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Original Research Article

From chaos to coordination: leveraging technology for efficient bed management in a large and complex healthcare system

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ABSTRACT

Background: Effective bed management is fundamental to hospital operations, significantly impacting patient care, resource utilization, and overall efficiency. AIG Hospitals, Hyderabad (India) accommodates 620 in-patient beds catering to more than 2,500 outpatients daily. The emergency department caters to over 70 visits each day and a 65% in-patient admission conversion rate. On average, the hospital handles 100 admissions and 100 internal transfer requests daily, maintaining a bed occupancy rate exceeding 75%. The Hospital tried handling through shared Excel sheets however bed management efficiency was a concern.
Methods: To solve the problem, the hospital decided to leverage modern technology with good user interface to undertake real-time bed management.
Results: This led to improvement in bed occupancy from 75% to 80%, increase in bed turnover rate by 11%, reduction in admission to arrival turnaround time (TAT) by 65% and improvement in net promoter score (NPS) by 14%. Average monthly admission went up by 12% on an average – converting to 323 additional admissions per month. The correlation for bed occupancy rate admission to arrival TAT and NPS was statistically significant.
Conclusions: This article explores this innovative solution that revolutionized bed management by leveraging real-time tracking, intelligent analytics, and improved communication. As healthcare demand grows, hospitals must adopt innovative solutions. This study demonstrates how integrating a web-based bed management system can transform hospital operations, optimize resource use, and improve care delivery-setting a new benchmark in hospital efficiency.

Keywords: Bed management, Hospital operations, Health care delivery, Healthcare technology, Operational excellence

INTRODUCTION

In-patient admissions might seem like a straightforward process to a bystander, particularly when the supply of hospital beds appears unlimited. However, the reality in a high-performing hospital environment, where occupancy levels are constantly high, is vastly different. Here, the availability of beds becomes a critical and often scarce resource, with significant operational implications. Hospital bed management is a complex and dynamic process that involves the systematic allocation, monitoring, and turnover of beds in response to fluctuating patient demands. It is essentially a balancing act between admissions and discharges, complicated by internal transfers, bed readiness, and the diverse clinical needs of patients. This study examines the transformative journey of bed management at AIG Hospitals, a tertiary care hospital in Hyderabad, India. AIG Hospitals operates a 620-bed facility distributed across 50 nursing stations on ten floors spanning two towers, with ten distinct bed categories. In addition to this infrastructure, over 150 consultants attend to more than 2,500 outpatients daily. The emergency department alone handles more than 70 patients a day, with an inpatient conversion rate of approximately 65%. The hospital also manages frequent intra-hospital transfers including step-ups (ward to ICU or critical care) and step-down (critical care towards). During calendar year 2023, AIG Hospitals managed an average of over 100 inpatient admissions and more than 100 transfer requests daily. The bed occupancy rate consistently hovered above 75%. This intense demand led to significant operational challenges including increased admission-to-arrival turnaround time (TAT), reduced bed turnover rates, and a decline in both bed occupancy and patient satisfaction. Initially, the hospital relied on its hospital information system (HIS) for bed management. However, due to its cumbersome interface and complex navigation, it proved inefficient and time-consuming, requiring staff to navigate multiple screens to locate relevant modules. Consequently, the hospital reverted to manual methods involving spreadsheets and direct verbal or written communication. These methods, however, introduced inefficiencies, communication gaps, and suboptimal utilization of available resources. Faced with these challenges, the hospital leadership decided to explore advanced, technology-driven solutions. Existing literature underscored the value of information technology in supporting timely inpatient placement and optimizing resource utilization. Decision support systems have shown promise in enabling hospital staff to manage inpatient beds more efficiently, potentially reducing costs and inpatient length of stay.[1]

This article presents a comprehensive narrative of the hospital's transition to a web-based bed management application. The objective was to develop a system that ensures precision, speed, and adaptability in bed allocation while enhancing the overall efficiency and patient experience. The primary aim of the project was to create a robust bed management system that would maximize bed utilization, minimize admission-to-bed allotment and bed-ready-to-bed-occupied times, and enhance communication with internal stakeholders and patients. The end goal was to improve patient experience and net promoter score (NPS).

Aims and objectives

Aims and objectives of the study were: to create a robust bed management system which: ensures maximization of bed utilization, reduces time from request for admission to bed allotment, minimizes bed ready time to bed occupied time, and enhances communication with internal stakeholders and patients, ultimately boosting the patient experience and NPS.

METHODS

Type of study

It was an implementation study with a quasi-experimental design.

The study was conducted in AIG Hospitals, Gachibowli, Hyderabad. AIG Hospitals is a 620 in-patient bed facility, accredited by JCI, NABH, and NABL located in Hyderabad. This study includes all admissions from outpatient (OP) and emergency room (ER) to inpatient (IP) beds. All inpatient admissions and Step-down transfers are included in the study. Day-care admissions and step-up transfers (wards to ICU/step down ICU) were excluded. Data was collected from HIS and manual spread sheets of bed requests and allotments. Operations team (admissions, ER, bed and floor), IT department were main stakeholders. It was well supported by nursing, clinical administration, and pharmacy. The study was conducted in two phases – evaluating improvements in the bed allotment process's efficiency.

Phased implementation of bed management system

Phase 1 (January 2023 – December 2023)

This phase focused on planning, designing, and deploying a structured bed management system and was carried out in three key stages. In stage 1 (requirement planning), the existing bed allotment process was analysed in detail by collecting and reviewing historical bed allocation data. Multiple bottlenecks were identified, including fragmented communication, lack of real-time tracking, and inconsistencies in status updates. Based on this analysis, a comprehensive requirement plan was developed to guide the system redesign. In stage 2 (application development and pilot testing), a digital application was developed to address the identified gaps and was pilot-tested in a single high-volume location to evaluate feasibility, usability, and responsiveness. In stage 3 (hospital-wide deployment), the application was rolled out across all departments in a phased manner. Issues encountered during deployment were systematically addressed through user feedback, real-time troubleshooting, and iterative updates. The complete roadmap of this implementation process is summarized in Table 1.

Table 1: Roadmap of study.

Week	Activity
1-2	Data collection
3-6	Gap analysis
7-8	Requirement planning
9-18	Product development
19-36	Pilot study
37-52	Deployment across the hospital

Phase 2 (January 2024 – December 2024)

In this phase, the revised bed management system was fully operational. Quantitative and qualitative data were collected post-implementation to evaluate the effectiveness of the new system. This included analysis of bed allotment efficiency, turnaround time, stakeholder satisfaction, and the accuracy and availability of real-time bed status information. Improvements in efficiency were measured across the following metrics: bed occupancy rate, admission-to-arrival TAT, bed turnover rate, admission throughput, and admission department NPS.

RESULTS

Stage 1

In stage 1, the bed management system operated through conventional, manual processes. During the initial stage of requirement planning, data collection revealed a highly fragmented workflow. A total of 74 spreadsheets were used to update and maintain patient records, with over 150 stakeholders engaged in bed tracking and coordination activities. Managing bed requests and allotments involved more than 300 phone calls per day and relied heavily on multiple WhatsApp groups. Communication of bed handovers occurred verbally and individually, without standardized documentation. Importantly, there was no mechanism to ensure real-time visibility of bed availability, particularly for beds nearing discharge status.

A comprehensive gap analysis revealed several critical shortcomings. First, there were frequent inaccuracies in bed tracking due to inconsistent and delayed manual updates. Second, the bed request process was inefficient, as urgent requests were difficult to manage owing to fragmented communication across multiple platforms, including calls and chat groups. Third, the lack of real-time data impeded timely and informed decision-making by the staff. Finally, essential details required for prioritizing bed allotment—such as the nature of the case, patient category, and urgency—were often missed or inadequately conveyed, further contributing to allocation delays and miscommunication.

A comprehensive requirements analysis was conducted to guide the design and development of the technology-enabled bed management system. The functional requirements were identified through detailed consultations with clinical, administrative, and IT teams.

A key functional requirement was the implementation of a real-time centralized dashboard, capable of providing consolidated updates on bed availability, admission requests (both allotted and pending), internal transfers, and discharge status. This data needed to be visible at the hospital-wide level as well as filtered by individual floors and bed categories.

To streamline workflows, two distinct forms were required—one for admission requests and another for internal transfers. These forms had to include prioritization flags ("high", "regular", "urgent") based on clinical urgency, the ability to register future requests, mandatory remarks for cancellation requests, and a "supporting care" feature to account for bedside care needs during transfers.

A dedicated bed allotment interface was also mandated to support informed decision-making. This screen needed to display the requested bed category and real-time availability (including ongoing discharges), with options to change bed categories (in case of non-availability), modify the admission date, hold requests, or cancel them as necessary.

The application was further expected to support drill-down dashboards for key operational metrics, including request volumes, current bed status, discharges, cancellations, bed category upgrades, and complete bed history logs.

Seamless integration with the HIS was considered essential to ensure automatic updates of occupied and discharged bed statuses, as well as accurate reflection of upgraded bed categories in real-time.

Additional critical features included automated notifications to patients via registered mobile numbers, acknowledging receipt of bed requests and confirming reservations with relevant documentation guidelines. Analytical dashboards were also required to support real-time KPI monitoring and performance tracking.

The non-functional requirements emphasized system scalability, data security, and compliance with applicable healthcare regulations. The platform had to support time-stamped entries and remarks for complete transparency across stakeholders. A user-friendly interface was crucial to ensure usability by a diverse group of users, including over 10 clinical administrators, more than 70 floor team members, over 10 admission staff, 15+ emergency department personnel, and 40+ administrative staff, with role-based access control to suit different user needs.

To summarize, the team set-out the following targets for the application (Table 2).

Table 2: Targets for the application.

Stage	Current	Target
Request submission	Verbal/written by staff	Electronic request via web based application platform
Verification	Manual search of logs or calls	Web based real-time availability check
Decision making	Based on staff discretion	Rule-based automatic suggestions-discharge stage wise bed visibility
Notification	Phone call/in-person update	Instant alerts via message to stakeholders
Waitlist handling	Manual update	Auto-generated and tracked digitally
Transparen-cy	Limited visibility	Full transparency to stakeholders across the hospital

Stage 2

A web-based system was devised to address the bottlenecks in bed management, aiming for better operational efficiency and resource utilization. A pilot implementation was conducted in one department, where all the staff of the user department underwent training to familiarize themselves with the system. This phase was closely monitored, focusing on usability and scalability. The feedback collected was pivotal in identifying any areas requiring improvement and in assessing the system's feasibility for wider implementation.

Stage 3

After the successful pilot, the web-based bed management model was rolled out hospital-wide. Adjustments and remodelling were made to ensure the system fit the larger hospital's workflow and requirements. Integration with the existing HIS was completed to streamline data flow and reduce manual input, making the system more efficient. Comprehensive training was provided to the entire staff across all departments. Departmental champions were identified to facilitate continuous, on-the-job training and to serve as go-to experts for their peers. Based on the observations and feedback from stage 2 and stage 3, a well-structured and fully functional web-based bed management system was finalized. This system was designed to be scalable, user-friendly, and adaptable to ongoing hospital operations.

The web application incorporated almost all the requirements laid out in stage 1, with the key highlights being the following.

Real-time bed status and availability

It offers live updates on bed status, empowering staff to make immediate decisions. This feature minimizes delays inpatient admissions and ensures effective utilization of resources.

Patient flow optimization

The application streamlines patient admission and internal transfers. By automating manual tasks, it reduces administrative burdens and accelerates bed turnover.

Analytics and reporting

With powerful analytics, it provides insights into key performance indicators, such as Average bed occupancy rates, turnaround times for bed preparation and trends in bed utilization.

Integration with HIS

It integrates seamlessly with existing HIS, ensuring consistency and eliminating duplicative workflows. This integration provides a holistic view of patient data, aligning bed management with clinical needs.

Ease of user interface

Role-based access tailor's dashboards to user roles, ensuring relevant information visibility. Floor-wise view filters bed status by floor, enabling quick decisions and efficient resource management.

Bed occupancy rate

The bed occupancy rate increased from 75.33% to 80.13%, primarily due to a reduction in administrative delays. The bed management system played a key role in supporting decisions regarding the length of patients' stays, significantly expediting the discharge process, and reducing delays in the admission queue.

Table 3: Bed occupancy paired-sample t-test results comparing variable 1 and variable 2 (n=12).

Metric	Variable 1	Variable 2	Difference (V2-V1)
Mean	0.7799	0.8090	+0.0291
Standard deviation (SD)	0.044	0.042	-
Pearson correlation (r)	-	-	0.735
t-value (df=11), two-tailed	-	-	-3.19
P value (two-tailed)	-	-	0.009
t-critical (two-tailed, α=0.05)	-	-	±2.201
P value (one-tailed)	-	-	0.004
t-critical (one-tailed, α = 0.05)	-	-	±1.796
Significance	-	-	Significant

A significant increase was observed from variable 1 to variable 2 ($p<0.01$). Strong positive correlation ($r=0.735$) indicates high linear association. Test was paired, two-tailed by default, one-tailed for directional hypothesis.

Admission to arrival turnaround time

65% improvement in the admission-to-arrival TAT was observed. With the web-based bed management system, stakeholders could track real-time bed status (ready, occupied, preparing, discharged). This instant information enabled effective communication with patients regarding their admission status, contributing to the enhanced TAT.

Results from a two-sample t-test assuming unequal variances indicate a statistically significant difference between variable 1 and variable 2 ($t(11)=2.25$, $p=0.046$). Variable 1 demonstrated a higher mean value compared to variable 2, suggesting a meaningful distinction between the groups.

Table 4: Admission to arrival TAT two-sample t-test results (assuming unequal variances) between variable 1 and variable 2 (n=12 per group).

Statistic	Variable 1	Variable 2
Sample size (n)	12	12
Mean	0.0536	0.0187
Variance	0.0029	0.0000043
Standard deviation (SD)	0.0539	0.0021

Table 5: Admission to arrival TAT t-test summary.

Test type	Two-sample t-test (unequal variances)
Degrees of freedom (df)	11
t-value	2.25
P value (two-tailed)	0.046
Significance level (α)	0.05
Statistical significance	Yes (p<0.05)

Bed turnover rate

Bed turnover rates saw an 11% increase, largely attributed to the visibility of bed status for stakeholders. Real-time updates allowed for timely bed allotment, leading to a reduction in bed turnover intervals. A paired samples t-test was performed to compare the means of variable 1 and variable 2.

Table 6: Bed turnover rate paired-sample t-test results comparing variable 1 and variable 2 (n=12).

Statistic	Variable 1	Variable 2	Test result
Mean±SD	4.59±0.44	4.89±0.24	
t-value (df=11)			–3.014
P value (two-tailed)			0.0118
Pearson correlation (between pairs)			0.621 (moderate positive correlation)
Interpretation			Significant difference (p<0.05)

A statistically significant increase was observed from variable 1 to variable 2, supported by both two-tailed and one-tailed tests.

The high Pearson correlation (r=0.735) indicates a strong linear relationship between the paired values.

Demographic data

Since the intervention is hospital wide, aggregate patient admissions is considered in demographics. The average monthly admissions increased approximately 11.6% per month which meant that the hospital admitted 323 more patients each month.

Patient experience

Patients experienced shorter waiting times and improved coordination during admissions and discharges, leading to an overall improvement in the efficiency of admission and transfer operations. Feedback from patient satisfaction surveys indicated a significant 14% increase in the NPS. A statistically significant difference between the two phases at a 95% confidence level (p value is less than 0.05) was noted.

Table 7: NPS one-way ANOVA results comparing group 1 and group 2 (n=24).

Parameter	Group 1	Group 2
Sample size (n)	12	12
Mean	69.50	79.17
Variance	142.45	24.88

Table 8: NPS ANOVA summary.

ANOVA summary	Result
F-statistic	6.70
Degrees of freedom (between, within)	(1, 22)
P value	0.0168
Significance level (α)	0.05
Result	Statistically significant (p<0.05)

One-way ANOVA comparing mean scores between group 1 and group 2. Despite unequal variances, the equal group sizes support the robustness of the analysis.

The results indicate a statistically significant difference in means, with group 2 outperforming group 1.

Table 9: Compilation table of results.

Variab-les	Bed occupan-cy rate (%)	Admissi-on to arrival TAT	Bed turnov-er rate	NPS
Phase 1	75.33	01:17:07	4.5	69.5
Phase 2	80.13	00:26:57	5	79.1
Improve-ment	6.37	39.63%	11%	12.67 %

Table 10: Impact of web-based bed management system.

Stage	Phase 1	Phase 2
Data accuracy	Prone to human error in recording and tracking	High accuracy due to automation and real-time data validation
Auditability	Limited historical data for audit	Detailed digital audit trail for every request and allotment
Reporting	Requires manual compilation of data	Automatic generation of comprehensive reports with filters and analytics
Utilization insights	Minimal visibility into bed utilization trends	Detailed insights into occupancy rates, average turnaround times, and bottlenecks
Compliance	Challenging to enforce standard protocols	Ensures compliance with predefined rules and hospital policies
Integration	Standalone process without system linkage	Seamless integration with other systems (e.g., EMR, HIS)
Scalability	Difficult to scale with increasing patient volume	Easily scalable with hospital growth and complex operations
Decision support	Relies on staff expertise	System driven suggestions for optimal bed management
Turnaround time (TAT)	Delays due to manual handling	Significantly reduced TAT through streamlined workflows
Communication	Dependent on verbal/phone updates	Digital notifications and multi-channel communication
Real-time monitoring	Not possible	Full real-time monitoring of bed occupancy and requests
Patient experience	Potential delays and confusion	Enhanced patient satisfaction due to faster and transparent allocation
Time efficiency	Longer due to manual effort	Significantly faster and accurate

DISCUSSION

The bed management system addresses the critical need for streamlined bed management in modern hospitals. By leveraging technology, one can ensure that the bed management process becomes real-time and intelligent, which bridges the gap between patient needs and hospital resources as well as ensures efficiency in process. Further it supports timely inpatient placement and reduction in wait times. This was in consonance with other bed management studies.[2-4] A web-based software was created to overcome the challenges faced during traditional method to improve efficiency. This approach was similar to reference study where a Bed central system was developed to centralize bed status information.[2] In the reference study by Blair (2005), bed status information is entered by the hospital staff. However, our study was HIS integrated and information sharing was Web based. In our study, bed to arrival TAT improved by 65 % and bed turnover improved by 11%. These findings align with Szabo’s 2003 study, which reported a 30% improvement in door-to-bed time.

Despite integration with the HIS, manual intervention is still required in the process. Marking a bed as vacant after a physical discharge must be done manually. Automating this step could enable early identification of empty beds and enhance operational efficiency. This was demonstrated in a study by Kannry (2007), where an RFID-based system identified vacant beds within an average of 25 minutes. Exploring technology to automate empty bed identification would be beneficial. We plan to incorporate this and any additional modifications in the next phase of our study.[5]

Our study proposed a transition of spreadsheets to centralized bed management system. This was similar to study of Reuille (2004) which proposed a centralized bed management system (bed control report) based on five Excel spreadsheets.[6] Szabo (2003) describes the use of the bed tracking system, developed by tele tracking technologies, to support the bed placement workflow and centralize bed status information (bed released, bed in maintenance and bed available), that is entered into the system by the hospital staff (administrative clerk, clinicians and housekeepers) using specific coded calls.[7] We plan to develop a predictable model of bed allocation. However, the challenge is that the use of target occupancy levels, such as the average length of stay (LoS), as the primary determinant of bed capacity is inadequate due to the unpredictable nature and distribution of hospital admission rates and patient LoS over time.[6-11]

Limitations

There were some limitations in the study. This study was conducted at a single tertiary care hospital (AIG Hospitals), and the findings may not be generalizable to smaller hospitals, rural healthcare settings, or institutions with different workflows and resources. While day care and transfer in admissions significantly affect bed availability and patient flow, they were excluded from the study. This may lead to a partial understanding of the overall bed management dynamics. Despite technological integration with the HIS, the system still relies on manual updates to mark beds as "vacant" post-discharge. This introduces variability and potential delay, which can affect real-time decision-making and resource planning. The second phase of the study spanned one calendar year post-implementation. A longer observation period may be required to evaluate sustainability, long-term outcomes, and scalability of the solution. The system was not integrated with ancillary departments such as housekeeping, diagnostics, or transport. Delays from these departments can impact actual bed readiness but were not directly captured in the bed management KPIs. Adoption and consistent usage of the web-based platform varied among stakeholders, especially during the early implementation phase. Behavioural inertia, reluctance to change from manual methods, and differing levels of digital literacy affected initial system usage. Since stakeholders were aware that performance was being monitored as part of a study, it's possible that this awareness influenced behaviour and improved performance temporarily. Although there was an improvement in NPS, other patient-centric outcomes (e.g., satisfaction with communication, stress related to waiting, clinical outcomes due to admission delays) were not comprehensively assessed. The application was built to align with the existing HIS structure. Limitations in HIS architecture or inter-system compatibility may have restricted full feature integration or hindered automation opportunities.

CONCLUSION

Bed occupancy is an important performance measure, but a universal definition of occupancy does not exist. Next to occupancy and blocking probability, workload is an important performance measure for a ward. There is a need to exploit and develop an efficient and practical technique that can be employed in the allocation of clinical beds. For this reason, using beds relevantly and saving resources is of importance for the advancement of the health care industry and the progress of the economy. The findings of this study strongly reinforce the transformative potential of technology in improving operational efficiency and care delivery in complex healthcare systems. By implementing a real-time, web-based bed management system (BMS), the hospital succeeded in bridging existing gaps between patient demand and bed availability-one of the most persistent operational challenges in high-volume hospitals. Through improved visibility and coordination across departments-admissions, nursing, housekeeping, and clinical teams-the system enabled a seamless and timely flow of patient admissions, discharges, and transfers. This enhanced coordination led to a marked improvement in bed occupancy rates, bed turnaround times, and admission-to-arrival TAT. These improvements translated into tangible operational gains-most notably, the hospital was able to accommodate 323 additional patients every month, a significant increase in service capacity without corresponding infrastructure expansion.

Beyond these quantitative results, the deployment of the BMS yielded intangible but critical benefits. The system introduced automated event tracking and timestamping, fostering transparency and auditability. This improved the accountability of each stakeholder and ensured that no step in the bed management workflow went undocumented. Additionally, by eliminating manual data entry and process redundancies, the hospital substantially reduced the likelihood of human errors and communication breakdowns. The digital system also facilitated multi-level analytics, enabling hospital leadership to make data-driven decisions both at the macro level (system-wide trends, resource planning, bottleneck identification) and at the micro level (individual case flow, team performance, and turnaround compliance). These insights have empowered continuous improvement and resource optimization.

As healthcare institutions worldwide grapple with rising patient volumes, workforce shortages, and the imperative to deliver timely, high-quality care, this study offers a scalable and replicable model. The successful implementation of a BMS exemplifies how technology can be leveraged not only for process efficiency but also for strategic transformation-aligning hospital operations with evolving care delivery models and patient expectations. In summary, this study validates the integration of digital tools in hospital bed management as a strategic enabler, not merely a support function. It has set a new benchmark for operational excellence, patient flow optimization, and responsive care delivery in the digital health era.

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REFERENCES

1. Matos J, Rodrigues PP. Modeling decisions for hospital bed management. HEALTHINF 2011 - International Conference on Health Informatics. 2011;504-7.
2. Blair R. Capacity management: the bedrock of efficiency. Health Manag Technol. 2005;26:30-1.
3. Szabo P. Bed-der than ever. Pittsburgh hospital uses Web-based bed tracking and control to speed efficiency in its ED. Health Manag Technol. 2003;24:58-9.
4. Reuille R. Bed control report: a computer-based system to track patient admissions delayed or rescheduled due to a bed shortage. J Nurs Adm. 2004;34:539-42.
5. Kannry J, Emro S, Blount M, Ebling M. Small-scale testing of RFID in a hospital setting: RFID as bed trigger. AMIA Annu Symp Proc. 2007;384:388.
6. Green LV, Nguyen V. Strategies for cutting hospital beds: The impact on patient service. Health Serv Res. 2001;36:421-42.
7. Nguyen JM, Six P, Antonioli D, Glemain P, Potel G, Lombrail P, et al. A simple method to optimize

hospital beds capacity. Int J Med Inform. 2005;74(1):39-49.
8. Kokangul A. A combination of deterministic and stochastic approaches to optimize bed capacity in a hospital unit. Comput Methods Programs Biomed. 2008;90(1):56-65.
9. Mackay M, Lee M. Choice of Models for the Analysis and Forecasting of Hospital Beds. Health Care Management Sci. 2005;8:221-30.
10. Millard PH, Mackay M, Vasilakis C. Measuring and modelling surgical bed usage. Ann Royal Coll Surg Engl. 2000;82:75-82.
11. Ridge JC, Jones SK, Nielsen MS, Shahani AK. Capacity planning for intensive care units. Eur J Operational Res. 1998;105(2):346-55.
12. van de Vrugt NM, Schneider AJ, Zonderland ME, Stanford DA, Boucherie RJ. Operations research for occupancy modeling at hospital wards and its integration into practice. In: Kahraman C, Topcu YI, editors. Operations Research Applications in Health Care Management. Springer US, Boston, MA. 2018;262:101-37.
13. Freitas EE, Schramm FR. The morality of allocating resources to the elderly care in intensive care unit. Rev Bras Ter Intensiva. 2009;21(4):432-6.
14. Suppapitnarm N, Pongpirul K. Model for allocation of medical specialists in a hospital network. J Healthc Leadersh. 2018;10:45-53.

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