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Investigating the causes and the consequences of hospitalization in intensive care units

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ABSTRACT

Aims: The demand for hospitalization in intensive care units is increasing. The purpose of this study was "to investigate the causes and the consequences of hospitalization in the intensive care units".

Methods: All patients hospitalized from July 20, 2010 to July 20, 2011 in Shohaday-e Ashayer Hospital, Khorramabad, Iran, were recruited to this observational descriptive-analytic study by using the census technique. The data collection instruments were the Sequential Organ Failure Assessment (SOFA) scoring and a demographic questionnaire whose validity and reliability had been confirmed. Study data were analyzed by using the SPSS v. 19.0.

Results: The most common cause of hospitalization in intensive care units was traffic accidents (42.2%). About 62.2% of the study participants developed hospital-acquired complications, chiefly pneumonia (24%). Mortality rate among the study participants was 29.13%. There was a significant correlation between the length of hospital stay and the rate of hospital-acquired complications.

Conclusions: The rate of hospitalization in intensive care units can be reduced through adopting strategies for preventing traffic accidents and brain strokes. Moreover, the rates of mortality and hospital-acquired complications can be decreased by shortening patients' stay in intensive care units.

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1. Introduction

Intensive care unit (ICU) is a critical and costly unit of hospitals in which patients, whose lives have been seriously jeopardized, are hospitalized and supported [1]. Large financial resources and competent critical care staffs are needed for managing this unit. The costs related to one ICU bed are about three times more than the costs related to a bed in other hospital wards [2]. A study conducted in the United States revealed that ICU-related costs are about 20% of all care-related costs and 1%–2% of gross national income [2].

Evidence shows that the need for intensive care is progressively increasing worldwide [4]. Given the prevalence of different diseases, currently, specialized ICUs such as cardiac,

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neurologic, nephrologic, pediatric, and neonate ICUs have been established [5]. Causes of hospitalization in ICU are different in different countries [6] and may include shock, acute respiratory distress, chronic pulmonary disease, infections, renal failure, neurologic disorders, bleeding, and clotting disorders [6]. The aims of all hospitalizations in ICU are to improve the quality of care as well as to minimize mortality rate and hospitalization-related complications [6]. Agalu et al. (2014) and Abrishamkar et al. (2004) reported cardiovascular disease [8], trauma, respiratory problems, cerebral hemorrhage, and need for post-operative care [9] as the main causes of hospitalization in ICU .

Mortality rate in the ICUs of different hospitals has been reported to be 1–35% [10–12]. The reasons behind such a wide range of mortality rate are the causes of hospitalization in ICU, the type and the severity of underlying disease, patients' age, length of hospital stay, and pre-ICU care quality [14–15]. Timely admission of patients to ICU can minimize complications and mortality rate. Moreover, more empty beds can be provided to patients through preventing unnecessary ICU admissions [16].

Patients who are hospitalized in ICU experience different hospitalization-related complications which may affect the outcomes of their treatments [17]. For instance, the rate of nosocomial infections in developed and developing countries is up to 25% and 50%, respectively [18]. Moreover, acute renal failure (ARF) affects about 25% of patients, increases mortality rate by 15–60%, prolongs hospital stay, and increases healthcare costs [19]. Wang et al. (2012) reported that hospitalization in ICU can enhance the risk of developing cardiovascular complications, infections, neurologic disorders, renal failure, and digestive diseases. The prevalence of pressure ulcer in superior American hospitals has been reported to be about 2% [20]. These complications can increase the length of hospital stay [2].

In line with the increasing number of accidents, better life expectancy, and growing elderly population in our country, Iran, the demand for intensive care services has also increased [22]. Many undue ICU hospitalizations can be prevented by identifying the causes and the consequences of hospitalization in ICU. Moreover, identifying the consequences and the complications of prolonged hospitalization in ICU can help healthcare professionals plan for preventing and managing them and reduce their related costs. The purpose of this study was to investigate the causes and the consequences of hospitalization in the ICUs of Shohaday-e Ashayer Hospital, Khorramabad, Iran.

2. Methods

This was an observational descriptive-analytic study. The study setting included all ICUs of Shohaday-e Ashayer Hospital, Khorramabad, Iran. Shohaday-e Ashayer Hospital encompasses three ICUs including medical ICU (six beds), surgical ICU (seven beds), and neurologic ICU (six beds). All patients who were hospitalized in these three ICUs from July 20, 2010 to July 20, 2011 were recruited by using the census technique. Necessary permissions were obtained before starting the study from the administrators of the hospital and the units .

The study instrument consisted of two checklists. Initially, we assessed patients' neurologic, respiratory, cardiovascular, coagulation, renal, and hepatic systems at the time of ICU admission by using the Sequential Organ Failure Assessment (SOFA) scoring [23]. The items of this instrument are scored on a five-point Likert scale from zero (Normal) to 4 (Abnormal).

The total score of the SOFA scoring is 0–24; the higher the score, the more serious the condition. The validity of this checklist was assessed by five faculty members while its reliability was evaluated by calculating its Cronbach's alpha. Ten patients were assessed by using the SOFA scoring and the Cronbach's alpha was determined to be 87% .

The second part of the study instrument was a questionnaire about patients' demographic and clinical characteristics. This questionnaire was developed based on the existing literature and its content validity was assessed and confirmed by ten faculty members and three anesthesiologists.

The reliability of the questionnaire was also assessed by the test-retest technique which yielded a Pearson correlation coefficient of 86%. This questionnaire contained items such as demographic characteristics, cause of hospitalization, history of previous conditions (such as diabetes mellitus, cardiovascular, neurologic, and psychiatric disorders, addiction, and so on), trauma-related information, if any, cause of trauma (motor-vehicle accidents, falls, self-harm, and assault), type of trauma (blunt or penetrating), length of ICU stay, duration of receiving mechanical ventilation, and hospital-acquired complications and their outcomes. This questionnaire was attached to each patient's medical record. Several critical nurses were recruited from each ICU and were educated both theoretically and practically about how to assess patients and complete the questionnaire.

These nurses gathered necessary information and completed the questionnaire through observing patients, interviewing them or their family members, consulting attending physicians, and reviewing patients' laboratory findings. For data analysis, the Chi-square, the independent-samples t, and the Pearson correlation tests as well as linear regression analysis were conducted by using SPSS v. 19.0.

3. Results

Most of the participants were male (62.3%) and married (75%) and lived in urban areas (82%). The mean and the range of participants' age were 52.4±12 and 10–80 years, respectively. The cause of hospitalization in ICU for 42.2% of the participants was traffic accidents most of which having happened in country roads (82%). Thirty two percent of accidents were automobile ones. The total ICU mortality rate was 29.13%. Most of patients had been transferred to ICU from the emergency department (64.4%). The main cause of transferring patients to ICU was loss of consciousness (58.9% **.(**

The mean of SOFA score for patients once admitted was 5.8±4.6. Moreover, the means of SOFA scores of patients who died in ICU and survived it were respectively 11±4.1 and 4.4±3.6. This difference was statistically significant (p =0.001).

The Pearson correlation test showed a direct correlation between the SOFA score and the length of hospital stay (r=0.32 and p=0.038). Moreover, the results of linear regression analysis revealed that the SOFA score was significantly correlated with mortality rate (p=0.001).

Most of the study participants (68.3%) had undergone tracheostomy. All female patients and 72% of male patients had a Foley catheter in place while the remaining male patients had an external urinary catheter. Most of the participants (62.20%, 316 patients) had developed hospital-acquired complications, mainly pneumonia (26%). Other hospital-acquired complications among the study participants were urinary tract infections (15.94%), renal failure (8.46%), and pressure ulcer (12.9%).

The Chi-square test showed that the length of ICU stay was significantly correlated with hospital-acquired complications of pneumonia, urinary tract infection, and renal failure (p=0.023). Moreover, the correlation of urinary tract infection with having a Foley catheter in place was statistically significant (p=0.013). Most of the patients, who died, had experienced death in the morning working shift (38.58%). The length of ICU stay for most of the dead patients (38.5%) was greater than sixteen days.

4. Discussion

The findings of this study revealed that the rates of mortality and hospital-acquired complications among patients hospitalized in ICU were high. Moreover, it was revealed that

the main cause of hospitalization in ICU was accident-related traumas. A high percentage of the patients had been involved in motorcycle accidents most of whom being male and more than half of them had finally experienced death. Generally, trauma-related mortality rate in the South Asian region is increasing. The World Health Organization has predicted that by 2020, the most common cause of Years of Life Lost (YLL) in developing and developed countries will be trauma-related death [24]. It is noteworthy that some of the trauma-related deaths are preventable [25]. Such preventable trauma-related deaths may occur due to inadequate pre-hospital care, resuscitation, or end-of-life care.

Our findings showed that most of trauma patients were male. This is in line with the

Table 1: Causes of hospitalization in ICU

Causes		Causes of hospitalization		Causes of transferring patients to ICU								Mortality rate	
		Absolute	Relative	Loss of consciousness		Respiratory distress		Cardiopulmonary arrest		Post operation		N	%
				N	%	N	%	N	%	N	%		
Accident	Automobile	162	32	126	77.7	31	19.13	5	8.03	-	-	45	27.77
	Motorcycle	60	11.83	51	85	7	11.66	1	1.66	1	1.66	27	2.76
	Pedestrian	7	1.37	7	100	-	-	-	-	-	-	3	42.85
Fall		9	1.77	6	66.66	2	22.22	-	-	-	-	1	19
Stroke		172	33.8	93		76		3				48	27.90
Myocardial infarction		1	0.19					1				-	-
Cardiac arrest		10	1.96	-	-	-	-	10	100	-	-	4	40
Post operation		12	2.4	-	-	-	-	-	-	12	100	-	-
Knife stabbing		22	4.33	3		17		-	-	2		4	18.18
Poisoning		15	2.95	6	40	8	53.33	-	-	3	20	5	33.33
Convulsion		14	2.3	8	57.14	6	42.85	-	-	-	-	3	21.42
Pulmonary embolism		3	0.59	-	-	3	100	-	-	-	-	1	0.33
Other		22	4.5	18	81.81	4	18.18	-	-	-	-	4	18.18
Total		509	100	318	-	154	-	20	-	18	-	145	29.13

findings of studies conducted in other countries [26]. Moreover, the most common cause of trauma in our study was traffic accidents. Other studies also reported the same finding [27-29].

More than half of the study participants experienced death. Chen et al. (2001) also reported a mortality rate of 22.5% for a sample of 342 trauma patients hospitalized in ICU [30]. The results of two studies conducted in our country, Iran, by Ahsan and Khaledi (2005) and Noorizadeh et al. (2005) also showed an ICU mortality rate of 45.5% and 34.6%, respectively [31 and 32]. Arabi et al. (2010) noted that mortality rate in ICU can be reduced through following clinical practice guidelines for patient admission and management [33].

Ellen et al. (2006) found that trauma-center care can significantly reduce the rate of mortality among patients with trauma [34]. The causes of traffic accidents are different and may include human factors, road conditions, and vehicle type [35]. Correcting the problems with these factors as well as improving the quality of pre-, in-, and post-hospital care can help reduce the number of accidents and the rate of accident-related deaths.

We also found that the second cause of hospitalization in ICU was cerebrovascular accidents (CVA) with a mortality rate of 33.8%. Pakgohar et al. (2008) also noted that stroke is the second leading cause of death in western countries [36].

All participating patients with CVA who were discharged from ICU had some degrees of disability. The results of a survey conducted by Donnan et al. (2008) also revealed that during the first six months after CVA, patients developed disabilities such as hemiparesis, difficulty in speaking, depression, and total or partial dependence in doing activities of daily living [37].

Moreover, in this study, more than half of the patients with CVA had the history of hypertension and about 34.7% of them reported having the history of diabetes mellitus at least in the last year preceding the study. According to Wilcox et al. (2007), a high percentage of diabetic patients are unaware of their diabetes mellitus until developing its chronic and debilitating complications such as CVA, myocardial infarction, and renal and ocular disorders [38].

Table 2: The length of hospital stay and the consequences of hospitalization in ICU

Length of hospital stay	N	Consequences								χ
		Death		Pneumonia		Urinary tract infection		Renal failure		
		N	%	N	%	N	%	N	%	
1–6 days	173	30	17.34	9	5.2	8	4.62	5	2.89	**p > 0.005**
6–11 days	127	40	31.49	15	11.81	13	10.23	10	7.87	
11–16 days	60	21	35	26	43.33	19	31.66	11	18.33	
> 16 days	148	57	38.51	72	48.64	41	27.70	17	11.48	
Total	508	148	29.13	122	24.01	81	15.94	43	8.46	

On the other hand, 33% of patients with hypertension die from CVA [39]. Accordingly, the complications of hypertension and diabetes mellitus can be prevented by effective screening and early diagnosis and treatment.

Our findings also revealed that more than half of patients hospitalized in ICU had developed hospital-acquired complications. For instance, the prevalence of nosocomial infection among the study participants was as high as 39.95%. Generally, the rate of nosocomial infections is increasing even in developed countries [40]. The prevalence of nosocomial infections in different areas of Iran has been reported to be 19.8% [41], 17.1% [42], and 15.6% [43]. Given the high prevalence of nosocomial infections, adopting strategies for identifying their underlying causes and eliminating them seems clearly crucial.

In the present study, the length of hospital stay was significantly correlated with nosocomial infections. Most of the previous studies also reported the same correlation [44]. We also found a direct correlation between nosocomial infections and mortality rate. Previous studies also have shown that nosocomial infections increase mortality rate [45].

The most important type of nosocomial infections among the study participant was respiratory infections, chiefly pneumonia. However, previous studies reported septicemia and pneumonia as the first and the second most common nosocomial infections [46 and 47]. About 68.3% of our participants had experienced tracheostomy. Righi et al. (2014) noted that tracheostomy is associated with greater risk for developing pneumonia [48]. Moreover, we found that the risk of developing pneumonia was raised as the length of hospital stay was increased (to more than thirteen days). Providing mechanical ventilation to patients based on the required clinical standards can mitigate the risk of respiratory infections [49].

Study findings also indicated a significant correlation between pneumonia and mortality rate. Other studies have also reported that delayed antibiotic therapy for patients with pneumonia is associated with greater mortality rate, particularly when the length of hospital stay exceeds two weeks [50]. Consequently, identifying and managing factors which increase the risk of nosocomial respiratory infections is highly recommended.

In the current study, urinary tract infection was the second most common type of nosocomial infections with a prevalence of 15.94%. There was no significant difference between male and female patients regarding the prevalence of urinary tract infection. Dadmanesh et al. (2008) found that 27.3% of hospitalized patients participating in their study had developed urinary tract infection [51].

Bouza et al. (2001) also reported that prevalence of urinary tract infection among male and female patients was respectively 45.3% and 54.7% [52]. Moreover, Carpenter et al. (2014) noted that urinary tract infection are the most common type of nosocomial infections and many factors can contribute to its development [53].

Another important hospital-acquired complication happening to our participants was ARF with a prevalence of 8.46%. Sean et al. (2007) reported a prevalence rate of 5.2% for ARF. They also noted that the prevalence of ARF and its associated mortality rate are progressively increasing among patients hospitalized in ICU [54].

The cause of hospitalization was significantly correlated with ARF rate in that it was more common among trauma patients. Brown et al (2008) also noted that trauma can be associated with ARF and hence, trauma patients should be monitored for the manifestations of ARF [55]. Early diagnosis of ARF among patients with conditions such as rhabdomyolysis can help initiate timely preventive treatments and reduce the risk of developing it [56].

Previous studies have shown that ARF among patients hospitalized in ICU can compromise quality of life and increase dialysis dependence, healthcare costs, and mortality rate [57 and 58].

We found that the highest rate of mortality was in the morning working shift while

Abrishamkar and Jivad (2004) reported no significant relationship between working shift and mortality rate [8].

This finding can be related to the diversity of management styles and care services, the abundance of medical visits, and the crowdedness of ICUs in the morning shift due to the presence of medical and nursing students. Consequently, it is thoroughly recommended to supervise all care and treatment services in the morning shift, particularly those services which are performed by students.

Study findings also showed that the mean of hospital stay was about eight days and the length of hospital stay for 34% of the participating patients was less than six days. Chen et al. (2001) reported a mean of hospital stay of five days and a direct correlation between the length of hospital stay and mortality rate [30].

Other studies reported a mean ICU stay of seven [59], two [51], and 8.4 [32] days. Moreover, the length of hospital stay in our study was directly correlated with the rates of mortality and hospital-acquired complications. Mahjobipoor et al. (2013) also reported the same finding [60].

5. Conclusions

Study findings indicate that the most common causes of hospitalization in ICU are traffic accidents and CVA. Consequently, adopting strategies for reducing accident rates and raising public awareness of the manifestations related to CVAs seems crucial. Moreover, given the high rates of mortality and hospital-acquired complications as well as the lengthy hospital stay among the study participants, conducting further studies for identifying and eliminating the causes of these problems is recommended.

This study was conducted in a single center and on patients with different underlying conditions. We recommend the replication of this study on patients with similar diagnoses and in multiple settings.

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