Original Research Article

Evaluation of Bed Utilization Pattern in a Tertiary Care Teaching Corporate Hospital in India

Sravan Saikumar Putla[1], Minal Bhatia[2]

[1]Senior Resident, [2]Junior Resident, Department of Hospital Administration, Post Graduate Institute of Medical Education and Research, Chandigarh.

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Abstract

Objectives: Assessment of bed utilization indices in a tertiary care hospital in India.

Methods: This cross-sectional study was conducted in a 730-bed tertiary care hospital. Average length of stay (ALOS), bed occupancy rate (BOR), bed turnover interval (BTI), bed turnover rate (BTR), gross death rate (GDR), and net death rate (NDR) were assessed over 12 months. Data included both primary and secondary data.

Results: During the study period, there were 355722 outpatients, of which 28296 were admitted and there were 32742 emergency room (ER) outpatients, of which 18361 were admitted. ALOS, BOR, BTI, BTR, GDR & NDR were 3.55, 63.55, 2.07, 5.43, 1.94 & 1.31 respectively. In the international ward, ICU, general ward, private room, and RAS ward the BOR was 37.04, 52.81, 77.66, 64.93, and 38.35 respectively and the value of ALOS was 4.01, 3.21, 3.47, 2.69, and 4.37 respectively.

Conclusion: Despite being better than many hospitals in India, there is still a need for improvement in the hospital management strategy of the hospital to reach its optimum level. Monitoring of bed utilization ratios is recommended in hospital settings.

Keywords: Bed occupancy; Hospital resource management; Bed occupancy rate; Length of stay; Hospital bed utilization.

Introduction

The domain of health management focuses on the optimum utilization of hospital resources for the efficient delivery of services.[1] To remove "hospital bottlenecks", optimum bed management is mandated.[2][3] Usually, how a community makes use of its hospital resources is represented by the term "hospital bed utilization". Both overutilization and underutilization prevail in different communities.

Corresponding Author: Minal Bhatia, Junior Resident, Department of Hospital Administration, Post Graduate Institute of Medical Education and Research, Chandigarh.

E-mail: meenal639@gmail.com

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Overutilization refers to staying in the hospital even after recovery whereas underutilization refers to the use of hospital resources below expectations.[4] Factors influencing hospital bed utilization include patient-related factors such as demographic characteristics and social and financial statuses of the patients, physician-related factors such as controlled autonomy of decision-making among resident doctors, fear of lawsuits, inadequate training, and lack of job description, exhaustive duty hours, and administration-related factors such as lengthy admission and discharge procedures, non-uniform admission policy, ineffective health information system (HIS), and lack of quality assurance.[5][6][7][8]

The world population is increasing at a fast rate, however, the number of hospital beds is not increasing at a matching rate. This mismatch has made hospital beds, both a scarce and expensive commodity in health care.[9] The optimum utilization of hospital beds can be analyzed with the help of hospital utilization indices including bed occupancy rate, average length of stay, bed turnover rate, and bed turnover interval.[10] Hospital administrators are in dire need of objective measures and methods to improve the utilization of scarce resources. Therefore, this study was undertaken for the identification of effective hospital bed utilization in a tertiary care hospital in India by assessment of indices like ALS- Average Length of Stay, BOR- Bed Occupancy Rate, BTI- Bed Turnover Interval, and BTR- Bed Turnover.

Methods

Study design, study duration, study population, sample size

This cross-sectional study was conducted in a tertiary care center in Secunderabad, India. This hospital has 730 Inpatient beds and 97 beds for daycare, emergency, dialysis, labor room, and post-operative recovery room. The study included not only the patients and their attendants but also the doctors and hospital staff posted in the study area as the admission of patients is under the supervision of doctors.

The study was conducted over a period of 12 months as the study aimed to understand the annual pattern of bed utilization in the hospital. The study included records of all the patients who visited the hospital's OPD (Outpatient department) during the study period and all the patients admitted to the medical and surgical departments hospital during the study period. The medical and surgical departments include critical care areas, general wards, Semi-private wards and Private wards, International wards, and Rajeev Arogyasri (RAS) wards. However, the record of patients' beds that do not come under the bed complement i.e., Daycare beds, Patient examination beds, Operation Theatre (OT) recovery beds, Dialysis beds, Emergency beds, Labour suite beds, e.g., Birthday beds Cots for healthy babies were excluded from the study.

The various indices recorded in this study were as follows:[11]

BED OCCUPANCY RATE (BOR)

$$\text{Bed occupancy rate (in percentage)} = \frac{\text{Total patient bed days x100}}{\text{Total no. of functional beds x No. of days in a month}}$$

$$\text{Average length of stay (ALOS)} = \frac{\text{Total bed days of all patients}}{\text{Discharges + Deaths}}$$

$$\text{Bed turn-over rate} = \frac{\text{Total discharge (including death)}}{\text{Total no. of functional beds}}$$

$$\text{Bed turnover interval} = \frac{365 - \text{ALS}}{\text{BTR}}$$

Data collection

Data included both primary and secondary data to gather information for one complete year (January to December). Secondary data was collected from the Medical Records Department (MRD) of the hospital. Data were analyzed using SPSS (Statistical Package for Social Sciences) 21.0 version, IBM, Chicago.

Results

Results of the study showed that during the study period, there were 355722 outpatients, of which 28296 were admitted and there were 32742 emergency room (ER) outpatients, of which 18361 were admitted. Month-wise distribution of patients visiting OPD, ER, and those getting admitted had been presented in Table 1. Month-wise- distribution showed an increase in total admissions in the rainy season. The Outpatient: Inpatient admission ratio was 12.6 i.e., 1 out of approximately 13 patients visiting the OPD needed inpatient care and got admitted to the hospital. The ratio of patients visiting the emergency room to the patients admitted through the ER was 1.78 i.e., approximately 1 out of 2 patients needed inpatient admission and were admitted through the ER. Month-wise distribution of bed occupancy, number of beds, available bed days, admission, discharges, and deaths has been presented in Table 2. The hospital utilization indices including Average length of stay (ALOS); Bed occupancy ratio (BOR), Bed turnover interval (BTI), and Bed turnover rate (BTR) in a month-wise pattern have been presented in Table 3. The study found that hospital areas like General wards and private rooms, Intensive care units (ICU) had more than 50% bed occupancy, and international wards, and RAS wards had less than 50 % bed occupancy among the available bed days. In the international ward, ICU, general ward, private room, and RAS ward the BOR was 37.04, 52.81, 77.66, 64.93, and 38.35 respectively and the value of ALOS was 4.01, 3.21, 3.47, 2.69, and 4.37 respectively.

Table 1. Month-wise distribution of the total number of Outpatients and admissions from the Outpatient Department and Emergency Room.

Month	OP	ER-OP	OP Admissions	ER Admissions	Total Admissions
January	27197	2609	2165	1369	3534
February	27980	2716	2087	1414	3501
March	27090	2337	2067	1214	3281
April	29412	2410	2472	1283	3755
May	27233	2339	2426	1271	3697
June	30221	2567	2476	1374	3850
July	31163	2684	2622	1400	4022
August	31658	2994	2530	1697	4227
September	32249	3400	2412	2072	4484
October	31188	3159	2317	1964	4281
November	31888	2935	2474	1780	4254
December	28443	2592	2248	1523	3771
Total	355722	32742	28296	18361	46657

OP-out patient, ER- emergency room.

Table 2. Month-wise distribution of bed occupancy, number of beds, available bed days, admission, and discharges.

Month	Bed Occupancy	Beds	Available Bed Days	Admissions	Discharge
January	12614	730	22630	3534	3598
February	13533	730	20440	3501	3519
March	11714	730	22630	3281	3367
April	13088	730	21900	3755	3652
May	12823	730	22630	3697	3659
June	13923	730	21900	3850	3891

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July	14046	730	22630	4022	3962
August	15311	730	22630	4227	4249
September	16736	730	21900	4484	4382
October	15454	730	22360	4281	4324
November	16184	730	21900	4254	4338
December	14050	730	22630	3771	3783
Total	163940	-	266180	46657	46724

Table 3. Month-wise presentation of hospital indices.

MONTH	ALOS	BOR	BTI	BTR	GDR	NDR
January	3.44	55.75	2.73	5.01	1.77	1.47
February	3.76	66.20	1.92	4.91	2	1.39
March	3.41	51.76	3.18	4.69	1.83	1.25
April	3.52	59.5	2.39	5.09	1.72	1.04
May	3.44	56.6	2.56	5.09	1.63	0.99
June	3.51	63.3	2.03	5.42	1.71	1.36
July	3.47	62.06	2.12	5.53	1.88	1.21
August	3.54	67.65	1.69	5.92	1.75	1.24
September	3.73	76.41	1.15	6.14	2.27	1.51
October	3.49	68.28	1.62	6.05	2.21	1.42
November	3.73	73.89	1.28	6.08	2.34	1.57
December	3.63	62.08	2.21	5.29	2.19	1.34
Total (Mean)	3.55	63.55	2.07	5.43	1.94	1.31

LOS- Average length of stay; BOR- Bed occupancy ratio; BTI- Bed turnover interval; BTR- Bed turnover rate; GDR- Gross death rate; NDR- Net death rate.

Discussion

In this study, the OP to IP admission ratio of 12.6:1 indicated that one out of approximately 13 patients visiting the outpatient department needed inpatient care and got admitted to the hospital. This large ratio could be attributed to the good availability of daycare beds and daycare procedures and surgeries in the hospital resulting in less need for hospitalization. According to previous studies, emergency departments (ED) account for nearly 50% of all inpatients, and approximately 14.7% of ED visits end in inpatient admissions.[12] Parker CA *et al.*, reported that 38.7% of the patients visiting the ED got admitted to the hospital.[13] The findings of our study were in agreement with the above-stated observation, we found that the ratio of patients visiting the Emergency room to the patients admitted through the Emergency Room was 1.78:1 i.e., approximately 1 out of 2 patients need inpatient admission, and getting admitted through the Emergency Room.

We observed that the inpatient and outpatient admissions and mortality rate was higher in July and September. In India, July to September is the rainy season. An increase in mortality due to seasonal infectious disease and an increase in the frequency of accidents has been usually observed in the rainy season.[14][15]

BOR is a measure of utilization of the available bed capacity in the hospital.[11] According to WHO and IPHS norms, the BOR of hospitals should be at least 80%, however, it shows national and international variations.[16] [17] In this study, the Bed Occupancy Rate (BOR) for the study year was 63.55%. In a comprehensive study of the economics of hospitals in India, in the majority of the hospitals, the overall occupancy rate did not exceed 80% and

it was as less as 42.0% in charitable hospitals.[18] In a study conducted in Nigeria, the BOR was reported to be 62.3%.[11] A study from Uganda reported a BOR of 78.8%.[19] In a hospital in Iran, BOR was 65.40%.[20] The national and international variation in BOR could be explained by variations in incidence and type of disease, financial access, type of hospital, and its services.[21]

Length of stay is an important performance indicator of Hospital management. It indicates recovery time and also defines the consumption of hospital resources.[22][23] We found that the average length of stay for the patients admitted to the hospital was 3.55 days which was lesser than the average length of stay in a district hospital (i.e., 5 days) reported by IPHS. A slightly reduced ALOS observed in the present study could be attributed to streamlined processes and standardized work being practiced in the present hospital.[24] This ultimately indicated effective hospital management. In this study, when ALOS was calculated in a monthly pattern for the hospital as a whole it was a minimum of 3.44 days in January and May, and a maximum of 3.7 days in February, September, and November. BOR also showed the same trend with a maximum of 76.41, and 73.89 in September and November respectively, and a minimum of 51.76 in March. This monthly variation could be attributed to the seasonal variation in the type of disease and other health-related conditions.

Bed turnover interval (BTI) gives the status of the hospital bed vacancy between one discharge to another admission to the bed. Ideally bed turnover interval should be 1-3 days. A higher BTI is indicative of inefficient management in the hospital.[11] In the present study, the average BTI for the year was recorded to be 2.07. BTI was lowest in September (1.15) and highest (3.08) in March, this was in accordance with the BOR which was maximum in September and lowest in March respectively.

Bed turnover rate (BTR) is a measure of the use of hospital beds, which involves the number of turnovers of patients in one year for a given bed complement.[25] In the present study, BTR was found to vary between 4.69 and 6.14 patients per bed per month (The average BTR for a year was 5.43 patients per bed per year). Aloh HE *et al*. reported BTR to vary from 6.84 and 34.34 patients per bed per year.[11] The low BTR seen in the present study demonstrated low productivity and a high level of inefficiency.

GDR (Gross Death Rate) and NDR (Net Death Rate/Hospital Death Rate) of the hospital for the study year were reported to be 1.94 and 1.31 respectively. According to the National Health Profile (NHP) 2018, the GDR value for India was 7.3 per 1000 population.[26] In the present study, the highest gross death rate (2.27) was reported in September. This could be due to the seasonal variations in the incidence of disease. The highest (1.57) and lowest(0.99) Net death rates were seen in November and May respectively. The GDR and NDR were comparatively lesser than the GDR reported by NHP 2018 which could be attributed to the availability of advanced equipment and technology and super specialties. Most of the deaths were contributed by terminally ill patients.

In the present study, the BOR was found to vary between different wards. BOR was 37.04 for the international wards, 52.81 for Intensive care units, 77.66 for General wards, 64.93 for Private Rooms, and 38.35 for the RAS wards. The highest bed occupancy was seen in General wards which was probably due to easy affordability and admission of patients with less severe disease. The inclusion of the limited specialties under the Arogya Sri scheme at Yashoda Hospital or the lack of knowledge among patients about the Arogya Sri scheme could be the reason for minimum bed occupancy in RAS wards. The BOR of Intensive care units was 52.81 which demonstrated an optimum utilization. The average annual ALOS for the hospital on area-wise/ward distribution was found to be highest (4.37) for the RAS wards compared to other areas of the hospital. The highest length of stay in the RAS wards was most probably due to the lengthy approval procedures and formalities for admission and discharge. ALOS was high (4.01) in the international ward also. According to the policy of the hospital, foreigners visiting the hospital could leave the country,only after the completion of the treatment and most of them visited our country because of critical diseases or organ transplants. Both these factors added to the prolonged ALS. The ALS for private or semi-private rooms was the smallest (2.69) as it is a payment-structured area. Also, patients often got admitted for

health checkups under insurance schemes and had less severe diseases, so they left early.

The number of admissions in medical specialties was almost double compared to surgical specialties. Among the surgical specialties, Orthopedics, and spine surgery department had the highest (nearly 300) admissions per month. In the dental department, no patient was admitted throughout the year.

Plastic Surgery, ENT, Ophthalmology, vascular surgery, liver transplantation, and Surgical Gastroenterology specialties contributed to approximately 50 admissions each. CT surgery, pediatric surgery, and interventional radiology contributed much less to hospital admissions. This highlighted the need for improvement in these specialties.

Limitations of the study

The present study was a single-center study and thus lacks generalizability

Conclusion

Despite being better than many of the hospitals in India, there is still a need for improvement in the hospital bed management strategy of the hospital to reach its optimum level. It is also recommended that bed utilization ratios should be monitored regularly in hospital settings.

Conflict of Interest: None

Ethical Considerations: The study was conducted after obtaining approval from the institutional ethics committee of Yashoda Academy of Medical Education and Research[Ethics committee registration number-ECR/49/Inst/AP/2013/RR-19].

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