

Assessing Direct Medical Costs and Quality of Life in Elderly Patients Using High-Alert Medications at Wongsonegoro Hospital

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ABSTRACT

High Alert Medications (HAM) are drugs that pose a significant risk of causing harm to patients if used incorrectly. This study aimed to evaluate the direct medical costs and quality of life of elderly patients aged 60 years and above using HAM at Wongsonegoro Hospital. An observational prospective cohort study design was employed, utilizing both secondary and primary data collection methods. Secondary data included patient demographics, medication usage, and direct medical costs obtained from hospital records and the finance department. Primary data on quality of life were gathered using the European Quality of Life 5 Dimensions (EQ-5D-5L) questionnaire. A total of 25 elderly patients were identified as users of HAM, with a gender distribution of 48% male and 52% female; 64% of these patients were aged between 60 and 70 years. The most prevalent medical condition among participants was diabetes mellitus, affecting 44% of one group and 32% of another. Sodium Chloride (NaCl) 500 mL infusion at a concentration of 3% was the most frequently administered medication (27.5%). The average direct medical cost for elderly patients using HAM was IDR 4,255,050. Additionally, the quality of life assessment revealed that 20% of patients experienced significant challenges in self-care activities. These findings highlight the impact of HAM on healthcare costs and quality of life among elderly patients, emphasizing the need for careful monitoring and management strategies to mitigate risks associated with high-alert medications.

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1. Introduction

Elderly patients are older adults with multiple illnesses and/or disorders resulting from the decline in organ function, psychological, social, economic, and environmental factors, requiring integrated healthcare services through an interdisciplinary, multidisciplinary approach (Permenkes, 2014). According to data collected by the Central Statistics Agency in 2023, out of all the people who were 60 years old and above, 63.59% were considered young elderly, 27.36% were middle-aged, and 8.65% were elderly (Statistik, 2023). With an average stay of 5-6 days, 5.52 % of the elderly patients had been hospitalized (Statistik, 2023). Elderly patients experience a decline in physiological functions, which can lead to various diseases. These physiological changes in elderly patients contribute to medication-related problems (Fauziah et al., 2020).

One component that may have deadly implications for the safety of older individuals, especially with High Alert Medications (HAM), is the delivery of medication. When administered improperly, medications designated as "High Alert Medications" pose a serious threat to patients' health. (ISMP, 2024). A study on medication use in three hospitals in Korea, based on 59,428 visits, found that 2,104 (3.5%) were associated with adverse events (AEs). AEs were most common among female and elderly patients (Kang et al., 2022). Out of 529 potential medication error interventions, 112 (21.2%) were related to drugs listed by Institute for Safe Medication Practices (ISMP), and 150 (28.3%) of these errors were found to be potentially harmful. There was a cost-benefit ratio of 3.46 Euros per intervention and an extra cost of 20.23 Euros associated with high-risk therapies according to ISMP guidelines, according to this study (Miarons et al., 2021). High Alert Medications (HAM) were determined to raise the possibility of damage to patients, with prescription mistake rates ranging between 0.24% and 89.6% (Alzarea et al., 2022).

There are direct expenses and indirect costs associated with disease. Administration, laboratory, and other direct expenses room accommodation, emergency department, doctor's fees, treatment costs, drug costs and medical measures, while indirect costs are lost productivity (Kemenkes RI, 2013). When it comes to health care, Pharmacoeconomics include analyses of cost-effectiveness, cost-benefit, and cost-minimization (Alzarea et al., 2022). A person's quality of life may be described as their outlook on life in relation to their aspirations, expectations, norms, and worries, as well as their cultural background and value system. The subjective assessment of one's quality of life is rooted in several social, cultural, and environmental factors. (WHO, 1996). The European Quality of Life 5 Dimensions (EQ-5D-5L) was used to assess quality of life in this research. The EQ-5D-5L is the most recent iteration of the EQ-5D series; the EQ-5D-3L was the first (Reenen et al., 2021). There are five tiers of responses in each domain of the EQ-5D-5L descriptive system. When asked to evaluate the severity of an issue, 1 implies no difficulties, 2 mild problems, 3 moderate problems, 4 severe problems, and 5 extreme problems are all possible responses. The EQ-5D-5L allows for the definition of 5⁵= 3125 health statuses via its 5 categories of response levels. Similar to the EQ-5D-3L, the EQ-5D-5L questionnaire follows the same format for completion. (Reenen et al., 2021).

The use of high-risk drugs therefore causes significant harm to patients if used incorrectly. Although errors in the use of HAM may not be more common than with other drugs, the consequences of misusing these drugs can be very serious (Rahmawaty et al., 2023). The use of HAM in older patients has been the subject of prior research. This research set out to examine the quality of life, financial implications, and use of HAM among the elderly patients at K.R.M.T. Hospital Wongsonegoro Semarang City, Indonesia. Evaluation of the use of HAM in elderly patients is needed to help minimize medical costs, so that quality control and cost control efforts can be achieved.

2. Materials and Methods

This research method uses an observational study (prospective cohort). The sample size was determined using OpenEpi, and the sampling method was purposive sampling with predetermined inclusion and exclusion criteria. Using the Open Epi method, we calculated the sample size based on the average monthly population of 25 patients and a 95% confidence level. Patients' willingness to participate, full cost data utilizing HAM for treatment according to indications, and data in comprehensive medical records were the inclusion criteria in this research. Hospital referrals, patients returned against their will, and patients who passed away were not included in this research. Secondary data includes information about patients' characteristics and medication use (such as HAM), as well as subjective and objective data from medical records, direct medical costs from the finance department, and primary data on patients' quality of life measured by the validated and reliable EQ5D5L questionnaire (Bhadhuri et al., 2020). Prescription medication expenses, laboratory costs, inpatient costs, and quality of life levels along each dimension were all included of the direct medical costs data set. Statistical information for describing the distribution of HAM usage, direct expenses, and quality of life levels across all dimensions, as well as their connection to one another, in the context of older people. The Research Ethics Committee of K.R.M.T Wongsonegoro Hospital, Semarang City Indonesia, gave their approval to this research with the number 090/Kom.Etik RSWN/VII/2024.

3. Results and Discussion

The research sample for this study consisted of 25 senior individuals who were hospitalized and who fulfilled the inclusion criteria. Table 1 details the proportions of patient characteristics based on the data acquired from K.R.M.T. Wongsonegoro Regional Public Hospital in Semarang City.

Table 1. Characteristics of Elderly Patients at K.R.M.T. Wongsonegoro Regional Public Hospital in Semarang City

Characteristics	Total Patient (n) = 25	Percentage
Gender		
Male	12	48%
Female	13	52%
Age		
60 – 70 years	16	64%
71 – 80 years	7	28%
81 – 90 years	1	4%
91 – 93 years	1	4%
Occupation		
Unemployed	14	56%
Informal	8	32%
Formal	3	12%
Payment Status		
Social Security Administration Agency (BPJS)	25	100%
Number of Diagnosis		
1 diagnosis	3	12%
2 diagnosis	6	24%
≥ 3 diagnosis	16	64%
Length of Stay		
≤ 4 days	7	28%
>4 days	18	72%

Twelve patients were male and thirteen were female, for a total of 25 patients. This is in line with research showing a higher proportion of female patients compared to male patients (Sasfi et al., 2022). According to 2023 Badan Pusat Statistik (BPS) data, the proportion of elderly females (52.82%) is higher than that of males (Statistik, 2023). Patients in the age bracket of 60–70 years made up 64% of the total, while those in the age bracket of 71–80 years made up 28%. A total of 32% of the patients were involved in informal occupations including farming, trade, or laboring, while 56% were jobless and 12% were working in official positions (Chrismardani & Satriawan, 2018). For the payment status characteristic of elderly patients at K.R.M.T. Wongsonegoro Regional Public Hospital in Semarang

City Indonesia, 100% of patients used the Social Security Agency (BPJS) for payment (Sari & Alvita, 2022). The results of the distribution of patient history were most prevalent in patients who had diabetes mellitus 44%. The data on the length of hospital stay revealed that 28% of patients were hospitalized for ≤ 4 days. Consistent with other studies, this one finds that patients' ages are a determinant in the expected duration of their hospital stays; in other words, the longer the patient's age, the longer their hospital stay is projected to be (Sari & Alvita, 2022).

The elderly patients on average experience multiple diseases or more than one disease experienced. Hypertension, diabetes mellitus, Chronic Kidney Disease (CKD), and other disorders are included in the distribution of primary and supplementary diagnoses. and other diseases - others referred to are Congestive Heart Failure (CHF), gout, stroke, melena, hyponatremia, cellulitis. While in the main and additional diagnoses, 10 (13.8%) elderly patients who used HAM were diagnosed with diabetes mellitus. The results of the disease history and diagnosis can be seen in Table 2 and 3. In the previous research, which states that diabetes mellitus (DM) is a chronic illness with an extremely high complication risk, and it ranks as the third greatest cause of death in Indonesia. Results showed that individuals with a history of diabetes mellitus were more likely to be female (57.48%) than male (42.52%) (Setiatjahjati, 2020). In a previous study, one of the most common diseases among elderly patients was cardiovascular diseases, such as hypertension and heart disease, with prevalence rates of 28.65% and 24.79%, respectively, in this research (Khairunnisa & Ananda, 2023). The decline in physiological functions and changes in pharmacokinetics processes, such as absorption, distribution, metabolism, and drug excretion, place elderly patients at risk of developing multiple diseases and experiencing adverse drug reactions (Fish, 2020).

Table 2. Distribution of Medical History Elderly Patients at K.R.M.T. Wongsonegoro Regional Public Hospital, Semarang City

Medical History	Total Patient (n) =25	Percentage
Hypertension	7	28%
Diabetes Mellitus	11	44%
Chronic Kidney Disease	2	8%
No Medical History	5	20%

Table 3. Distribution Diagnosis of Elderly Patients at K.R.M.T. Wongsonegoro Regional Public Hospital, Semarang City

Diagnosis	Total Diagnosis (n) = 72	Percentage
Hypertension	8	11.1%
Diabetes Mellitus	10	13.8%
Chronic Kidney Disease	3	4.1%
Bronchopneumonia	7	9.7%
Other	44	61.1%

The use of drugs in elderly patients as shown in Table 4. shows that most elderly patients get more than 10 kinds of drugs by 92%. Previous research also mentioned a similar thing where the majority of elderly patients received polypharmacy prescriptions (Soejono & Rizka, 2021). In the results that did not use HAM drugs, there were 19 elderly patients (76%) while the most elderly patients only used one HAM drug as many as 12 patients (30%). Where the most elderly patients obtained HAM drugs, namely Sodium chloride NaCl 3%, had a high prescription percentage of 27.5%. In previous studies, patients who experience uncontrolled hyperglycemia will cause hyperosmolarity. Hyperosmolarity stimulates the process of osmotic diuresis in the body, so that intra-cell fluids and electrolytes escape to extra cells. This fluid transfer causes cells to experience a decrease in body fluid composition and causes dehydration (Lutfi, 2019). Fluid therapy will also reduce blood glucose levels without relying on insulin, and reduce levels of counter insulin hormones thereby improving sensitivity to insulin (Zeitler et al., 2011). Sodium is the primary cation in

extracellular fluid, regulated by the renin-angiotensin-aldosterone (RAAS) system and the sympathetic nervous system. A rapid decline in sodium concentration can cause cellular swelling and cerebral edema, triggering adaptive mechanisms in the brain (Carmenita & Wreksoatmodjo, 2023).

Sansulin Rapid insulin Aspart 100 U/mL dominated its use by 17.5%. This is in line with the results of the diagnosis suffered by elderly patients such as Diabetes mellitus. The oldest age group, defined as 55–64 years old (104 out of a total of 512 DM patients in one study), is considered to be in its twilight years (Anggriani et al., 2020). Insulin is categorized based on its speed in producing effects and its ability to maintain blood sugar levels (Simamora et al., 2021). Insulin injections caused dizziness (38.5% of patients), weakness (32.3%), palpitations (12.4% of patients), perspiration (4.6% of patients), tremors, and hypoglycemia (4.6%), according to a prior research conducted at a Denpasar hospital (Udayani et al., 2021). Insufficient insulin secretion characterizes all hyperglycemia conditions (Lebovitz, 2021). Blood glucose monitoring is crucial to prevent hypoglycemia. If hypoglycemia occurs in patients undergoing insulin therapy, glucagon 1 mg intramuscular injection can be administered as an alternative when intravenous dextrose is not feasible (Febrianti & Hisni, 2024).

Table 4. Characteristics of Drugs use In Elderly Patients at K.R.M.T. Wongsonegoro Regional Public Hospital in Semarang City

Number of types of drug use (HAM and Non HAM)	Total Patient (n) =25	Percentage
5-9 drugs	2	8%
≥ 10 drugs	23	92%
Non HAM	Total Patient (n) =25	
5-9 drugs	6	24%
≥ 10 drugs	19	76%
HAM	Total Patient (n) =25	
1 drugs	12	30%
2 drug	8	20%
≥ 3 drugs	5	
Class/Drug Name	Total Drug Type (n) = 40	
Insulin		
Sansulin Rapid Insulin Aspart 100 U/mL	7	17,5%
Ezelin Insulin Cartridge 100 IU/mL 3 mL	1	2,5%
Adrenergic Agonist Injections		
Norepinephrine Bitartrate Monohydrate 1 mg/mL	6	15%
Epinephrine Injection 1 mg/mL	1	2,5%
Lidocaine HCl 2%	1	2,5%
Narcotics		
Fentanyl 0,05mg	1	2,5%
Psychotropics		
Alprazolam 0.5 mg	5	12,5%
Haloperidol 5 mg	1	2,5%
Diazepam Injection 5 mg/mL	1	2,5%
Electrolytes and Intravenous Solutions		
Dextrose 25 mL Injection 40%	5	12,5%
Sodium Chloride (NaCl) 3%/500 mL Infusion	11	27,5%

The cost components are taken from direct costs which include treatment costs during hospitalization, doctor's fees, doctor visits, clinical pharmacist visits, inpatient accommodation,

laboratory costs, and pharmaceutical costs. The following are the direct costs for geriatric patients undergoing inpatient care at K.R.M.T. Hospital. Wongsonegoro Semarang City in Table 5.

Table 5. Direct Medical Cost in Elderly Patients Using High Alert Medications at K.R.M.T. Wongsonegoro General Hospital, Semarang

Cost Component	Average Costs (IDR) (n) = 25 patients
Cost of prescribed drugs	1.321.250
Laboratory Costs	1.190.200
Inpatient Costs	1.743.600
Direct medical costs	4.255.050

The average total direct costs for elderly patients covered by BPJS at the K.R.M.T. Regional General Hospital. Wongsonegoro of 4,255,050 with previous research, the difference in hospital rates is influenced by room rates, length of stay, and procedures performed (Aminda & Rahayu, 2020). Inpatient care is defined as accommodations for health services provided to patients for a minimum of one day (Irdiana, 2019). Although hospitals carry a high social value, they are also business units operating in the clinical medical field, with the majority of their income derived from inpatient care services and facilities (Asmadi et al., 2023). K.R.M.T. Hospital's senior patients on HAM medications have their quality of life evaluated. Age assessment in Wongsonegoro, Semarang City, Indonesia using the EQ-5D-5L. A measure of health quality is used to represent the evaluation findings. The five aspects that made up the health profile were mobility, self-care, daily activities, pain/discomfort, and anxiety/depression. Table 6 displays the quality of life reported by the respondents. Based on the data, domain 10 (anxiety/depression) was the one where the majority of older patients utilizing HAM reported no issues (40%). The Self-Care domain of five patients (20%) presents a very serious situation for the quality of life of elderly patients using HAM medications.

Table 6. Quality of Life in Elderly Patients Using High Alert Medications at K.R.M.T. Wongsonegoro General Hospital, Semarang

Dimension	Total (n) =25, Percentage				
	Level 1*	Level	Level	Level 4*	Level
Walking Ability	6 (24%)	7 (28%)	4	6 (24%)	2 (8%)
Self-Care	4 (16%)	6 (24%)	7	3 (12%)	5 (20%)
Usual Activities	4 (16%)	8 (32%)	5	5 (20%)	3 (12%)
Pain/Discomfort	6 (24%)	10	7	2 (8%)	0(0%)
Anxiety/Depression	10	5 (20%)	6	2 (8%)	2 (8%)

*Level 1 = 1 (No problems); Level 2 = 2 (Slightly problematic)
 Level 3 = 3 (Moderately problematic); Level 4 = 4 (Very problematic)
 Level 5 = 5 (Extremely problematic)

This result can also be seen when giving questionnaires directly through visits to patients, on average, patients do not experience complaints that make them feel anxious/depressed. A decline in quality of life is significantly associated with morbidity, mortality, and reduced life expectancy (Amalia et al., 2024). Using the EQ-5D-5L questionnaire, researchers in India evaluated the HRQoL of individuals who had adverse drug reactions (ADRs). Results showed that neither mobility nor anxiety/depression were problems for the majority of respondents (47.5% and 56.3%, respectively). Pain or discomfort (44.6%), difficulties with daily tasks (60.4%), and self-care (44.9%) were the most common (Pavan et al., 2024). Similarly, participants in a Chinese research that used the EQ-5D-5L reported no problems across all five dimensions. Still, the majority had to deal with pain or discomfort (27% of the total) and anxiety or despair (26.2%) (Bai et al., 2024).

Given the significant risks posed by HAM and their impact on both healthcare costs and quality of life, implementing rigorous monitoring protocols and evidence-based management strategies becomes imperative. This includes regular reviews of medication regimens, education on proper medication use, and multidisciplinary team approaches to manage chronic conditions effectively. Our study highlighted that the healthcare providers can tailor their strategies to better serve

vulnerable elderly populations, minimizing the adverse consequences associated with high alert medications and enhancing overall patient safety and well-being.

4. Conclusion

The most commonly administered medication in the inpatient unit was a 500 ml infusion of Sodium Chloride (NaCl) at a concentration of 3% (27.5%). The average total direct medical cost for elderly patients using HAM was IDR 4,255,050. Additionally, the quality of life assessment revealed significant challenges in self-care, with 20% of geriatric patients experiencing severe difficulties in this domain.

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Competing Interests

None of the writers have any financial stake in the outcome.

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