

Research Article**Bed Management System: A Health Informatics Project****Ftoon Kedwan*, PhD**

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Abstract

This is a case scenario report reporting the successful Bed Management System (BMS) implementation project in Prince Sultan Medical Military City (PSMMC) in Saudi Arabia. Several advantages and challenges of the BMS implementation are reported, and a few findings are documented. The aim of this short paper is to demonstrate an ideal example of a technical solution implementation in a healthcare environment, which in most cases fail due to many people-related reasons including lack of cooperation. Such failing reasons and their solutions are explored in further detail to benefit the readers and healthcare organizations who are about to implement a similar project.

Keywords: Health Informatics, Bed Management, Information Systems, Healthcare, Medical Project Implementation.

Introduction

There is a considerable interest in healthcare technology and technical means, especially with the growing population and the increase in the number of patients in hospitals [1,2]. This paper discusses the implementation of a bed management system, which is of great importance to healthcare. Managing a hospital's resources is a core foundation required to provide high-quality healthcare services since hospitals are where patients expect proper healthcare services from [3]. Thus, patients' trust should be considered with high regard. However, poor management of hospital resources lead to reduced healthcare quality delivered to patients [4]. When visiting a hospital, there are repeated images seen and found, such as when elderly patients wait for prolonged period of times to be cared for, or the replacement and transferring of patients to other hospitals for urgent treatments in emergency cases. This patients' transfer necessity arises from the hospital's bed unavailability, leading to stressed arguments between patients and hospital's staff regarding medical services shortcomings. These scenarios, which seem to be repeated very often, must be solved and addressed.

The "bed" in hospitals is not a place for sleeping, relaxing or for rehabilitation. It is a valuable resource and a service that healthcare organizations continuously utilize to enhance and improve a better healthcare [5]. Therefore, the objective of this short paper is to address the

Bed Management System (BMS) solution implementation challenges and demonstrate its advantages to healthcare organizations.

Experiment & Methodology**Experimental Environment**

Saudi Central Region Military Hospitals include three military hospitals, Prince Sultan Medical Military City (PSMMC); that is the main one and is considered as one of the most advanced hospitals in the middle east. Then, there is Al-Kharj Military Industry Corporation Hospital, and King Abdul-Aziz Military Academy Hospital, in addition to Prince Sultan Cardiac Center. However, PSMMC is aspiring to be the leader in providing the highest quality level of healthcare for patients, and willing to become a reference in medical services.

PSMMC hospital provide medical services in variety of disciplines. The hospital was suffering from patients' overload that led several medical departments to issue requests for bed demand provision. As a result, lots of problems accumulated over time, especially in finding and preparing beds for new inpatients. A bed request starts with doctors needing to book rooms or beds for particular clinical purposes. The booking procedure requires a request form to be filled by the doctor. Then, it is sent to the admission office unit, whom in coordination with the case management staff, coordinates and holds

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the responsibility to find available rooms and beds among hospital departments to allocate patients in a certain date and time. The communication between the two departments is done remotely, mostly by phone. Sometimes, case management staff need to go and check the availability of beds by themselves, increasing the time and effort of staff responsibility which delays the bed booking procedure consequently. In this case, doctors had to wait until a nurse in charge declares any room vacancies. Moreover, delay in patients' discharge leads to longer times of beds' occupation needlessly [6]. This affects future patients' needs for beds vacancies, and affects the healthcare organization as well by increasing the patients' waiting list without proper outcomes. Having such issues occurring continuously in health organizations makes the involvement of health informatics technical solutions essential to resolve hanging problems [7]. One of the important departments under PSMHC is the Bed Management Department (BMD). This division holds a critical task that affects the performance of several other departments who rely on the manner beds allocation is controlled and managed. The function of BMD staff is to observe all delays in patients' admission, discharge and transfer processes in the hospital. They are involved heavily in promoting the optimal use of beds and monitoring the efficiency of healthcare services. Hence, BMS plays a critical role that enhances the provision of excellent healthcare service. Nevertheless, there are certain evidences that led to the necessity of adopting a BMS solution, such as:

- Increasing number of patients with long waiting times to be assigned beds and be admitted in the hospital.
- Delay in surgery operations due to busy rooms.
- Delay in patients' discharge processes.
- Increasing hospital costs while providing additional beds when the existing beds are not ready or unavailable.
- BMD staff time consumption to check for bed availability.

Problem Implications

When hospital resources, such as beds and recovery rooms, are being mismanaged and continuously unavailable, this leads to inefficient healthcare service. This will not only affect patients' health and lives, but also physicians, nurses and hospital's productivity and performance quality in many different aspects [8]. Patients expect a high-quality healthcare and quick service from hospitals, especially in emergency conditions. However, without proper BMS, patients are forced to wait for a long time for bed vacancies. In urgent situations, the admission office transfers patients to other hospitals or wards. For example, a patient who needs an orthopedic care will be admitted to cardiac wards, in this situation there is a lack of supplies and bed type which would affect the treatment's overall outcome [9]. Such a situation would lead to additional costs and resources being wasted, patients' admission delays and forces physicians to operate on patients improperly putting patients' lives and wellbeing at tremendous risk. Furthermore, prolonged patients' stay in a hospital causes a consequent delay in preparing the bed for other patients in the waiting list [10].

Solution Implementation

New technical implementations of any kind in a large-scale medical enterprise such as the PSMHC hospital, which has over 1,400 beds and more than 1,200 employees, is a big challenge and would probably cause obvious challenges [7]. There are tremendous efforts exerted upon patients' healthcare

and medical services in terms of quality and safety. Therefore, BMS was taken into consideration after several undesirable experiences with unsatisfied patients stuck in the waiting list, and the obvious negative impact resulted from the lack of bed management strategies. BMS importance comes from the need to develop a more suitable and efficient way of dealing with beds unavailability issue.

PSMHC hospital administration, in collaboration with Medical Informatics Research and Development Center (MedIC) and Information Technology Department (ITD), found BMS as a solution to reduce the pressure of patients' admission bottleneck and to control patients' capacity that is frequently increasing. The decision was to use BMS as a new system to automate bed management workflow efficiently and reliably. A BMS implementation activities and operations strategy plan was laid out using the waterfall system development model. Thus, the current problematic situation was analyzed, and system requirements were defined as goals and objectives for the BMS implementation project, which are mostly about meeting the hospital's mission and vision and patients' needs.

Then, they distributed the responsibilities and tasks between the project team and defined the "go-live" date for the BMS system. In addition, the committee convened a plan for system maintenance to ensure the system efficiency and continuity.

Finally, the ITD team adopted the BMS system, integrated it with the Hospital Information System (HIS), and tested it to check for system compatibility and performance.

Moreover, the clinical staff, who are going to interact with the new system, were trained by the ITD team, and were prepared for the "go-live" day.

The adopted BMS system swiftly proved its efficiency by enhancing the bed allocation workflow through the following functions:

1. Pre-Admission Booking: a function that enables system users to book a bed or an entire room for a particular patient, and choose a specific doctor, date and time as shown in Figure 1.
2. Bed Status Inquiry: a function that acts as a dashboard in providing the user a quick and precise information such as: the number of vacant beds, number of occupied beds, total number of beds, beds availability in each specialty, bed occupants (patients) details who are occupying the beds and patients' length of stay, as shown in Figures 2 and 3.

After the successful BMS system implementation, both administrative and clinical staff (e.g. physicians and nurses) found the system comprehensive, easy to use, and simple to understand. BMS reduced the delay in surgeries booking backlog, patients' waiting list, hospital's costs, and improved patient's satisfaction.

Results and Discussion

Several findings are extracted from this system implementation experience that would inspire future IT projects in healthcare, such as:

- Reduce Hospital Beds Need: The most effective way to reduce hospital beds need is to improve and facilitate rapid admission and rapid discharge of patients by establishing an appropriate system. Such a system shall help organizing bed allocations, and hence, increase the volume of hospital's patient's capacity.



Figure 1: Pre-Admission Booking System Interface

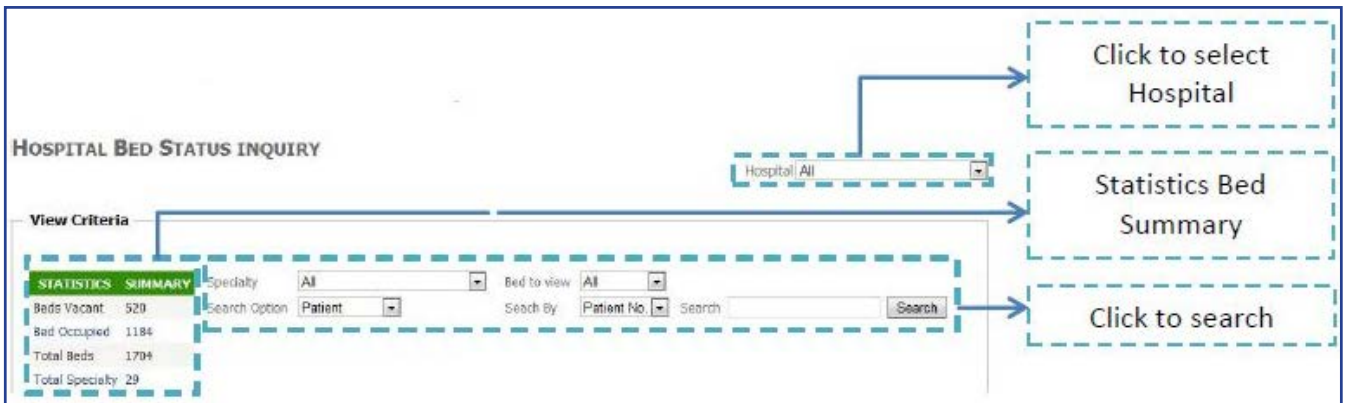


Figure 2: Bed Status Inquiry System Interface

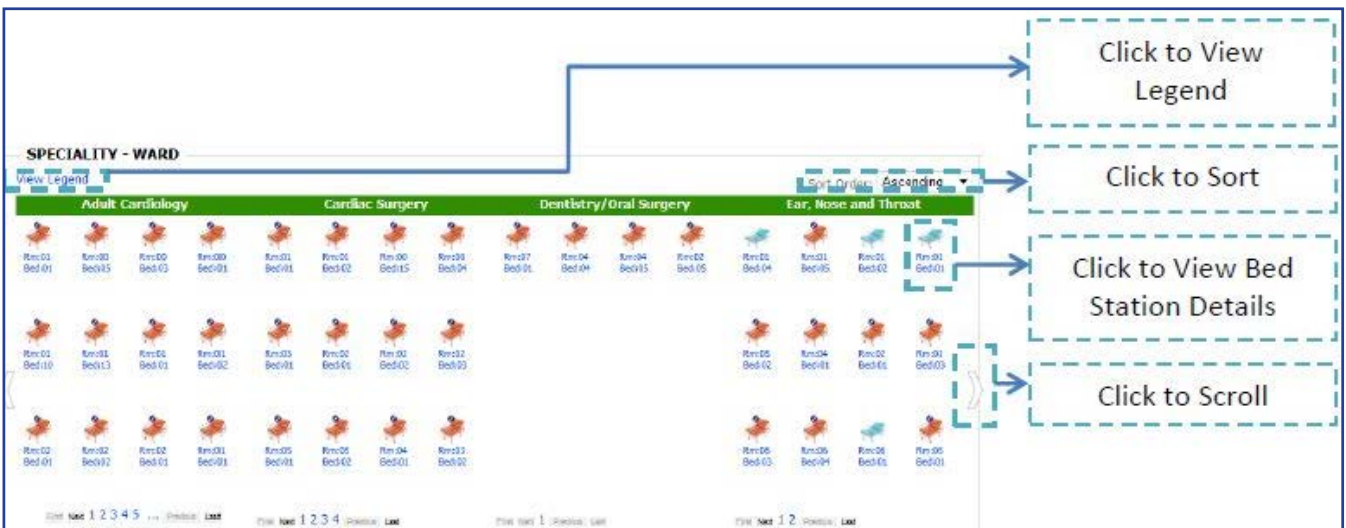


Figure 3: Bed Search by Specialty System Interface

Firm Details													
Firm Name:		GYNAECOLOGY											
Remarks:		ACTUAL ADMIT DAY SAT.MOH											
Date:				Time:									
Doctor List				Firm Schedule									
BADRIA AL MOBRAD MOHAMMED AL SHEHRI JIBRAEL KHOURI SULTAN AL SULTAN				Days Of	Routine		Over Booking		Total				
				The Week	M	F	M	F	U	Max	B-1	B-2	Bal.
				Saturday	3	4	0	2	1	10	1	0	9
				Sunday	0	0	0	0	0	2	0	0	2
				Monday	0	0	0	0	0	2	5	0	-3
				Tuesday	0	0	0	0	0	2	1	0	1
				Wednesday	0	0	0	0	0	2	0	0	2
				Thursday	0	0	0	0	0	2	0	0	2
Friday	0	0	0	0	0	2	1	0	1				
Legend: Available ■ , No More Vacant ■ , Not Allowed ■ U = Urgent, B-1= Booked by HIS, B-2= Booked by RMS													

- **The BMS Does Not End with Implementation:** The process of BMS adoption should not stop after the implementation phase. Ongoing evaluation, improvement, maintenance, and staff training is necessary to meet the healthcare organization's future needs, and the patients' expectations of high-quality medical care.
- **Reduce Hospital Costs:** Patient's discharge delay and prolonged hospital admissions affect the hospital expenditure by increasing needless operations costs that could be eliminated by implementing an appropriate BMS system that coordinates and organizes bed utilization.
- **Involve Clinical Staff:** Involvement of clinical staff and granting them the system establishment leadership is essential to the implementation project success since they are the eventual end-users, and with their knowledge of practice they can effectively advise the technical team with indispensable points of consideration.

Conclusions

PSMMC, like many other major hospitals in Saudi Arabia, is suffering from complex and difficult issues of hospital's beds allocation. The previous hospital BMS system had huge amount of written information located in a variety of computer files and hardcopies, which requires specific searching methods. The new BMS system integrated this existing information with a level of visualization, which allows clinical staff to make more accurate decisions about patients' admission and discharge necessities. In addition, this system allows staff to monitor and track beds availability and determine how many beds are empty and need to be cleaned.

Hospitals without effective BMS systems are facing a big waste of manpower time who are continuously struggling with beds allocation and coordination, besides the ever-increasing costs of alternative placement of patients when beds are not ready or unavailable when needed. Applying BMS addresses these issues excellently and ensures the best use of healthcare resources.

Some future considerations might include integrating the BMS system with other PSMMC branches and regions, in addition to potential integration of BMS with the Electronic Medical Record (EMR) system. Furthermore, using new emerging technologies such as RFID (Radio Frequency Identification) to track the exact locations of beds using sensor situated in corridors and tags attached to beds will possibly enhance beds searching and hospital security. Such propositions shall improve healthcare services outcomes as well as patients' safety, privacy, and satisfaction.

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