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ORIGINAL ARTICLE

A Descriptive Study of Length of Stay at an Intensive Care Unit

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ABSTRACT

Background and aims: As intensive care units (ICUs) are very resource intensive, length of stay (LOS) is of prime importance. This study was done to analyze the LOS in different ICUs and analyze it against a set benchmark.

Materials and methods: This retrospective study was conducted from April to June 2013 on patients admitted during January to March 2013 in the neurosurgery ICU (NICU), medical ICU (MICU), high dependency unit (HDU) and isolation ICU of a large multispecialty hospital in Pune (India). As per the quality manual of the hospital, benchmark LOS was considered as 3.08 days for ICU. Mean and median LOS was analyzed through Student's t and Chi-square test; proportion of short (<2 days) and long stay (>4 days) patients was also computed.

Results: Out of 835 patients admitted to the NICU, MICU, HDU and Isolation ICU, the overall mean LOS was 3.37 ± 5.54 days which was statistically significant at a p-value <0.001 (t = 17.58, 95% CI 3-3.75). The overall mean LOS was higher than the benchmarked 3.08 days but still within the optimal range of 2 to 4 days. Mean LOS was statistically significant when tested for department-wise variations with a Chi-value of 173.56 (p-value < 0.001, LR = 113.75). Highest mean LOS was observed for isolation ICU and lowest for MICU. 360 (43.1%) were short stay, 141(16.8%) were long stay and remaining were optimal stay patients.

Conclusion: The mean LOS for the ICUs varied significantly across the type of ICUs which needs to be continuously monitored. Mean LOS variation across ICU type indicates need for separate benchmarks.

Keywords: Benchmark, Hospital, ICU, Length of stay.

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INTRODUCTION

Intensive care units (ICUs) are specialized inpatient units that provide care for the critically ill patients. The previous studies on improving quality of care provided to the critically ill patients, focus largely on patients with prolonged length of stay (LOS).[1] Prolonged stay in ICU is costly, can impact the bed availability, and lead to cancellation of elective surgeries.[1]

There is a need for optimizing the use of ICU beds.[1] LOS is one such indicator used to assess quality of care and resource utilization in ICU.[2]

Intensive care unit consumes around 20% of the total hospital costs;[3,4] thus prolonged LOS can have cost implications and may be utilized as the economic performance measure of hospital. However, Indian studies with data on LOS across different types of ICUs are rare. Hence, we conducted this study to fill the knowledge gap by analyzing the LOS in different departmental ICUs and study the variations across other characteristics.

MATERIALS AND METHODS

Study design and settings: This was a retrospective record based study conducted from April 2013 to June 2013 on patients admitted during January to March 2013 at a large multispecialty hospital in Pune, Maharashtra (India). The study was done in the neurosurgery ICU (NICU), medical ICU (MICU), high dependency unit (HDU) and isolation ICU of the Hospital.

Selection of participants: All patients admitted in the above-mentioned four ICUs were included after obtaining official consent from hospital authorities. The admission and discharge dates were noted from the respective registers of each of the 4 ICUs in the customized recording sheets developed for the study.

Through this data, LOS was computed[5] as follows: LOS (in days) = Total discharge days/total discharges. Total discharge days defined as the sum of the number of days spent in the ICU for each inpatient who is discharged during the time period regardless of when admitted and total discharges were the number of inpatients discharged from the ICU during the time period. The overall calculated LOS value was compared against the LOS benchmark set by the hospital. The benchmark to compare the LOS was obtained from the Quality Manual

of the Hospital.[6] The LOS benchmarked value for all the ICUs were 3.08 days.

Inclusion and exclusion criteria: All the patients admitted during January to March 2013 in the NICU, MICU, HDU and Isolation ICU were included along with the deaths and transfers in these departments. Only the days when the patient was in ICU (excluding step down or observation) was counted as ICU LOS. The neonatal ICU and kidney transplant unit were excluded due to managerial reasons. Further, LAMA cases (Leave against Medical Advise) were excluded from the study.

Primary and secondary outcomes: Primary outcome under study was the length of stay for each ICU. Secondary outcomes were analysis of LOS across different department and months, comparing it with the benchmark value and study of short and long stay patients.

Data analysis: The data were computerized and statistical analysis was done with SPSS v.17 for Windows (SPSS Inc, Chicago, II, USA). Statistical analysis was performed at 95% confidence interval and results with p-value ≤0.05 were considered statistically significant. We calculated mean and median LOS for each of the four ICUs. For univariate analysis, the overall LOS, LOS across months and departments was tested for statistical significance using one-sample test. Chi-square test was applied to test for statistically significant differences in LOS across departments and months. Median LOS was computed and the mean LOS was individually tested through one-sample t-test for statistical significant variations across departments and months. Bi-variate analysis was conducted through independent samples t-test for month-wise variations in LOS across different departments. Length of stay was compared and analyzed against the benchmark values defined in the quality manual of the hospital. We also analyzed the LOS of patients by categorizing them as short stay and long stay patients wherein long stay was defined as patient stay in ICU for >4 days and short stay as <2 days. Stay of between 2 and 4 days was considered optimal duration of stay based on the benchmark value. All analysis was done at 95% confidence level.

RESULTS

Records of 835 patients admitted during January 2013 to March 2013 in NICU, MICU, HDU and Isolation ICU were analyzed. The overall mean LOS in the study was 3.37 ± 5.54 days which was statistically significant at a p-value <0.001 (95% CI 3-3.75). The median LOS was 2 days. The overall mean LOS was higher than the benchmarked 3.08 days but still within the optimal range. Mean LOS was statistically significant when tested for department-wise variations with a Chi-value of 173.56 (p-value < 0.001, LR = 113.75). However, mean LOS was not significantly different across the 3 months.

Out of total 835 subjects, 327 (39%) were from the NICU, 363 (43%) from MICU, 121 (15%) from HDU and 24 (3%) from isolation ICU. The analysis of mean LOS across the four departments showed that in HDU (n = 121) the median LOS was 2 days and mean LOS was 4.79 ± 8.77 days which was statistically significant (p-value <0.001, 95% CI 3.21-6.36). The median LOS in NICU (n = 327) was 1 day but mean LOS was 3.39 ± 5.1 days which was also statistically significant (p-value <0.001, 95% CI 2.84-3.95). The results were statistically significant for MICU and isolation ICU. The median LOS in MICU (n = 363) was 2 days and mean LOS was 2.6 ± 3.2 days (p-value <0.001; 95% CI 2.28-2.95). In isolation ICU (n = 24), the median LOS was 4 days and the mean LOS was 7.54 ± 11.76) days (p-value <0.001; 95% CI 2.57-12.51).

The overall mean LOS when statistically analyzed for month-wise variation as in indicated that in January (n = 263) mean LOS was 3.82 ± 6.85 days (p-value <0.001, 95% CI 2.99-4.65). The overall mean LOS in February (n = 276) was 3.49 ± 5.2 days (p-value <0.001, 95% CI 2.87-4.1) and in March (n = 296) the mean LOS was 2.88 ± 4.4 days (p-value <0.001, 95% CI 2.37-3.38). Table 1 shows the results of month-wise comparison of the overall mean LOS for the four ICUs and its comparison against the benchmarked mean LOS value and the optimal range of patient stay in ICU. The values higher than the benchmark are highlighted by underlining in Table 1. It is evident that the mean LOS in MICU was well within the optimal limits in contrast to NICU where mean LOS was slightly higher than the benchmarked value for the 3 months. However, the value was within the optimal range across the 3 months period for NICU. Mean LOS in HDU was marginally higher than benchmark in March and February but extremely high in the January which was also the highest across the month of January on comparison to MICU and NICU. On further comparison the mean LOS in Isolation ICU was marginally higher in February as compared to NICU, MICU and HDU. It was highest in March and exceptionally high in January as compared with the NICU, MICU and HDU. Apart from January and February months in Isolation ICU, all results were significant at p-value <0.0001.

Table 1: Month-wise comparative ALOS for the four ICUs

	Average LOS (benchmark: 3.08 days; optimal range 2-4 days)		
	January'13	*February'13*	*March'13*
NICU	3.13 ± 3.86	3.83 ± 5.90	3.27 ± 5.35
MICU	3.04 ± 4.34	2.61 ± 2.90	2.24 ± 2.32
HDU	6.02 ± 11.56	4.90 ± 7.32	3.22 ± 6.05
Isolation ICU	16.60 ± 22.03	5 ± 7.90	5.43 ± 2.50

The analysis of mean LOS across the months and departments showed that mean LOS in NICU was statistically different (p-value <0.0001) for January (n = 104) February (n = 98) and March (n = 125). Mean LOS was 3.13 ± 3.86 days (95% CI 2.38-3.89), 3.83 ± 5.90 days (95% CI 2.64-5.01) and 3.27 ± 5.35 days (95% CI 2.32-4.22) respectively for January, February and March. Eighteen percent (n = 59) of the total subjects in NICU had a prolonged stay (>4 days).

The mean LOS in MICU was statistically significant (all p-values <0.0001) for variations across months. Mean LOS in January (n = 111) was 3.04 ± 4.34 days (t = 7.356 95% CI 2.22-3.85), February (n = 125) was 2.61 ± 2.90 days (t = 10.040, 95% CI 2.09-3.12) and 2.24 ± 2.32 days in March (t = 10.859, 95% CI 1.84-2.65) respectively. Twelve percent (n = 43) of the subjects in MICU had a prolonged stay (>4 days).

The mean LOS in HDU was different across the 3 months when tested statistically (all p-value <0.0001). The mean LOS in January (n = 43) was 6.02 ± 11.56 days (t = 3.415, 95% CI 2.46-9.58), February (n = 41) was 4.90 ± 7.32 days (t = 4.288, 95% CI 2.59-7.21) and March (n = 37) was 3.22 ± 6.05 days (t = 3.233, 95% CI 1.20-5.23) respectively. 23% (n = 28) of the total subjects in HDU were long stay (>4 days).

The mean LOS in Isolation ICU in January (n = 5) was 16.60 ± 22.03 (t = 1.685, 95% CI-10.75-43.95), February (n = 12) was 5 ± 7.90 (t = 2.190, 95% CI-0.02-10.02) and in March (n = 7) was 5.43 ± 2.50 days (t = 5.729, 95% CI-3.11-7.75). The mean LOS in Isolation ICU was statistically significant in the month of March (p-value <0.0001) but not significant for the month of January and February. 46% (n = 11) of Isolation ICU patients had a prolonged stay (>4 days).

Table 2 shows the comparison of short and long stay patients in each of the four ICUs. It is evident from Table 2 that the isolation ICU had the least % of short stay patients as compared to the NICU, MICU and HDU. The MICU has the lowest % of long stay patients compared to NICU, HDU and Isolation ICU.

The overall mean LOS of the four ICUs was found to be 3.37 ± 5.54 days. Figure 1 shows the comparison between the overall calculated mean LOS and benchmarked mean LOS. It revealed that overall calculated mean LOS of the four ICUs was higher than the benchmarked 3.08 days. Thus, mean LOS in the ICU was prolonged as compared to the benchmarked reading.

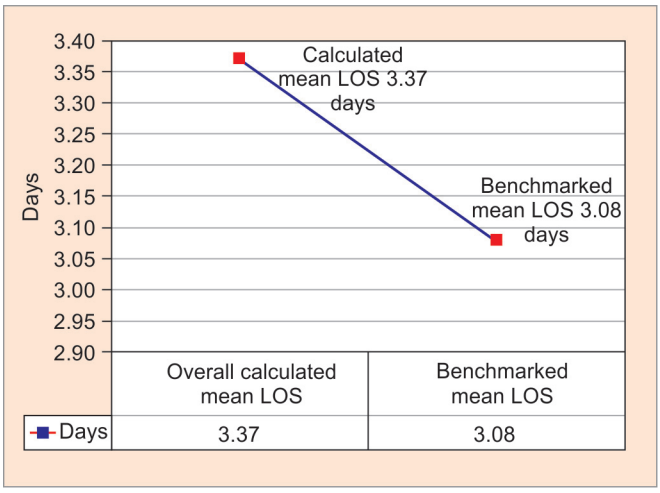

Fig. 1: Comparison of overall mean LOS and benchmarked LOS

DISCUSSION AND CONCLUSION

The present study aimed to calculate the overall mean LOS in 4 ICUs and compare it with the benchmarked mean LOS proposed in the quality manual of the hospital. We observed that overall mean LOS of our study was similar to a previous study[7] where the mean LOS was 3.86 days. In a Canadian study[8] done in a medical-surgical ICU of a tertiary hospital, mean LOS was 4.74 ± 0.2 days and median was 2 days. Other studies have also reported mean LOS of ICUs in the range of 2 to 5 days.[1,9] However, long stay patients have been observed to be about 11% of the total study subjects in which case mean LOS went as high as 27 ± 2 days and median LOS was 21 days.

We found that mean LOS was prolonged for some patients which may have a bearing on the hospital costs for providing care for additional days.[1] Studies have repeatedly shown that lengthy ICU admissions account for a small percentage (7-11%) but result in a large proportion (40-50%) of resource use.[7,8,10,11] Because patients with a prolonged ICU stay consume a disproportionate amount of resources, their early identification can assist in improving unit efficiency.[12-14]

In our study, highest mean LOS was in the Isolation ICU (8.01) days. Isolation ICU had longest stay of patients to prevent any adverse event like spread of the infections due to early discharges as Isolation ICU catered to patients with highly contagious diseases. We also observed that the proportion of short stay patients was highest in NICU followed by MICU and HDU and the least in Isolation ICU. This is because the admission and physiological characteristics of patients with prolonged ICU stay are quite different from those with shorter ICU

Table 2: Comparison of short and long stay patients in each of the four ICUs

	Patients n(%)			
Type of ICU	*Short stay (n = 360)*	*Long stay (n = 141)*	*Optimal stay (n = 334)*	*Total*
NICU	142 (43)	59 (18)	126 (39)	327
MICU	160 (44)	43 (12)	160 (44)	363
HDU	52 (43)	28 (23)	41 (34)	121
Isolation ICU	6 (25)	11 (46)	7 (29)	24
Total				835

stay. Patients with a short stay are those who likely die within a few hours of admission to ICU or other medical and administrative reasons.[15]

Some studies have shown that nonelective admissions, readmissions, trauma cases or those with other secondary infections or complications had a prolonged ICU stay.[1] However, cases other than isolation may also have a long stay in ICU like respiratory and trauma cases, gastrointestinal surgery followed by cardiothoracic surgery, trauma and neurosurgery.[1,16] A relation between the severity of illness and ICU LOS has also been observed. Patients with low severity of illness have short ICU stay in contrast with patients having very high severity of illness who may also have a shorter ICU stay as they die early in the ICU course.[1] Studies also show that the morbidity, mortality and cost of treatment of patients who stayed longer is higher than those who stayed for shorter periods in the ICU.[16] This is directly related to the incidence of nosocomial infections, especially with multidrug resistant and unusual organisms leading to long stay in ICU.[16]

Intensive care unit daily care costs are much higher than the general medicine and surgical costs reflecting both higher staffing ratios and greater resource consumption.[2] Hence, strategies to decrease ICU LOS and maintain it within the optimal range can improve patient turnover and increase ICU utilization resource constraint conditions.[2]

The strength of our study is that we computed the LOS for different ICUs. However, the limitation of our study is that the findings may not be generalizable to other settings where benchmark value of mean LOS is different or is undefined. Besides, setting a uniform benchmark for all ICUs also need some rethinking. Further studies are needed to validate the present findings across additional demographic characteristics. The LOS of LAMA patients may be 'lower than real' which will lead to misinterpretation of data. Further, they are lost to follow-up. Due to both these reasons they were excluded. Studies that provide the cost implications of prolonged stay in ICU on the hospital costs are also required in local context.

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