



Yeliz Bilir,
Fulya Ciyiltepe,
Dilara Çopur,
Kemal Tolga Saraçoğlu

Effect of the Timing of Admission Upon Patient Prognosis in the Intensive Care Unit: Off-hours and On-hours

Yoğun Bakım Ünitesine Kabul Zamanının Hasta Prognozu Üzerine Etkisi: Mesai İçi ve Mesai Dışı Yatışlar

Received/Geliş Tarihi : 10.06.2022
Accepted/Kabul Tarihi : 06.03.2023

©Copyright 2023 by the Turkish Society of Intensive Care / Turkish Journal of Intensive Care is published by Galenos Publishing House.

Licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND) International License.

Yeliz Bilir, Dilara Çopur, Kemal Tolga Saraçoğlu
University of Health Sciences Turkey, Kartal Dr. Lütfi Kırdar City Hospital, Clinic of Anesthesiology and Reanimation, Intensive Care Unit, Istanbul, Turkey

Fulya Ciyiltepe
University of Health Sciences Turkey, Antalya Training and Research Hospital, Clinic of Intensive Care, Antalya, Turkey

Yeliz Bilir MD (✉),
University of Health Sciences Turkey, Kartal Dr. Lütfi Kırdar City Hospital, Clinic of Anesthesiology and Reanimation, Intensive Care Unit, Istanbul, Turkey

E-mail : dryelizbilir@yahoo.com
Phone : +90 532 665 79 76
ORCID ID : orcid.org/0000-0003-2217-4741

Presented in: The article was presented oral presentation at the "21st National Intensive Care Congress".

ABSTRACT Objective: This study was planned to evaluate the clinical features and outcomes of patients hospitalized in intensive care units (ICUs) on-hours [workdays (WD)] and out of hours [time-off (TO)].

Materials and Methods: Ethics committee approval was obtained for this study. Patients hospitalized in adult ICUs between July 2021 and January 2022 were retrospectively evaluated. The patients were divided into two groups: those who were accepted during on-hours (group WD, WD 08.00 am-05.00 pm) and out of hours (group TO; WD-05.01 pm-07.59 am, weekends, and all public holidays). The groups were compared in terms of patient characteristics and intensive care outcomes.

Results: Of the 173 patients included in the study, 69.94% (n=121) were hospitalized during out-of-hours and 30.05% (n=52) during on-hours. The median age of the patients was 70.3±9.5 years, 58.4% were male and 41.6% were female. The number of patients hospitalized in TO was statistically significantly higher than the number of patients in WD (p=0.04). There was no significant difference between the two groups in terms of demographic data, except that chronic renal failure (18.2%, p=0.024) was more common as a comorbidity in TO patients. The need for continuous renal replacement therapies treatment, which is one of the reasons for ICU admission, was found to be significantly higher in TO patients (p=0.048). The length of stay in the ICU and intubation period was higher in group TO (p=0.006, p=0.022). It resulted in death in 34.1% of the patients. There was no significant difference in mortality and discharge between the groups.

Conclusion: In our study, the clinical outcome was found to be similar in patients followed up in ICUs under WD and TO conditions. This result; This can be attributed to the fact that the shift team is not different in our hospital, the number of experienced health personnel is high, and the necessary diagnostic procedures are not delayed.

Keywords: Intensive care unit, working hours, workdays, time-off, mortality, discharge

ÖZ Amaç: Yoğun bakım üniteleri (YBÜ), kritik hastaların 24 saat boyunca dinamik olarak takip edildiği kliniklerdir. Bu çalışma; YBÜ'ye mesai içi (Mİ) ve mesai dışı (MD) zamanlarda yatan hastaların klinik özelliklerini ve sonuçlarını değerlendirmek amacıyla planlanmıştır.

Gereç ve Yöntem: Bu çalışma için etik kurul onayı alındı. Temmuz 2021 ile Ocak 2022 tarihleri arasında erişkin YBÜ'lerinde yatan hastalar geriye dönük olarak değerlendirildi. Hastalar Mİ (grup Mİ; hafta içi 08.00-17.00) ve MD (grup MD; hafta içi 17.01-07.59, hafta sonları ve tatil günleri) kabul edilen olmak üzere iki gruba ayrıldı. Gruplar hasta özellikleri ve yoğun bakım sonuçları açısından karşılaştırıldı.

Bulgular: Çalışmaya dahil edilen 173 hastanın %69,94'ü (n=121) MD, %30,05'i (n=52) Mİ zamanlarda takip edilmişlerdir. Hastaların medyan yaşı 70,3±9,5 yıl olup, %58,4'ü erkek, %41,6'sı kadındır. MD yatan hasta sayısı, Mİ yatan hasta sayısına göre istatistiksel olarak anlamlı daha yüksektir (p=0,04). MD yatan hastalarda komorbidite olarak kronik böbrek yetmezliğinin (%18,2, p=0,024) daha sık görülmesi dışında iki grup arasında demografik veriler açısından anlamlı fark yoktur. YBÜ'ye yatış nedenlerinden sürekli renal replasman terapi tedavisi ihtiyacı MD yatan hastalarda anlamlı daha yüksek olarak bulunmuştur (p=0,048). YBÜ gün sayısı ve entübe gün sayısı grup MD'de daha yüksek bulunmuştur (p=0,006, p=0,022). Hastaların %34,1 ekstitus ile sonuçlanmıştır. Gruplar arasında mortalite ve taburculuk açısından anlamlı fark yoktur.

Sonuç: Çalışmamızda YBÜ'lerde Mİ ve MD koşullarda takip edilen hastalarda klinik sonuçların benzer olduğu görüldü. Bu sonuç; hastanemizde nöbet ekibinin farklı olmamasına, deneyimli sağlık personeli sayısının fazla olmasına ve gerekli tanısal işlemlerin geciktirilmemesine bağlanabilir.

Anahtar Kelimeler: Yoğun bakım ünitesi, çalışma saatleri, mesai içi, mesai dışı, mortalite, taburculuk

Introduction

Intensive care units (ICU); are clinics where critically ill patients are treated with a multidisciplinary approach. Situations that require close observation and rapid intervention may develop during patient follow-up. Although mortality rates in the ICUs vary depending on the underlying disease, they are usually higher than in other services of the hospital. Mortality rates tend to decrease in ICUs, especially with the training of qualified personnel and the presence of technological developments (mechanical ventilation, extracorporeal membrane oxygenation, continuous renal replacement, etc.).

In the literature, there are many studies that show that clinics work more effectively during weekdays than weekends (1-3). Some researchers have suggested that this relationship is causal and is due to weekend reductions in hospital staff and/or the fact that out-of-hours staff generally have less seniority and experience than regular-time workers. Others have argued that this correlation is due to unobservable characteristics of hospitalized patients. It is important to provide the same quality of service in ICUs 24/7 for the prognosis of the patient. As a result, in this study, our primary aim is to evaluate the outcomes of patients hospitalized in ICUs out of hours and our secondary aim is to determine the factors affecting mortality.

Materials and Methods

Study Design and Participants

This retrospective cohort study was carried out in a single 10-bed ICU of a city hospital operating with 90 intensive care beds. After obtaining the University of Health Sciences Turkey, Kartal Dr. Lütfi Kırdar City Hospital Clinical Research Ethics Committee approval (decision no: 2022/514/218/8, date: 28.01.2022) and informed consent from all patients, data was started to collect by scanning the electronic system and patient files. The study was carried out in accordance with the ethical principles stated in the Declaration of Helsinki and Good Clinical Practices.

The study included 173 adult patients who were hospitalized in the tertiary level ICU between July/2021 and January/2022. The patients were divided into two groups as those who were accepted during on-hours [group workdays (WD); weekdays 08:00 am-05:00 pm] and those who were

accepted out-of-hours [group time-off (TO); weekdays 05.01 pm-07.59 am, weekends and all public holidays].

Data Collection

The clinical and demographic characteristics of the patients, the reasons of hospitalization, accompanying comorbidities, the number of days intubated, the length of stay in ICU, discharge and death status were recorded. Patients hospitalized for postoperative follow-up and patients who were hospitalized for less than 24 hours were excluded from the study. The groups were compared in terms of patient characteristics and intensive care outcomes.

Intervention

The primary predictor was whether the admission was on a during working hours or out of hours.

Measurement

The primary outcome was in ICU mortality and secondary outcomes were discharge and length of stay.

Statistical Analysis

All statistical analyses were performed using the SPSS (Statistical Package for Social Sciences) software, version 21.0 (IBM Corp., Armonk, NY). Quantitative variables expressed as mean \pm standard deviation, were compared using the Student's t-test. The qualitative variables were expressed in percentages and compared using either the chi-square test or Fisher's Exact test. A p-value <0.05 was considered significant.

Results

In the study period, 121 (69.94%) patients in group TO and 52 (30.05%) patients from group WD were included into the study. Number of patients hospitalized outside of working hours were significantly higher than hospitalized during working hours ($p=0.04$). The median age of these 173 patients was 70.3 ± 9.5 years, 58.4% male and 41.6% female. There was no significant difference between the two groups in terms of comorbidity, except that chronic renal failure (CRF). CRF was significantly higher in group TO than in group WD ($p=0.024$) (Table 1).

The number of patients receiving invasive mechanical ventilation support was similar in the two groups. However, length of stay in ICU and intubated days were found to be significantly higher in group TO ($p=0.006$, $p=0.022$) and the

Table 1. Characteristics of patients admitted to the ICU

	Group workdays (n=52)	Group time-off (n=121)	p-value
Number of patients, n (%)	52 (30.05)	121 (69.94)	0.04
Age	70.08±15.2	70.08±15.3	0.856
Gender, n (%)			
Male	34 (65.4)	76 (62.8)	
Female	18 (34.6)	45 (37.2)	0.443
APACHE-II (mean ± SD)	20.1±3.62	21.1±3.3	0.900
SOFA score (mean ± SD)	5.7	6.2	0.534
Comorbidity, n (%)			
Malignancy	14 (26.9)	38 (31.7)	0.345
COPD	4 (7.7)	14 (11.7)	0.319
CHF	10 (19.2)	19 (15.7)	0.358
CRF	3 (5.8)	22 (18.2)	0.024
Liver cirrhosis	3 (5.8)	13 (10.8)	0.232
DM	16 (30.8)	25 (20.7)	0.109
CVD	5 (9.6)	18 (14.9)	0.250
Transfer from which clinic, n (%)			
From the outer hospital	0	1 (0.8)	0.805
Emergency service	28 (53.8)	65 (53.7)	
In patient clinics	24 (46.2)	55 (45.5)	
Readmission to ICU, n (%)	1 (1.9)	4 (4.4)	0.709
APACHE-II: Acute Physiological and Chronic Health Evaluation-II, SOFA: Sequential Organ Failure Assessment, COPD: chronic obstructive pulmonary disease, CHF: congestive heart failure, CRF: chronic renal failure, CVD: cerebrovascular diseases, DM: diabetes mellitus, SD: standard deviation, ICU: intensive care unit			

need for continuous renal replacement therapies treatment was found to be significantly higher in group TO ($p=0.048$) (Table 2).

A total of 59 (34.1%) patients died in ICU. Of these, 15 (32.7%) belonged to group WD, 44 (35.5%) belonged to group TO, and there was no significant difference between the groups in mortality ($p=0.429$). A total of 65.9% of the patients were discharged from ICU. There was no significant difference in the number of discharged patients between the groups (Table 2).

Discussion

In this study, we examined the hospitalization of patients in ICUs for a period of 6 months. We found that the number of patients hospitalized out of hours was higher than those hospitalized during working hours, but there was no significant difference between the two groups in terms of discharge from ICU and mortality. This result may reflect that

there is no difficulty in accessing in-hospital care during non-working hours. When the literature is searched, there are many studies showing that hospital admission during out-of-hours is associated with higher in-hospital mortality rates (1-3), but the reasons for this phenomenon is controversial.

As a result of a 10-year study, Bell and Redelmeier (4) concluded that the mortality rate is high in weekend inpatients and that this result is unlikely to be due to chance, with the exact binomial distribution. They attributed the high causes of death to the unpopularity of working on the weekends, the lack of equal numbers and skills of staff working on the weekends, and also the fact that there are fewer supervisors on weekends. In our study; in the ICU, the same team and the same number of ICU staffing work during working hours and on the shifts. We believe that this situation is effective on equalizing the quality of work. Similarly, Fan and Needham (5) supported this conclusion with their study.

Laupland et al. (6), in their study, found that 41% of the patients hospitalized in the ICU were overnight and 49%

	Group workdays (n=52)	Group time-off (n=121)	p-value
Hospitalization, n (%)			
Trauma	2 (3.8)	5 (4.2)	0.647
Cerebrovascular diseases	5 (9.6)	18 (15)	0.243
Cardiac overload	5 (9.6)	9 (7.4)	0.417
Acute renal failure	14 (26.3)	41 (33.9)	0.236
Gastrointestinal bleeding	3 (5.9)	6 (5)	0.542
Infectious diseases	9 (17.3)	9 (7.4)	0.050
Acute respiratory failure	10 (19.2)	22 (18.2)	0.513
Post-CPR	2 (3.8)	8 (6.6)	0.376
CRRT treatment, n (%)	4 (7.7)	21 (17.3)	0.048
Intubated patients, n (%)	28 (53.8)	79 (65.3)	0.106
Intubation periods (days) (mean ± SD)	4.58±7.9	9.2±13.4	0.022
LOS (days) (mean ± SD)	6.62±7.4	11.9±12.9	0.006
Vasopressor need, n (%)	20 (40)	38 (31.7)	0.193
Central catheter need, n (%)	19 (36.5)	40 (33.3)	0.406
Discharge, n (%)	37 (66.4)	77 (64.2)	0.842
Discharge planning, n (%)			
To the surgical clinics	13 (25)	31 (25.6)	
To the internal medicine clinics	22 (42.3)	39 (32.2)	0.187
To the home	2 (3.8)	7 (5.8)	
Death, n (%)	15 (32.7)	44 (35.5)	0.429
LOS: Length of stay in ICU, CRRT: continue renal replacement therapy, CPR: cardiopulmonary resuscitation, ICU: intensive care unit			

were overnight and/or weekends, and they emphasized that overnight stay was associated with mortality. Similarly, Buck et al. (7) evaluated the relationship between patient admission to the ICU out of hours and on the weekend, and 90-day mortality and showed that the risk of death in adult patients was slightly higher in those hospitalized out of hours; as in our study, emphasized that increasing the out-of-hours services may result in the desired decrease in the inpatient mortality rate.

Halm and Chassin (8) raised the question of why hospital mortality rates are changing, and they argued that this situation is based on medical-social-biological procedural knowledge and therefore deserves careful investigation.

In a meta-analysis of forty-five articles by Honeyford et al. (9) concluded that there is high heterogeneity for the “weekend effect” and further studies are needed. In a comprehensive meta-analysis by Hoshijima et al. (10); they concluded that although weekend admissions were

associated with a higher risk of death than weekday admissions, this effect was limited to certain diagnostic groups and admission subtypes. As can be seen, the relationship between patient prognosis and admission time is limited and shows quite heterogeneity. In this study, we observed that a similar population of patients were admitted to our hospital during the day and night. Mitchell et al. (11) examined a similar study on a specific population. They cohort 3,729 adult stroke patients hospitalized in tertiary care between 2001 and 2012. As a result of that study; the effect of weekend ICU-admission for stroke patients appears to be significant for in-hospital mortality, but no significant difference in adjusted ICU-mortality, length-of-stay, or longer-term morbidity and mortality measures (11).

On the other hand, Adigüzel et al. (12) concluded in their study that full-time staff would improve outcomes in the ICUs. In a recent study, Aiken et al. (13) showed that nurse employment and education are effective on patient mortality.

In our study, only the patients hospitalized in the ICU were evaluated and the training of the personnel as a single unit was based on.

Barnett et al. (14) conducted a study in 38 ICUs in 28 hospitals, reported that the length of stay in the ICU was significantly longer for weekend or Friday admissions. Ko et al. (15) showed that there was a significant increase in weekend hospital admissions, mortality rate, and length of stay. Similarly, in the present study, length of stay in the ICU and intubation period were found to be longer in patients in group TO. This may be associated with unmeasured factors such as patient characteristics and the severity of the disease. This result suggests that the patient risk profile and a difference in severity of illness greatly affect the course of the disease from patient to patient even if it does not change the outcome.

In present study, we aimed to investigate whether there is a difference in patient outcomes in patients admitted to the ICUs out of hours compared to patients hospitalized during working hours, and we found that mortality rates did not change when full care and support can be provided. Discharge rates were also similar. We attributed this situation to the fact that the patients who admitted to the hospital during and out of hours had a similar profile in terms of factors that could affect mortality and that they could receive similar health care independent of working hours. Differences in patient risk factors and disease severity affected the process, but did not change the outcome.

The results of our study need to be interpreted within the context of its limitation. First, our study was a retrospective study and sample size was small. Secondly, our study did not account patient's intrinsic factors and the severity of illness. Finally, we did not attempt to determine whether

the outcomes were associated with qualities of care and weekend working staff in this study.

Conclusion

Numerous adverse prognostic factors have been described that affect mortality rates in critically ill patients admitted to the ICU. Our study showed that hospitalization of patients out-of-hours is not one of these reasons. Thus, we wanted to emphasize that the number of full-time personnel should be sufficient and the necessary diagnostic procedures should not be delayed.

Ethics

Ethics Committee Approval: After obtaining the University of Health Sciences Turkey, Kartal Dr. Lütfi Kırdar City Hospital Clinical Research Ethics Committee approval (decision no: 2022/514/218/8, date: 28.01.2022). The study was carried out in accordance with the ethical principles stated in the Declaration of Helsinki and Good Clinical Practices.

Informed Consent: Informed consent from all patients, data was started to collect by scanning the electronic system and patient files.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Y.B., F.C., D.Ç., K.T.S., Concept: Y.B., Design: Y.B., K.T.S., Data Collection and Process: F.C., D.Ç., Analysis or Interpretation: Y.B., F.C., Literature Search: Y.B., D.Ç., K.T.S., Writing: Y.B.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Bressman E, Rowland JC, Nguyen VT, Raucher BG. Severity of illness and the weekend mortality effect: a retrospective cohort study. *BMC Health Serv Res* 2020;20:169.
2. Pauls LA, Johnson-Paben R, McGready J, Murphy JD, Pronovost PJ, Wu CL. The Weekend Effect in Hospitalized Patients: A Meta-Analysis. *J Hosp Med* 2017;12:760-6.
3. Williams A, Powell AGMT, Spernaes I, Basu P, Edwards S, Edwards P. Mode of presentation rather than the 'weekend effect' is a major determinant of in-hospital mortality. *Surgeon* 2019;17:15-8.
4. Bell CM, Redelmeier DA. Mortality among patients admitted to hospitals on weekends as compared with weekdays. *N Engl J Med* 2001;345:663-8.
5. Fan E, Needham DM. An intensivist all day, keeps the bad outcomes away. *Crit Care Med* 2007;35:286-7.
6. Laupland KB, Shahpori R, Kirkpatrick AW, Stelfox HT. Hospital mortality among adults admitted to and discharged from intensive care on weekends and evenings. *J Crit Care* 2008;23:317-24.
7. Buck DL, Christiansen CF, Christensen S, Møller MH; Danish Intensive Care Database. Out-of-hours intensive care unit admission and 90-day mortality: a Danish nationwide cohort study. *Acta Anaesthesiol Scand* 2018;62:974-82.
8. Halm EA, Chassin MR. Why do hospital death rates vary? *N Engl J Med* 2001;345:692-4.
9. Honeyford K, Cecil E, Lo M, Bottle A, Aylin P. The weekend effect: does hospital mortality differ by day of the week? A systematic review and meta-analysis. *BMC Health Serv Res* 2018;18:870.
10. Hoshijima H, Takeuchi R, Mihara T, Kuratani N, Mizuta K, Wajima Z, et al. Weekend versus weekday admission and short-term mortality: A meta-analysis of 88 cohort studies including 56,934,649 participants. *Medicine (Baltimore)* 2017;96:e6685.
11. Mitchell WG, Pande R, Robinson TE, Jones GD, Hou I, Celi LA. The weekend effect for stroke patients admitted to intensive care: A retrospective cohort analysis. *PLoS One* 2020;15:e0234521.
12. Adigüzel N, Karakurt Z, Moçin ÖY, Takır HB, Saltürk C, Kargin F, et al. Full-Time ICU Staff in the Intensive Care Unit: Does It Improve the Outcome? *Turk Thorac J* 2015;16:28-32.
13. Aiken LH, Clarke SP, Sloane DM, Sochalski J, Silber JH. Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. *JAMA* 2002;288:1987-93.
14. Barnett MJ, Kaboli PJ, Sirio CA, Rosenthal GE. Day of the week of intensive care admission and patient outcomes: a multisite regional evaluation. *Med Care* 2002;40:530-9.
15. Ko SQ, Strom JB, Shen C, Yeh RW. Mortality, Length of Stay, and Cost of Weekend Admissions. *J Hosp Med* 2018;13:476-81.