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Designing and Evaluating the Establishment of Admission Criteria for Patients in an Intensive Care Unit: A Descriptive Study in Iran

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ABSTRACT

Background: A few studies have reviewed and revised ICU admission criteria based on specific circumstances and local conditions. The aim was to develop ICU admission criteria and compare the cost, mortality, and length of stay among identified admission priorities.

Methods: This was a cross-sectional study conducted in an intensive care unit of a training hospital in Qazvin, Iran. The study was conducted among 127 patients admitted to ICU from July to September 2019. The data collection tool was a self-designed checklist, which included items regarding patients' clinical data and their billing, type of diagnosis, level of consciousness at the time of hospitalization based on GCS scale or Glasgow Coma Scale, length of stay, and patient status at the time of discharge. Descriptive statistical tests were used to describe study variables, and in order to determine the relationship between study variables, ANOVA and Chi-square test were used.

Results: A set of criteria were designed to prioritize patient admissions in ICU. Based on the defined criteria, patients were categorized into four groups based on patient's stability, hemodynamic, and respiration. Study findings revealed that a significant percentage of patients were admitted to the ward while in the second and third priorities of hospitalization (26.8 % and 32.3 %, respectively). There was a statistically significant difference in the four groups in terms of patients' age, total cost, and insurance share of the total cost (P-value < 0.05).

Conclusion: Study results emphasize the necessity to classify patients based on defined criteria to efficiently use available resources.

Key words: ICU admission, Prioritization, Cost, Mortality, Length of stay

Citation

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Introduction

As most health systems face resource scarcity, the issue of equitable resource allocation is a major concern and a key part of the decision-making process (1). One of the main strategies to achieve these two objectives is developing clinical guidelines and integrating the best evidence in service provision (2). Adherence to clinical practice guidelines increases healthcare services quality and reduces costs by eliminating unnecessary or inappropriate clinical interventions (3).

The intensive care unit (ICU) is a key and the most resource-intensive component of a hospital. several studies reported that ICU accounts for 20–30 % of hospital care costs (4). Due to the financial pressures and the necessity to enhance efficiency and effectiveness, hospitalization in ICUs should be considered for patients with a reasonable prospect of substantial recovery (5-7).

According to the World Bank statistics, approximately 50 to 80 percent of the health sector budget belongs to the services provided in hospital settings, of which ICU provides the most expensive services (8, 9). Unfortunately, the criteria for ICU admission are very general, and hard to explicitly determine whether admitted patients in the unit will benefit from hospitalization or not. This uncertainty leads to significant cost losses and deprives critically ill patients of intensive care (5). One of the difficulties in managing ICU costs is the lack of a simple and clear protocol in prioritizing patients according to admission necessity (6).

Numerous studies have emphasized the need to develop clinical decision-making guidelines or patient evaluation criteria in terms of ICU admission by a multi-professional team to ensure that defined policies are scientific, evidence-based, and applicable for health service providers (10-12). Research has also shown that in countries that use standardized clinical protocols, effective changes have occurred to improve community health. Besides, implementing standard protocols resulted in cost control by reducing unnecessary medical interventions and providing services for those who will most benefit from intensive care (13).

Another important issue is to examine some of the key indicators, including hospital costs, length of stay, and mortality among different groups of patients in terms of admission priority in ICU. The Society of Critical Care Medicine (SCCM) developed criteria based on disease severity to assess patients' priority in receiving ICU services. According to these indicators, patients are classified to one of four priority levels from priority one, critically ill patients depending on intensive monitoring in the ICU, to priority four, who are too well or too sick to benefit from intensive care unit (14). Literature affirmed that when patients with priority 3 and 4 were admitted to ICU, their mortality was more than the other two groups. Moreover, they stayed longer in the hospital and incurred a higher burden of costs to the health system (15). Despite the importance of the issue, a few studies have reviewed and revised ICU admission criteria based on specific circumstances and local conditions. Such information gap, especially in Iran, notifies the need to conduct a study to develop criteria for ICU admission and compare the cost, mortality, and length of stay among identified prioritization groups in one of the training hospitals of Qazvin, Iran.

Materials and Methods

Design

This was a cross-sectional study conducted in the intensive care unit of a training hospital in Qazvin, Iran, during July and September 2019. Three phases, including different steps, have been performed in this study.

Sample and Setting

Patients over 18 years old admitted to ICU of a training hospital in Qazvin city, Iran, from July to September 2019 were included in the study. This ward consists of 12 beds with an average monthly admission of 50 patients who were mainly suffered from internal medical problems and were not candidates for surgery. Furthermore, those with less than 24 hours of hospital stay were excluded from the study.

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Study phases

Phase 1. Developing prioritization criteria for ICU admission

In this stage, to identify key factors in deciding about patients' admission in ICU and then to consider them in a codified and structured format as determined criteria, the following steps were taken.

Step1. In this step, through reviewing the literature and scientific texts in the field of ICU admission in both internal and external databases, including Irandoc, Iran Medex, Magiran, Google Scholar, Pubmed, and Scopus, the influencing factors on ICU admission were extracted. Some of the main keywords were ICU admission, priority setting, ICU admission criteria, Intensive care unit, and critically ill patients. The reviewed texts included internal sources and upstream documents and information obtained from external sources to identify ICU admission guidelines.

Step 2. After classifying obtained information, an initial draft of factors was sent to a number of anesthesiologists to give their expert opinions on the factors. The method used was a modified Delphi technique to implement the expert panel process. As a result, the instruction was developed to conduct the study's next steps (Table 1).

Phase 2. Classification of admitted ICU patients based on the developed prioritization criteria

Step 1. After receiving legal permits, and the ethics code of the project, the researcher attended an intensive care unit to collect demographic and clinical data from admitted patients since the starting of July 2019 under an anesthesiologist's supervision. To do so, a data collection checklist was designed which included items regarding patients' clinical data, their billing information (patients' total bill including hospitalization, diagnosis, and treatment based on the hospital's share cost, patient share cost, and share of the insurance organization), type of diagnosis or cause of hospitalization in ICU, level of consciousness at the time of hospitalization based on GCS scale or Glasgow Coma Scale, length of stay, and patient status at the time of discharge. Required data about the study variables were obtained from the Hospital Information System (HIS), patient records, and sometimes through interviews with physicians or nurses in charge of patient care. It should be noted that patients who had less than 24 hours of stay, underwent surgery, or were referred to other centers for follow-up reasons were excluded from the study.

Step 2. All patients were classified into four groups based on admission priority by collecting necessary information about each patient and matching it with ICU admission criteria.

Phase 3. Comparing admitted patients in different priority groups based on variables such as cost, length of stay, nosocomial infection rate, and mortality

In this step, the frequency of patients admitted to ICU was calculated for each priority group based on variables such as age and sex. These groups were then compared to variables including hospitalization cost (average total cost, the share of the insurance company, and patient contribution), mortality rate, nosocomial infection, and length of stay. Patient cost information from admission to discharge included accommodation, diagnostic and therapeutic interventions, medicine, nutrition, blood products, laboratory tests, and rehabilitation care.

Analyses

Data obtained for quantitative analysis were entered into $SPSS_{20}$ (Statistical Package for the Social Sciences). Descriptive statistical tests (including mean + SD) were used to describe study variables. The ANOVA test was used for quantitative variables, and the Chi-square test was used for qualitative ones to compare variables among different patient groups. Further, in the current study, all ethical issues were observed, and the ethic code was IR.QUMS.REC.1397.224.

After obtaining a license from the Ethics Committee of Qazvin University of Medical Sciences, data gathering was performed to conduct the research. The researchers introduced themselves to the hospital authority and explained the purpose of the study, and confidentiality of the data to obtain their oral consent.

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Results

Among 127 patients who participated in the study, 62.2 % were male, and 37.8 % were female. By the time of discharge, 59.05 % of the patients had died, and the rest were discharged from the hospital, among which 3.8 % died within three months of discharge. Table 2 summarizes patients' information.

As Table shows, most of the patients had comorbidity, were hospitalized with a stroke diagnosis, and had social insurance coverage.

After collecting and classifying obtained information, a guideline for prioritizing the admission of patients in intensive care units was prepared as a prototype and sent to a number of experts, including two anesthesiologists and a number of experts on the design and development of national guidelines in the Ministry of Health and Medical Education who had managerial positions with a history of conducting similar projects to comment on the initial draft of the compiled guideline.

Based on the defined criteria, patients were categorized into four groups. Table 3 depicts the frequency of patients in each of the prioritization categories. As it is shown, although a great number of patients were admitted in the intensive care unit with the first priority, nevertheless, a significant number of them were still admitted in the ward while they were in the second and third priority of hospitalization.

The relationship between patients' placement in different priority groups, age, and cost information was examined. According to the ANOVA test, there was a statistically significant difference in the four groups in terms of patients' age, total cost, and insurance share (P-value < 0.05). The highest amount of costs was associated with patients in groups A and D. Furthermore, these patients were reported to have the longest hospital stay (Table 4).

Table 1. Indicators in classifying patients according to hospitalization priority

Prioritization group	Indications for entering each priority	Categorization based on inclusion criteria	
A	Control by inotropic	Unstable If BP < 40 % of normal	Hemodynamic
	Control by ventilation	Unstable If Pao_2 < 60 mmHg	Respiration
B	Probably control by inotropic Other modalities include: 1- Intravenous therapy 2- Acidosis treatment by bicarb 3-Blood transfusion 4-Close the bleeding site 5-And other interventions	Unstable If BP < 40 % of normal	Hemodynamic
	Probably control by ventilation Other modalities include: 1-O_2 therapy by nasal cannula 2-O_2 therapy by mask 3-O_2 therapy by reversal bag 4-O_2 therapy by Venturi mask 5-O_2 therapy by CPAP	Unstable If Pao_2 < 60 mmHg	Respiration
C	Probably control by inotropic Critically patients with diagnosis: 1- Dysrhythmias 2-Myocardial infraction 3-Congestive heart failure 4-Diabetic Ketoacidosis 5-Conscious drug overdose 6-Meningitis 7-Gastrointestinal bleeding 8-Stroke 9-Epileptic Seizures	Stable	Hemodynamic

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Prioritization group	Indications for entering each priority	Categorization based on inclusion criteria	
D	Probably control by ventilation Critically patients with diagnosis: 1-Respiratory failure 2-Pulmonary emboli 3-Guillain-Barre syndrome 4-Myasthenia Gravis	Stable	Respiration
	Too well to benefit	Stable	Hemodynamic
	Included: 1-Post-operative patients 2-Peripheral vascular surgery 3-Mild congestive heart failure	Stable	Respiration
	Too sick to benefit: Patients with terminal and irreversible illness facing imminent death. For example:	Unstable	Hemodynamic
	1-Brain dead non-organ donors 2-Irreversible multi-organ system failure 3-Metastatic cancer unresponsive to chemotherapy	Unstable	Respiration

Table 2. Patients' demographic, clinical, and cost information

Characteristic (a)		Mean	Standard deviation
Age (year)		64.11	20.09
The total length of stay (day)		15.44	7.50
Length of stay in ICU (day)		8.44	4.80
Cost of hospitalization ($)		7151.74	1320.16
Insurance share of total costs ($)		6885.65	775.01
Patient share of total costs ($)		26.61	2.90
Characteristics (b)		Frequency	Percent
Comorbidity	No	47.00	37.00
	Yes	80.00	63.00
Type of diagnosis	Stroke	34.00	26.80
	Pneumonia	16.00	12.60
	Poisoning	12.00	9.40
	Cerebral hemorrhage	9.00	7.10
	Other	56.00	44.10
Insurance coverage	Social insurance	64.00	50.40
	Health service insurance	22.00	17.30
	Other	35.00	28.90
	None	6.00	3.40
Supplementary insurance	No	90.00	74.40
	Yes	31.00	25.60

Table 3. Frequency of patients in each of the prioritization categories

Priority	Frequency
A	44.00
B	34.00
C	41.00
A	44.00

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Table 4. Comparison of study variables in prioritization groups

	Prioritization group	Mean	Standard deviation	F	P
Age (year)	A	74.22	11.90	8.64	0.00
	B	64.20	19.10		
	C	53.95	21.80		
	D	60.12	25.80		
Total Cost ($)	A	10182.74	943.90	4.76	0.00
	B	4346.04	1986.10		
	C	5500.12	576.20		
	D	6642.41	258.70		
Insurance share of total cost ($)	A	12080.98	1856.90	3.40	0.00
	B	4006.24	322.70		
	C	4623.52	865.20		
	D	6368.91	225.50		
Patients' share of total cost ($)	A	387.03	13.49	0.99	0.40
	B	424.83	57.06		
	C	460.09	27.18		
	D	389.64	87.44		
ICU length of stay (day)	A	13.95	10.20	8.59	0.00
	B	5.50	4.70		
	C	4.60	2.30		
	D	10.00	8.60		

Discussion

Intensive care is required for patients who need advanced respiratory or circulatory support or those with the chronic deterioration of one or more organs needing continuous monitoring. Timely referral to ICU increases patients' chance of recovery, and any delay can cause irreparable damages or even lead to their death.

Furthermore, an early referral may reduce ICU length of stay and consequently decreases hospitalization costs. Thus, determining appropriate indicators can lead to physicians' effective guidance regarding patients' admission in this ward (16). Bahadori et al. (17) have emphasized the necessity to designate an individual or a clinical team responsible for appropriately triaging patients through applying defined admission criteria. Griner mentioned two situations in which providing care in ICU is of no benefit to patients. The two groups were titled "Too well to benefit" and "too sick to benefit," which were relatively at low or remarkably high risk of death (18). Thus, developing an appropriate prioritization tool for triaging patients based on the disease severity and prognosis of illness combined with clinical judgment would help physicians make appropriate decisions and hospitals in cost control (2, 19-21). Ebrahimpour et al. (22) have highlighted that several countries suffer from the lack of structured triage criteria to assess the necessity of being admitted in the intensive care unit. No consensus on admission criteria and lack of written instructions for ICU admission prevent correct and evidence-based clinical decisions.

In the current study, patients were categorized into four groups based on the prioritization and objective parameters model. The first category belonged to critically ill patients with an unstable condition requiring intensive care, including ventilator support, continuous drug infusions, and monitoring. The second group described patients with chronic comorbidities who were at potential risk of developing severe medical or surgical illness requiring immediate medical intervention. Patients in the third category were those unstable patients with a reduced chance of recovery due to the nature of the acute illness. Finally, patients in the fourth category were those with two extreme

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conditions, whether too well to benefit or too sick to benefit from ICU care with life-threatening and permanent illness facing death. The objective parameters were determined through consensus and were mainly based on patients' clinical conditions. Findings of the research conducted by Orgeas-Garrouste et al. (23) and Thomas et al. (24) revealed that most admitted patients in ICU were male with a mean age of 64 years old. These findings were in line with the current study.

Furthermore, study results revealed that a huge amount of money was spent to deliver ICU care to patients in the fourth priority group with the lowest hospitalization indications. A similar study conducted in Canada by Reardon et al. (25) affirmed our study results and stated that nearly half of the ICU cost was spent by 10 % of costly patients.

In line with Aung et al.'s study (26), our findings also showed a higher mortality rate among costly users, emphasizing the necessity to develop ICU admission criteria for admitted patients' suitability. A study conducted by Kramer et al. (27) found similar results and emphasized that despite the high-cost burden in hospitalized patients with low indication of ICU admission, the mortality rate in this group is high, and treatment's success rate is very low.

Length of stay in ICU was another factor that was assessed among different prioritization groups. Compared to previous studies that reported the average length of stay in ICU to be approximately six days, our findings revealed a higher average that might be due to the differences in the disease pattern among the population of different areas. The mean length of hospital stay is shorter than in western countries as per reported studies (28).

Conclusion

Hospital resources scarcity delay a proper allocation of critical care services to patients who need timely care or medical interventions. This is even more important in intensive care units that should serve critically ill patients and provide them life-supportive remedies. Our study found that priority 1 and 2 patients benefit more from ICU admission than those in priority 3 and 4. Findings highlight the necessity to classify patients based on defined criteria in order to use available resources efficiently. This recommendation would act as an effective strategy for hospital managers and health policymakers.

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Conflict of interests

Authors declared no conflict of interests.

Authors' contributions

Rafiei S designed research; Hosseinpour F collected data and analyzed data; Sedighi M and Hashemi F wrote manuscript. All authors read and approved the final manuscript.

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