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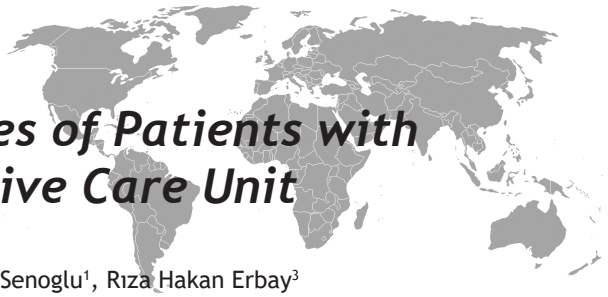
Original Article



Characteristics and Outcomes of Patients with Prolonged Stays in an Intensive Care Unit

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ABSTRACT

Objective: *To determine the characteristics and outcomes of patients with prolonged stay in a tertiary-care ICU.* ***Method:*** *Electronic database records of patients 18 years or older and hospitalized in the ICU from March 2010 to March 2013 were enrolled. Age, gender, main reason for ICU admission, length of mechanical ventilation and ICU stay, in-hospital and one year mortality were noted.* ***Results:*** *The records of 1,908 patients from their initial ICU stays were analyzed. The mean Length Of Stay (LOS) for patients with a LOS≥ 28 days (n: 215) was 85.6±81.9 days. The main disease category necessitating prolonged stays was neurologic disorders according to the diagnosis by the admission to ICU, while the main disease category necessitating a LOS< 28 days stays was elective surgery. Among the prolonged stay patients, 37 (17.2%) were alive one year post-discharge and only 13 (6%) were living independently.* ***Conclusion:*** *Patients with a prolonged ICU stay constituted a small percentage of all ICU admissions but they proportionally used many more ICU bed days than short-stay patients. The mortality of prolonged ICU stay patients was very high. Very few survivors were living independently at one year. Thus, development of intermediate care units, palliative care and home care services are emerging necessities, to decrease the LOS in ICUs.*

Key words: *Intensive Care, Length of Stay, Survival, Palliative Care*

Yoğun Bakımda Uzun Süre Yatan Hastaların Özellikleri ve Sonuçları

ÖZET

Amaç: *Üçüncü düzey bir yoğun bakımda uzun süre yatan hastaların özellik ve sonuçlarının belirlenmesi.* ***Yöntem:*** *Mart 2010-Mart 2013 tarihleri arasında yoğun bakım ünitesinde yatan 18 yaşından büyük hastaların elektronik ortamdaki kayıtları incelendi. Hastaların yaş, cinsiyet, yoğun bakıma yatış nedenleri, mekanik ventilasyon ve yoğun bakım kalış süreleri, ayrıca hastane ve bir yıllık mortaliteleri kaydedildi.* ***Bulgular:*** *1908 hastanın kayıtları, yoğun bakıma ilk yatışlarından itibaren incelendi. 28 günden uzun yatan hastalar için (n:215) ortalama yatış süresi 85.6±81.9 gün bulundu. Uzamış yatış sürelerine gerek duyan hastalarda yatış tanısı en sık nörolojik bozukluklar iken kısa yatış süreleri için tanı en çok elektif cerrahi idi. Uzun süre yatan hastaların 37'sinin (%17.2) 1 yıl sonunda hayatta kaldığı ve yalnızca 13'ünün (%6) bağımsız yaşayabildiği saptandı.* ***Sonuç:*** *Yoğun bakımda uzun yatan hastalar tüm yatışların küçük bir bölümünü oluştursa da kısa yatan hastalara göre daha fazla toplam yatak gününe neden olurlar. Aynı zamanda bu hastaların ölüm oranı da çok yüksektir. Bir yıl sonunda çok az sayıda hasta bağımsız yaşayabilmektedir. Ülkemizde ara bakım ünitelerinin, palyatif ve evde bakım hizmetlerinin geliştirilmesi yoğun bakım ünitelerinde uzun kalış sürelerini kısaltabilecek acil gereksinimlerdir.*

Anahtar kelimeler: *Yoğun Bakım, Yatış Süresi, Sağkalım, Palyatif Bakım*

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INTRODUCTION

Limited Intensive care unit (ICU) beds are major problem worldwide. As is the case in most countries around the world, the number of ICU beds has increased in our country over the past few years, from 16,020 in 2009 to 23,606 in 2012 (1). However, this number is still far below what is needed to meet demand. Because the ICU beds are often full, delay to ICU admission from the emergency department occurs frequently (2). Delays of more than 6 hours for transfer to an ICU bed lead to increased mortality (3). Considering the scarcity and high cost of ICU beds, using them prudently is very important so as to not create barriers for other patients who might benefit from needed ICU care. Moreover, ICUs are specialized units, which are staffed by highly trained healthcare professionals. Although the proportional rate of beds in ICU are few within the total hospital beds; the use of intensive monitoring, frequent laboratory testing, advanced imaging studies, and low patient: staff ratios result in ICU care constituting a large proportion of healthcare costs (4,5).

Prolonged length of stay (LOS) of ICU patients is a well-defined problem, associated with increased healthcare costs and delayed ICU admissions from the emergency departments, in many studies. In the study by Stricker et al., patients staying longer than 1 week in their ICU consumed more than 50% of all ICU resources (6). Although 'prolonged' is not well defined in the literature, many authors who studied costs and mortality in 'prolonged stay' ICU patients have used a LOS of more than 7-14 days (7-9). While Knaus et al. reported a survival rate of nearly 50% in patients who stayed longer than 14 days in the ICU; Fakhry et al. reported a higher survival rate (63%) However, they found that less than half had functional recovery and were able to return to work (9,10). Despite the patients with prolonged LOS in the ICU are few in number, they use a large percentage of ICU bed days, in most studies (11-13).

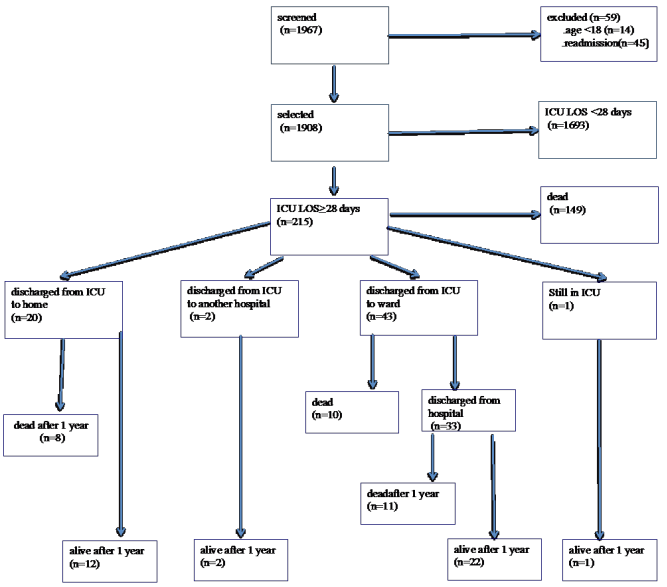

***Figure 1**. Study flowchart of patients admitted to our tertiary-care hospital ICU over a 36-month period.*

This study was performed to determine the characteristics, and outcomes of patients with prolonged LOS in a tertiary-care ICU, and to assess risk groups for long ICU stays and 1-year mortality.

MATERIAL AND METHODS

The study was carried out after obtaining the local ethical committee approval. The unit is a 27 beds tertiary ICU that is staffed by anesthesiologists and accepts nearly 650 annual admissions per year. Electronic database records of patients 18 years or older and hospitalized in the ICU from March 2010 to March 2013 were enrolled. The data of the first admissions were recorded if a patient had

***Table 1**. Demographic, and outcome data of patients according to LOS in ICU*

		All Patients (n=1908)	*LOS ≥28 days (n=215)*	*LOS<28 days (n:1,693)*	*p value*
*Age **		*63.7±17.7*	*64.3±17.9*	*63.6±17.7*	*0.584*
*Female***		*793 (42)*	*105 (48.8)*	*688 (40.6)*	*0.023*
*SAPS2**		*28.7±20.2*	*39.5±17.2*	*27.4±20.1*	*<0.001*
ICU Outcome	*mortality***	*690 (36.2)*	*149 (69.3)*	*541 (32)*	*<0.001*
	*LOS **	*14.6±37.7*	*85.6±81.9*	*5.5±5.9*	*<0.001*

*LOS: length of stay, *mean±SD, **n (%)*

Table 2. Reasons for ICU admission in patients with a LOS of ≥28 days and <28 days.

	LOS ≥28 days*	LOS <28 days*	All patients*
Infection	28 (13.0)	104 (6.1)	132 (6.9)
Malignancy	4 (1.9)	14 (0.8)	18 (1.5)
Metabolic	14 (6.5)	206 (12.2)	220 (11.5)
Neurologic	56 (26.0)	176 (10.4)	232 (12.2)
Cardiac	30 (14.0)	130 (7.7)	160 (8.4)
Respiratory	14 (6.5)	49 (2.9)	63 (3.3)
Emergency surgery	18 (8.4)	169 (10)	187 (9.8)
Elective surgery	16 (7.4)	494 (29.2)	510 (26.7)
Trauma	34 (15.8)	250 (14.8)	284 (14.8)
Intoxication	1 (0.5)	49 (2.9)	50 (2.6)
GIB	0	52 (3.1)	52 (2.7)
Total	215	1693	1908

*: number of patients (%), LOS: length of stay, GIB: Gastrointestinal bleeding

repeated admissions. Age, gender, main reason for ICU admission, length of ICU stay, in-hospital mortality, and length of mechanical ventilation for each patient were noted. Admission diagnoses were placed into one of eleven categories: infectious, metabolic, neurologic, cardiac, respiratory, gastrointestinal bleeding, intoxication, trauma, malignancy, emergency surgery, and elective surgery. Simplified Acute Physiology Score (SAPS) II was used to assess severity of illness. All patients received protocol directed weaning from mechanical ventilation (spontaneous breathing trial or stepwise reduction in support). Prolonged mechanical ventilation (PMV) was defined as more than 21 days of mechanical ventilation for at least six hours per day. Prolonged LOS in the ICU was defined as a stay of 28 days or longer.

Information about one-year mortality and the patient's ability to live independently (bathing, dressing, eating, using the toilet, taking a few steps) were performed by a phone interview with the patient or a family member, 1 year after the discharge.

Statistical Analysis

Quantitative variables were expressed as the means ±standard deviations. Student's t-test and Mann-Whitney U-test were used to analyze continuous variables. Receiver operating characteristic (ROC) curves was performed to evaluate the cut-off values of independent numerical variables with a p-value of < 0.05 and converted to categorical variables. Categorical variables were analyzed by the x^2 and Fisher's exact test and correlation coefficient and unadjusted Odds Ratio (OR) were calculated. Then bivariate logistic regression was performed to obtain adjusted ORs for confounders. P<0,05 was taken to indicate statistical significance.

RESULTS

During the study period 1.922 patients had 1.967 stays in the ICU. (Figure 1) The stays of 45 patients with repeated hospitalization and 14 patients with age lower than 18 years old are excluded. The records of 1,908 patients from their initial ICU stays were analyzed.

The mean age of all ICU patients was 63.7±17.7 years (range 18-105 years); 42% were female. The mean length of stay for all patients was 14.6±37.7 days. 215 patients (11.3%) stayed longer than 28 days with a mean LOS of 85.6±81.9 days. The SAPS II scores and number of females were significantly higher in patients with longer ICU stays (Table 1). The area under the ROC curve (aROC) for the SAPS II was 0.67 at a cut-off value of 25. The most common admission diagnosis was neurologic disorders for prolonged stays and elective surgery for shorter stays (Table 2). The predictors of long ICU LOS were shown in Table 3. Female patients had longer stays than males with some degree of significance with chi-square statistic but logistic regression didn't show any degree of correlation.

Table 3. Predictors of Long ICU Stays

	Phi coefficient	OR (CI 95%)	p value	Adjusted OR (CI 95%)	p value
SAPS II (>25)	0.297	7.56 (5.36-10.67)	<0.001	1.03 (1.02-1.03)	<0.001
Female	0.053	1.394(1.05-1.85)	0.023	1.27 (0.95-1.7)	0.105
Neurological Disorder	0.151	3.04 (2.16-4.27)	<0.001	2.44 (1.71-3.47)	<0.001

***Table 4**. One-year outcome characteristics of patients with long ICU Stays*

	Survivors	*Nonsurvivors*	*p value*
Age, mean years	*47.08*	*67.88*	*0.000*
Female, n(%)	*12 (32.4)*	*93 (52.2)*	*0.031*
Prolonged MV, n(%)	*27 (73)*	*165 (92.7)*	*0.002*
Trauma, n(%)	*18 (48.6)*	*16 (9)*	*0.000*
LOS in ICU,days	*74.41*	*87.93*	*0.362*
LOS in Hospital, days	*91.00*	*97.51*	*0.699*

Of the 215 patients with a LOS ≥28 days, 192 patients needed PMV. ICU mortality was seen in 149 (69.3%) patients. Hospital mortality was observed in additional 10 patients after ICU discharge. Total number of patients who were discharged from the hospital was 55 (25.6%), and one patient was still in the ICU when the study ended. Thirty-seven patients (17.2%) were alive one year post-discharge and only 13 (6%) were living independently. During the study period, 27,953 bed days were used, with 18.405 of these being used by the prolonged LOS patients.

The one-year survivors were significantly younger than nonsurvivors and had a lower incidence of PMV. The characteristics of survivors and nonsurvivors at 1 year were shown in Table 4. The cutoff value of 62 years was determined for age for one-year mortality. Mortality rate was 94.3 % in patients older than 62 years of age, while it was 61.3 % in younger patients. One-year mortality rates of female patients were found significantly higher with chi-square statistics. But similarly to ICU LOS, logistic regression didn't show any significant gender difference between survivors and non-survivors (Table 5). As seen in the bar graphs for survival and dependency at 1 year the highest survival and less dependency rates were in trauma patients (52.9% and 20.6%) (Figure 2 and 3). Characteristics of dependent and independent patients were shown in Table 6.

DISCUSSION

The most common reason for admission among our prolonged ICU stay patients was neurologic disorders, similar to that of other studies (14). A study from Australia found that mortality and inability to live independently at three months post-discharge was very high among stroke patients admitted to the ICU (15). The percentage of survivors was highest in our trauma patients, and these constituted the largest proportion of patients living independently at one year. These findings are similar to those of Ong et al., who reported high survival rates in trauma patients, even in those with an ICU LOS of 30 or more days. Predictors of prolonged ICU stay include age and diagnosis at admission, as well as infectious and pulmonary complications occurring during the ICU stay (16). Patients' quality of life after discharge from the ICU is

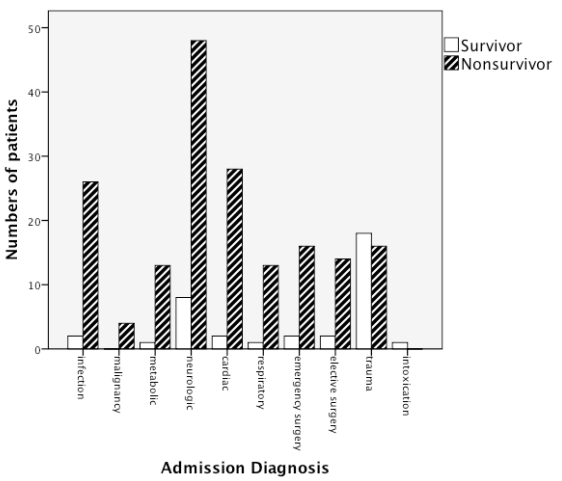

***Figure 2**. Survival of prolonged stay ICU patients at one year post-discharge, according to reason for ICU admission.*

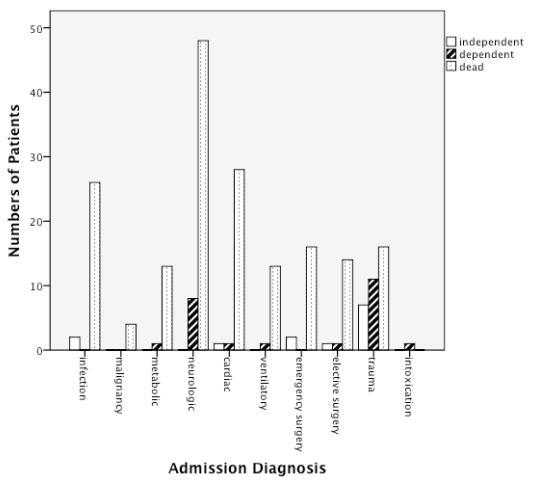

***Figure 3**. Numbers of prolonged stay ICU patients living independently at one year, according to reason for ICU admission.*

***Table 5**. Predictors of one-year mortality*

	Phi coefficient	*OR (CI 95%)*	*p value*	*Adjusted OR (CI 95%)*	*p value*
Age (>62 years)	*0.416*	*10.402(4.44-24.38)*	*<0.001*	*8.22 (3.24-20.86)*	*<0.001*
Female	*0.150*	*2.28(1.078-4.82)*	*0.031*	*1.09 (0.44-2.71)*	*0.856*
Prolonged MV	*0.241*	*4.70(1.87-11.79)*	*<0.001*	*3.17 (1.09-9.22)*	*0.034*
Trauma	*-0.410*	*0.10(0.05-0.24)*	*<0.001*	*0.15 (0.06-0.39)*	*<0.001*

often poor. Greater age, longer ICU LOS and lower Quality of Life score at the time of ICU admission are strongly associated with poor outcomes (17,18). We also found that only 6% of survivors were independent at one year; and results were poorer for those with longer ICU stays and longer use of mechanical ventilation.

The SAPS II is the commonly used scoring systems for critically ill patients admitted to ICU. It is a severity score and mortality estimation tool. In our study, patients with longer LOS in ICU had a significantly higher SAPS II scores. Previous studies reported similar findings and showed that SAPS II score is a predictor of prolonged ICU stay (6,19).

Age is a well-known factor leading to mortality. Hamel et al. reported a 29% in-hospital mortality rate among patients>70-years-old during hospitalization. Another similar study reported age-specific 6-month mortality rates of 44% and 60% for 55- and 85-year-old patients, respectively (20). Fuchs et al. reported that aging was a significant independent risk factor for 28-day and one-year mortality, especially for ICU patients older than 75-years-old (21). In those with multiple organ dysfunctions, the in-hospital mortality of ICU patients was up to 80% in patients over 85years (22). Our results were similar to those above; the mortality rates in the ICU and during the hospital stay of prolonged stay ICU patients were high (69% and 74%, respectively). The overall mortality at one year post-discharge was over 80%. Age was found the most important factor in predicting 1-year mortality.

***Table 6**. Characteristics of patients according to dependency at 1-year*

	Dependent	*Independent*	*p value*
*Age (years)**	*46.0*	*49.2*	*0.659*
*Female***	*9/24 (37.5)*	*3/13 (23.1)*	*0.303*
*Prolonged MV***	*21 (87.5)*	*6 (46.2)*	*0.011*
*ICU LOS (days)**	*91.2*	*43.4*	*0.026*
*Hospital LOS (days)**	*111.5*	*53.2*	*0.010*

* means, ** n (%)

Few studies to date have specifically addressed prolonged ICU stays in hospitals in Turkey. Uysal et al. reported that long stay patients made up 14% of their ICU admissions, and these patients occupied more than 50% of ICU bed days (23). The number of patients with prolonged ICU stays has been reported to range from 7% to 16% (11, 24,25). In our study, prolonged stay ICU patients constituted only 11.3% of admissions but used more than twice the number of bed days than the other 88.7% of patients.

Although the term "chronically critically ill" (CCI) is described in 1985 by Girard and Raffin, it is still not a common term in our country (26). CCI's are the patients who survive their acute critical illness but they need long-term life support or therapeutic interventions. The most common reason for admission among our prolonged ICU stay patients was neurologic disorders. Furthermore, there was no patient living independently at one year post-discharge who had a diagnosis of neurologic disorder. Patients with neurologic disorder usually need long-term life support. Unfortunately, all the patients with neurologic disorder needed long-term support in this study. Thus these patients should be regarded as CCI. Over the past decade, the definition of CCI was modified slightly, with its main characteristic now being use of mechanical ventilation for more than 21 days (27). Most of the patients (89.3%) in our institution met this newer definition of CCI. In many critically ill patients, modern treatment methods in ICUs enable patients to survive longer. Complication rates, costs, and damage to the patient's psychological state are increased when the ICU stay is prolonged (28). Recently, alternative healthcare facilities with appropriate staffing should be sought such as long-term acute care facilities, skilled nursing facilities, palliative care homes (hospice), and home care are the major health care modalities for CCI patients, all over the world. Palliative care is a very important health care

modality in reducing length of stay in the ICU. Campbell and Guzman reported that a proactive palliative care approach for patients in ICU has positive effects on the length of stay at ICU and on the prognosis as well (29). Palliative care support and intervention are also decreased the time that dying patients remained in the ICU. Moreover, it is known that palliative care modalities reduce the use of non-beneficial health care sources and the cost afford for health care. Palliative care units are founded by the mid 2013, home care service facilities are also held in last few years in Turkey.

The lack of palliative care and home care service facilities, and the fear of malpractice lawsuits in our country, may be some of the reasons that patients have such long ICU stays in our institution. Besides, high ICU occupancy, partially due to patients who might not be benefiting from long-term ICU care, leads to delays of appropriate transfers to the ICU. This may even mean death to those who are waiting at the critical manner for an ICU bed, to those who would have benefited from ICU care (2,3).

As a result, patients with a prolonged ICU LOS constituted a small percentage of all ICU admissions but they proportionally used many more ICU bed days and healthcare resources than short stay patients. The mortality of prolonged ICU stay patients was very high. Very few survivors were living independently at one year. Thus, development of intermediate care, palliative care and home care services are emerging necessities, to decrease the LOS in ICUs.

In our study we defined the predictors for longer ICU stays. Further research to more clearly define the characteristics of patients with prolonged ICU stay would guide optimal use of ICU resources.

REFERENCES

1. *The Ministry of Health of Turkey Health Statistics Yearbook 2012. Republic of Turkey Ministry of Health General Directorate of Health Research. Ankara: Sentez Matbaacılık ve Yayıncılık; 2013. p. 69.*
2. *Işıl CT, Turk HŞ, Sayın P, Çınar ASÖ, Oba S. Evaluation of emergency consultations requested from our hospital's intensive care unit. The Medical Bulletin of Şişli Etfal Hospital 2012;46(2):49-52.*
3. *Chalfin DB, Trzeciak S, Likourezos A, Baumann B, Dellinger RP, DELAY-ED study group. Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit. Crit Care Med 2007;35(6):1477-83.*
4. *Dasta JF, McLaughlin TP, Mody SH, Piech CT. Daily cost of an intensive care unit day: the contribution of mechanical ventilation. Critic Care Med 2005;33:1266-71.*
5. *Gooch RA, Kahn JM. ICU bed supply, utilization, and health care spending: an example of demand elasticity. JAMA 2014;311(6):567-8. doi: 10.1001/jama.2013.283800.*
6. *Stricker K, Rothen HU, Takala J. Resource use in the ICU: short- vs. long-term patients. Acta Anaesthesiol Scand 2003;47(5):508-15.*
7. *Mahesh B, Choong CK, Goldsmith K, Gerrard C, Nashef SA, Vuylsteke A. Prolonged stay in intensive care unit is a powerful predictor of adverse outcomes after cardiac operations. Ann Thorac Surg 2012;94(1);109-16.*
8. *LaPar DJ, Gillen JR, Crosby IK, et al. Predictors of operative mortality in cardiac surgical patients with prolonged intensive care unit duration. J Am Coll Surg 2013;216(6):1116-23.*
9. *Fakhry SM, Kercher KW, Rutledge R. Survival, quality of life, and charges in critically ill surgical patients requiring prolonged ICU stays. J Trauma 1996;41(6):999-1007.*
10. *Knaus WA, Wagner DP, Zimmerman JE, Draper EA. Variations in mortality and length of stay in intensive care units. Ann Intern Med 1993;118(10):753-61.*
11. *Arabi Y, Venkatesh S, Haddad S, Al Shimemeri A, Al Malik S. A prospective study of prolonged stay in the intensive care unit: predictors and impact on resource utilization. Int J Qual Health Care 2002;14(5):403-10.*
12. *Hall WB, Willis LE, Medvedev S, Carson SS. The implications of long-term acute care hospital transfer practices for measures of in-hospital mortality and length of stay. Am J Respir Crit Care Med 2012;185(1):53-7.*
13. *Hughes M, MacKirdy FN, Norrie J, Grant IS. Outcomes of long-stay intensive care patients. Intensive Care Med 2001;27(4):779-82.*
14. *Boniatti MM, Friedman G, Castilho RK, Vieira SRR, Fialkow L. Characteristics of chronically critically ill patients: comparing two definitions. Clinics (Sao Paulo) 2011;66(4):701-4.*
15. *Fanshawe M, Venkatesh B, Boots RJ. Outcome of stroke patients admitted to intensive care: experience from an Australian teaching hospital. Anaesth Intensive Care 2002;30(5):628-32.*
16. *Ong AW, Omert LA, Vido D, et al. Characteristics and outcomes of trauma patients with ICU lengths of stay 30 days and greater: A seven-year retrospective study. Crit Care 2009;13(5):154. doi: 10.1186/cc8054*
17. *Fildissis G, Zidianakis V, Tsigou E, Koulenti D, Katostaras T, Economou A, et al. Quality of life outcome of critical care survivors eighteen months after discharge from intensive care. Croat Med J 2007;48(6):814-21.*
18. *Rocker G, Cook D, Sjokvist P, et al. Level of Care Study Investigators; Clinician predictions of intensive care unit mortality. Crit Care Med 2004;32(5):1149-54.*
19. *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. Critical Care Med 2003;31(1):45-51.*

20. Hamel MB, Davis RB, Teno JM, et al. Older age, aggressiveness of care and survival for seriously ill, hospitalized adults. Ann Intern Med 1999;131(10):721-8.

21. Fuchs L, Chronaki CE, Park S, et al. ICU admission characteristics and mortality rates among elderly and very elderly patients. Intensive Care Med 2012;38(10):1654-61.

22. Pisani MA. Considerations in caring for the critically ill older patient. J Intensive Care Med. 2009;24(2):83-95. doi: 10.1177/0885066608329942

23. Uysal N, Gündoğdu N, Börekçi Ş, et al. Prognosis of patients in a medical intensive care unit of a tertiary care center. J Med Surg Intensive Care Med 2010;1:1-5.

24. Soares M, Salluh JI, Torres VB, Leal JV, Spector N. Short- and long-term outcomes of critically ill patients with cancer and prolonged ICU length of stay. Chest 2008;134(3):520-6.

25. Teno JM, Fisher E, Hamel MB, et al. Decision-making and outcomes of prolonged ICU stays in seriously ill patients. J Am Geriatr Soc 2000;48(5 suppl):70-4.

26. Girard K, Raffin TA. The chronically critically ill: to save or let die? Resp Care 1985;30(5):339-47.

27. Donahoe MP. Current venues of care and related costs for the chronically critically ill. Respir Care 2012;57(6):867-86. doi: 10.4187/respcare.01656.

28. Desai SV, Law TJ, Needham DM. Long-term complications of critical care. Crit Care Med 2011;39(2):371-9. doi: 10.1097/CCM.0b013e3181fd66e5.

29. Campbell ML, Guzman JA. Impact of a proactive approach to improve end-of-life care in a medical ICU. Chest 2013;123(1):266-71.