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Severity of illness affecting the length of stay and outcomes in patients admitted to intensive care units, Iran, 2019

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Abstract:

BACKGROUND: Length of stay (LOS) and patients' outcome are two important indicators in intensive care units (ICUs). The severity of illness influences these variables and could have a predictive value in clinical settings. The impact of severity of illness on the LOS and outcomes in patients admitted to ICUs was investigated in a selected hospital in Iran in 2019.

MATERIALS AND METHODS: This research was a descriptive longitudinal study. Data were prospectively collected on 150 patients. The sequential organ failure assessment (SOFA) score, LOS, and demographic variables of the patients were recorded. Abbreviated mental test and Barthel index measuring activities of daily living questionnaires were completed at the time of the discharge from ICU and 1 month later to show the patient outcomes. Data analysis was performed using Chi-square test, *t*-test, analysis of variance, Pearson's correlation, and linear and ordinal logistic regression with SPSS software version 16.

RESULTS: The mean of LOS was 11.21 ± 10.54 days. 24.7% of the patients were discharged from ICUs with optimal recovery, 49.3% with poor recovery, and 26% died in ICUs. One month after discharge, 67.6% of patients had optimal recovery, 24.3% had poor recovery, and 8.1% died. The SOFA score had a significant relation with LOS and patient outcomes in discharge and 1 month later. All the patients with SOFA score <5 survived, and all the patients with SOFA score more than 12 died.

CONCLUSIONS: The severity of illness had a significant relation with LOS and patient outcomes in the time of the discharge from ICU and 1 month later. It seems that the initial SOFA score of 12 and higher can be suggested as a cutoff point for poor prognosis in ICU patients.

Keywords:

Intensive care units, length of stay, organ dysfunction scores, patient outcome assessment

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Introduction

Most of the hospitals are facing shortage in the number of intensive care unit (ICU) beds, and extension of these wards would encounter various limitations, because they would require large spaces, experienced personnel, and excessive costs. Therefore, evaluating the functional indicators of these wards including length of stay (LOS) and patient outcomes is important.[1]

LOS is defined as the number of days that a patient is hospitalized in a medical center or hospital department.[2] LOS is used for purposes such as department management, quality control, and hospital planning.[3] It could also be used as the indirect estimation of the hospital effectiveness and optimal resource allocation.[4] Since expenses are intensely related to the LOS, shorter stays in general are associated with decreased expenses.[5] Usually, about 50%–80% of the spending in health care would be allocated

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to hospitals and the highest hospital cost is related to the LOS.[6]

Karim *et al*. in 2013 conducted a review study to evaluate the effective factors on the patients' LOS in hospital and classified the effective factors into four categories of clinical, demographic, management, and hospital factors.[4]

Despite the increasing advances in the ICUs, the mortality is high and up to 20% in America and Canada.[7] In 2011–2012, Janmohammadi *et al*. investigated the outcome of patients who were hospitalized in the ICUs in Iran. From the 344 studied patients, 45% were fully recovered, 16.5% died, and the rest were discharged with partial recovery.[7] In a study which was conducted in Israel, the mortality rate of the patients in the ICUs was 32.4%. In the patients who had a critical condition but could not be hospitalized in the ICUs because free beds were not available, the rate of mortality increased to 52%.[8]

Considering the limited number of beds in the ICUs, sometimes patients need to be prioritized to be admitted in these wards.[9] However, various factors are effective on making the decision about hospitalization in the ICUs including the severity of illness.[5] There are different tools for the assessment of the severity of illness such as Simplified Acute Physiology Score (SAPS3), Acute Physiology and Chronic Health Evaluation (APACHE) II, and sequential organ failure assessment (SOFA).[10] The SOFA score is a valid tool for the assessment of acute morbidity in critical illness.[11] SOFA score has been a valuable tool for predicting the severity of illness in different conditions such as pneumonia,[12] sepsis,[13] and acute respiratory distress syndrome.[14]

Demands for intensive care beds are increasing in the world, and patients should be selected carefully because of expensive treatments and limited number of intensive care beds. Long LOS in ICUs cause high costs and affect mortality and poor outcomes.[15] To improve the quality of medical care, the LOS in ICUs should be reduced and patients should be admitted according to evidence-based indicators. Severity of illness is a key indicator that can affect LOS and patient outcomes. Despite the importance of these indicators, few studies have been conducted in this area. Therefore, the present study was conducted to evaluate the impact of the severity of illness on the LOS and patient outcomes in the ICUs in the selected hospital in Kashan/Iran.

Materials and Methods

Study design and participants

The present study was a longitudinal descriptive study that was conducted in the ICUs of Shahid Beheshti Hospital that is the only general hospital in the Kashan city, from October 2019 to January 2020. This hospital has three ICUs of internal, neurosurgery, and surgery. Considering the LOS in ICUs in the study of Shukla *et al*.,[16] which was 3.37 ± 5.54 days, the sample size was calculated using the formula for descriptive studies (Z^2SD^2/d^2). Standard deviation was 5.54, confidence level was 95%, and the estimation error was 1 day, and the number of participants was calculated as 118; then, considering a 20% of participant loss, the final sample size was determined as 150. The inclusion criteria were consent of the patients or their families for participating in the study, being older than 18 years, being hospitalized in the ICUs for at least 1 day, and not having any known cognitive and motor problems before hospitalization in the ICU. Patients who were not willing to continue the study and those whose information could not be recorded were excluded from the study. The patients were entered to the study sequentially.

Measurement tools

Four questionnaires were used in this study. The demographic characteristics (including age, gender, marital status, occupation, and educational level) and information about admission and discharge (underlying diseases, the type of ICU, date of admission, and discharge from the unit) were recorded.

The second questionnaire was abbreviated mental test (AMT). The validity of AMT for recognizing individuals with cognitive disorders was 96.5 in the study of Bakhtiyari *et al*., which was considered desirable and its alpha Cronbach's was 0.76.[17] This questionnaire contains 10 questions and each correct answer would be assigned one score while wrong answers would have no score. The minimum score is 0 and the maximum score is 10, and if the patient would gain a score higher than 6, the patient has a normal cognitive condition.[18]

The third questionnaire was Barthel measuring tool, which shows individual's ability for performing activities of daily living (ADL). In the study of Tagharrobi *et al*.,[19] the Cronbach's α for this questionnaire was higher than 0.83, which is considered as desirable reliability; this study has also evaluated the validity of this tool with a Kappa coefficient of 0.6, which is considered desirable. This questionnaire has 10 subscales and the minimum score is 0 and the maximum score is 100. A score between 80 and 100 indicates independent ADL.[20] These two questionnaires were used to investigate the patient outcomes. It was assumed that if a patient gained a normal cognitive status and has an independent ADL, he/she would be considered optimal recovery. If the patient gained a lower score in any of the questionnaires, it would be considered as poor recovery; the patient's death was also recorded.

The fourth questionnaire was SOFA score, which shows the severity of illness. The content validity of this tool was approved in the study of Mahjoubipour *et al*.[21] and its reliability was also considered as desirable with a Cronbach's α of 0.92. This questionnaire contains 6 subscales for evaluating the respiratory, cardiovascular, liver, renal, nervous system, and coagulation conditions. Each subscale would gain a score between 0 and 4; therefore, the total score of the questionnaire ranges between 0 and 24. Higher scores of SOFA indicate more severity of illness.[22] SOFA score was calculated at the 1st day of patients' hospitalization.

Data gathering method

The first author and a trained nurse completed the patients' information in the ICUs. Demographic characteristic questionnaire was completed at the time of admission to the ICU. All of the patients who met the inclusion criteria were evaluated. If the patient was conscious, demographic characteristic questions and history of the disease were asked from the patient; otherwise, the questions were asked from patient's companion. The information for SOFA tool was recorded from patients' files and their vital signs at the 1st day of their hospitalization. Questionnaires for evaluating the cognitive condition and the ability for performing daily activities were completed at the time of discharge from ICU. Phone number and address of the patients and their families were recorded and they were contacted after 1 month and Barthel and AMT questionnaires were completed by asking questions from the patients or their families through the phone call or patient's death was recorded. If there was any problem in making the phone call, the researcher would refer to the patient's house and questionnaires were completed in person. If patient's score of Barthel was lower than 80 or their AMT score was lower than 6, the patient was considered as having poor recovery. On this basis, patients were divided into three groups regarding their outcome and condition at the time of discharge and 1 month later. The first group was the patients who died. The second group were patients with desirable cognitive condition and ability to perform ADL independently that were categorizes as optimum recovery, and the third group were patients who had cognitive problems or were dependent in doing ADL that were considered as poor recovery.

Data analysis

Data were analyzed using SPSS version 16 (IBM Corp., Armonk, NY, USA). The descriptive statistics were used for data presentation. The Kolmogorov–Smirnov test was used to test the normality of data. The Pearson's correlations, *t*-test, analysis of variance, and Chi-square tests were used to analyze the relationship of SOFA score and other variables. For multivariate analysis of variables related to LOS, the Poisson regression was used, and to analyze variables related to the outcome of the patients, the ordinal logistic regression analysis was used. The level of significant was considered as 0.05.

Ethical considerations

The study design was approved by the Kashan University of Medical Sciences Ethical Committee by ethical code: IR.KAUMS.NUHEPM.1398.020. All the permissions were obtained from university and hospital management. The informed consent form was signed by the patient or her/his relatives. The subjects were informed that they could leave the study any time without any consequences.

Results

In this study, 150 patients were studied; the mean age of the subjects was 53.02 ± 20.53 years and 81 patients (54%) were male. The mean of LOS in ICU was 11.21 ± 10.54 days. The minimum LOS was 1 and the maximum was 64 days. The median of LOS was 7 days. The mean of SOFA score was 5.86 ± 3.8, with the range of 1–17. The median of SOFA score was 5. The patient outcomes are shown in Tables 1 and 2.

The bivariate analysis showed that SOFA score, marital status, type of ward, underlying disease, and age had a significant relation with patient outcomes in the time of discharge. Among them, only SOFA score and underlying disease showed a significant relation with the patient outcomes 1 month after discharge [Tables 1 and 2]. Ordinal logistic regression showed that SOFA score was the only variable related to the outcome of the patients at the time of discharge from ICU and 1 month later in a way that with every increase in the SOFA score, the poor recovery increased 1.67 times at the time of the discharge and doubled 1 month later. The data showed that all the patients with SOFA score <5 survived, and all the patients with SOFA score more than 12 died [Figure 1].

The correlation between severity of illness and LOS was 0.45 that showed a significant relationship ($P = 0.000$). The scatter plot shows that there is a direct relationship between severity of illness and LOS in the SOFA score of 1–8, then with increasing in the SOFA score to 11, the LOS decreases, and then it shows an increasing pattern again [Figure 2].

The LOS had a significant relation with educational level, type of ICU ward, and patient outcomes at discharge and 1 month later. The mortality was significantly higher in patients with longer LOS [Table 3].

The Poisson regression analysis showed that SOFA score ($B = 0.065$, confidence interval [95%]: 0.05–0.0780), education under diploma ($B = 0.318$, confidence

Table 1: The demographic and clinical characteristics of patients and the outcome at the time of discharge from intensive care units

Type of variable	Optimal recovery (%)	Poor recovery (%)	Death (%)	*P*
Gender				
Female	18 (26.1)	31 (44.9)	20 (29)	0.59
Male	19 (23.45)	43 (53.1)	19 (23.45)	
Age				
18-40	4 (10)	30 (75)	6 (15)	0.0001
41-65	28 (43.1)	26 (40)	11 (16.9)	
>65	5 (11.1)	18 (40)	22 (48.9)	
Marital status				
Single	6 (15.8)	22 (57.9)	10 (26.3)	0.035
Married	27 (35.5)	32 (42.1)	17 (22.4)	
Widowed or divorced	4 (11.1)	20 (55.6)	12 (23.3)	
Educational level				
Under diploma	12 (17.4)	35 (50.7)	22 (31.9)	0.172
Diploma	13 (37.1)	14 (40)	8 (22.9)	
University degree	12 (26.1)	25 (54.3)	9 (19.6)	
Type of ward				
Internal ICU	4 (13.3)	10 (33.3)	16 (53.4)	<0.001
Surgical ICU	27 (38.6)	33 (47.1)	10 (14.3)	
Neurosurgical ICU	6 (12)	31 (62)	13 (26)	
Underlying disease				
Yes	29 (28.2)	42 (40.8)	32 (31)	0.008
No	8 (17)	32 (68.1)	7 (14.9)	
Total	37 (24.6)	74 (49.4)	39 (26)	150
SOFA score	3±1.49	4.7±2.27	10.76±3.09	<0.001

ICU=Intensive care unit, SOFA=Sequential organ failure assessment

Table 2: The demographic and clinical characteristics of patients and the outcome 1 month after discharge from intensive care unit

Type of variable	Optimal recovery (%)	Poor recovery (%)	Death (%)	*P*
Gender				
Female	35 (71.4)	9 (18.4)	5 (10.2)	0.377
Male	40 (64.5)	18 (29)	4 (6.5)	
Age (years)				
18-40	25 (73.5)	8 (23.5)	1 (2.9)	0.565
41-65	37 (68.5)	12 (22.2)	5 (9.3)	
>65	13 (56.5)	7 (30.4)	3 (13)	
Marital status				
Single	18 (64.3)	8 (28.6)	2 (7.1)	0.458
Married	44 (74.6)	11 (18.6)	4 (6.8)	
Widowed or divorced	13 (54.2)	8 (33.3)	3 (12.5)	
Educational level				
Under diploma	25 (53.2)	17 (36.2)	5 (10.6)	0.085
Diploma	20 (74.1)	5 (18.5)	2 (7.4)	
University degree	30 (81.1)	5 (13.5)	2 (5.4)	
Type of ward				
Internal ICU	8 (57.1)	4 (28.6)	2 (14.3)	0.644
Surgical ICU	44 (73.3)	12 (20)	4 (6.7)	
Neurosurgical ICU	23 (62.2)	11 (29.7)	3 (8.1)	
Underlying disease				
Yes	47 (66.2)	16 (22.5)	8 (11.3)	0.028
No	28 (70)	11 (27.5)	1 (2.5)	
Total	75 (67.6)	27 (24.3)	9 (8.1)	111
SOFA score	3.58±1.76	4.51±2.1	7.55±2.55	<0.0001

ICU=Intensive care unit, SOFA=Sequential organ failure assessment

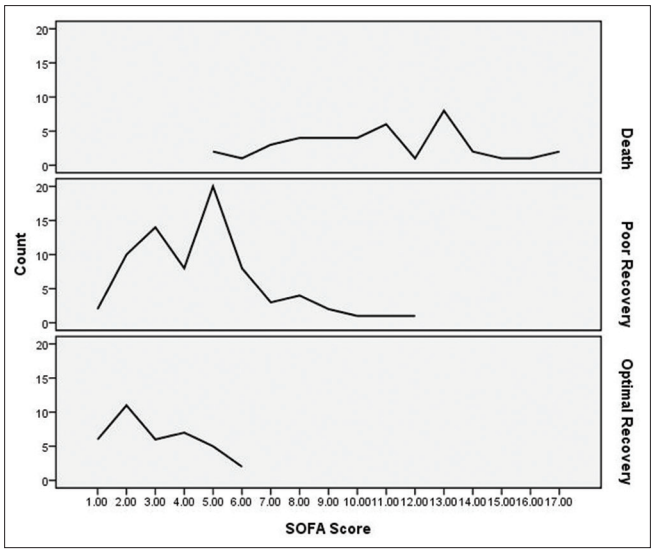

Figure 1: The outcome of patients in the time of discharge according to sequential organ failure assessment score

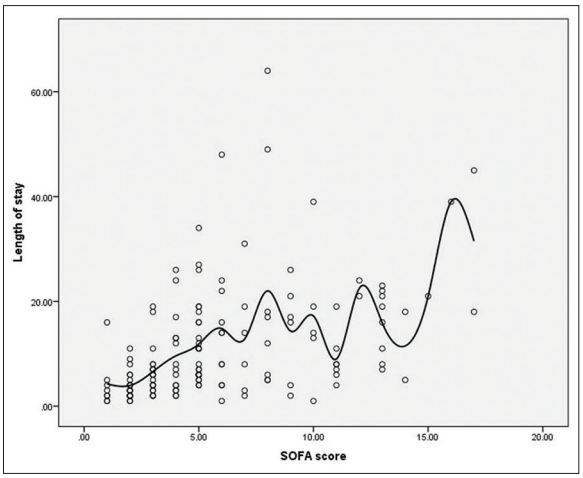

Figure 2: The relation between sequential organ failure assessment score in admission and the length of stay in Intensive care units

interval [95%]: 0.151–0.485), and internal ICU ward (*B* = 0.351, confidence interval [95%]: 0.214–0.5) were the variables that could make a significant model with LOS.

Discussion

SOFA score as the indicator of the severity of illness had a significant impact on the patient outcomes and LOS in ICUs. The mean of LOS in ICUs was 11.21 ± 10.54 days. In the study of Bohmer *et al*., the LOS was 9.4 days. After excluding the patients who died in the ICU, the LOS increased to 11.5 days.[23] In the study of Sugiarto and Darmawan in Indonesia, the mean of LOS was 14.36 days with a range of 4–91 days.[24] In the study of Abelha *et al*., the LOS was 4.22 ± 8.76 days, which was shorter in comparison with the present study.[25] The difference in LOS depends on various factors such as the type of ICU and patients' conditions. In the study of Toptas *et al*., the LOS had a direct significant relation with the level of urea, creatinine, and sodium and a reverse relation with the level of uric acid and hematocrit. Furthermore, the LOS was significantly higher in internal ICUs.[15] In the study of Shukla *et al*., also, the type of ICU had a significant relation with the LOS.[16] In our study also, the LOS was about 10 days longer in internal ICU compared to surgical and neurosurgical ICUs. This difference indicates that for comparing the LOS between different wards, separate criteria are required.

In the study of Strand, the mean of LOS in patients who died in the ICU was 1.3 days. The LOS had a reverse relation with the severity of disease that was measured using APACHE II and SAPS 2.[26] On the contrary to Strand study, there was a direct correlation between

Table 3: Evaluating demographic and clinical characteristics with the length of stay

Type of variable	Mean	*P*
Gender		
Female	11.39±11.76	0.393
Male	11.06±9.45	
Marital status		
Single	9.55±6.32	0.109
Married	10.51±11.14	
Widowed or divorced	14.44±12.23	
Educational level		
Under diploma	14.17±12.69	0.015
Diploma	8.2±6.88	
University degree	9.06±7.95	
Type of ward		
Internal ICU	19.5±15.36	0.001
Surgical ICU	8.4±8.28	
Neurosurgical ICU	10.18±6.86	
Underlying disease		
Yes	12.15±11.9	0.89
No	9.14±6	
Outcome at the time of discharge		
Death	16.84±12.71	<0.001
Poor recovery	10.16±9.74	
Optimal recovery	7.37±6.68	
Outcome one month after discharge		
Death	19.44±13.33	<0.001
Poor recovery	12.81±11.5	
Optimal recovery	6.72±5.3	
SOFA	*R*=0.546	<0.001

ICU=Intensive care unit, SOFA=Sequential organ failure assessment

LOS and severity of illness up to the SOFA score of 8 and then a reverse relation was found in the current study. It seems that the relation between LOS and severity of illness might not be linear.

Considering that ICUs are expensive, as Agrawal *et al*. mentioned them as the most expensive wards in

hospitals,[27] it is necessary that the reasons for the long stay of patients in these wards would be investigated. Gruenberg *et al*. in a review study concluded that palliative care, ethical counseling and other methods that would increase the communication between the health-care personnel, and the patients and their families could decrease the LOS in ICUs.[28] Decreasing the LOS in ICUs could have an important role in economic saving and could also decrease the risk of side effects such as nosocomial infections.

In the study of Bohmer *et al*., the severity of illness in the survived patients was related to longer LOS in ICUs. However, in patients who died, the LOS had an inverse relation with severity of illness, because most of the patients with severe problems died during the 1st days of hospitalization.[23] In the current study, the mean of LOS in patients who died in the ICUs was 16.84 days that showed these patients did not benefit from the long stay in ICUs; on the contrary, some mortality might be related to the complications of long stay in ICUs. The exact causes of mortality in ICUs need further investigation.

In the study of Ferreira *et al*., the SOFA score was related to mortality, but not to the LOS in ICU. The initial score of 11 or mean scores of 5 could predict 80% of mortality.[22A] In the current study, also, all the patients with the SOFA score <5 survived, and all the patients with the SOFA score of more than 12 died. It seems that the SOFA score of 12 can be suggested as a cutoff point for poor prognosis in ICU patients. This can be considered when there is a limitation in ICU beds, and patients need to be prioritized for admission to these wards, although this needs further investigation.

The results of this study showed that 24.7% of the patients were discharged from ICUs with optimal recovery. 49.3% of the patients were discharged with poor recovery and 26% died. Furthermore, one month after discharge, 67.6% of the patients had optimal recovery, 27% had poor recovery, and 9 more patients died. In the study of Bohmer *et al*., the mortality rate was 9.5%.[23] In the study of Feizi, the mortality rate was 15%. Most of the deaths were occurred during the first 5 days of hospitalization.[29] In the study of Abelha *et al*., the mortality was 11.2% in surgical ICUs.[25] The mortality rate was considerably higher in the current study compared to previous studies. Recruiting patients from internal ICU that generally have higher mortality rate might explain a part of this difference.

In the study of Janmohammadi *et al*. in Iran, 49.4% of patients were fully recovered, and 29.6% were discharged with partial recovery or transferred to other wards.[7] The rate of full recovery was twice comparing to the current study. In the present study, the outcome 1 month after discharge was also investigated, which is considered as one of the strengths of this study and could provide important information in this regard.

This study had some limitations. It was conducted in one hospital and could not show the general condition of all the ICUs. Only the initial SOFA score was recorded, while the serial scores might have a better prognostic value. Furthermore, various qualitative and managerial factors such as the quality of nursing care were not evaluated in the present study and this requires more investigation.

Conclusions

There was a significant relation with the severity of illness and LOS and patients' outcomes at the time of discharge from ICU and 1 month later. The correlation between LOS and severity of illness seems to be nonlinear. Patients with initial SOFA score of 12 and above did not show to receive benefit from long stay in ICU, and this number can be considered as a cutoff point for poor prognosis. The type of ICU ward is also a crucial variable in both LOS and patient outcomes, so there might be a need for different functional indicators in different ICU wards.

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Conflicts of interest

There are no conflicts of interest.

References

1. Yaghoubi M, Karimi S, Ketabi S, Javadi M. Factors affecting patients' length of stay in alzahra hospital based on hierarchical analysis technique. Health Inf Manag 2012;8:326-34.
2. Hachesu PR, AhmadI M, Alizadeh S, Sadoughi F. Use of data mining techniques to determine and predict length of stay of cardiac patients. Healthc Inform Res 2013;19:121-9.
3. Ravangard R, Arab M, Rashidian A, Akbarisari A, Zare A, Salesi M, *et al*. Hospitalized patients' length of stay and its associated factors in Tehran University of Medical Sciences Women's Hospital using the survival analysis method. J Schl

Public Health Institute Public Health Res 2010;8:25-35.
4. Karim H, Tara SM, Etminani K. Factors associated with length of hospital stay: A systematic review. J Health Biomed Inform 2015;1:131-42.
5. Verburg I, Holman R, Dongelmans D, de Jonge E, de Keizer NF. Is patient length of stay associated with intensive care unit characteristics? J Crit Care 2018;43:114-21.
6. Arab M, Zarei A, Rahimi A, Rezaiean F, Akbari F. Analysis of factors affecting length of stay in public hospitals in Lorestan province, Iran. Hakim Health Syst Res J 2010;12:27-32.
7. Janmohammadi N, Alijanpour E, Bahrami M, Taheri M, Hoseini F. Outcome of the patients admitted to the surgical intensive care unit of Shahid Beheshti hospital (Babol, Iran). J Babol Univ Med Sci 1393;16:72-7.
8. Sagy I, Fuchs L, Mizrakli Y, Codish S, Politi L, Fink L, *et al*. Characteristics and outcomes of critically-ill medical patients admitted to a tertiary medical center with restricted ICU bed capacity. J Crit Care 2018;43:281-7.
9. Norouzi K, Mashmool Z, Dalvandi A, Soleimani MA. Comparison of two tools APACHE IV and SAPS II in predicting mortality rate in patients hospitalized in intensive care unit. Koomesh 2015;16:347-55.
10. Mbongo CL, Monedero P, Guillen-Grima F, Yepes MJ, Vives M, Echarri G. Performance of SAPS3, compared with APACHE II and SOFA, to predict hospital mortality in a general ICU in Southern Europe. Eur J Anaesthesiol 2009;26:940-5.
11. Lambden S, Laterre PF, Levy MM, Francois B. The SOFA score-development, utility and challenges of accurate assessment in clinical trials. Crit Care 2019;23:374.
12. Asai N, Watanabe H, Shiota A, Kato H, Sakanashi D, Hagihara M, *et al*. Could qSOFA and SOFA score be correctly estimating the severity of healthcare-associated pneumonia? J Infec Chem 2018;24:228-31.
13. Bonjorno Junior JC, Caruso FR, Mendes RG, da Silva TR, Biazon TM, Rangel F, *et al*. Noninvasive measurements of hemodynamic, autonomic and endothelial function as predictors of mortality in sepsis: A prospective cohort study. PLoS One 2019;14:e0213239.
14. Laffey JG, Bellani G, Pham T, Fan E, Madotto F, Bajwa EK, *et al*. Potentially modifiable factors contributing to outcome from acute respiratory distress syndrome: The LUNG SAFE study. Intensive Care Med 2016;42:1865-76.
15. Toptaş M, Sengul Samanci N, Akkoç I, Yücetaş E, Cebeci E, Sen O, *et al*. Factors affecting the length of stay in the intensive care unit: Our clinical experience. BioMed Res Int 2018;2018:1-4.
16. Shukla K, Chandrashekhar P, Kumar N, Devade PK. A descriptive study of length of stay at an intensive care unit. Int J Res Found Hosp Healthcare Administ 2015;3:29-32.
17. Bakhtiyari F, Foroughan M, Fakhrzadeh H, Nazari N, Najafi B, Alizadeh M, *et al*. Validation of the persian version of abbreviated mental test (AMT) in elderly residents of Kahrizak charity foundation. Iran J Diabetes Lipid Dis 2014;13:487-94.
18. Abbreviated Mental Test Score. Occasional Paper (Royal College of General Practitioners); 1993. p. 28.
19. Tagharrobi Z, Sharifi K, Sooky Z. Psychometric evaluation of the short forms of barthel index in the elderly residing in nursing home. J Paramed Sci Rehabil 2013;2:26-38.
20. Sinoff G, Ore L. The Barthel activities of daily living index: Self-reporting versus actual performance in the old-old (> or=75 years). J Am Geriatr Soc 1997;45:832-6.
21. Mahjoubipour H, Mohammadi M, Salmani F, Saneei F. Efficiency of SOFA scoring system on predicting mortality rate and stay length in intensive care unit for patients of Al-Zahra hospital of Isfahan. Med Surg Nurs J 2013;1:6-10.
22. Ferreira FL, Bota DP, Bross A, Mélot C, Vincent JL. Serial evaluation of the SOFA score to predict outcome in critically ill patients. JAMA 2001;286:1754-8.
23. Bohmer AB, Just KS, Lefering R, Paffrath T, Bouillon B, Joppich R, *et al*. Factors influencing lengths of stay in the intensive care unit for surviving trauma patients: A retrospective analysis of 30,157 cases. Critical care (London, England) 2014;18:R143.
24. Sugiarto N, Darmawan E. The factors affecting the length of stay in the intensive care units of Pertamina central hospital in Indonesia related to healthcare associated infections. J US-China Med Sci 2014;11:195-204.
25. Abelha F, Maia P, Landeiro N, Neves A, Barros H. Determinants of outcome in patients admitted to a surgical intensive care unit. Arquivos de Med 2007;21:135-43.
26. Strand K, Walther SM, Reinikainen M, Ala-Kokko T, Nolin T, Martner J, *et al*. Variations in the length of stay of intensive care unit nonsurvivors in three Scandinavian countries. Critical care (London, England) 2010;14:4.
27. Agrawal A, Gandhe M, Gandhe S, Agrawal N. Study of length of stay and average cost of treatment in Medicine Intensive Care Unit at tertiary care center. J Health Res Rev 2017;4:24.
28. Gruenberg DA, Shelton W, Rose SL, Rutter AE, Socaris S, Mcgee G. Factors influencing length of stay in the intensive care unit. Am J Crit Care 2006;15:502-9.
29. Feizi I, Eidi M, Ansari M. Mortality rate and effective factors of patients in intensive care Unit. J Ardabil Univ Med Sci 2008;8:3.