ABSTRACT

Background: Hip fractures are one of the most serious injuries affecting older adults. Evidence-based knowledge regarding the functional status of older persons after hip fracture can provide information critical for developing effective continuous-care and rehabilitation programs.

Purpose: This study was developed to examine the post-hospital-discharge outcome measures and predictors of functional status in older adults in Indonesia after hip fracture surgery.

Methods: The functional status of 109 patients discharged from an orthopedic hospital in Indonesia after hip fracture surgery was evaluated in this prospective cohort study. Functional status was evaluated using measures of physical and independent activities of daily living (PADL and IADL, respectively) at 1, 3, and 6 months postdischarge. Predictors of changes in functional status, including age, length of hospital stay, comorbidity, prefracture walking ability, type of surgery, status of depression and nutrition, type of insurance, and residential status (urban vs. rural), were also examined. Data were analyzed using generalized estimating equations.

Results: Significant improvements in PADL were found at 3 and 6 months, and significant improvements in IADL were found at 6 months. Predictors of poor outcomes found in this study included age, a dependent prefracture walking ability, depression, and having public health insurance.

Conclusions/Implications for Practice: The findings of this study support the effectiveness of using presurgery assessments to identify individuals at a higher postdischarge risk of having poor PADL and IADL outcomes. Home nursing or subacute rehabilitation is recommended to improve and maintain functional status in older persons after hip fracture surgery. In addition, interventions and rehabilitation should take into consideration different recovery periods for PADL and IADL after hospital discharge after hip fracture surgery.

Key Words: functional status, hip fracture, older persons.

Introduction

Hip fractures are one of the most serious injuries affecting older adults, with countries in Asia seeing a twofold-to-threefold increase in the incidence of hip fractures over the past 30 years (Cheung et al., 2018; Kim et al., 2019; Mithal et al., 2014). Indonesia has the largest population of older persons in Southeast Asia, with life expectancy expected to reach 80 years by 2050, at which time one third of the total population will be at a high risk for osteoporosis (Mithal et al., 2014; Tirtarahardja et al., 2006). Currently, the standard care for hip fractures is surgical treatment (Chang et al., 2017; Lee & Elfar, 2014), which has 10- and 20-year success rates of 90%–95% and 80%–85%, respectively (Pourrabas et al., 2017). However, surgery is sometimes followed by complications such as dislocation (8.3%) and infection (1.0%; Huette et al., 2020; Katz et al., 2001; Ogawa et al., 2020). Related mortality has been reported between 8.4% and 36% during the first year after hip fracture (Abrahamsen et al., 2009; Yong et al., 2020). Several independent factors associated with an increased risk of mortality include admission to the intensive care unit because of postoperative complications such as delirium or lack of ambulation (Morri et al., 2019; Zaki et al., 2019), older age, having a prefracture comorbidity, and time between injury and surgery exceeding 48 hours (Klestitl et al., 2018; Seong et al., 2020; Yong et al., 2020).

Functional status after hip fracture surgery includes losses in physical and instrumental activities of daily living (PADL and IADL, respectively; Dubljanić Raspovic et al., 2020; Segev-Jacobovski et al., 2018). A review of studies on long-term outcomes for older adults after hip fracture surgery found that, although most recovery occurs within the first
6 months, 20%–60% of patients continue to require some form of assistance for up to 2 years (Dyer et al., 2016). Several variables have been shown to be predictors of poor recovery. These include the need for assistance when performing activities of daily living (ADLs) such as dressing, meal preparation, and housekeeping; having a poor functional status before hip fracture; being over 80 years old; and having a cognitive impairment (Ganczak et al., 2018; Wantonoro et al., 2020). Activities involving the lower extremities typically improve during the first 3 months after hospital discharge (Magaziner et al., 2015). In one study, substantial improvement in functional status during the first 3 months after hospitalization was identified as critical for regaining long-term total functional independence (Tseng et al., 2012).

The conceptual framework of this study was modified from the ecological model of aging described by Lawton et al. (1982), which focused on personal variables, extrinsic variables, and the interaction between these two variables (Lawton & Brody, 1969). Personal variables include age, length of hospital stay, having a comorbidity, prefracture walking ability, type of surgery, and depression and nutrition status, whereas extrinsic variables include income, insurance status, and living status (urban vs. rural; Hindmarsh et al., 2014; Maharlouei et al., 2019; Wallace & Ellington, 2014). These factors have been shown to influence the physical functioning of older persons with hip fracture (Hindmarsh et al., 2014; McGilton et al., 2016).

In Indonesia, public access to healthcare is often difficult because of the wide geographical dispersion of Indonesia’s islands, the low ratio of healthcare provider to population, and the low concentration of healthcare services in urban areas. Therefore, significant regional disparities exist in terms of health status and in the quality, availability, and capacity of health services in Indonesia (Mahendraadha et al., 2017). In addition, although Indonesia began working toward universal healthcare coverage in 2014, most of the population has public health insurance, which is used primarily by low-income residents, whereas wealthier Indonesians receive healthcare mostly through private insurance schemes. The latter is more accessible, provides a broader range of services, and delivers higher quality care (Mahendraadha et al., 2017; Sparrow et al., 2013). Most (75%–90%) of hip fractures in Indonesia are managed surgically, and large hospitals in the country estimate that the average wait-time for hip fracture surgery is approximately 1–2 days for patients with public insurance (Tirtarahardja et al., 2006).

Evidence-based knowledge on functional status after hip fracture in older persons is necessary for the development of continuous care and rehabilitation programs. However, few studies in Indonesia have examined the trajectory of improvements in functional status in older adults after hip fracture surgery. Therefore, the aim of this study was to investigate changes in ADL measures of functional status in older Indonesians over a 6-month period after hospital discharge after surgical treatment for hip fracture. This study also explored predictors of functional recovery, including personal and extrinsic variables.

### Methods

#### Design

A prospective cohort study was used, and the “Strengthening the Reporting of Observational studies in Epidemiology” statement checklists were completed by all of the participants. Outcomes were measured at 1, 3, and 6 months postdischarge (Shyu et al., 2004).

#### Study Setting and Sample

The study was conducted from March 2017 to May 2019 at an orthopedic hospital in Central Java, Indonesia. Older adults who had undergone surgery for repair of a hip fracture were recruited if they met the following inclusion criteria: (a) ≥ 50 years old, (b) hospitalized for hip fracture surgery, (c) received internal fixation or arthroplasty, (d) free of cognitive impairment, and (e) current resident of Java Island, Indonesia. Patients were excluded if they had experienced stroke or had paralysis.

#### Procedures

The institutional review board of the local orthopedic hospital approved this study (Ref. 0568/2017), which was conducted in accordance with the General Data Protection Regulations (2018) and the Declaration of Helsinki (Carlson et al., 2004; McCall, 2018). Data were collected using self-report instruments during follow-up appointments in the hospital at the end of the first, third, and sixth months after hospital discharge (T1, T2, and T3, respectively). If participants were unable to read or complete the instruments independently, research assistants conducted face-to-face interviews to assist them in answering the questions.

#### Instruments

A demographic and clinical questionnaire was used to collect baseline data on the participants for age, length of hospitalization, prefracture walking ability, and type of surgery. Prefracture walking ability was assessed retrospectively by the patient or a family member using the Barthel Index domain, which was used to indicate high income (Harimurti et al., 2013). Most (75%–90%) of hip fractures in Indonesia are managed surgically, and large hospitals in the country estimate that the average wait-time for hip fracture surgery is approximately 1–2 days for patients with public insurance (Tirtarahardja et al., 2006).

Evidence-based knowledge on functional status after hip fracture in older persons is necessary for the development of continuous care and rehabilitation programs. However, few studies in Indonesia have examined the trajectory of improvements in functional status in older adults after hip fracture surgery. Therefore, the aim of this study was to investigate changes in ADL measures of functional status in older Indonesians over a 6-month period after hospital discharge after surgical treatment for hip fracture. This study also explored predictors of functional recovery, including personal and extrinsic variables.
The Geriatric Depression Scale-Short Form (GDS-SF) and the Mini Nutritional Assessment (MNA) were used to assess level of depression and nutritional status, respectively, before hospital discharge. The GDS-SF was designed to measure symptoms of depression experienced over the past week in older adults. Fifteen questions are scored either “yes” (1 point) or “no” (0 points), with higher scores indicating more severe depression, with a total score of ≥ 5 indicating depression. The Indonesian version of the GDS-SF was used in this study (Njoto, 2014). The MNA tool is a valid and rapid instrument for screening older adults in outpatient clinics, hospitals, and nursing homes who are at risk of malnutrition. The MNA is designed to measure the respondent’s food intake, weight loss, and body mass index (or calf circumference if an individual cannot be weighed). The maximum total score for the MNA is 30, with total scores of 24–30 = well nourished, 17–23.5 = risk of malnutrition, and < 17 = malnourished. The Indonesian version of the MNA, which has been used to screen community-dwelling older Indonesians, was used in this study (Prasetyo et al., 2016).

Self-report instruments for PADL and IADL were used in this study as the outcome measures of functional status at T1, T2, and T3. We assessed PADL using an Indonesian version of the Barthel Index (Agung, 2006), which is designed to measure physical functions such as walking, climbing stairs, dressing, and bowel and bladder control. Total possible scores for the PADL range from 0 to 100, with 0 indicating complete dependence and 100 indicating total independence. Item-to-total correlation for this scale is .48–.87. In this study, the Cronbach’s alpha was .76.

The Indonesian version of Lawton and Brody’s IADL scale (Ri, 2017) was used to assess independent functioning in this study. This scale is designed to measure the ability of older patients with hip fracture to perform activities such as using a telephone, going shopping, taking medication, and handling money. Summary scores range from 0 to 8, with 0 representing total dependence and 8 representing total independence. Item-to-total correlation for the Indonesian version of this scale is .45–.77. In this study, the Cronbach’s alpha was .66.

Statistical Analysis

Data were analyzed using SPSS for Windows Version 18.0 (SPSS, Inc., Chicago, IL, USA). Mean and SD were calculated for the continuous variables, and frequency and percentage were calculated for the categorical variables. Linear regression models using the generalized estimating equation (GEE) approach (Liang & Zeger, 1993) were used to determine significant outcomes for PADL and IADL at T1, T2, and T3. Data were analyzed for participants after discharge before dropping out of the study or death. One-way analysis of variance and chi-square tests were used to compare baseline measures of personal and extrinsic variables for participants before hospital discharge and at T1, T2, and T3 to ensure that significant differences in predictor variables were not attributable to changes in sample size over time. In Model 1, the influence of time on postdischarge functional status outcomes was assessed by entering PADL and IADL scores at the three time points (T1, T2, and T3). In Model 2, the influence of time and personal variables as predictors of functional status of PADL and IADL was assessed. Finally, in Model 3, time, personal variables, and extrinsic variables were analyzed as predictors of functional status.

Results

Of the 149 patients who completed surgery for hip fracture and met the inclusion criteria, 132 agreed to participate in this study and provided informed consent. Of the 132 participants, four did not complete the first assessment (withdraw: n = 3; died: n = 1). Therefore, 128 (97%) completed functional assessments at T1. One hundred seventeen participants (89%) completed the questionnaires at T2 (withdraw: n = 9; died: n = 3). Eight participants withdrew from the study before the 6-month follow-up, with 109 participants (83%) completing the questionnaires at T3. The flowchart for participants in this study is shown in Figure 1.

The mean age of the 132 participants before hospital discharge was 69.67 years (SD = 9.26), and 59.8% were male (n = 79). No significant differences were found in terms of type of surgery. Most of the participants had ≥ 2 comorbidities (81.8%, n = 108) and were independent in terms of walking ability before their fracture event (75.8%, n = 100). Risk of malnutrition was 42.4%, with 36.4% assessed as malnourished. No significant differences in terms of characteristics between the participants at baseline and those who completed assessments for PADL and IADL at T1, T2, or T3 were found.

The demographic and clinical characteristics of participants at baseline and at the three postdischarge time points are presented in Table 1.

Scores for PADL and IADL and their subscales at T1, T2, and T3 are shown in Table 2. The mean scores for total PADL at both T2 and T3 had increased significantly over T1 (p < .01). In addition, with the exception of eating, bathing, and grooming, the PADL subscale scores increased significantly between T1 and T2 (p < .01). Furthermore, at T3, only eating and grooming scores had not improved significantly from T1. By contrast, the total mean score for IADL showed a significant increase at T3 only. In terms of IADL subscale scores, only housework increased between T1 and T2 (p < .01), whereas scores for taking medication and managing money decreased (p < .01). In terms of comparing subscales scores at T3 with those at T1, taking medication and managing money remained significantly lower (p < .01). However, with the exception of telephone usage, all of the other subscales had significantly improved (p < .01). The graphs for the total scores and subscales scores at the three time points illustrate the postdischarge changes in PADL (Figure 2A and B) and IADL (Figure 2C and D).

Variables shown to have a significant influence on changes in total scores for PADL and IADL were examined using GEE analysis (Table 3). The influence of time after hospital discharge on
changes in PADL and IADL is examined in Model 1. PADL scores significantly increased between T1 and T2 ($\beta = 11.65$, 95% CI [10.47, 12.83], $p < .001$) and further increased significantly from T2 to T3 ($\beta = 10.93$, 95% CI [9.77, 12.09], $p < .001$). However, no significant increase in IADL scores between T1 and T2 was found, although IADL scores were significantly higher at T3 than at either T1 ($\beta = 1.59$, 95% CI [1.39, 1.79], $p < .001$) or T2 ($\beta = 1.63$, 95% CI [1.43, 1.84], $p < .001$).

The influence of time and personal variables on changes in PADL and IADL is examined in Model 2. In this study, the significant predictors of lower mean PADL scores during the first 6 months after hospital discharge were found to be age and having a prefracture walking ability classification of “dependent” ($\beta = -0.96$, 95% CI [-1.11, -0.81], $p < .001$) and having public health insurance ($\beta = -6.23$, 95% CI [-10.73, -1.73], $p = 0.007$, respectively). Furthermore, significant predictors of a lower IADL score were shown to be age and depression ($\beta = -0.13$, 95% CI [-0.14, -0.12], $p < .001$, and $\beta = -0.29$, 95% CI [-0.56, -0.01], $p = 0.037$, respectively).

Extrinsic variables with GEE analysis were added in Model 3. The variables found to be significant predictors of having a lower mean PADL score were age, having a prefracture walking ability classification of “dependent,” and having public health insurance ($\beta = -0.97$, 95% CI [-1.12, -0.82], $p < .001$; $\beta = -6.02$, 95% CI [-10.44, -1.61], $p = 0.007$; and $\beta = -5.56$, 95% CI [-10.17, -0.94], $p = 0.018$, respectively). Furthermore, significant predictors of a lower IADL score were shown to be age and depression ($\beta = -0.13$, 95% CI [-0.14, -0.12], $p < .001$, and $\beta = -0.29$, 95% CI [-0.56, -0.01], $p = 0.037$, respectively).

**Discussion**

The mean total scores for PADL and IADL both increased significantly between 1 and 6 months postdischarge. However, only the mean total PADL score was significantly higher at 3 months postdischarge. These findings suggest improvements in functional status for older persons after surgery for hip fracture are realized more slowly in the dimension of IADL than PADL. In addition to time, age was associated with poorer PADL and IADL outcomes. Moreover, depression was found to be a predictor of poorer IADL, whereas having a
prefracture walking ability classification of “dependent” and holding public health insurance were shown to be predictors of poorer PADL.

Bathing and grooming were the only PADL subscale variables that had not significantly improved at 3 months compared with 1 month postdischarge. Moreover, although the bathing score had improved significantly by 6 months postdischarge, grooming had not. The lag in improvement in bathing may be explained by the need to engage the lower extremities when transferring from one position to another during bathing, which is an ability that is slow to recovery after hip fracture surgery (Shyu et al., 2004). The finding in this study that participant mobility was almost at the level of “independent” at 6 months agrees with a recent study of functional outcomes in older adults in Japan in which walking ability reached an “independent” level in > 50% of patients by 6 months after hip fracture surgery (Takahashi et al., 2020).

In comparing IADL subscale scores over time, only the ability to do housework had improved by 3 months postdischarge. Two of the measured activities (taking medication and managing money) actually declined over the same period. A literature review focused on studies of older individuals after surgery for hip fracture conducted by Dyer et al. (2016) showed that most IADL scores required a full year to return to prefracture levels. The findings in this study regarding activities such as shopping, food preparation, housework, cleaning, and transportation support the need highlighted by Dyer et al. for a longer recovery time to achieve prefracture IADL levels. Although these IADL scores were significantly better at 6 months

| Table 1 |
|---|
| Demographic and Clinical Characteristics of Participants Predischarge (Baseline) and at 1 Month (T1), 3 Months (T2), and 6 Months (T3) Postdischarge |

| Characteristic | Baseline (n = 132) | T1 (n = 128) | T2 (n = 117) | T3 (n = 109) | p |
|---|---|---|---|---|---|
| Age (years; mean and SD) | 69.67 | 9.26 | 69.44 | 9.24 | 69.21 | 9.10 | 69.00 | 9.12 | .984 |
| Gender | .966 | .999 | .999 | .999 |
| Female | 53 | 40.2 | 52 | 40.6 | 48 | 41.0 | 43 | 39.4 | .996 |
| Male | 79 | 59.8 | 76 | 59.4 | 69 | 69.0 | 66 | 66.0 |
| Type of surgery | .999 | .999 | .999 | .999 |
| Internal fixation | 64 | 48.5 | 60 | 46.9 | 55 | 47.0 | 51 | 46.8 |
| Arthroplasty | 68 | 51.5 | 68 | 53.1 | 62 | 53.0 | 58 | 53.2 |
| Comorbidities | .999 | .999 | .999 | .999 |
| ≤ 1 | 24 | 18.2 | 23 | 18.0 | 21 | 17.9 | 19 | 17.4 | .999 |
| ≥ 2 | 108 | 81.8 | 105 | 82.0 | 96 | 82.1 | 90 | 82.6 |
| Length of hospital stay | .999 | .999 | .999 | .999 |
| ≤ 2 weeks | 79 | 59.8 | 78 | 60.9 | 73 | 62.4 | 66 | 60.6 | .999 |
| > 2 weeks | 53 | 40.2 | 50 | 39.1 | 44 | 37.6 | 43 | 39.4 |
| Prefracture walking ability | .959 | .966 | .774 | .999 |
| Dependent | 32 | 24.2 | 31 | 24.2 | 26 | 22.2 | 24 | 22.0 |
| Independent | 100 | 75.8 | 97 | 75.6 | 91 | 77.8 | 85 | 78.0 |
| GDS-SF score | .966 | .966 | .986 | .999 |
| < 5 (no depression) | 98 | 74.2 | 96 | 75.0 | 88 | 75.2 | 84 | 77.1 |
| ≥ 5 (depression) | 34 | 25.8 | 32 | 25.0 | 29 | 24.8 | 25 | 22.9 |
| MNA score | .774 | .774 | .774 | .774 |
| < 17 (malnourished) | 48 | 36.4 | 45 | 35.2 | 41 | 35.0 | 27 | 33.9 |
| 17–23.5 (risk of malnutrition) | 56 | 42.4 | 56 | 43.8 | 54 | 46.2 | 51 | 46.8 |
| ≥ 24–30 (well-nourished) | 28 | 21.2 | 27 | 21.1 | 22 | 18.8 | 21 | 19.3 |
| Type of insurance | .986 | .986 | .986 | .986 |
| Public | 126 | 95.5 | 122 | 95.3 | 111 | 94.9 | 103 | 94.5 |
| Private | 6 | 4.5 | 6 | 4.7 | 6 | 5.1 | 6 | 5.5 |
| Place of residence | .999 | .999 | .999 | .999 |
| Urban | 58 | 43.9 | 56 | 43.8 | 51 | 43.6 | 47 | 43.1 |
| Rural | 74 | 56.1 | 72 | 56.3 | 66 | 56.4 | 62 | 56.9 |

Note: GDS-SF = Geriatric Depression Scale-Short Form; MNA = Mini Nutritional Assessment tool.

* One-way analysis of variance. ** Chi-square test. *** Prefracture walking ability determined by Barthel Index for mobility: dependent = a score of 0, 1, or 2; independent = a score of 3.
Table 2
Mean Total Scores and Subscale Scores for Functional Status at 1 Month (T1), 3 Months (T2), and 6 Months (T3) After Hospital Discharge, and Changes in Scores From T1, Examined by GEE Analysis

| Functional Status          | T1 (n = 128) | T2 (n = 117) | T3 (n = 109) | T1-T2 | T2-T3 | T1-T3 |
|----------------------------|--------------|--------------|--------------|-------|-------|-------|
|                            | Mean  | SD  | Mean  | SD  | Mean  | SD  | p     | p     | p     |
| Total PADL (range: 0–100)  | 62.66 | 14.52 | 74.66 | 14.76 | 85.70 | 12.21 | .001  | .001  | .001  |
| Subscales                  |       |     |       |     |       |     |       |       |       |
| Eating                     | 9.88  | 0.79 | 9.96  | 0.46 | 10.00 | 0.00 | .161  | .167  | .169  |
| Bathing                    | 0.51  | 1.51 | 0.60  | 1.63 | 4.82  | 0.94 | .154  | .001  | .001  |
| Grooming                   | 4.49  | 1.51 | 4.49  | 1.52 | 4.59  | 0.94 | .898  | .232  | .272  |
| Dressing                   | 6.84  | 2.42 | 8.72  | 2.19 | 9.22  | 1.82 | .001  | .001  | .001  |
| Bowel                      | 8.71  | 2.19 | 9.19  | 1.85 | 9.31  | 1.73 | .008  | .351  | .002  |
| Bladder                    | 8.48  | 2.31 | 8.93  | 2.05 | 9.17  | 1.86 | .009  | .078  | .001  |
| Toileting                  | 5.50  | 2.36 | 7.22  | 2.96 | 7.61  | 2.77 | .001  | .006  | .001  |
| Transfer                   | 7.50  | 3.65 | 9.36  | 3.62 | 11.28 | 3.22 | .001  | .001  | .001  |
| Mobility                   | 9.77  | 3.42 | 12.09 | 3.36 | 13.99 | 2.23 | .001  | .001  | .001  |
| Climbing stairs            | 1.05  | 2.63 | 4.15  | 2.56 | 5.64  | 3.34 | .001  | .001  | .001  |
| Total IADL (range: 0–8)    | 3.02  | 1.32 | 3.09  | 1.30 | 4.72  | 1.85 | .092  | .001  | .001  |
| Subscales                  |       |     |       |     |       |     |       |       |       |
| Telephone usage            | 0.90  | 0.30 | 0.92  | 0.26 | 0.93  | 0.26 | .059  | .667  | .055  |
| Shopping                   | 0.10  | 0.31 | 0.09  | 0.28 | 0.35  | 0.47 | .694  | .001  | .001  |
| Food preparation           | 0.05  | 0.21 | 0.06  | 0.23 | 0.22  | 0.41 | .364  | .001  | .001  |
| Housework                  | 0.31  | 0.46 | 0.96  | 0.20 | 0.99  | 0.09 | .001  | .158  | .001  |
| Cleaning                   | 0.11  | 0.31 | 0.15  | 0.36 | 0.65  | 0.47 | .064  | .001  | .001  |
| Transportation             | 0.02  | 0.15 | 0.03  | 0.18 | 0.55  | 0.50 | .501  | .001  | .001  |
| Taking medication          | 0.80  | 0.40 | 0.44  | 0.49 | 0.53  | 0.50 | .001  | .009  | .001  |
| Managing money             | 0.72  | 0.45 | 0.44  | 0.49 | 0.50  | 0.50 | .001  | .078  | .001  |

Note. GEE = generalized estimating equation; PADL = physical activity of daily living; IADL = instrumental activity of daily living.

*PADL generalized estimating equation T1-T2, T2-T3, and T1-T3. *IADL generalized estimating equation T1-T2, T2-T3, and T1-T3.

Figure 2
Description of Total Scores and Subscale Scores for Functional Status of Physical Activities of Daily Living (PADLs) and Independent Activities of Daily Living (IADLs)
than at 1 month after discharge, the mean item scores remained low.

Age was found in this study to be a predictor of both IADL and PADL. In contrast, depression was found to be a predictor of IADL only, whereas dependent prefracture walking ability was found to be a predictor of PADL only. This finding for age is consistent with a prior systematic review of hip fracture studies that showed age (> 60 years) to be significantly associated with slower recovery of functional activities (Wallace & Ellington, 2014). This same review also reported that depression had been shown in several studies to be associated with a poorer total IADL score (Cristancho et al., 2016; Wallace & Ellington, 2014). In addition, depression in prefracture walking ability has consistently been shown to adversely affect post-hip-fracture recovery (Ko, 2019; Mallick et al., 2020). This same review also reported that depression was found to be a predictor of slower recovery of functional activities (Wallace & Ellington, 2014). In addition, depression in prefracture walking ability has consistently been shown to adversely affect post-hip-fracture recovery (Ko, 2019; Mallick et al., 2020).

Difficulties faced by older persons in Indonesia in performing ADL after hospital discharge have also been reported to be associated with the inability of families to facilitate rehabilitation, lack of public transportation to healthcare services, and the low concentration of healthcare services in urban areas (Mahendradhata et al., 2017). Healthcare facilities that are accessible to older individuals are not yet widely available in Indonesia because of an insufficient focus of public attention on older adult healthcare and the cultural assumption that older age is associated with weakness and illness (Setiawan et al., 2017). A study conducted in Taiwan on factors that influence improvements after hip fracture surgery of PADL and IADL in older adults suggests that the home environment and availability of rehabilitation services may significantly affect patients’ recovery of functional status (Shyu et al., 2004). In addition, interventions that increase self-confidence to perform rehabilitation exercises may improve functional status in older adults after hip fracture surgery (Shyu et al., 2004; Zidén et al., 2008). Therefore, the constraints experienced in home environments and clinics in Indonesia’s current healthcare system may influence functional recovery negatively.

Almost all of the participants in this study (95%) had public health insurance (Jamkesmas), which was found to be a predictor of poorer PADL scores, as compared with participants who had private insurance. This finding may be explained by the nature of Indonesia’s government-run public healthcare system, which is challenged with patient overcrowding, inadequate primary care facility numbers, and poor quality of care (Agustina et al., 2019). Public health insurance is often perceived as being inferior in quality to private insurance (Sparrow et al., 2013), which is the case in Indonesia. Public health insurance provides less support than private insurance for subacute rehabilitation after hip fracture surgery, with this inequity affecting both inpatient and outpatient services (Erlangga et al., 2019). Additional barriers include the requirement that patients cover all indirect costs and the need to travel long distances to utilize healthcare services (Sparrow et al., 2013). Therefore, the inadequacy of services provided by public health insurance and the limited or nonexistent access to subacute rehabilitation may have contributed to the slow improvement in PADL scores after hip fracture surgery.

### Table 3

Linear Regression With GEE for Models of Significant Predictors of Changes in Functional Status for PADL and IADL

| Variable                                      | PADL            | IADL            |
|-----------------------------------------------|-----------------|-----------------|
|                                               | β               | 95% CI          | β               | 95% CI          |
| Model 1 (time)                                |                 |                 |                 |                 |
| T2 vs. T1                                     | 11.65           | 10.47           | 12.83           | .001            | 0.03            | −0.00           | 0.08            | .092            |
| T3 vs. T1                                     | 22.61           | 21.18           | 24.03           | .001            | 1.63            | 1.43            | 1.84            | .001            |
| T3 vs. T2                                     | 10.93           | 9.77            | 12.09           | .001            | 1.59            | 1.39            | 1.79            | .001            |
| Model 2 (Time × Personal Variables)           |                 |                 |                 |                 |
| Age                                           | −0.96           | −1.11           | −0.81           | .001            | −0.13           | −0.14           | −0.12           | .001            |
| Prefracture walking, dependent a              | −6.23           | −10.73          | −1.73           | .007            | −              | −              | −              | −              |
| Depression b                                  | −              | −              | −              | −              | −0.29           | −0.56           | −0.01           | .037            |
| Model 3 (Time × Personal Variables × Extrinsic Variables) |                 |                 |                 |                 |
| Age                                           | −0.97           | −1.12           | −0.82           | .001            | −0.13           | −0.14           | −0.12           | .001            |
| Prefracture walking, dependent a              | −6.02           | −10.44          | −1.61           | .007            | −              | −              | −              | −              |
| Depression b                                  | −              | −              | −              | −              | −0.29           | −0.56           | −0.01           | .037            |
| Health insurance, public c                    | −5.56           | −10.17          | −0.94           | .018            | −              | −              | −              | −              |

Note. GEE = generalized estimating equation; PADL = physical activity of daily living; IADL = instrumental activity of daily living; CI = confidence interval; T1 = 1 month postdischarge (n = 128); T2 = 2 months postdischarge (n = 117); T3 = 3 months postdischarge (n = 132).

a Prefracture walking ability, dependent = a score of 0, 5, or 10 on the mobility domain of Barthel Index, compared with independent = 15. b A score on the Geriatric Depression Scale-Short Form of ≥5 (depression) versus <5 (no depression). c Health insurance = public versus private. d Model 1 = influence of time after hospital discharge. e Model 2 = influence of time + personal variables—personal variables of gender, length of hospital stay, number of comorbidities, type of surgery, and nutritional status were not significant predictors of functional status. f Model 3 = influence of time + personal variables + extrinsic variables—extrinsic variable of residence was not a significant predictor of change in functional status.
Type of health insurance was the only extrinsic variable found to predict functional status, and it was shown to be a predictor for PADL only. Pinto et al. (2016) reported that, in 2016, nearly 186 million individuals in Indonesia (76% of the total population) were covered under the Indonesian national health insurance program (Jaminan Kesehatan Nasional). It is estimated that 22.5% of the Indonesian population is uninsured and only 1.5% have private health insurance (Mahendra, et al., 2017). Therefore, the influences of the type and the presence or absence of health insurance are issues that should be explored in future studies.

Research Limitations
This study was affected by several limitations. First, the sample population was recruited from only one hospital in Central Java, Indonesia, which may limit the generalizability of the findings to the rest of the country. Second, Indonesia has different types of public health insurance that offer varying provisions for patients, which could have differing impacts on postsurgical recovery. However, data were not collected regarding public insurance subtypes in this study. In addition, all of the participants had either public or private health insurance. This may reflect the need for insurance subsidization to cover the high cost of hip fracture surgery.

Third, data regarding income, which is an important extrinsic variable, were not collected. However, public and private insurance may adequately reflect low and high income status, respectively. Fourth, PADL and IADL measures were not obtained from the participants before surgery. Only measures of patients' prefracture walking ability were available. Therefore, recovery of postdischarge functional status could not be determined. Moreover, a significant limitation of the findings is that ADL was assessed using interviewer observations and self-reporting by the participants or family members rather empirical testing, which may bias the results because of subjective overestimation/underestimation. Finally, additional variables that may be predictors of functional status after discharge such as availability of rehabilitation and/or support from family or caregivers, postsurgical pain, and fear of falling were not considered. Therefore, future studies should consider the extrinsic variable of income, objective assessments of functional status, and additional dependent variables to obtain a broader picture of the predictors of poor functional status after hip fracture surgery.

Conclusions
The longitudinal changes over 6 months after hospital discharge after hip fracture surgery for older adults in Indonesia differed between PADL and IADL. The total mean PADL score had improved at both 3 and 6 months after discharge compared with 1 month, whereas no significant improvement in the total mean IADL score was detected until 6 months. The predictors of poorer outcomes for IADL found in this study included the personal variables of age and depression. Predictors of poorer outcomes for PADL included age and dependent prefracture walking ability as well as the extrinsic variable of public health insurance.

The above findings suggest that time after hospital discharge should be considered when healthcare providers evaluate improvements in functional status for older patients recovering from hip fracture surgery. Nurses should take note of how much time has transpired since hospital discharge when determining appropriate nursing care and rehabilitation interventions for patients because of the different trajectories of change in PADL and IADL. In addition, to identify older individuals at risk for poor recovery, comprehensive assessments of patients before hospital discharge should consider patient age, depressive status, prefracture walking ability, and type of health insurance. Finally, support for recovery should include providing home nursing or subacute rehabilitation support that is tailored to the needs of each patient.

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