

Predictors of 3-Month Mortality in Elderly Patients Visiting the Emergency Department: A Retrospective Cohort Study

Syafitri Yuliani, Aulia Rizka¹, Ceva Wicaksono Pitoyo², Muhadi Muhadi³

Department of Internal Medicine, Faculty of Medicine, Dr. Cipto Mangunkusumo National Hospital, Universitas Indonesia, ¹Department of Internal Medicine, Geriatrics Division, Faculty of Medicine, Dr. Cipto Mangunkusumo National Hospital, Universitas Indonesia, ²Department of Internal Medicine, Respiratory and Critical Care Division, Faculty of Medicine, Dr. Cipto Mangunkusumo National Hospital, Universitas Indonesia, ³Department of Internal Medicine, Cardiology Division, Faculty of Medicine, Dr. Cipto Mangunkusumo National Hospital, Universitas Indonesia, Jakarta, Indonesia

Abstract

Objective: Various studies have documented the cases of failure to thrive among elderly patients following admission to the emergency department (ED), leading to early mortality. However, studies determining the predictors of 3-month mortality in elderly patients visiting the ED in Indonesia are lacking. **Materials and Methods:** A retrospective cohort study was performed using secondary data of elderly patients in the ED at Dr. Cipto Mangunkusumo National Hospital between September 2016 and January 2017. We gathered 3-month mortality data using medical records and telephone interviews. Functional status decline, cognitive function impairment, polypharmacy, delirium, frailty, hypoalbuminemia, malnutrition risk, and Rapid Emergency Medicine Score were analyzed using the Chi-square test. Multivariate logistic regression analysis was performed to identify independent predictors of mortality. **Results:** From the 501 patients studied, 36 (7.2%) were lost to follow-up. A total of 465 patients were evaluated, with a median age of 67 years old (60–89). The overall 3-month mortality of elderly patients admitted to the ED was 32.5%. The independent predictors of 3-month mortality obtained from the multivariate analysis were functional status decline (odds ratio [OR]: 3.05; 95% confidence interval [CI]: 1.63–5.73), polypharmacy (OR: 2.65; 95% CI: 1.74–4.04), delirium (OR: 2.01; 95% CI: 1.26–3.21), and hypoalbuminemia (OR: 1.89; 95% CI: 1.02–3.50). **Conclusion:** Functional status decline, polypharmacy, delirium, and hypoalbuminemia are independent predictors of 3-month mortality among elderly patients in the ED.

Keywords: 3-month mortality, elderly, emergency department, predictors

INTRODUCTION

The elderly population is rapidly increasing, both worldwide and in Indonesia.^[1,2] The increasing elderly population entails a corresponding increase in the number of elderly people visiting emergency departments (EDs), raising concerns about mortality risks.^[3,4] A report from Dr. Cipto Mangunkusumo Hospital, a national referral hospital in Jakarta, indicated that 3211 (15%) elderly patients visited the ED in 2015.^[5] Providing high-quality emergency care for elderly people is challenging, as they tend to have a greater burden of comorbidities and higher rates of serious illness.^[6] The Comprehensive Geriatric Assessment (CGA) is a widely used tool for examining elderly patients.^[7] The CGA contains several components, including biopsychosocial problems, physical complaints, psychological condition, functional status, nutritional status, cognitive function, and interactions between these factors. Because the ED environment requires immediate action, the adoption

of the CGA has been difficult.^[7] Furthermore, the busy atmosphere of the ED is not an appropriate environment for elderly patient care, particularly for patients with dementia or delirium. Emergency health-care providers are expected to make accurate decisions regarding admission or discharge of patients within a short time frame and are required to see large numbers of elderly patients.^[6] Elderly individuals are at a higher risk of functional decline and medical complications following an ED visit. Various studies have documented cases of failure to thrive among elderly people at 3 months following admission. Elderly patients were reported to be not only more

Address for correspondence: Dr. Syafitri Yuliani, Department of Internal Medicine, Faculty of Medicine, Dr. Cipto Mangunkusumo National Hospital, Universitas Indonesia, Jl. Diponegoro No. 71, Central Jakarta 10440, Indonesia. E-mail: syafitri_yuliani@yahoo.com

Access this article online

Quick Response Code:



Website:
www.jnsbm.org

DOI:
10.4103/jnsbm.JNSBM_32_19

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Yuliani S, Rizka A, Pitoyo CW, Muhadi M. Predictors of 3-month mortality in elderly patients visiting the emergency department: A retrospective cohort study. *J Nat Sc Biol Med* 2019;10:S48-52.

likely to experience a deterioration of activities of daily living following hospitalization, but they are also less likely to fully recover at 3 months following discharge.^[8] Studies of 3-month mortality of elderly people in the ED are limited; a study by Limor *et al.*^[9] found that only immobility was associated with 3-month mortality of elderly in ED, whereas another study by Gentile *et al.* found that the presence of comorbidity and malnutrition was associated with 3-month mortality.^[10] None of these previous studies were conducted in Indonesia.

Considering the merit of developing and introducing strategies to improve outcomes among elderly patients in the ED, it is necessary to explore predictors of 3-month mortality in elderly patients visiting the ED. To address this question, the current study aimed to investigate factors predicting 3-month mortality in elderly patients visiting a national referral hospital in Jakarta, Indonesia.

MATERIALS AND METHODS

We conducted a retrospective cohort study using secondary data on elderly patients visiting the ED at Dr. Cipto Mangunkusumo General Hospital between September 2016 and January 2017. Patients were elderly (>60 years old) patients at the ED, who were recruited consecutively and asked questions from the validated Identification of Seniors at Risk (ISAR) questionnaires and other variables. The secondary data were obtained using questionnaires as well as direct measurements of several variables. We excluded patients whose outcome was unknown from the study sample. This study was approved by the Ethical Committee of the Faculty of Medicine, Universitas Indonesia/Dr. Cipto Mangunkusumo General Hospital No. 0302/UN2.F1/ETIK/2018.

Eight independent predictors were analyzed

Functional status decline, impaired cognitive function, polypharmacy, delirium, frailty, hypoalbuminemia, malnutrition risk, and Rapid Emergency Medicine Score (REMS), all of which were deemed potential 3-month mortality predictors of elderly patients in the ED.

Functional status decline, impaired cognitive function, and polypharmacy (defined as consumption of more than three types of drugs each day) were obtained using the ISAR questionnaire based on the results of a previous study.^[11] Delirium status was determined from the secondary data of previous research.^[12] Frailty status was determined from the Frailty Index-40 (FI-40) assessment performed when the patient was treated in the ED (frail ≥ 0.25 and nonfrail < 0.25).^[13] Malnutrition was determined based on the results of the Malnutrition Screening Tools (MSTs), in which a score of ≥ 2 indicates the presence of a malnutrition risk and < 2 implies no risk of malnutrition.^[14] Albumin levels are available from the serum albumin laboratory results of the patients (hypoalbuminemia < 3.0 g/dL), which were examined at the time of patient arrival to the ED. The REMS is based on seven parameters (age, mean arterial pressure, heart rate, respiratory rate, body temperature, Glasgow Coma Scale, and

peripheral oxygen saturation), assessed when the patient was first admitted to the ED, with a value of > 17 corresponding to a high risk and a value of ≤ 17 corresponding to a low risk.

We defined 3-month mortality as the occurrence of death within 3 months following admission to the ED, within the time frame between September 2016 and January 2017. The 3-month mortality of patients was determined from medical records or telephone interviews.

In the current study, the predictor variables were used as independent variables and the 3-month mortality was the dependent variable. The collected data were analyzed using IBM SPSS Statistics for Windows Version 23.0 (SPSS Inc.). The Chi-square test was used for bivariate analysis, and the results were presented in terms of relative risk (RR) and 95% confidence interval (CI). All bivariate analysis variables with $P < 0.25$ were included in the multivariate analysis. Multivariate logistic regression analysis was performed to identify the independent predictors of 3-month mortality. The final logistic regression results are presented as odds ratio (OR) and 95% CI to identify the factors influencing 3-month mortality in older adults at the ED.

RESULTS

A total of 501 elderly patients were admitted to the ED in the study period. Of these, 36 (7.2%) patients were unable to be contacted and were considered lost to follow-up. As a result, 465 (92.8%) patients met the inclusion criteria and had a median age of 67 years (60–89). The baseline characteristics of the patients are summarized in Table 1.

The 3-month mortality rate of patients in the ED was 32.5% ($n = 151$), comprising 81 (53.64%) males and 70 (46.36%) females. Functional status decline (RR: 2.71; 95% CI: 1.64–4.49; $P < 0.001$), impaired cognitive function (RR: 1.63; 95% CI: 1.20–2.21; $P = 0.004$), delirium (RR: 1.72; 95% CI: 1.33–2.22; $P < 0.001$), frailty (RR: 1.52; 95% CI: 1.13–2.04; $P = 0.010$), polypharmacy (RR: 1.89; 95% CI: 1.42–2.52; $P < 0.001$), and hypoalbuminemia (RR: 1.53; 95% CI: 1.11–2.12; $P = 0.018$) had significant associations with 3-month mortality following bivariate analysis. Meanwhile, malnutrition risk (RR: 1.21; 95% CI: 0.93–1.57; $P = 0.161$) and REMS (RR: 1.19; 95% CI: 0.59–2.40; $P = 0.640$) exhibited nonsignificant associations with 3-month mortality following bivariate analysis [Table 2]. Multivariate analysis was performed on all predictor variables that met the requirements (variables with $P < 0.25$ in bivariate analysis) [Table 3]. The independent predictors of 3-month mortality following the multivariate analysis were functional status decline (OR: 3.05; 95% CI: 1.63–5.73), polypharmacy (OR: 2.65; 95% CI: 1.74–4.04), delirium (OR: 2.01; 95% CI: 1.26–3.21), and hypoalbuminemia (OR: 1.89; 95% CI: 1.02–3.50).

DISCUSSION

The median age of 67 years (range of 60–89 years) in this study

Table 1: Demographics and clinical characteristics of participants (n=465)

Characteristics	Total, n (%)
Age (years)	67 (60-89)
Age category (years old)	
60-69	271 (58.3)
≥70	194 (41.7)
Gender	
Male	257 (55.3)
Female	208 (44.7)
Level of education	
No formal education	6 (1.3)
Elementary school	126 (27.1)
Junior high school	112 (24.1)
Senior high school	144 (31.0)
Tertiary education (e.g., academy and university)	77 (16.6)
Health insurance	
National insurance (JKN)	333 (72)
Others	132 (28)
Chief complaint	
Shortness of breath	118 (25.3)
Loss of consciousness	58 (12.5)
Lethargic	46 (9.9)
Hemiparesis	45 (9.6)
Low intake	42 (9.0)
Bloody defecation	32 (6.8)
Chest pain	31 (6.6)
Seizure	25 (5.3)
Abdominal pain	19 (4.1)
Fever	12 (2.5)
Main diagnosis	
Pneumonia	89 (19.1)
Sepsis	72 (15.5)
Acute coronary syndrome	70 (15.0)
Heart failure	59 (12.7)
Cerebrovascular disease	52 (11.2)
Cancer	34 (7.3)
End-stage renal disease	17 (3.6)
Electrolyte imbalance	12 (2.5)
Diabetes mellitus	7 (1.5)
Triage	
Red	130 (28)
Yellow	260 (55.9)
Green	75 (16.1)
Frailty status (FI-40)	
Fit	162 (34.8)
Prefrail	233 (50.1)
Frail	70 (15.1)
REMS	
0-7	312 (67)
8-17	141 (30.4)
>17	12 (2.6)
Questionnaire source	
Patient	256 (55)
Patient and informant	113 (24.3)
Informant	76 (16.3)
Unconscious patient and informant not present	20 (4.4)

JKN: Jaminan Kesehatan Nasional, REMS: Rapid Emergency Medicine Score, FI-40: Frailty Index-40

was substantially lower than similar studies conducted in other countries.^[9,10] The cutoff point for elderly age classification in Indonesia is younger than many other countries, which may explain this difference in results. The current results also revealed that, among the patients, 257 (55.3%) were male and 208 (44.7%) were female. Previous studies in other countries involved variable sex distributions. Gentile *et al.*'s^[10] sample was 58.6% male, whereas Limor *et al.*'s^[9] sample was 35.9% male. Aging women are more susceptible to several illnesses and disabilities, although men are more prone to cardiovascular diseases, including heart disease and stroke.^[15] The most frequently diagnosed disease in the current study was pneumonia. Pneumonia is one of the leading causes of death due to infectious disease in developing as well as developed countries. The reported incidence of pneumonia varies between 8 and 15 cases per 1000 people per year and increases with age. In elderly populations, the incidence has been reported to increase by up to 2–4 times.^[16]

A 3-month mortality rate of elderly patients visiting the ED in Indonesia in the current study was 32.5%. This figure is higher compared with reports from other countries, with rates of 16.6% reported by Limor *et al.*^[9] and 14.6% reported by Gentile *et al.*^[10] This difference in results may be related to differences in the characteristics of the research patients. Elderly patients in Indonesia tend to visit the ED only for severe complaints. This phenomenon is reflected in the proportion of patients classified as green during the triage process, which was found to be only 16.1% in this study. We observed an association between preadmission functional status decline, polypharmacy, delirium status, and hypoalbuminemia with 3-month mortality among elderly patients in the ED, which is supported by various studies. Silva *et al.*^[17] studied mortality in the elderly and found that it was associated with functional status decline, delirium status, and hypoalbuminemia. However, this study was limited to inpatients. Gentile *et al.*^[10] and Limor *et al.*^[9] examined 3-month mortality among elderly patients in the ED. However, their studies did not include delirium, hypoalbuminemia, frailty, or REMS score as variables. Wang *et al.*^[18] reported that polypharmacy was a common phenomenon among elderly people and was associated with different clinical outcomes, such as adverse drug reactions (OR: 1.21; 95% CI: 1.17–1.28), fall risk (OR: 1.18; 95% CI: 1.10–1.26), disability, and 3-month mortality (OR: 1.9; 95% CI: 1.12–1.23). Pasina *et al.*^[19] also reported that hypoalbuminemia was associated with 3-month mortality among nononcological hospitalized elderly patients (OR: 2.47; 95% CI: 1.12–5.44).

The current results revealed that impaired cognitive function and frailty were not associated with 3-month mortality among elderly people treated in the ED. This finding is in accordance with the existing literature.^[9,10] However, a number of other studies reported that frailty predicts mortality in the elderly. For example, a study performed by Fuentes *et al.*^[20] revealed that frailty increases mortality rate, with a hazard ratio of 3.91 (95% CI: 2.69–5.68). The presence of functional status decline in the FI-40 may be the primary cause of this difference,

Table 2: Bivariate analysis

Variable	Frequency		P	RR	95% CI
	Deceased, n (%)	Alive, n (%)			
Functional status decline					
Yes	137 (37.6)	227 (62.4)	<0.001	2.71	1.64-4.49
No	14 (13.9)	87 (86.1)			
Impaired cognitive function					
Yes	28 (49.1)	29 (50.9)	0.004	1.63	1.20-2.21
No	123 (30.1)	285 (69.9)			
Delirium					
Yes	52 (47.7)	57 (52.3)	<0.001	1.72	1.33-2.22
No	99 (27.8)	257 (72.2)			
Frailty status					
Yes	32 (45.7)	38 (54.3)	0.010	1.52	1.13-2.04
No	119 (30.1)	276 (69.9)			
Polypharmacy					
Yes	101 (42.1)	139 (57.9)	<0.001	1.89	1.42-2.52
No	50 (22.2)	175 (77.8)			
Hypoalbuminemia					
Yes	24 (47.1)	27 (52.9)	0.018	1.53	1.11-2.12
No	127 (30.7)	287 (69.3)			
REMS					
High	5 (38.5)	8 (61.5)	0.640	1.19	0.59-2.40
Others	146 (32.3)	306 (67.7)			
Malnutrition risk					
Yes	67 (36.2)	118 (63.8)	0.161	1.21	0.93-1.57
No	84 (30.0)	196 (70.0)			

RR: Relative risk, CI: Confidence interval, REMS: Rapid Emergency Medicine Score

Table 3: Multivariate analysis

Predictor variables	P	OR	95% CI
Functional status decline	<0.001	3.06	1.63-5.73
Polypharmacy	<0.001	2.65	1.74-4.04
Delirium	0.003	2.01	1.26-3.22
Hypoalbuminemia	0.042	1.89	1.02-3.50

OR: Odds ratio, CI: Confidence interval

preventing frailty from being a significant predictor of 3-month mortality and confirming the role of functional status decline in influencing 3-month mortality among elderly patients visiting the ED.

A study by Gentile *et al.*^[10] reported that malnutrition was a predictive factor of mortality among elderly patients presenting to the ED (OR: 20.2; 95% CI: 5.74–71.35). However, there was a difference in the instrument used. While the current study evaluated malnutrition risk using the MST, Gentile *et al.* used the Mini Nutritional Assessment Short-Form. The MST is considered an effective screening tool that can be easily and quickly administered by health workers.^[14] However, the results obtained from this tool only predict the likelihood of a patient being malnourished and not the diagnosis of malnutrition itself. Neelemaat *et al.*^[21] stated that after screening was performed, further nutritional status assessment by a professional is necessary. In addition, there were no differences in the proportion of mortality between the two groups. The

risk of mortality among elderly individuals with a risk of malnutrition was 36.2%, whereas that in individuals without a risk of malnutrition was 30%. The phenomenon discussed above reduced the power of the current study to only 27%, which was too low to conclude that a significant difference was found.

Among the elderly patients in this study, the REMS results had no association with 3-month mortality in the ED. The REMS is considered a useful instrument to stratify patients in the ED.^[22] However, elderly patients may have atypical manifestations of various diseases. The existence of a high rate of comorbidity in the elderly population also complicates effective clinical approaches.^[23] This study has several limitations that should be taken into consideration. First, this was a single-center retrospective cohort study that obtained data from medical records and telephone interviews. Therefore, there is a possibility of information bias and missing data. Second, the limitations of variables in the secondary data may have led to a lack of independent factors predicting mortality in the ED. Nevertheless, despite these limitations, this was the first study to examine the factors predicting 3-month mortality among elderly patients visiting the ED of Dr. Cipto Mangunkusumo General Hospital, a national referral hospital in Jakarta, Indonesia. In conclusion, the current results revealed that functional status decline, polypharmacy, delirium, and hypoalbuminemia were independent predictors of 3-month mortality among elderly patients in the ED in Indonesia.

CONCLUSION

Functional status decline, polypharmacy, delirium, and hypoalbuminemia are independent predictors of 3-month mortality among elderly patients in the ED.

Acknowledgments

The authors would like to thank all the participants of this study, the Geriatric Division, and the patients at the ED of Cipto Mangunkusumo General Hospital who have tremendously supported this research. This study was partially funded by the Hibah PITTA Universitas Indonesia grant (Publikasi Terindeks Internasional Untuk Tugas Akhir Mahasiswa UI).

Financial support and sponsorship

Geriatric Division, and the patients at the ED of Dr. Cipto Mangunkusumo General Hospital, Hibah PITTA for partially funding the research. The 3rd ICE on IMERI committee supported the peer review and manuscript preparation of this article.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. He W, Goodkind D, Kowal P. An Aging World: 2015 International Population Reports. Vol. 1. Washington DC: U.S. Census Bureau; 2016. p. 1-13.
2. Suzman R, Beard J. Global Health and Aging. Vol. 1(4): NIH Publication; 2011. p. 2737.
3. Center of Data and Information of the Ministry of Health of the Republic of Indonesia. The situation of elderly in Indonesia in 2017. In: Analysis of the Elderly in Indonesia 2017. Jakarta: The Ministry of Health the Republic of Indonesia; 2017. p. 1-2.
4. McCabe JJ, Kennelly SP. Acute care of older patients in the emergency department: Strategies to improve patient outcomes. *Open Access Emerg Med* 2015;7:45-54.
5. Cipto Mangunkusumo Hospital. Data of Patient Visit in Emergency Department of Cipto Mangunkusumo Hospital in 2015. Jakarta: Cipto Mangunkusumo Hospital; 2016.
6. Carpenter CR, Shelton E, Fowler S, Suffoletto B, Platts-Mills TF, Rothman RE, *et al.* Risk factors and screening instruments to predict adverse outcomes for undifferentiated older emergency department patients: A systematic review and meta-analysis. *Acad Emerg Med* 2015;22:1-21.
7. Ellis G, Marshall T, Ritchie C. Comprehensive geriatric assessment in the emergency department. *Clin Interv Aging* 2014;9:2033-43.
8. Boyd CM, Landefeld CS, Counsell SR, Palmer RM, Fortinsky RH, Kresevic D, *et al.* Recovery of activities of daily living in older adults after hospitalization for acute medical illness. *J Am Geriatr Soc* 2008;56:2171-9.
9. Limor R, Borodin O, Sherman S, Halpern P, Justo D. Emergency department geriatric assessment and short-term mortality in hospitalized elderly medical patients. *Int J Gerontol* 2015;9:211-4.
10. Gentile S, Lacroix O, Durand AC, Cretel E, Alazia M, Sambuc R, *et al.* Malnutrition: A highly predictive risk factor of short-term mortality in elderly presenting to the emergency department. *J Nutr Health Aging* 2013;17:290-4.
11. Rizka A. Modification of Identification of Senior at Risk (ISAR) to Predict 30-Day Mortality of Elderly Visiting Emergency Department [Thesis]. Jakarta: Universitas Indonesia; 2016.
12. Sands MB, Dantoc BP, Hartshorn A, Ryan CJ, Lujic S. Single question in delirium (SQiD): Testing its efficacy against psychiatrist interview, the confusion assessment method and the memorial delirium assessment scale. *Palliat Med* 2010;24:561-5.
13. Setiati S. The concept of frailty in elderly: Definition, pathophysiology, and newest management. In: Management of Frailty as a New Geriatric Giant: How to Deal with Dilemmatic Health Problems in Elderly Patient. Jakarta: Indonesian Geriatric Society Jakarta Branch; 2015. p. 1-17.
14. Platek ME, Hertroijs DF, Nicholson JM, Parekh N. Sensitivity and specificity of malnutrition screening tools used in the adult hospitalized patient setting a systematic review. *Top Clin Nutr* 2015;30:289-301.
15. Hutton D, World Health Organization. Older People in Emergencies: Considerations for Action and Policy Development. World Health Organization: Ageing and Life Course Unit; 2008. p. 13.
16. Luque S, Gea J, Saballs P, Ferrández O, Berenguer N, Grau S. Prospective comparison of severity scores for predicting mortality in community-acquired pneumonia. *Rev Esp Quimioter* 2012;25:147-54.
17. Silva TJ, Jerussalmy CS, Farfel JM, Curiati JA, Jacob-Filho W. Predictors of in-hospital mortality among older patients. *Clinics (Sao Paulo)* 2009;64:613-8.
18. Wang R, Chen L, Fan L, Gao D, Liang Z, He J, *et al.* Incidence and effects of polypharmacy on clinical outcome among patients aged 80+: A five-year follow-up study. *PLoS One* 2015;10:e0142123.
19. Pasina L, Cortesi L, Tiraboschi M, Nobili A, Lanzo G, Tettamanti M, *et al.* Risk factors for three-month mortality after discharge in a cohort of non-oncologic hospitalized elderly patients: Results from the REPOSI study. *Arch Gerontol Geriatr* 2018;74:169-73.
20. Fuentes L, Lebenkoff S, White K, Gerds C, Hopkins K, Potter JE, *et al.* Frailty and mortality outcomes in cognitively normal older people: sex differences in a population-based study. *J Am Geriatr* 2016;93:292-7.
21. Neelemaat F, Meijers J, Kruizenga H, van Ballegooijen H, van Bokhorst-de van der Schueren M. Comparison of five malnutrition screening tools in one hospital inpatient sample. *J Clin Nurs* 2011;20:2144-52.
22. Dunder ZD, Karamercan MA, Ergin M, Colak T, Tuncar A, Ayranci K, *et al.* Rapid Emergency Medicine Score and HOTEL Score in geriatric patients admitted to the emergency department. *Int J Gerontol* 2015;9:87-92.
23. Rizka A. Performance of rapid emergency medicine score (REMS) in predicting 30-day mortality of elderly in emergency department. *J Penyakit Dalam Indones* 2017;4:62-7.