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RESEARCH ARTICLE

Medication complexity and COVID-19 pandemic impact on the cost burden in non-COVID elderly patients at the emergency department

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Abstract

Background: The global increase in the elderly population and the incidence of emergency conditions due to physiological changes pose cost challenges for emergency services. COVID-19 potentially affects the financial burden of medication in elderly patients. **Objective:** To analyse the impact of medication complexity on the cost burden in elderly patients admitted to the Emergency Department (ED) before and during the COVID-19 pandemic. **Method:** A retrospective observational study was conducted among elderly patients (aged > 60 years) who visited ED but were not hospitalised between January to April 2020. The medication complexity was measured using the Medication Regimen Complexity Index (MRCI) while the cost was collected from the hospital information system. **Result:** A total of 321 ED visits were included in this study. The results showed that the mean of the total medication was 3.89 ± 1.70 , while the mean score of the MRCI was 15.20 ± 6.54 . The mean medication cost required was IDR 56,342 for each ED visit. **Conclusion:** This study provided an overview and input to control medication costs for elderly patients in the emergency setting. Interested parties can design policies that are beneficial in economics and therapeutic outcomes.

Introduction

The elderly population is one of the components that make up a country's society, and it reached 9.92% of the total number of Indonesian people in 2020. This condition impacts aspects of life that need to be anticipated, including those related to the health sector (Indonesia Central Statistics Agency, 2020).

In the elderly group, complex physiological conditions occur due to biological changes in the body. Physiological changes in various body systems pose a risk of increasing the severity of the disease and the possibility of complications associated with the disease. In addition, the excretion, metabolism, and distribution of drugs and their action at the receptor site will also be affected by the ageing process in the elderly.

Therefore, these conditions are potential factors for medication complexity (Mancini & Allen, 2018).

Negative health outcomes such as medication non-adherence, adverse drug reactions, inappropriate prescribing, hospitalisation, drug-drug interactions, increased health care costs, and decreased quality of life (QOL) may occur due to the medication complexity in elderly patients. Using tools such as a validated Medication Regimen Complexity Index (MRCI) can reduce medication complexity (Brysch *et al.*, 2018).

The pandemic and spread of CoronaVirus Disease 2019 (COVID-19) has been designated by the World Health Organisation (WHO) a global pandemic since March 11, 2020. To measure the effect on the Emergency Department (ED), a US study compared the number of

ED visits during the four weeks at the beginning of the pandemic to the previous year, resulting in a 42% drop (Hartnett *et al.*, 2020).

The Emergency Department (ED) of Universitas Airlangga Teaching Hospital, one of the health service providers in Surabaya, provides important public services. It contributes health services to the elderly in Surabaya and does not rule out the possibility of experiencing similar problems in the implementation. Research data show that a quarter of all ED visits were to elderly patients. Therefore, to improve the effectiveness and efficiency of services, the value of the medication complexity in elderly patients should be reviewed (Samaras *et al.*, 2010).

This study analysed the medication complexity in patients admitted to the ED. Other outcomes resulted from the analyses of the impact of the medication complexity on cost burdens before and during the COVID-19 pandemic. Furthermore, the study provides an overview and input to improve health service coverage that is more comprehensive, including controlling medical expenses for elderly patients in emergency services.

Methods

Design

A retrospective observational study was conducted at Universitas Airlangga Teaching Hospital. The inclusion criteria were patients aged ≥ 60 who visited the ED, received medication, had complete medical records, and were not hospitalised before and after the first reported COVID-19 case in Universitas Airlangga Teaching Hospital on March 14th, 2020 (Asmarawati *et al.*, 2021). This study was approved by The Research Ethics Committee at the Universitas Airlangga Teaching Hospital. (No. 177/KEP/2020).

Assessment and data analysis

Patients' characteristics and medication were recorded from medical records. Emergency triage colours are distinguished by the severity of the illness. Medication complexity was measured using the Medication Regimen Complexity Index (MRCI) which is a 65-item instrument to quantify medication regimen complexity (Hirsch *et al.*, 2014), consisting of dosage form, dosing frequency, and additional instructions. The cost was stated in Indonesian Rupiah (IDR) value by 2020, collected from the hospital information system, including medicines, disposable medical devices, and pharmacy service fees. The impact of patients' characteristics and MRCI on the cost burden were

further analysed using Spearman's rank correlation coefficient. In contrast, the second outcome was analysed using the Mann-Whitney U Test. All the statistical analyses were measured using IBM SPSS Statistics v.25.

Results

A total of 321 from 1,885 elderly patient visits met the inclusion criteria, and more than half were 60-69 years old (61.7%) and female (56.1%). Most of them who visited the ED were in yellow triage (93.1%) and received more than three medications (99.1%). The patient's characteristics are shown in Table I.

Table I: Patients' characteristics in the emergency department

Characteristics	Category	Frequency
Gender	Male	141 (43.9%)
	Female	180 (56.1%)
Age	60-69	198 (61.7%)
	70-79	100 (31.2%)
	80-89	20 (6.2%)
	90-99	3 (0.9%)
Domicile	Surabaya	310 (96.6%)
	Outside Surabaya	11 (3.4%)
Marital status	Single	5 (1.6%)
	Married	234 (72.9%)
	Widowed	82 (25.5%)
Educational status	Unschooling	7 (2.2%)
	Elementary school	78 (24.3%)
	Middle school	39 (12.1%)
	High school	155 (48.3%)
	Diploma	17 (5.3%)
	Bachelor	19 (5.9%)
Occupational status	Master's degree	6 (1.9%)
	Employed	290 (90.3%)
Payment status	Unemployed/Retired	31 (9.7%)
	Insured	277 (86.3%)
ED Triage	Non insured	44 (13.7%)
	Green	4 (1.2%)
	Yellow	299 (93.1%)
Number of medications received	Red	18 (5.6%)
	>3.89	318 (99.1%)
Total	<3.89	3 (0.9%)
		321 (100%)

Figure 1 shows the top 10 most prescribed drugs in the ED, and the highest percentage was ranitidine at 11.2%.

In this study, MRCI and the COVID-19 pandemic impact the ED's cost burden, as shown in Table II. The mean MRCI score was 15.20 ± 6.54 , while the mean medication cost required was IDR 56,343 for each ED visit. The MRCI score positively correlates with cost burden (Significant value = 0.000), which means the higher the MRCI score, the higher the costs ($r = 0.406$). On average, the initial cost burden was IDR 56,805, which was higher than during the pandemic (IDR 54,006), but it is not statistically significant (Significant value = 0.389). These calculated costs include medicines, disposable medical devices, and pharmacy service fees.

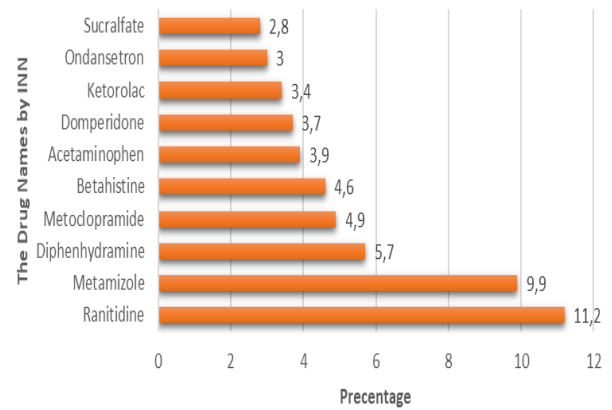


Figure 1: Top 10 most prescribed drugs at the emergency department

Table II: MRCI and COVID-19 pandemic impact on the cost burden at the emergency department

	Mean of cost burden	Number of visits	Significant value	r
MRCI^a (Mean Score: 15.20 ± 6.54)	IDR 56,343	321	0.000 ^b	0.406 ^b
Before COVID-19 pandemic	IDR 56,805	268	0.389 ^c	-
During COVID-19 pandemic	IDR 54,006	53		

^a Medication Regimen Complexity Index; ^b Using Spearman's rank correlation coefficient; 95% CI; ^c Using Mann Whitney U test; 95% CI

Table III identified the correlation between patients' characteristics and the medication cost burden at the ED. Furthermore, the data represents that only ED

triage impacts the cost burden (Significant value = 0.000; $r = 0.258$).

Table III: Correlation between patients' characteristics and the medication cost burden at the emergency department

Patient's characteristics	Category	Frequency	Mean of cost burden	Significant value*	r*
Gender	Male	141	IDR 56,343	0.620	-0.028
	Female	180			
Age	60-69	198	IDR 56,343	0.929	0.005
	70-79	100			
	80-89	20			
	90-99	3			
Educational status	Unschooling	7	IDR 56,343	0.911	0.006
	Elementary school	78			
	Middle school	39			
	High school	155			
	Diploma	17			
	Bachelor	19			
Occupational status	Employed	290	IDR 56,343	0.105	-0.091
	Unemployed/Retired	31			
Emergency severity (ED triage)	Green	4	IDR 56,343	0.000	0.258
	Yellow	299			
	Red	18			

*Using Spearman's rank correlation coefficient; 95% CI

Discussion

Elderly patients often attend the ED due to the need for emergency medical treatment. This population usually comes with multiple comorbidities, which create complexity in their treatments (Samaras *et al.*, 2010). This study reported that about 18.19% of the patients who visited the ED were elderly. They were dominated by 60-69-year-olds with a percentage of 61.7%. This result is similar to a study by Lumjeaksuwan *et al.* (2022) conducted in Thailand, with a dominance of about 45.42%.

The most prescribed drug was the H-2 Receptor Antagonist group, known as ranitidine. This was similar to a cross-sectional study by Hajjar *et al.* (2005), which reported that 9.4% of subjects were prescribed an H-2 Receptor Antagonist. Furthermore, a retrospective observational cohort study of 6,628 Japanese patients reported that 20.5% of patients were prescribed an H-2 Receptor Antagonist. This medication group is often given as preventive therapy related to digestive system problems and is prescribed with NSAIDs to avoid potential side effects (Akazawa *et al.*, 2010). This finding supports the situation that metamizole was the second most prescribed drug, commonly used to treat acute pain. A retrospective, observational, cross-sectional study in Serbia and Croatia showed that the utilization from 2010 to 2015 was also quite high as an analgesic (Miljkovic *et al.*, 2018).

The medication complexity in elderly patients at the ED was determined using the MRCI tool with an average score of 15.20 ± 6.54 . In addition, Sevilla-Sanchez *et al.* (2019) used this tool in a ten-month cross-sectional study in the Geriatrics Unit in Spain's second-level hospital, which revealed that 57.9% of patients had high medication complexity with an MRCI score of >35 points.

A retrospective study of all pharmacy-related medication costs and ED visits from January 1 to December 31, 2013, at the Austin Hospital in Australia, showed that the average cost per patient per episode of care in 2013 was \$7.49. The medication costs were defined as all items supplied by the pharmacy (Harding *et al.*, 2015). Meanwhile, in this study, the average cost burden of treatment for elderly patients in the ED was IDR 56,343, including medicines, disposable medical devices, and pharmacy service fees.

The impact of medication complexity on the cost burden was also analysed. This finding was in line with a study by Morrow & Laher (2022), which stated that visits to the ED have a substantial financial impact on patients.

This study's second outcome was to analyse the difference in cost burden and the average cost before

and during the pandemic was IDR 56,805 and IDR 54,006. However, the two conditions were not significantly different based on the statistical analysis. A study by Miethke-Morais *et al.* (2021) stated that the ED was one of the three sectors with the highest cost burden related to the pandemic. The different finding was probably associated with the separation of the emergency service at the Universitas Airlangga Teaching Hospital during the COVID-19 pandemic, and the research focused on patients discharged from the ED.

Finally, the patients' characteristics as factors related to the medication cost burden at the ED were analysed. There were no significant correlations between gender, age, educational status, and occupational status on the cost burden. However, the medication cost burden was significantly correlated with the disease severity. This result is in line with the previous study that the average cost of ED patients increases with the severity of the triage category (Gedmintas *et al.*, 2010).

Limitation

This study was carried out for only four months. Therefore, further research is highly recommended to take a longer period in analysing factors that affect the medication complexity on the cost burden.

Conclusion

This study showed that the medication complexity increases the cost burden with the disease severity, but the pandemic does not affect the costs. Therefore, continued vigilance with compliance to policies in the emergency department is important for maintaining the therapeutic outcome and appropriate medication cost.

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