



The Factors Affecting the Length of Stay in the Intensive Care Unit

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Abstract

Introduction: Length of stay in the intensive care unit (ICU) is one of the most important factors that impacts the health care resource utilization. This study aimed to identify the factors associated with prolonging the patients' stay in Nemazi Hospitals ICUs and do interventions to reduce the length of hospital stay to improve the quality of care and decrease hospital costs.

Methods: During two months, eight sessions were held with the senior physicians, head nurses, and supervisors of eight adult ICUs working in Nemazi hospital, a 850-bed university hospital in Shiraz, south of Iran. Factors contributing to the prolongation of the patients' stay in the intensive care units were examined. Based on a researcher-made questionnaire, 28 important factors were identified and ranked according to the degree of importance.

Results: The most important factors in terms of the degree of importance were unavailable bed vacancies in the step-down wards, financial problems of the families to pay for the home-based primary nursing care, ICU-acquired infections, and admission of patients too sick to benefit from the ICU due to unjustified administrative pressure. The most amendable factors were hospital-acquired infections, delay in surgical tracheostomy when indicated, unavailable beds in step-down wards, and poor interdisciplinary collaboration of the staff physicians.

Conclusion: Interventional projects have been designed to reduce ICU-acquired infections, facilitating the process of surgical tracheostomy and supporting families who are not able to pay the costs of home-based care.

Keywords: Length of stay (LOS), Intensive care unit (ICU), Health care utilization

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Introduction

Length of stay (LOS) in the intensive care unit (ICU) is one of the most important factors that impacts the effective utilization of health care resources (1). Some of the most important factors that can affect the duration of hospitalization in the ICU include clinical factors such as the type and severity of the diseases, efficiency of the care process, method of management of the ICU by the physicians, and duration of stay in the hospital before admission to the ICU (2). Organizational factors like geographical location of the hospital, type of hospital, and hospital resources are also important (2). Social factors including the type of communication between the physicians and patients, and poor communication and collaboration between the caregiver team

members are also important (3). As provision of intensive care is expensive and the number of beds are limited (4), reducing the length of ICU stay to make optimal use of the resources is of paramount significance.

Many hospitals have adopted guidelines related to admission to and discharge from ICU to decrease the variability of practice between the clinicians and justify allocation of ICU beds (5). However, these guidelines could be different according to different regional availability of ICU beds and financial resources (4). Despite the regional variability, reducing the duration of ICU stay while providing adequate clinical care is a favorable initiative.

The intensive care team in Namazi hospital recently started to participate in the CORE (Center for Outcome and Resource Evaluation)

program in collaboration with Australia and New Zealand Intensive Care Society. This program has been used for more than 20 years for auditing and benchmarking of intensive care performance across Australia and New Zealand. Comparative reports are provided for the submitting units for clinical performance, safety, and quality of care. After releasing the 2017 annual report, we noticed that Namazi Hospital is an outlier in the field of ICU LOS among similar centers in the CORE program. This study aimed to identify the factors associated with prolongation of the patients' stay in Nemazi Hospital ICUs and do interventions to reduce the length of hospital stay to improve the quality of care and decrease hospital costs.

Methods

This descriptive-analytical study was conducted on all head nurses and attending physicians working in the intensive care units of Shiraz Nemazi Hospital in 2020. The factors affecting the prolongation of the length of stay in Nemazi Hospital intensive care units and methods for improving the quality of this part were discussed in the form of a focused group, in cooperation with senior clinicians of Nemazi Hospital in Shiraz. This hospital is the largest one in the south of Iran, an 850-bed university hospital with 91 adult ICU beds located in 9 separate spaces. Seven ICUs are led by intensivists using closed model of management, and two of them are managed by non-intensivists with an open type of operation.

During two months and within 8 sessions, the factors influencing the prolongation of the patients' stay in the intensive care units were discussed. After the focused group discussions, 28 influential factors were identified, and a researcher-made questionnaire was designed to determine the degree of importance (i.e., which factors are more effective in reducing the stay in the ICU) and the feasibility of the intervention (i.e., according to the existing conditions and facilities, in which of the factors investigated the possibility of intervention exists to reduce the length of stay).

To confirm the content validity ratio (CVR), it is recommended that the number of specialists should be more than 10 individuals (6). Twenty-eight factors identified in the form of a researcher-made questionnaire were distributed among 13 experts and intensive care professors. They were

asked to express their views on the quality of the items and the entire questionnaire. To calculate CVR, we used the Lawshe method which is calculated according to the following formula (6):

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}}$$

n_e = The number of evaluators who considered the desired factor to be necessary

N = The total number of evaluators

In the current study, content validity was approved by 13 evaluators, and the minimum acceptable CVR with this number, based on the Lawshe table, was 0.54 (6, 7). Finally, 28 factors obtained the required score for entering the main questionnaire (Table 1). The reliability of the questionnaire was also determined by internal consistency, with a Cronbach's alpha of 70%.

In the second stage of the study, 35 head nurses and attending physicians, working in 8 adult ICUs of Nemazi Hospital entered the study after they gave their informed consent; they were asked to express their ideas about 28 effective factors on prolongation of the ICU stay in their unit. They were asked to rank first the importance of each factor and then the degree of the feasibility of possible interventions to improve each of the 28 factors based on a five-point Likert Scale (from very low (1) to very high (5)). SPSS software was used to analyze the data.

Results

The possible factors affecting the length of the patients' stay in the ICU were prioritized in terms of importance, and the feasibility of probable interventions is shown in Table 1. Our results showed that, regarding the relative importance, the clinicians believed that no vacancy in the step-down wards had the highest probable effect on the prolongation of patients' stay in ICU with an average of 4.11 ± 1.26 score, and the highest priority for corrective interventions belonged to the ICU-acquired infections with an average score of 4.05 ± 1.91 .

Based on the results shown in Figure 1, the most important factors in terms of the degree of importance include: 1. No vacancy in the step-down wards, 2. ICU-acquired infections, 3. Delay in discharge from ICU in high-risk obstetric patients, 4. Absence of high-risk obstetric ward in the hospital, 5. Poor inter-disciplinary

collaboration to finalize the therapeutic plan, 6. Admission of patients too sick to benefit from the ICU due to unjustified administrative pressure, 7.

Higher priority in hospital wards for admitting patients from emergency department rather than ICUs, 8. Postponement of the surgical

Table 1: The scores given to each factor by the clinicians according to the degree of importance and feasibility of possible interventions

Factors	Feasibility	Importance
	Mean±SD	Mean±SD
1 Dependence on the ventilator device	2.68±1.76	2.94±1.05
2 No vacancy in the step-down wards	3.87±1.42	4.11±1.26
3 Poor inter-disciplinary collaboration to finalize the therapeutic plan	3.74±1.63	3.74±1.15
4 ICU acquired infections	4.05±1.91	3.94±1.65
5 Cancellation of planned surgery	2.22±1.37	2.28±1.24
6 Treatment delay due to shortage of medications or equipment	2.45±1.63	2.88±1.45
7 Delay in discharge from ICU in high-risk obstetric patients	3.42±1.80	3.88±1.30
8 Absence of high-risk obstetric ward in the hospital	3.34±1.73	3.84±1.35
9 Poor contribution of the obstetric attending physician in daily ICU rounds	2.57±1.45	2.71±1.65
10 Postponement of the surgical tracheostomy procedures due to patient factors	3.11±1.60	3.34±1.34
11 Postponement of the surgical tracheostomy procedure because of the anesthetic barriers	3±1.94	3.11±1.60
12 Postponement of the surgical tracheostomy procedure because of the surgical problems	3.94±1.45	3.51±1.34
13 Postponement of tracheostomy procedure due to family refusal	2.74±1.85	2.8±1.40
14 The disagreement between referring physicians and intensivists about patient's readiness for discharge or transfer from ICU	2.17±1.74	2.28±1.57
15 Keeping patients in ICU to guarantee ICU bed availability for the next elective surgery	2.6±1.54	2.57±1.48
16 Family request to keep their patients in ICU for better care	3.61±1.55	3.34±1.33
17 Admitting too sick patients who may not benefit from the ICU due to unjustified administrative pressure	3.68±1.59	3.68±1.13
18 Admitting too sick patients from other health care centers	3.22±1.94	3.47±1.38
19 Delay in the patient transfer due to unavailability of same-sex bedroom	2.25±1.91	2.65±1.73
20 Financial problems of the families to pay for home-based primary nursing cares	2.62±1.80	3.39±1.55
21 Continuity of internal problems, such as dialysis and age, etc., which causes the occupation of ICU	2.57±1.84	3.05±1.86
22 Hospital instructions mandating clearing patients' bill before discharge from ICU	2.68±1.33	2.42±1.26
23 Higher priority in hospital wards for admitting patients from the emergency department rather than ICUs	2.91±1.35	3.59±1.30
24 Difficulty admission of patients from the sectors	3.45±1.49	3.41±0.96
25 Delay in completing transfer related forms (e.g. transfer order, transfer note)	2.34±1.57	2.02±1.50
26 Delay in the patient transfer due to the absence of a colleague or a nurse or doctor	1.88±1.55	1.6±1.67
27 The delay in answering the case for transferring the patient to the units by the doctors of the destination department	2.45±1.75	2.45±1.35
28 Family request for the patient stay in ICU for better care	3.28±1.49	2.4±1.32

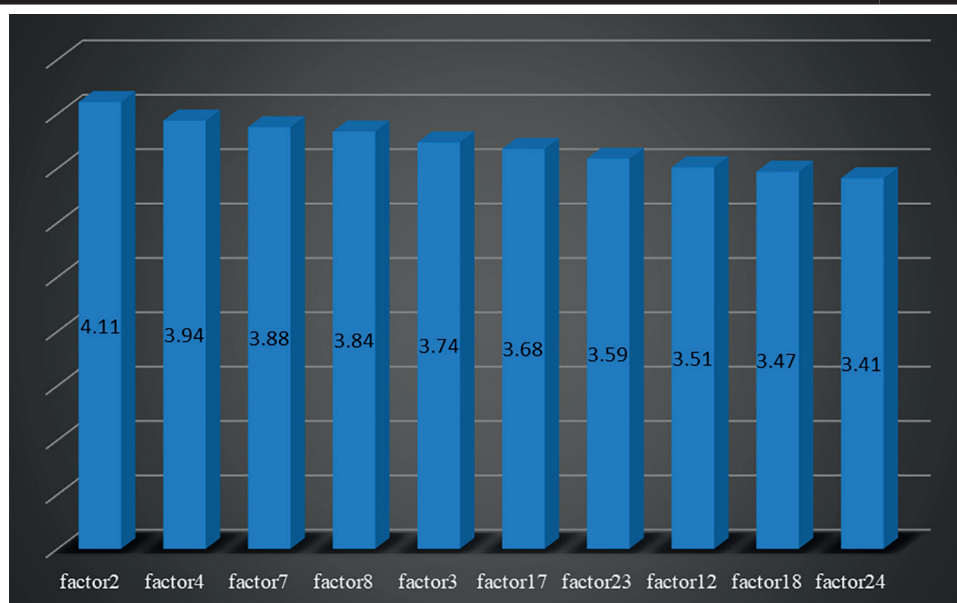


Figure 1: 10 important influential factors in terms of the degree of importance

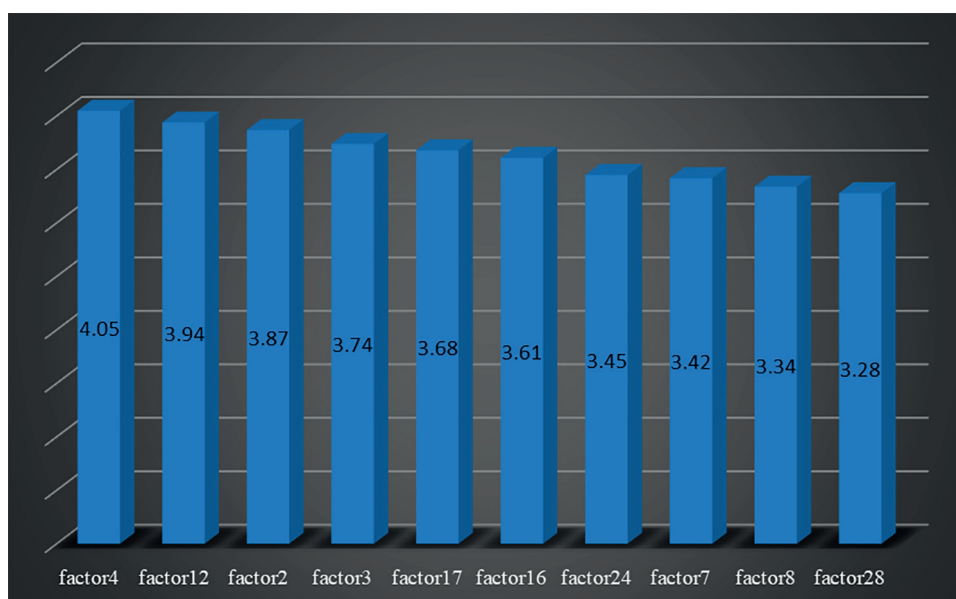


Figure 2: 10 important influential factors in terms of the degree of intervention

tracheostomy procedure because of the surgical problems, 9. Admission of critically ill patients from other health care centers, and 10. Difficulty in the admission of patients from other sectors.

Also, based on the results shown in Figure 2, the most important factors in terms of the degree of intervention were: 1. ICU-acquired infections, 2. Postponement of the surgical tracheostomy procedure because of the surgical problems, 3. No vacancy in the step-down wards, 4. Poor inter-disciplinary collaboration to finalize the therapeutic plan, 5. Admission of the patients too sick to benefit from the ICU due to unjustified administrative pressure, 6. Family request to keep their patients in ICU for better care, 7. Difficulty in admission of the patients from the sectors, 8. Delay in discharge from ICU in high-risk obstetric patients, 9. Absence of high-risk obstetric ward in the hospital, and 10. Family request for their patients' stay in the intensive care unit for better care.

Discussion

The ICU is a hospital unit providing continuous surveillance and highly specialized care for patients (8). In today's health care systems, it is important to allocate resources appropriately (9). Since resources are limited, the proper use of ICU beds is essential, but it is complex and challenging to achieve. Therefore, this study aimed to identify the factors associated with prolonging hospital stay in ICU and reducing the length of stay to improve the quality of medical care.

The results of our study showed that according to the degree of importance, no vacancy in the step-down wards had the greatest impact on the length of stay in the intensive care unit. In similar studies by Azarfarin et al.(10), Rosenberg et al.(11) and Robert et al. (12), lack of sufficient beds influenced the prolonged ICU stay.

Our findings showed the lack of home care centers under the insurance coverage was effective in the length of stay in the intensive care unit. Gruenberg et al. (2), Amrita et al.(13), Mainous et al. (14) and Vahidi et al. (15) confirmed the significant relationship between insurance and length of stay in the intensive care unit.

In the present study, hospital infection significantly affected the length of stay in the studies conducted by Higgins et al. (16), Gharacheh et al. (17) and Shakib et al. (18). The effect of hospital infection on the length of stay in the intensive care unit was significant.

Our study also showed that the postponement of the surgical tracheostomy procedure had a significant effect on the length of stay in the intensive care unit. In the studies of Arabi et al.(19), Kiakojouri et al. (20) and Hemmati et al. (21), the effect of the surgical tracheostomy procedure on the length of stay in the intensive care unit was significant.

Our findings showed the insistence of the patient's companion on staying with their patients in the intensive care unit was effective in the length of stay. Truog et al. (22) and Schneiderman et al. (23) indicated the significant

relationship between the satisfaction of the patient's companion and length of stay in the intensive care unit.

In the current study, delay in discharge from the ICU in high-risk obstetric patients and lack of high-risk obstetric ward in the hospital had a significant effect on the length of stay. Ntuli et al. (24) reported in their study, the length of stay of high-risk obstetric cases in the intensive care unit ranged between 0-163 days with a mean of 8 days, which represents a high length of stay. Also, Özçelik et al. (25) reported the length of stay of high-risk obstetric cases in the intensive care unit ranged between 3-49 days with a mean of 7 days.

After summarizing the comments of the group members, for reducing the length of the hospitalization period in the ICU, it is possible to intervene in some of the factors affecting the length of the patient's stay in the ICU; First, getting a low-cost care service and having the right to complain caused the patients' companions to insist on their patients' stay in the ICU. Second, the patient's companions insist on the patient's stay in the intensive care unit; finally, sick patients who do not benefit from the intensive care unit are admitted.

In this regard, the group members suggested that this section should overcome the prolonged hospital stay in the ICU. Post-ICU is a secondary care unit and an alternative to the ICU for moderately sick patients. This section needs less equipment than the ICU, and it admits patients who are at low risk of death but should be given special care to prevent this risk, or terminally ill patients who stay in the ICU and utilize the facilities of the sector, but it does not affect their improvement. Approval and current use of the Post-ICU in Iran is currently almost unknown, and only a few private hospitals have launched this part; however, the insurance companies do not reimburse the costs of this section. As we mentioned earlier, the results of previous studies indicate that if this section is established, many of the problems associated with the intensive care unit will be resolved, such as the constant problem of unavailable beds in step-down wards, prolongation of hospitalization, and hospital costs.

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References

1. Chan CL, Ting HW, Huang HT. The definition of a prolonged intensive care unit stay for spontaneous intracerebral hemorrhage patients: an application with national health insurance research database. *Biomed Res Int.* 2014;2014:891725. doi: 10.1155/2014/891725.
2. 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(5):502-9.
3. Kwame A, Petrucka PM. A literature-based study of patient-centered care and communication in nurse-patient interactions: barriers, facilitators, and the way forward. *BMC Nurs.* 2021;20(1):158. doi: 10.1186/s12912-021-00684-2.
4. Blanch L, Abillama FF, Amin P, Christian M, Joynt GM, Myburgh J, et al. Triage decisions for ICU admission: Report from the Task Force of the World Federation of Societies of Intensive and Critical Care Medicine. *J Crit Care.* 2016;36:301-5. doi: 10.1016/j.jcrc.2016.06.014.
5. Nates JL, Nunnally M, Kleinpell R, Blosser S, Goldner J, Birriel B, et al. ICU Admission, Discharge, and Triage Guidelines: A Framework to Enhance Clinical Operations, Development of Institutional Policies, and Further Research. *Crit Care Med.* 2016;44(8):1553-602. doi: 10.1097/CCM.0000000000001856.
6. Mohammadbeigi A, Mohammad-salehi N, Aligol M. Validity and reliability of the instruments and types of measurements in health applied researches. *Journal of rafsanjan university of medical sciences.* 2015;13(12):1153-70.
7. Lawshe CH. A quantitative approach to content validity. *Personnel psychology.* 1975;28(4):563-75.
8. Capuzzo M, Moreno RP, Alvisi R. Admission

- and discharge of critically ill patients. *Curr Opin Crit Care*. 2010;16(5):499-504. doi: 10.1097/MCC.0b013e32833cb874.
9. Rosenfeld R, Smith JM, Woods SE, Engel AM. Predictors and outcomes of extended intensive care unit length of stay in patients undergoing coronary artery bypass graft surgery. *J Card Surg*. 2006;21(2):146-50. doi: 10.1111/j.1540-8191.2006.00196.x.
 10. Azarfarin R, Ashouri N, Totonchi Z, Bakhshandeh H, Yaghoubi A. Factors influencing prolonged ICU stay after open heart surgery. *Res Cardiovasc Med*. 2014;3(4):e20159. doi: 10.5812/cardiovascmed.20159.
 11. Rosenberg AL, Zimmerman JE, Alzola C, Draper EA, Knaus WA. Intensive care unit length of stay: recent changes and future challenges. *Crit Care Med*. 2000;28(10):3465-73. doi: 10.1097/00003246-200010000-00016.
 12. Robert R, Coudroy R, Ragot S, Lesieur O, Runge I, Souday V, et al. Influence of ICU-bed availability on ICU admission decisions. *Ann Intensive Care*. 2015;5(1):55. doi: 10.1186/s13613-015-0099-z.
 13. Badgal A. Factors affecting the average length of stay of the patients in the inpatient department in a tertiary care centre in North India. *Journal of Evolution of Medical and Dental Sciences*. 2015;4(2):150-6.
 14. Mainous AG, 3rd, Diaz VA, Everett CJ, Knoll ME. Impact of insurance and hospital ownership on hospital length of stay among patients with ambulatory care-sensitive conditions. *Ann Fam Med*. 2011;9(6):489-95. doi: 10.1370/afm.1315.
 15. Vahidi R, KOUSHAVAR H, Khodayari R. Factors affecting coronary artery patients hospital length of stay of Tabriz Madani Hospital; 2005-2006. *Journal of Health Administration*. 2006;9(25):63-8.
 16. Higgins TL, McGee WT, Steingrub JS, Rapoport J, Lemeshow S, Teres D. Early indicators of prolonged intensive care unit stay: impact of illness severity, physician staffing, and pre-intensive care unit length of stay. *Crit Care Med*. 2003;31(1):45-51. doi: 10.1097/00003246-200301000-00007.
 17. Gharacheh L, Torabipour A, Khiavi FF, Malehi AS, Haddadzadeh M. Comparison of Statistical Models of Predict the Factors Affecting the Length of Stay (LOS) in the Intensive Care Unit (ICU) of a Teaching Hospital. *Mater Sociomed*. 2017;29(2):88-91. doi: 10.5455/msm.2017.29.88-91.
 18. Shakib P, Lavakhamseh H, Mohammadi B. The prevalence of nosocomial infection in ICU, Besat Hospital, Sanandaj City, Iran. 2014;15(45):36-41.
 19. Arabi YM, Alhashemi JA, Tamim HM, Esteban A, Haddad SH, Dawood A, et al. The impact of time to tracheostomy on mechanical ventilation duration, length of stay, and mortality in intensive care unit patients. *J Crit Care*. 2009;24(3):435-40. doi: 10.1016/j.jcrc.2008.07.001.
 20. Kiakojoury K, POURHASAN AA, HAJIAHMADI M, Madadian M. Indication and early complications of tracheostomy in the intensive care unit patients in Shahid Beheshti and Shahid Yahyanejad Hospital (Babol, Iran; 2001-2006). *JBUMS*. 2009;11(1):67-71.
 21. Hemmati H, Forozeshfard M, Hosseinzadeh B, Hemmati S, Mirmohammadkhani M, Bandari R. Tracheostomy in Patients Who Need Mechanical Ventilation: Early or Late? Surgical or Percutaneous? A Prospective Study in Iran. *Indian J Surg*. 2017;79(5):406-11. doi: 10.1007/s12262-016-1497-7.
 22. Truog RD, Campbell ML, Curtis JR, Haas CE, Luce JM, Rubenfeld GD, et al. Recommendations for end-of-life care in the intensive care unit: a consensus statement by the American College [corrected] of Critical Care Medicine. *Crit Care Med*. 2008;36(3):953-63. doi: 10.1097/CCM.0B013E3181659096.
 23. Schneiderman LJ, Gilmer T, Teetzel HD, Dugan DO, Blustein J, Cranford R, et al. Effect of ethics consultations on nonbeneficial life-sustaining treatments in the intensive care setting: a randomized controlled trial. *JAMA*. 2003;290(9):1166-72. doi: 10.1001/jama.290.9.1166.
 24. Ntuli TS, Ogunbanjo G, Nesengani S, Maboya E, Gibango M. Obstetric intensive care admissions at a tertiary hospital in Limpopo Province, South Africa. *Southern African Journal of Critical Care*. 2015;31(1):8-10.
 25. Ozcelik M, Turhan S, Bermede O, Yilmaz AA, Unal N, Bayar MK. Outcomes of Antepartum and Postpartum Obstetric Admissions to the Intensive Care Unit of A Tertiary University Hospital: An 8-Year Review. *Turk J Anaesthesiol Reanim*. 2017;45(5):303-9. doi: 10.5152/TJAR.2017.56323.