The Correlation of Instrumental Activity Daily Living (IADL) Score with Functional Outcome Status and Long-Term Rehospitalization amongst Geriatric Patients

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Abstract: Rehospitalizations amongst geriatric patients are increasing the health care burden. Nonetheless, we have limited information on unplanned long-term rehospitalization. IADL is the more complex functional capacity that usually decreasing before deficits in basic ADL. The aim of this study is to correlate the IADL score before the first admission with functional outcome status and long-term rehospitalization amongst geriatric patients. It is a cross-sectional study. Twenty-one database of geriatric patients with a history of rehospitalization within one-year was included, which set in the geriatric inpatient ward in Cipto Mangunkusumo Hospital. The decline of IADL was measured with Lawton's score before first hospital admission, the number of rehospitalizations was recorded during history taking, and functional outcome status was assessed with modified Barthel Index (mBI) at discharge. Lower IADL decline before first hospital admission was significantly correlated with higher mBI at rehospitalization discharge ($r= -0.647$; $p= 0.002$), but poor correlated with the number of long-term rehospitalization ($r = -0.09$, $p > 0.05$). This finding suggests that the independence of ADL at hospital discharge will be achieved if patients have a higher IADL score before admission. Further study needs to be constructed about factors contributing to long-term rehospitalization amongst geriatric patients.

1 INTRODUCTION

Among developed and developing countries, elderly (aged over 60 years) make up a large proportion of the population and many require hospitalization for aging-related disease (Divo et al., 2016). Data from Riset Kesehatan Dasar (Riskesdas) revealed that, as of 2018, Indonesia has 9.27% proportions of elderly. The report estimated that by the year 2050, more than one in four persons living in Indonesia will be older than 60 years (Silviliyana et al., 2018). Such a demographic process will directly impact the national healthcare system, with increasing needs for care and important implication on direct healthcare costs.

A geriatric is elderly who have more than one medical condition and/ or comorbidities due to decreased function of physical or psychological. In Indonesia, more than 50% of geriatric have experienced health complaints in a month due to aging-related diseases, including hypertension, arthritis, stroke, obstructive pulmonary disease, and diabetes mellitus. These conditions caused 25.7% of disability and 8.46% of hospital admission and/ or readmission in one year (Silviliyana et al., 2018).

A number of studies have investigated geriatric patient's hospitalization-related characteristics, events, and outcomes. They focused on rehospitalization prevention amongst geriatric patients as a high-risk population. They found that patient factors are possible predictors of rehospitalization, such as age, gender, marital status, insurance status, socioeconomic status, employment status, living conditions, and functional impairment

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(Wong et al., 2011; Tonkikh et al., 2016). The functional decline during hospitalization is associated with 1.5 to 3 times greater likelihood of rehospitalization (Hoyer et al., 2015; Greysen et al., 2016).

Functional status refers to the ability to perform self-care, self- maintenance, and physical activity. Maintenance of functional status is an important indicator of health in the elderly. The loss of this capacity leads to a rise in morbidity and mortality (Millan-Calenti et al., 2010).

Functional status is usually classified into two types, basic activities of daily living (ADL) and instrumental activities of daily living (IADL). ADL are defined as activities that essential for an independent life,while IADL are more complex activities that require a higher level of personal autonomy. These IADL-scores refer to tasks implying enough capacity to make decisions as well as greater interaction with the environment. Usually, deficits in IADL precede deficits in ADL. However, most of the studies measured the functional status of geriatric patients using ADL.

The aim of this study is to correlate the IADL score before the first admission with functional outcome status and long-term rehospitalization amongst geriatric patients. We hypothesized that the lower decline of IADL at first hospital admission negatively correlated with functional outcome status at discharge and positively correlated with the number of rehospitalization.

2 METHODS

We performed a cross-sectional study of the Geriatric Division's database which consecutively included geriatric patients (aged over 60 years who has more than one medical condition and/ or comorbidities) that consulted to Medical Rehabilitation Department. The database of in-patient setting was Cipto Mangunkusumo Hospital (Jakarta, Indonesia), particularly in geriatric inward. We excluded database of patients that was the first admission and/ or no history of rehospitalization within one year, also the database that not include complete information of patient's functional status (ADL and IADL), neither in the first admission nor the latest discharge, and those who died during in-patient care. The study was approved by the Ethics Committee of the Faculty of Medicine, University of Indonesia.

2.1 Data sources

All data were collected through an existing database of Geriatric Division, Medical Rehabilitation Department.

2.2 Variables and Instruments

2.2.1 Lawton's Instrumental Activity Daily Living (IADL) Score Before First Admission

IADL was measured using Lawton's score, which consisted of 8 items including the ability to use the telephone, shopping, food preparation, housekeeping, laundry, mode of transportation, responsibility for own medications, and ability to handle finances. Each item is ranked on the 1-point scale. The total scores are summarized into a total score ranging from 0 (totally dependent) to 8 (fully independent). We examined the change of IADL before the first admission, defined as a decline of IADL before the first acute hospital admission within one year before the latest admission, that reported by the patient or the caregiver and recoded on the database.

2.2.2 Outcome Definition

Rehospitalization was defined as any unplanned hospital admission related to the main diagnosis at any hospital in Jakarta, that occur within one year before the last admission. The number of rehospitalization collected from history taking section, either in present illness or past medical history. If a patient was rehospitalized more than once, each episode was counted as a separate hospitalization.

Functional outcome status was assessed with modified Barthel Index (mBI), consisted of 10 items including personal hygiene, bathing, eating, toileting, dressing, chair/ bed transfers, ambulation, stair climbing, and bowel and bladder control. Each item is ranked on a 2- point scale (except for transfer and mobility which ranked on a 3-point scale), indicating the amount of assistance required in functional independence in each task. The scores are summarized into a total score, ranging from 0 (totally dependent) to 20 (fully independent). The information was given by the patient's caregiver before the latest hospital discharge and recoded on the database.

2.3 Statistical Analysis

All analyses were performed using SPSS (Statistical Package for Social Sciences, SPSS Inc., Chicago, IL) version 20.0.

The sociodemographic characteristics were systematized through descriptive statistics, using the relative frequencies when the variables were categorical. For continuous variables—functional status, age, number of caregivers, and number of rehospitalization—we used measures of central tendency (means) and dispersion measures (standard deviation).

To identify the correlation between the decline of IADL score and both outcomes – the number of rehospitalization and functional outcome status – a bivariate analysis was performed. Prior to the correlation analysis, normality in the distribution of the variables was verified through the Shapiro-Wilk test. Because IADL score as the predictor has a normal distribution, we choose using Pearson correlation test to analyze the association between variables. It was conventionally used that $r < 0.2$ indicates a poor association; between (0.21; 0.50) fair; between (0.51; 0.70) moderate; between (0.71;

0.90) very strong; and finally, between (0.91; 1.00) a perfect association. To compare the global IADL score and each domain IADL according to gender, we choose using the Fisher test. For the tests performed, the lower limit of significance was set at $p < 0.05$ (95% confidence level), and the null hypothesis was rejected when the probability of significance of the test (p-value) was lower than this value

3 RESULTS

Of a total 45 database of Geriatric Division that collected in the last four years (2015- 2019), 32 were considered eligible. Of these number, 11 databases were excluded because 7 of them were the first hospital admission, 2 of them had no rehospitalization history in the last one years, and the last 2 had not complete information of patient's functional status (ADL and IADL), thus the total number of sample in this study was 21.

Table 1: Clinical characteristics and demographics of geriatric patient's database.

Variable	Total (n= 21)	Men (n=12)	Women (n=9)
Age, years, mean ± SD	67.0 ± 5.98	67.67 ± 6.47	66.11 ± 5.51
Living alone, n (%)	1 (4.8)	0 (0)	1 (11.1)
Non-formal caregiver, n (%)	20 (95,2)	11 (91.7)	0 (0)
Education, n (%)			
Elementary school	3 (14.3)	1 (8.3)	2 (22.2)
Junior high school	1 (4,8)	0 (0)	1 (11.1)
Senior high school	10 (47.6)	7 (58.3)	3 (33.3)
College or university	7 (33.3)	4 (33.3)	3 (33.3)
Last occupational status, n (%)			
Unemployed	4 (19.0)	0 (0)	4 (44.4)
Government employees	4 (19.0)	2 (16.7)	2 (22.2)
Private employees	4 (19.0)	3 (25.0)	1 (11.1)
Entrepreneur	9 (42.9)	7 (58.3)	2 (22.2)
The main disease that caused rehospitalization, n (%)	9 (42.9)	4 (33.3)	5 (55.6)
Diabetes mellitus	2 (9.5)	2 (16.7)	3 (33.3)
Heart failure	1 (4.8)	1 (8.3)	0 (0)
Chronic obstructive pulmonary disease	8 (38.1)	5 (41.7)	0 (0)
Malignancy	1 (4.8)	0 (0)	1 (11.1)
Autoimmune disease			
Body structure/function that caused IADL decline at first hospital admission, n (%)	12 (57.1)	6 (50.0)	6 (66.7)
Pain function	2 (9.5)	2 (16.7)	0 (0)

Heart function Lung function Cognitive function Gastrointestinal function Metabolic function	1 (4.8) 1 (4.8) 3 (14.3) 2 (9.5)	1 (8.3) 1 (8.3) 1 (8.3) 1 (8.3)	0 (0) 0 (0) 2 (22.2) 1 (11.1)
Number of rehospitalization, mean ± SD	1.71 ± 0.902	1.67 ± 0.778	1.78 ± 1.093
IADL before first admission (1-8), mean ± SD	3.90 ± 2.02	4.33 ± 2.35	3.33 ± 1.41
IADL decline (1-8), mean ± SD	4.10 ± 2.02	3.67 ± 2.35	4.67 ± 1.41
ADL at latest hospital discharge (mBI) (0-20), mean ± SD	9.71 ± 5.1	10.75 ± 6.27	8.33 ± 2.69

As shown in Table 1, the mean age of patients was 67,0 years (standard deviation (SD) 5.98) and most were men (57.14%). Almost all patients have cared by non-formal caregivers who lived together with them (95.2%). We tried to descriptively investigate the main disease that caused the rehospitalization of geriatric patients as baseline data, that was diabetes mellitus (42.9%), malignancy (38.1%), heart failure (9.5%), chronic obstructive pulmonary disease (4.8%), and autoimmune disease (4.8%). We also evaluated what body structure/ function that impaired in the first hospital admission that caused IADL decline, those were pain (57.1%), gastrointestinal (14.3%), metabolic (4.8%), heart (4.8%), lung (4.8%), and cognitive function (4.8%).

From eight domains of IADL, the mean IADL and IADL decline before the first admission was 3.90 (SD 2.02) and 4.10 (SD 2.02), respectively. Lower IADL decline before first hospital admission was significantly correlated with higher functional outcome (mBI) at discharge (r= -0.647; p= 0.002) (Table 2), but poor correlated with long-term rehospitalization (r = -0.09, p = 0.685) (Table 3).

Because historically there was a different assessment of Lawton's IADL in men and women, we tried to describe each domain of IADL that preserved before the first hospital admission for both genders. After observing the activities assessed according to gender, men present a higher global average score than women (4.33 vs. 3.33), though the difference is statistically not significant (p = 0.27). As shown in Table 4, the ability to use the telephone (95.2%) and responsibility for own medications (81.0%) were two domains that mostly preserved in geriatric patients. Interestingly, men were more independent in activities doing the laundry (50.0% against 0% of women) (p = 0.017). However, there were no differences (p>0.05) for other continuous variables of clinical characteristics and demographics between both genders, including IADL decline, total IADL, age, number of caregivers, and number of rehospitalization.

Table 2: The correlations of IADL decline with mBI in geriatric patients

	IADL Decline	
mBI at last discharge	p = 0.002	r = -0.647*

*Pearson correlation test

Table 3: The correlations of IADL decline with the number of rehospitalization in geriatric patients

	IADL Decline	
Number of rehospitalization	p = 0.685	r = -0.09*

*Pearson correlation test

4 DISCUSSIONS

The topic of unplanned rehospitalization prevention amongst geriatric patients has received increasing attention (Morandi et al., 2013). The major purpose of this study is to examine whether the decline IADL at the first hospital admission data can be used to detect high-risk patients for unplanned long-term rehospitalization and also to predict functional outcome status at every hospital discharge.

To our knowledge, ours is the first study investigating the correlation of functional status at first hospital admission and unplanned long-term rehospitalization (> 30 days). Previous studies showed that at-admission functional status associated with short-term unplanned rehospitalization (Morandi et al., 2013; Tonkikh et al., 2016). Interestingly, when we tried to correlate the decline of functional status representing by

IADL at first hospital admission score with the number of rehospitalization within one year, there was a poor correlation between these two variables. This discrepancy may due to many factors that influence rehospitalization amongst geriatric patients, especially in a long-term setting. Campbell et al conducted a systematic review of factors affecting the outcome in older medical patients admitted to hospital, one of the outcome measures was rehospitalization rate that influenced by functional status score, illness severity, co-morbidity, polypharmacy, diagnosis or presenting illness, and age (Campbell, Seymour and Primrose, 2004).

Diabetes and malignancy are two main diagnoses that underlie the rehospitalization of geriatric patients in our study. Data from Health and Nutrition Survey 2001, HANES III, approximately 20% of the population develop diabetes by the age of 60 (Meneilly and Tessier, 2001) and it will nearly double by 2025 (Bethel et al., 2007). Previous studies suggest that there was a relationship between glycemic control and hospital admission, which very poor glycemic control (HbA1c > 10%) was associated with a 2.13 times greater likelihood of rehospitalization (Menzin et al., 2010). Patients with

Table 4: Domains of IADL that preserved in the first hospital admission according to gender, n(%)

	Total (21)	Male (12)	Female (9)	P value
Ability to use telephone	20 (95.2)	11 (91.67)	9 (100)	0.571
Shopping	4 (19.0)	2 (16.67)	2 (22.22)	0.586
Food preparation	5 (23.8)	4 (33.33)	1 (11.11)	0.258
Housekeeping	6 (28.6)	5 (41.67)	1 (11.11)	0.148
Laundry	6 (28.6)	6 (50.00)	0 (0.00)	**0.017**
Mode of transportation	12 (57.1)	7 (58.33)	5 (55.55)	0.623
Responsibility for own medications	17 (81.0)	9 (75.00)	8 (88.88)	0.414
Ability to handle finances	11 (52,4)	7 (58.33)	4 (44.44)	0.425

*Fisher test

diabetes who were rehospitalized within 1 year had higher plasma glucose levels at admission (Dungan, 2012). Both the inpatient and outpatient settings of glycemic control could potentially reduce the need for rehospitalization. Therefore, the ideal discharge therapy should be made that implemented with knowledge of the pre-hospital and in-hospital glycemic control, also considered the needs and capabilities of the individual patient.

In the elderly with cancer, previous studies suggested that functional status can predict survival, chemotherapy toxicity, postoperative morbidity, and mortality. The main goal of geriatric care in this population is the improvement in the ability to complete ADL, as well as an improvement in pain and quality of life (Extermann and Hurria, 2007).

Our study found that pain was the most chief complaint that brought cancer patients to an acute hospital setting. During the data collection, the available pain killer was found to be inadequate in managing pain after hospital discharge. The identification of this symptom focuses attention on the need for improved management of pain as well as enhanced patient and family education and assessment. The patient should be educated about the method to reduce pain, such as proper medication usage. Assessment should include their understanding of specific instructions, including when to call the nurse or physician. These preventive measures were expected to reduce the number of rehospitalization among geriatric patients.

The other result of our study found that lower IADL decline at first hospital admission is negatively correlated with the functional outcome at the latest hospital discharge. When geriatric patients had lower IADL decline before the first hospital admission, they will have better independency of ADL at discharge. Efforts to maintain or improve functional status, especially IADL, an outpatient setting may be an important modifiable risk factor to have better independence at the next hospital discharge (Hoyer et al., 2015). Researchers had demonstrated that elderly patients who received occupational therapy services had significantly better ADL and IADL performances compared to patients who had not received these services (Koketsu, 2018). Consequently, we suggest that every hospitalized geriatric patient should get

occupational therapy services during hospitalization with the goal to establish or restore IADL ability at discharge. This strategy should also be maintained in outpatient setting with considering cultural, social, and environmental factors of patient.

If we refer to the differences in gender and Lawton's IADL score of our study, men present a higher average score than women. In general, this result means men are more independent than women in the assessed area, though these differences are not significant statistically. Our finding is similar to the previous study by Millan-Calenti et al that investigating the relationship between gender and functional dependence using the IADL score. But, if we assessed for each domain of IADL, our study found an interesting difference compared with the previous study, thus women were more dependent on activities doing the laundry. Traditionally, women have been more bounded to domestic activities including doing the laundry, housekeeping, and cooking, thus they should be more independent in these domains (Millan-Calenti et al., 2010). Unfortunately, from clinical characteristics and demographics data of our study still can not explain this discrepancy. One hypothesis that we could propose is the absence of IADL detail of our database. When reviewing the original IADL form, each domain of IADL should be recorded in detail. For example in laundry ability, the elderly considered independent (scored 1) when they can do personal laundry completely or launders small items, for example, rinse socks or stockings (Lawton and Brody, 1969). This point should be a concern for further research. The other limitation of our study was the small number of sample sizes that possible had less conclusive results and risk of recall bias since functional status data at first admission and hospital discharge were collected from participant's self-reports.

5 CONCLUSIONS

Patients with lower IADL decline before the first admission will have better independency of ADL at hospital discharge within one year. However, IADL decline can not be a predictor of long-term rehospitalization amongst geriatric patients. Further study needs to be constructed about factors contributing to long-term rehospitalization amongst geriatric patients with focusing on detail IADL for each domain.

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