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Admission time and outcomes of patients admitted to intensive care unit in a tertiary hospital in Nepal: an observational study.

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ABSTRACT

Background and aims: Time of admission to the intensive care unit may have a significant impact on the outcome. However, there is scarcity of published literature regarding admission hours and outcomes from low-income and middle-income countries like Nepal. The aim of this study was to compare the outcome of patients admitted to intensive care units at office hours and off hours.

Methods: This observational study was conducted in the intensive care units of Tribhuvan University Teaching Hospital, Kathmandu, Nepal. Data from 1 January 2020 to 31 December 2022, over a period of three years, were curated from the ICU registry. Patients were divided into two groups based on the time of admission to intensive care unit: 1) office hours (from 9:00 am till 4:59 pm that day) and 2) off hours (5:00 pm to 8:59 am next day, including Saturdays and public holidays).

Results: Among 3733 patients admitted to ICU, 3242 patients were enrolled for analysis. There were no significant differences in mortality rate as well as average duration of mechanical ventilation between two groups. The average length of stay was however longer by 1 day among patients admitted during off hours compared to office hours.

Conclusion: The time of admission in ICU has no significant effect on the outcome of patients. Off hour ICU admission is not associated with poor patient outcomes compared to office hours.

Keywords: *intensive care unit, LMICs, outcome, time of admission.*

INTRODUCTION

An intensive care unit (ICU) is a specialized unit within the hospital where patients who need immediate medical attention are admitted both during office hours and off hours.[1] Initial resuscitation efforts of critically ill patients have significant effect on patient outcomes.[2] As patients can present at any time of day, provision of all resources is to be made throughout the day. However, a reduced number of staff and working efficiency because of long working hours, the unavailability of 24/7 intensivist staffing, and the absence of the same level of hospital services like laboratory investigations during off hours have been reported in the literature to affect the outcomes of the critically ill patients.[3-7]

High intensity staffing models and shorter work hours can improve the outcome.[8] However, these are not always feasible in ICUs in low-income and middle-income countries (LMICs) like Nepal. Any variations in outcome depending upon time of ICU admission may impact the workforce planning, medical insurance, and healthcare system policy.[9,10]

The aim of this study was to compare the outcomes of patients admitted to the ICU during office hours and off hours in terms of ICU mortality, length of ICU stay and duration of mechanical ventilation.

METHODS

Retrospective analytical study was conducted with the data obtained from Nepal Intensive Care Research Foundation (NICRF) among patient admitted from January 2020 till December 2022 at the ICUs of Tribhuvan University Teaching Hospital after obtaining ethical clearance from the Institutional Review Committee of the Institute of Medicine [Ref no: 442(6-11) E2; dated March 15, 2023]. This study used data collected prospectively as part of the NICRF dataset. Individual patient datasets were extracted and analyzed. Details of the registry design and data management are published in detail on Wellcome Open Research.[11] All patients aged more than 16 years and admitted during the study period were included. Patients who had treatment limitations in the form of withdrawal of life sustaining therapies (WLST), discharged on request or left against medical advice were excluded from this study.

Based on the time of admission to the ICU, patients were divided into two groups: office hours and off hours. According to policy of our hospital, office hours of admission included admissions between 9:00 am till 4:59 pm the same day, from Sunday to Friday and off hours of admission included those admitted between 5:00 pm and 8:59 am the next morning, including anytime on weekend (Saturday in Nepal), New Year, Dashain, Tihar, and Holi (the public holidays in Nepal). A reduced number of staff, along with laboratory services, are available during off hours compared to office hours.

The clinical and demographic data of the patients collected at the time of admission included age, gender, co-morbidities, APACHE II score, requirement of vasopressors and ventilation status. The outcomes observed were duration of mechanical ventilation (MV), ICU length of stay (ICU LOS), ICU mortality and discharged alive from the ICU.

The data were analyzed using the IBM SPSS® version 25 for Windows. Categorical variables were expressed as frequency and percentage. Continuous variables were expressed as median and interquartile range. The association between categorical variables and office/off hours was examined with Pearson's chi square test. The difference in median of the continuous variable between two groups of office/off hours was checked with Man-Whitney U test. We considered a significance level of 0.05% (alpha-0.05) and conducted two-tailed test. A binary logistic regression analysis was done to look for any association between ICU admission time and ICU mortality after controlling for baseline variables which included age, gender, surgical cases, APACHE II score, comorbidities, intubated at admission, vasopressors use and renal replacement therapy.

RESULTS

There were 3733 patients admitted to the ICU during the study period from January 1, 2020, to December 31, 2022. Of these patients, 180 patients left against medical advice, 29 were discharged on request and 282 had WLST. These patients were excluded, and only 3242 patients were included in the final analysis.

Out of these 3242 patients, more than half (56.01%) of the patients were male, and the median age was 50 years, with a range of 34-64 years. The median APACHE II score at ICU admission was 12, with an interquartile range (IQR) of 7-18. Regarding outcomes, 74.43% of patients were discharged alive from the ICU while ICU mortality was 25.57% (Table 1).

Table 1. Socio-demographic and clinical characteristics of study population at admission (n=3242)

Variables	N (%)
Gender	
Male	1819 (56.01%)
Female	1423 (43.9%)
Admitting category	
Medical (non-operative)	2217 (68.38%)
Surgical (operative)	1025 (31.62%)
Emergency surgery	
Yes	296 (28.87%)
No	729 (71.13%)
Comorbidities	
Yes	1305 (40.25%)
No	1937 (59.75%)
Intubated	
Yes	1668 (51.44%)
No	1574 (48.56%)
HFNC or NIV immediately after admission	
Yes	126 (8.01)
No	1448 (91.99)
Vasopressors	
Yes	770 (23.75%)
No	2472 (76.25%)
Renal Replacement Therapy	
Yes	176 (5.4%)
No	3066 (94.57%)
Readmission	121(3.73%)

Of the total enrolled patients, 27.7% were admitted during office hours and 72.3% during off hours (Fig 1). The two groups were similar in age distribution, which was 50 (34-64) years. The median APACHE II score was higher in off hours (12, IQR:7-18) compared to office hours (11, IQR:6-18) (p=0.035). Other characteristics like gender, co-morbidities, ventilation status at admission, need for emergency surgery, vasopressors use, renal replacement therapy at admission, rate of readmission were similar at admission. However, there was difference in proportion of operative and non-operative cases between the two groups, with more non-operative cases admitted during off hours and more postoperative cases during office hours (p=0.028) (Table 2).

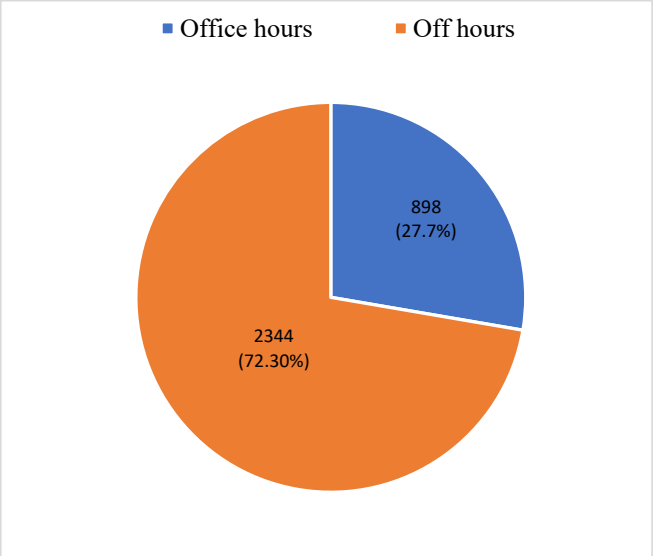

Figure 1. Distribution of patients based on time of admission.

Table 2. Distribution of variables and outcome of office hours and off hours.

Variables	Office hours N = 898 (%)	Off hours N = 2344 (%)	p value
Age (median and IQR)	50 (34-64)	50 (34-64)	0.742
Gender			
Male	499 (55.56%)	1320 (56.31%)	0.702
Female	399 (44.44%)	1024 (1423%)	
Admission category			
Medical (non-operative)	588 (65.47%)	1629 (69.50%)	0.028*
Surgical (operative)	310 (34.43%)	725 (30.50%)	
Emergency surgery n (%)	84 (9.30%)	212 (9.0%)	0.784
Comorbidities n (%)	371 (41.31%)	934 (39.84%)	0.466
APACHE II (median and IQR)	11 (6-18)	12 (7-18)	0.035*
Intubated			
Yes	463 (51.56%)	1205 (51.40%)	0.939
No	435 (48.44%)	1139 (48.60%)	
Vasopressors use	223 (24.8%)	547 (23%)	0.370
Renal Replacement Therapy	48 (5.34%)	128 (5.4%)	0.446
Readmission	41 (4.5%)	80 (3.41%)	0.121

p value*= significant(p<0.05)

The ICU length of stay was significantly different between the two groups (p=0.025). Other outcomes such as duration of mechanical ventilation, discharge alive from ICU, and ICU mortality were similar in both groups. (Table 3). After adjusting for any possible confounding variables, there was no significant association between ICU admission time and ICU outcome (Table 4).

Table 3. ICU outcome of office hours and off hours.

ICU Outcome	Office hours	Off hours	p value
ICU length of stay (median and IQR)	3 (1-4)	4 (2-7)	0.025*
Duration of MV (median and IQR)	2 (1-6)	3 (1-6)	0.179
ICU mortality			
Yes	233 (25.95%)	596 (25.43%)	0.761
No	665 (74.05%)	1748 (74.57%)	

p value*= significant(p<0.05)

Table 4. Binary Logistic regression analysis for association of off hour ICU admission and mortality.

Variables	Beta Coefficient	Significance	Odds ratio	95% C.I. for odds ratio	
				Lower	Upper
Off hours	-0.098	0.333	0.907	0.744	1.1
Age	0.014	0.000	1.014	1.009	1.01
Gender (Male)	0.273	0.003	1.315	1.098	1.57
Readmission (yes)	0.052	0.823	1.054	0.667	1.66
Surgical Cases	-2.010	0.000	0.134	0.104	0.17
APACHE II score	0.067	0.000	1.070	1.055	1.08
Comorbidities	-0.202	0.045	0.817	0.671	0.99
Intubated at admission	0.746	0.000	2.108	1.719	2.58
Vasopressor	0.751	0.0000	2.118	1.694	2.64
Renal Replacement Therapy	-0.070	0.714	0.933	0.643	1.35

DISCUSSION

Among total admission more than two third occurred during off hours. This proportion of admission resembled the findings of study in Japan but was higher than those reported in Morocco.[12,13] One possible explanation for this discrepancy could be the longer duration of off hours in Nepal which was similar to that in Japan.

In our study we found that the median length of ICU stay differed by 1 day between the two groups, being longer in patients admitted off hours. This could be due to more number of non-surgical cases, slightly higher baseline median APACHE II score among patients admitted off hours. The findings of another study support our observation, as they found non-elective admissions, non-operative reason for admission and illness severity to be the predictors for longer duration of ICU stay.[14] The duration of mechanical ventilation was similar in both the groups in our study. One possible reason could be, similar level of care these patients receive despite their illness severity or time at which they are admitted to ICU. In a study done in Malawi, a lower middle income country, no difference in mortality was observed between patients admitted during office hours and off hours.[15] In their study, they stated that the ICU and hospital mortality rates were very high (around 50 and 56% respectively) throughout their country which was attributed to weak critical care medicine system in terms of lack of expertise as consultant intensivist, no physician oversight, lesser availability of ICU beds resulting in similar mortality rates in both the groups. The mortality rate within our ICU was found to be 25.52% and the mortality was similar among both the groups. In Nepal, critical care services have significantly improved over time with establishment of various critical care societies that focus on enhancing competencies of healthcare workers. The implementation of training programs, workshops and medical education has played a vital role in improving effectiveness at work and patient-centered care.[16-18] Besides these, high-intensity staffing model (closed or open with mandatory intensivist being present throughout the day) along with protocolized patients care are found to have reduced mortality compared to those with low intensity staffing (open with no or elective availability of intensivist).[19,20] As this ICU is a high-intensity staffing model with standardized protocol including care bundles the mortality has likely been reduced and was similar among both the groups.[21,22]

In our study, we observed slightly higher APACHE II score of 12 among patients admitted during off hours compared to APACHE II of 11 among those admitted during office hours. This difference observed might be due to large sample size in this study resulting statistical significance. However, this difference was not clinically significant as there was no

difference in mortality or duration of mechanical ventilation among both the groups. The predominance of male gender (56.1%) follows the similar trend of 59 % as observed in other study among patients admitted to different ICUs in Nepal including this ICU.[23] Role of sex hormone in immune responses during critical illness, gender dimorphism of various diseases, and tendency of male patients seeking more health care services as described in different studies could be a possible reason for more males being admitted in our ICU.[24-26] Of all the patients, 40.25% of them had one or more co-morbidities. This was however higher than that observed in Japan which was 19.6%.[12] Prevalence of chronic conditions tends to differ across different countries owing to differences in dietary practices, lifestyle, alcohol consumption, tobacco use and level of physical activities.[27] Reduced efficiency of health care delivery system at peripheries and our center being a tertiary referral center, a greater number of patients with comorbidities are being admitted to our ICUs.

The present study has some limitations. The definition of office hours and off hours varies across studies due to a lack of consensus and standardization, leading to variability in interpretation and comparisons. This study was conducted in tertiary level teaching hospital with ongoing training programs in multiple specialties (DM/MD), thus the results may not be generalizable to other ICUs. Moreover, the study did not consider other potential factors that could have influenced the outcome of the patients like number of staffs in each group, availability of doctors at different hours and the time delay in admission.

CONCLUSION

Patients were commonly admitted to our ICU during off hours, and their outcome was similar to those admitted during office hours. These results could be explained by the high intensity staffing model of our ICU coupled with standardized protocols.

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