2016;223:163–7.
- Skalska A, Wizner B, Więcek A, et al. Reduced functionality in everyday activities of patients with self-reported heart failure hospitalization--population-based study results. *Int J Cardiol* 2014;176:423–9.
- Katz S. Assessing self-maintenance: activities of daily living, mobility, and instrumental activities of daily living. *J Am Geriatr Soc* 1983;31:721–7.
- Katz S, Downs TD, Cash HR, et al. Progress in development of the index of ADL. *Gerontologist* 1970;10:20–30.
- Rodríguez-Pascual C, Vilches-Moraga A, Paredes-Galán E, et al. Comprehensive geriatric assessment and hospital mortality among older adults with decompensated heart failure. *Am Heart J* 2012;164:756–62.
- Gure TR, Kabeto MU, Blaum CS, et al. Degree of disability and patterns of caregiving among older Americans with congestive heart failure. *J Gen Intern Med* 2008;23:70–6.
- Wong CY, Chaudhry SI, Desai MM, et al. Trends in comorbidity, disability, and polypharmacy in heart failure. *Am J Med* 2011;124:136–43.
- Dunlop DD, Hughes SL, Manheim LM. Disability in activities of daily living: patterns of change and a hierarchy of disability. *Am J Public Health* 1997;87:378–83.
- Gill TM, Guo Z, Allore HG. The epidemiology of bathing disability in older persons. *J Am Geriatr Soc* 2006;54:1524–30.
- Gill TM, Allore HG, Han L. Bathing disability and the risk of long-term admission to a nursing home. *J Gerontol A Biol Sci Med Sci* 2006;61:821–5.
- Miller MS, Vanburen P, Lewinter MM, et al. Mechanisms underlying skeletal muscle weakness in human heart failure: alterations in single fiber myosin protein content and function. *Circ Heart Fail* 2009;2:700–6.
- Naik AD, Concato J, Gill TM. Bathing disability in community-living older persons: common, consequential, and complex. *J Am Geriatr Soc* 2004;52:1805–10.
- Gill TM, Han L, Allore HG. Predisposing factors and precipitants for bathing disability in older persons. *J Am Geriatr Soc* 2007;55:534–40.
- Gill TM, Han L, Allore HG. Bath AIDS and the subsequent development of bathing disability in community-living older persons. *J Am Geriatr Soc* 2007;55:1757–63.