Revista Administração em Diálogo
DOI: http://dx.doi.org/10.23925/2178-0080.2017v19i3.31356
Evaluation: *Double Blind Review*
Scientific Editor: Francisco Antonio Serralvo

The Technology of Information in Support of Bed Management: a Multiple Case Studies in Private Hospitals

A Tecnologia da Informação no Apoio à Gestão de Leitos: Um Estudo Multicaso em Hospitais Privados

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Abstract

The aim of this study was to identify the relationship between Information Technology's supportand bed management, in terms of: system performance and perception of managers in private reference hospitals in the city of São Paulo. This study used a descriptive multiple case studies, elaborated from the collection of data in sources of evidences including: interviews with managers and documentary analysis. In this study, the most productive hospital was the one with the shortest average length of stay, the highest turnover rate and the lowest replacement interval index. As a conclusion, it was shown that organization D was considered as the most productive one which gaveinvestment and technological support related to modern management practices.

Keywords:. Information Technology; Bed Management; System Performance ; Private Hospitals

Resumo

O objetivo deste artigo é identificar a relação da Tecnologia da Informação no apoio à gestão de leitos, no que se refere ao desempenho dos sistemas, na percepção de gestores, em hospitais particulares de referência da cidade de São Paulo. A pesquisa contempla um estudo multicaso descritivo, elaborado a partir da coleta de dados em fontes de evidências que incluíram entrevistas com gestores e análise documental. Nesta pesquisa confirmou-se que o hospital mais produtivo é o que apresentou menor tempo médio de permanência, maior índice de giro e menor índice de intervalo de substituição. Como conclusão, verificou-se que a organização D foi considerada a mais produtiva, dado o investimento e apoio tecnológico associado as modernas práticas de gestão.

Palavras-chave: *Tecnologia da Informação; Gestão de Leitos; Desempenho dos Sistemas; Hospitais Particulares.*

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Received in 12.31.2016
Approved in 01.24.2017

Introduction

With the rapid progress of Information Technology (IT), companies have become increasingly dependent on information and computer systems. Hundreds of different applications are often found in hospital settings.In addition, hospital computerization software is often complex, costly, and difficult to develop and implement. Thus, it is necessary to have a strategic positioning of health organizations for the treatment of information resources, as well as the choice of an Information Systems (SI) tool which iscapable of bringing the expected benefits to these organizations (PEREIRA et al., 2012).

Hospitals, within health organizations, stand out as representation of management models that respond to the high costs of health care, the need to expand service coverage, increasing consumer demands, and incorporate technologies (BRITO, 2004; GÜRSEL et al., 2014).

According to Hendy et al. (2013) NHS (National Health Service) is increasingly criticized for lack of beds, leading to delays in elective hospitalizations and long waiting lists. The number of hospitalizations is increasing every year due to the limited performance of primary care services and the increase of elderly population. Evidence shows that the situation reported by the same author is also experienced by Swedish hospitals, the increase cost of pressure and aging population.

Brazilian population over 65 requires four times more admissions than the average population. Mendoza-Giraldo et al. (2012) accompanied all discharges from a University Hospital of 1,205 beds in Spain. In one year period, it represented 3.5% (1,170) patients who were discharged late due to non-medical problems, resulting in 1,603 improper patients per day.

As pointed out by Cunningham and Sammut (2012), Hendy et al. (2013) the number of beds available to population is decreasing worldwide over the years. So the existing ones deserve special attention for better results from the welfare or financial point of view. It is estimated that 7% to 9% of brazilian population will need hospital admissions during the year, in a specific region.

The efficiency in health care in a complex institution such as those in the health area requires the creation and implementation of organizational management tools which

allow the organization and standardization of work processes (ARAÚJO; BARROS; WANKE, 2014).

The use of IT can support logistics in secondary flows, such as: hospital bed control, which is an appropriate step to advance efficiency in the organization (LIN; STEAD, 2009). It is worth remembering that the Bed Management directly impacts the financial results of the hospital because it is the heart of its production.

Therefore, the objective of this article is to identify the relationship among information technology, the management of beds, andthe perception of managers for the quality of services offered in private hospitals.? The article has the following structure: introduction, methodological procedures, theoretical revision which provides a conceptual basis on the subject, then the findings referring to the discussion of the results, and, finally, the conclusions are presented.

Methodological Approach

The research utilized a descriptive multicase study, elaborated from the collection of data in sources of evidences including: interviews with managers and documentary analysis (YIN, 2013). The data were collected between May and August 2016 by scheduling interviews with five managers, one representative per private hospital. The interviews were guided by semi-structured open-ended questions following a roadmap (see Table 1).

Table 1: Interview script

Guiding themes	References
IT support is relevant to bed management.	Kumar *et al.* (2008); Lin e Stead (2009); Gartner, Zwicker e Rodder (2009); Vries e Huijsman (2011). Araújo, Barros e Wanke (2014).
Knowledge of all times that involve the process of bed management, through the support of Information Technology IT.	Jones (2009).
Follow up of the average of permanence / occupation rate / Interval of Replacement and Turn of the bed, through the support of IT Information Technology.	Jones (2009).
Technological Support for the evacuation / discharge process.	Hendy *et al.* (2013). Godden, McCoy e Pollock (2009).
IT support to follow the sector goals, identification of the centralized in the admission and not in the discharge routine.	Araújo, Barros e Wanke (2014).

Fonte: Elaborado pelos autores.

Data collection also used secondary sources, such as:recording analysis , private or official source documents, including forms, reports, system manuals, or others documents related to the research objective, such as: standards manual and routines; indicators; management reports issued by the system; and flows of bed management processes. The purposes in using these secondary sources were to obtain more data about the research and to complement the obtained data. Secondary data used in this research were obtained through access to the hospital organizations via the internet and Intranet, containing: procedures, regulations, explanatory leaflets, information about their organizational structure and indicators.

The use of data triangulation method made it possible to analyze the theoretical basis, the facts obtained by documents,opinions, and memories reported in the interviews (TEIXEIRA; NASCIMENTO; ANTONIALLI, 2013).

Theoretical Framework

In this section, we present the use of Information Technology in Private Hospitals; Hospital Bed Management; The use of Information Technology in Hospital Bed Management; and Indicators to measure efficiency in bed management.

Information Technology in Private Hospitals

The use of Information Systems (IS) by health managers has become increasingly important. This instrument serves as a source of information on the hospital's indicators, providing important information about the institution and supporting the decision-making and strategic process in administrative management.

The Health Information Systems (SIS) are configured as tools for the production of information that guide the decision-making process of health care professionals in different levels. Thus, the information are detected in real time helping in the planning and execution of actions according to the servisse reality and specificity.

The current health care model imposes the need to review the situation of SIS implementation in organizations, as well as the evaluation of data centralization, the limitation of their use, the delay in accessing them, and the locations where systems are deployed has already become a reality.

In addition, in order to achieve the quality of Information System in health services, it is essential to ensure that the information required is measurable and given in a consistent database. However, the suitability of SIS for greater applicability to hospitals is still a challenge (SOUZA, et al., 2012).

Health innovation is indispensable in current scenario, being one of its possible innovations in the production process, that is, the introduction of new elements in the tasks of the organization, in its IS or in the physical production or service operations. They represent advances in the company's technology. (2007).

Health institutions invest enormous amounts of financial resources in Hospital Information Systems (HIS). The aim of this investment is to enable more effective and efficient health care (KEIZER; AMMENWERTH, 2008).

However, there is a considerable amount of research that revealed the negative effects from the implementation of Information Technology (IT) on health care. It is

Revista Administração em Diálogo
ISSN 2178-0080
Programa de Estudos Pós-Graduados em Administração
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estimated that almost 70% of IT implementation projects in health failed, resulting in the loss of large amounts of investments, and as a consequence, the loss of trust in these implementations (AMMENWERTH; ILLER; MAHLER, 2005; GÜRSEL et al., 2014).

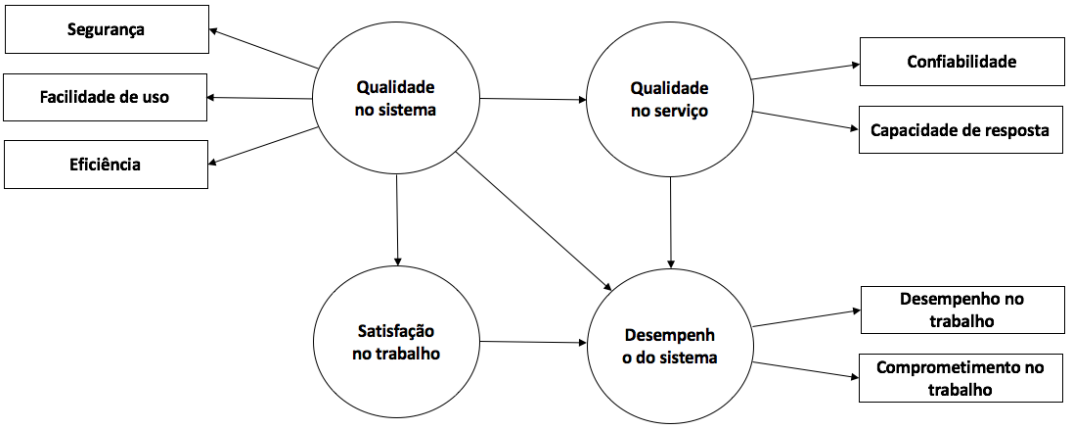
Despont-Gros, Mueller and Lovis (2005) identified that the main reasons for failure are: technical issues; poor project management; organizational issues; and accelerated growth of IS resources without adequate planning. However, implementation failures can not be attributed only for technical reasons. Other reasons can be avoided, or at least the failure rate can be significantly reduced through management tools which are easy to use,assess, prioritize, monitor, and control the IT investments (ALSHAWI, 2007).

Therefore, effective evaluation of any type of IS is crucial to determine if these systems adequately meet the requirements or needs of users and health organizations. This is due to the fact that many analytical structures in the literature analyze the systems instead of evaluating them. In this sense, when there is an evaluation, a concrete result is obtained andmeasured in numerical value. This value can be obtained by evaluating all SIs as well as for each variable required by the user.

Gürsel et al. (2014) developed a model that seeks to analyze the information systems in hospitals from the perspective of the end user who observed the dimensions: expectation of use; expectation of data and systems; expectation of improvements; and management expectations. As a result, it has been observed that systems that are familiar to users are likely to be the first to meet their expectations.

According to Chang, Chen and Lan (2012), it is recommended that the IT area of the hospitals take into account the quality of services and the satisfaction of the end users, besides placing emphasis on the system quality and the information quality when designing, developing or acquiring a particular IS. Thus, one gains more in IS performance in hospitals. Next, the developed model is presented, along with a summary of the dimensions and variables defined by the authors to analyze thesystems performance based on user satisfaction (see Figure 1 and Table 2).

Figure 1: Conceptual structure of the relationship between system quality, service quality, job satisfaction and system performance.



Source: Adapted from Chang, Chen and Lan (2012, p. 4).

Table 2: Summary of dimensions and variables from the conceptual structure of the relationship between system quality, service quality, work satisfaction and system performance.

Dimension	Variable	Operational definition	References
Quality in the system	Security	Refers to the capabilities that a hospital has in providing IS services that securely protect users' information; confirm user identification and prevent viruses, among others.	DeLone (1992). Li, Tan e Xie (2002).
	Ease of Use	It refers to the degree to which the IS service is perceived as easy and oriented to the users' learning.	Li, Tan e Xie (2002).
	Efficiency	Refers to the degree to which the service of the information system is perceived as very useful to facilitate and improve the work efficiency and agility.	Li, Tan e Xie (2002).
Quality in service	Reliability	It refers to a hospital capacity to provide IS services that correctly deliver the requests made by the users.	Parasuraman e Grewal (2000).
	Responsiveness	It refers to a hospital capabilities to provide IS services that respond quickly and instantly to the users demands.	Parasuraman, Zeithaml e Berry (1985).
Work satisfaction	Work satisfaction	The psychological state of the SI user involves his or her positive or negative feelings or attitudes towards experience with IS services.	Dabholkar, Bobbitt e Lee (2003).
System performance	Work performance	Refers to benefits such as: work efficiency; professional skills; operation process; among other services that IS can offer.	Myers, Kappelman e Prybutok (1997).
	Work Commitment	It refers to the users inclination to remain within the hospital because of the ability to overcome any encountered problem with the support that IS services can provide.	Bhattacherjee (2001).

Source: Adapted from Chang, Chen and Lan (2012, p.5).

Hospital Bed Management

As the average length of hospitalization varies, as well as the diagnoses, managers need adequate predictions and up-to-date information on patient and outpatient admissions. An efficient bed flow reduces wait time, among other benefits (BRYAN; GAGE; GILBERT, 2006; WINKELMANN et al., 2008).

This study was carried out to determine the causes and financial costs of delays in discharges at the medical clinic wards of a teaching hospital. Most patient discharges were delayed, 50% of the patients. One-third of these delays was preventable. These results are similar to those of a British study and a large US study, where 13.5% of hospitalization days were inadequate and 63% of delays had non-medical reasons (FONSECA, 2013).

In this context, a growing awareness of late discharge is being developed in the United States, since Medicare no longer charges hospitalization, it is allowed to discharge patient, even if s/he does not agree. It was becauserefusal of the discharge program allows the financial and legal responsibility of the patient or a relative for hospitalization. Refusing or not cooperating with the progress of the discharge plan is contrary to the interests of the system that invested resources and efforts seeking improvement in the conditions for discharge. The patient who remains hospitalized without clinical reasons spend unnecessary costsresulting in the use of resourcesin an inefficient way (SCHLAIRET, 2014).

The process (Table 3), which begins on discharge and release of the environment for hygiene, is replete with critical points in internal communication, requiring team awareness and agility of hotel and maintenance. Removing possible ″bottlenecks″ is indispensable for business. From then on, one must act on the indicators, determine goals and, consequently, plan the use of the bed.

Table 3: Steps for deploying bedside management

Steps	Coments
Define systematics for the implementation of Bed Management.	Create criteria for vacating the beds for elective hospitalizations, as well as for non-scheduled hospitalizations (requested by Emergency Care or transfers from other institutions)
Establish Interfaces and Integration between areas.	Some institutions create one sector for bed management, others assign this task to the hospitalization and admission sector. It is important to establish a leader for this process, to determine guidelines for other sectors that have direct interface with bed management, such as cleaning, nursing, among others.
Manage times of all steps	Before setting goals to be achieved, some "times" should be monitored, such as: average length of hospital stay, discharge time, bed release time for hygiene, average sanitation time, and bed composition. Based on these data the process manager will have a pre-diagnosis to identify the priority focus of action.
Use System/*Softwares*	The use of an electronic system can be a great facilitator on the bed management process, since all times of all steps can be followed simultaneously and effectively.
Define Indicators	Defining which indicators will be used to follow the established actions and processes is fundamental to identify their impact. Examples of indicators: average sanitation time; average time for hospitalization; mean discharge time until bed release; rate of prescribed discharges until 9 or 10 am, among others.

Source: Adapted from Hawk, Repetto and Gelonesi (2015, p.223).

From observation, it is found that for the ″reutilization″ (occupation by a new patient) of the bed, it is necessary to perform several activities that can vary from hospital to hospital, such as: medical discharge, discharge in the system, printing of all the examinations (by the clerk of the floor) which are performed for delivery to the patient.The routine is to return the exams performed during hospitalization, nursing discharge orientation, bed emptying, terminal cleaning, bed disinfection, release of the bed. In this case, the management has become a central issue in health organizations. The evaluation of installed capacity involves two main questions: what capacity should be available and how to use it in the most appropriate way to face oscillating demand.

According to Jones (2009), the ideal for a quality service and for an adequate financial management of the organization, the average maximum occupancy should not exceed 85%, and the average stay should be between 3 and 7 days.

Delays in discharge may expose the patient to hospital infection risks, in addition to other consequences. Correcting these delays would reduce costs and improve service quality. Because variation and delays in this process can create bottleneck that may ultimately delay new admissions, the discharge process has received special attention. Thus, the delays that interfere with the discharge of the wards have received little attention

because the government's goals are mainly on admission rather than discharge (HENDY et al., 2013).

Managing patient flow is one of the most challenging aspects of any health care unit. The management of installed capacity (bed management) is usually a critical task. Some steps can be used for the implementation of bedside management in health institutions which consider the profile of the institution and its conditions (FALCÃO; REPETTO; GELONESI, 2015).

In this context, in order to improve efficiency in bed management, it is necessary to use ISs to predict discharge, improve communication between the multiprofessional team, have a team in search of beds, process definition and place to wait hospital discharge for high-signed patients and released from the hospitalization unit (JONES, 2009).

The use of Information Technology in Bed Management

Another variable to consider is that the management of bed which can be facilitated by the use of IT to control and coordinate this service. It is hard to imagine, though it exists, the operation of a hospital without the widespread use of IT as a tool for information, intelligence, integration and control.

With the increase in health spending, as a result of the adoption of high technology for diagnosis and the high rate of waste;the segment faces difficulties in balancing the accounts. In addition, health care institutions need to use knowledge and information at all times and this creates a greater reliance on IT resources. They then become an important strategic, tactical and operational tool to help managers and others to be more agile and organized. Also, they can be used to to increase organizational efficiency.

However, the degree of automated operations in health care is limited due to the high variability and unpredictable demands (Viers, Huijsman, 2011). IT is already widely used in health care because many daily routines are dependent on various computer systems such as: patient's diagnoses for safe treatments (LIN; STEAD, 2009).

A survey carried out in the Länssjukhuset Ryhov by Hanaeus and Tolic (2015) found that it is difficult to control the hospital beds released. It was because often the information is not correlated to any integrated software system or information system. Often, this control is the responsibility of nurses. Without a rigorous system, this task is

more vulnerable to be misunderstood and can waste time and resources. With this technology support, bed-cleaning scheduling could be more accurate, with less risk of errors and poor bed management, containing detailed information on cleaning time, reducing the risk of misunderstandings and errors in the bed management process.

Indicators and their Relevance for Measuring Efficiency in Bed Management

Throughout the 1980s and early 1990s, several authors have suggested measurement frameworks such as the performance pyramid (LYNCH; CROSS, 1991), the determinant scoreboard, the performance measurement matrix (KEEGAN et al. al., 1989) and the BSC (Balanced Scorecard) (FREZATTI et al., 2014).

A study by Neely (2015) concludes that the most interesting observation about collected data related to measuring instruments that mostly used is BSC. Taking into account that in the research data the author suggests that between 30% and 60% of companies adopted this methodology, this finding is interesting, especially when considering the relative paucity of empirical research on the impact of measurement frames.

According to the author, the area of performance measurement can be considered recent. Several questions have arisen, such as the fact that strategic maps assume as a logical and causal set of relations between organizational performance dimensions, while the reality of these relations is dynamic. Or it is even the danger of organizations implementing BSC which becomes overly obsessed with performance measurement rather than performance management. Indicators of productivity in bed management are used internationally. In thesimplest form, they include the mean of permanence, the occupation rate and the replacement interval.

Productivity indicators are important for bed management, since from efficient bed management, surgeries are canceled less frequently, beds are rotated faster, the average stay will be in acceptable standards, considering each diagnosis and the occupancy rate within the goals are stipulated by the organization.

Bittar and Olimpo (2000) affirm that the hospital with the shortest average length of stay, higher rate of turnover or turnover of the bed, and a lower replacement interval index are more productive.

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ISSN 2178-0080
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Results Discussion

In this section, we present five organizations surveyed IT cases, the internationally adopted indicators for the control of bed management and the analysis of collected information.

Organization A

In this hospital the information system used is MV Sistemas, but it was decided not to hire the specific module for bed management of this company (this module is acquired separately). Some spreadsheets are performed manually and there is no parameterization of all stages of the bed management process, so it does not meet the real needs of the sector, in addition, it allows the realization of retroactive discharge.

The occupancy rate target of this current hospital is 85%, and to maintain it, if necessary, it can get patients in partner hospitals. It does not have all the necessary indicators to carry out bed management despite having the integrated management system of MV Sistemas, since they use spreadsheets in parallel. The average time that the patient needs to be admitted to the emergency room is two hours, but the registration of this time is only from the release of the agreement for hospitalization, the information that does not accurately reflect the patient's waiting time.

For this hospital, the most important thing is not the waiting time, but the feedback from the patient and / or companion. They want to know how the process is going. Regarding the epidemiological indicators, it only comments on seasonality (specific diseases of some seasons) (see Table 4).

Table 4: Bed management adoptted productivity indicators - Hospital A

Indicators/months	March	April	May	June	July	August	Semester Average
Occupancy rate (%)	81,72	85,67	82,77	85,22	80,19	81,46	82,83
Average stay (days)	5,56	4,98	5,93	6,54	6,23	5,59	5,80
Bed rotation index (hours)	6,37	6,49	6,59	6,33	6,07	6,10	6,32
Replacement interval (hours)	0,33	0,64	0,82	0,52	0,57	0,86	0,62

Source: Bed Management - Hospital A.

Revista Administração em Diálogo
ISSN 2178-0080
Programa de Estudos Pós-Graduados em Administração
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The hospital realizes that the ″security″ of information is flawed since, for the management of beds, spreadsheets are used, the handling of the information by diverse teams can generate unreliable data, the margin of error increases. But for easyuse, employees have adapted the system and used spreadsheets easily. Regarding ″efficiency″ and ″response capacity″ in bed management, the system leaves something to be desired, since the indicators indicate results outside the theoretical parameters proposed.

Organization B

Thishospital has a contract with the integrated management system of MV Sistemas. It also has the specific module for bed management that does not meet the real needs of the sector. This system allows the realization of retroactive highs, hindering the ″reliability″ in the information.

It is also planned to purchase the Voice module, which operates as a telephone support system. This system provides a panel which identifies the patient′s exit time, where bed management can prioritize which bed to be sanitized, as well as reporting all phases of the bed management process. Many of the major hospitals located in the city of São Paulo already have this innovative technology.

The hospital has an average occupancy rate goal of around 85%. Average stay is around 5 days. It has indicator to control the average time of delay in the hospitalization of PS (Emergency) patient - less usual. In response to the question regarding the epidemiological indicators of P.S entrance gate, it is reported that they respond to seasonal factors, periods of virus, dengue, H1N1, among others (see Table 5).

Tabela 5: Bed management adoptted productivity indicators– Hospital B

Indicators/months	March	April	May	June	July	August	Semester Average
Occupancy rate (%)	75,91	78,08	73,73	81,76	78,26	72,73	76,74
Average stay (days)	4,91	4,68	4,75	5,06	4,52	4,71	4,77
Bed rotation index (hours)	4,82	5,02	4,85	4,90	5,39	4,80	4,96
Replacement interval (hours)	1,70	1,30	1,80	1,10	1,30	1,80	1,5

Fonte: Bed management – Hospital B.

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In this organization, it is noticed that the ″security″ of the information has flaw.For the management of beds, Excel spreadsheets are carried out, the handling of information by diverse teams can generate unreliable data. However, there is a concern on the part of managers in acquiring a new system that interacts with the existing one to improve the monitoring of the bed management process. The bed management module generates management reports and displays the updated indicators. Management is already concerned with the ″efficiency″ and ″responsiveness″ to the bed management system since it has a financial impact on the institution, which is why it is acquiring the Voice module.

Organization C

This hospital has its own system. However, it does not meet the expectations of the sector. Many difficulties are encountered in this case, since, all indicators are generated manually. Therefore, the hospital considers IT to be of the utmost importance and should help the bed management by optimizing the system?, including the available staff to perform tasks manually. They do not have the financial resource of investments in this area.

In addition, the hospital has no occupancy rate target, which is around 70-80% at weekends and during the week reaches 100%. This difference occurs due to surgeries, which are not scheduled on weekends. It has indicator to control the average time of delay in the hospitalization of PS patient, which now revolves around 4 hours. Its goal is to reach two hours. Regarding the epidemiological indicators of the entrance gate of the PS, since it is a specialized hospital, the main cause of hospitalization via Pronto Atención (PA) is the leucopenic patient (sudden fall of the leukocytes). Cases of PA hospitalization are aggravated by seasonal factors, i.e. periods of virus, dengue, H1N1 flu, and others. The average length of stay is around 14 to 17 days (see Table 6).

Tabela 6 Bed management addopted productivity indicators – Hospital C

Indicators/months	March	April	May	June	July	August	Semester Average
Occupancy rate (%)	90,9	86,9	92,5	93,9	90,5	93,8	91,41
Average stay (days)	9,8	9,7	14,6	16,3	12,5	16,5	13,23
Bed rotation index (hours)	2,9	2,7	2,0	1,7	2,2	1,8	2,21
Replacement interval (hours)	1,0	1,5	0,8	1,1	1,3	1,1	1,13

Source: Bed Management – Hospital C.

Therefore, it was found that the hospital has its own system (developed by the IT staff) considered to be obsolete by the manager since the indicators of bed management are carried out manually, almost in their entirety. The ″responsiveness″ of the system is also poor in relation to bed management, since to end the indicator, the month? must be closed. This implies a low ″efficiency″ of this system. ″Job satisfaction″ is also low because the system does not provide the necessary support for the operations described above. management of beds are not generated management reports.

Organization D

In this hospital, the structure is the IT department manages the need for IT in the organization - in this case, there is greater autonomy and flexibility in the investment decisions by the IT staff. The hospital has a contract with the company MV Sistemas accompanied by the Voice module that controls cleaning times, etc. This module works as a telephone support system, there is a panel, from the moment the patient is discharged and leaves the room, the cleaning of the same enters a queue, where bed management can prioritize the bed that prefers clean up at that time. Also, it performs spreadsheets in parallel to complement decision making.

The average hospital stay is around five to six days, the bed management does not monitor the average time of delay for emergency room admission, claiming to be the task controlled by another department. Regarding epidemiological indicators, only seasonality was highlighted.

in this research, it was identified based on the floors in tables posted in different places: the mission, vision and institutional values, as well as some indicators among them: the occupancy rate target of 80% (Table 7).

Tabela 7: Bed management addopted productivity indicators– Hospital D

Indicadores/meses	March	April	May	June	July	August	Semester Average
Occupancy rate (%)	91,52	95,64	86,89	91,45	89,19	86,44	90,18
Average stay (days)	4,57	4,78	4,93	4,55	4,55	4,54	4,6
Bed rotation index (hours)	6,21	6,01	6,04	6,04	6,08	5,90	6,04
Replacement interval (hours)	0,42	0,22	0,74	0,43	0,55	0,71	0,51

Source: Bed management – Hospital D.

In this Organization it can be affirmed that the concern of the managers with the dimension of ″quality of the system″ is perceived clearly, since ″efficiency″ stands out as fundamental in the organizational context. Bed management achieves a satisfactory result for the organization′s financial balance and customer satisfaction. The ″reliability″ of the system is viewed properly because it is possible to monitor all times in the bed management process. It is worth mentioning that the organization has the MV system, with a specific module for bed management, adding the Voice module. These three technologies cited above raise the ″reliability″ of information, and few controls still happen in spreadsheets.

Organization E

In the case of this hospital, it was verified that it also has its own system, however considered by users as obsolete system. It is because they work with Excel worksheets and colored panels to control the vacancies of ICU.

Adopt for the management of the bed, all indicators are recommended by ANAHP (National Association of Private Hospitals). The hospital occupancy rate target is 85%, but it can not be achieved by the number of ICU vacancies. The average length of stay is, on average, 5.5 days, but some institutional protocols, such as revascularization, recommend higher averages. With regard to the average time between the exit of a patient and the entrance of another is, on average of 8 hours. Nevertheless,the hospital wants to improve to four hours. The hospital has no protocol for discharge and no therapeutic plan. The median time to hospital admission is four hours (Table 8).

Tabela 8: Bed management addopted productivity indicators – Hospital E

Indicators/months	March	April	May	June	July	August	Semester average
Occupancy rate (%)	77,76	79,55	78,34	77,54	76,88	78,96	78,17
Average stay (days)	5,67	6,88	6,97	5,96	5,89	6,98	6,39
Bed rotation index (hours)	8,12	8.78	9,02	8,67	9,06	9.66	8,88
Replacement interval (hours)	1.03	0,89	0,78	0,87	0,98	1,12	0,94

Source: Bed Management – Hospital E.

This hospital also has its own integrated management system (developed by the organization′s IT staff), out dated in front of competitors in the sector, since most of the indicators of bed management here are performed manually. The ″responsiveness″ of the system is unsatisfactory in relation to bed management. STo finalize the indicator, it is necessary to end the month?. This implies a low ″efficiency″ of this system. ″Job satisfaction″ and ″system performance″ are also low, as the system does not provide the necessary support. Therefore, management reports are not generated for bed management.

Conclusions

It is possible to emphasize that the dependent use of IT resources by hospitals, specifically private ones, is an emerging health phenomenon. Thus, it requires adequate infrastructure, a high implantation cost and a permanent technological maintenance due to the contracts of specialized companies in the sector. In the face of technological changes in the health sector, private hospitals use information systems as a way to maintain professional management in several fields.

Despite the difficulties of deploying and using an IS, it is common for hospital organizations in general to have their departments purchase medical software separately or to create an individual database for storing and recording hospital's data. However, many of these systems do not allow communication between them, that is, the integration of information (SOUZA, et al., 2012).

In order to control the flow of a bed management system the use of IS is highly recommended (KUMAR et al., 2008). The five hospitals surveyed have the support of IT, but they all point out that the current system does not meet all their needs / expectations.

The development of manual spreadsheets can compromise the veracity of the information since manipulation of the data can generate errors.

In addition, health organizations need to use knowledge and information at all times, a factor that demonstrates the dependence of IT (LIN; STEAD, 2000). This is a tool to help employees perform tasks more easily, increasing organizational efficiency (Viers, Huijsman, 2011).

The bed management sector, for example, needs to have quick access to the discharge schedule period, otherwise it may cause incorrect decisions in terms of accommodation of new patients (PEREIRA, 2012).

It is known that IT investment is considered necessary in the current sector. However, a study developed by Gartner, Zwicker and Rodder (2009) showed that there is a significant and positive relationship between the increase in IT investments and the increase in production.Hospitals can improve bed utilization with technological support. The use of an electronic system can be a great facilitator of the bed management process since all stages can be followed simultaneously and effectively. Also, it can be seen that hospitals do not adopt all the recommended indicators by the ANAHP (National Association of Private Hospitals). As a consequence, it does not follow all productivity data in bed management, nor identifying their actual efficiency (FALCÃO; REPETTO; GELOSI, 2015).

In this study, it was confirmed that the most productive hospital is the one with the shortest average length of stay, the highest turnover rate and the lowest replacement interval index. The replacement interval marks the average time that a bed remains unoccupied between the exit of one patient and the entanglement of another. The turnover or renovation index represents the use of the bed during the considered period (BITTAR; OLIMPO, 2000).

Therefore, the organization D was considered the most productive in this study. It was because it hadlower average stay, higher turnover rate andshorter replacement interval, as shown in Table 4. In addition, this hospital has the System MValong with the Voice module (specific for bed management) that monitors all phases of the bed management process and provides the monitoring of the stipulated goals. This

technological support were in tandem with modern management practices which made this hospital the most productive one.

In the dimensions proposed by Chang, Chen and Lan (2012), it was found that the most evident variables in this study were: ″safety″, ″efficiency″, ″responsiveness″ and ″reliability″ wchih wererelated respectively to the ″quality in the system″ and ″quality in service″ dimensions. It was shown that the technological support in bed management was the evidence from the case of organization D, which is the best support and technological infrastructure in addition to modern management practices in the hospital environment.

Management Recommendations

Recommendations for hospital sector, especially for the private hospitals, was portryated in the object of analysis of this research/ It is the need for managers to adapt to the use of these systems in function of the perceived benefits. It can be observed based on the data analysis which can be generated thatthe work process assists in making daily decision for all stakeholders.

Information systems become indispensable for management as it provides subsidies for the decision-making of managers, both in the administrative area and the care area. As a matter of concern for quality, hospital organizations have begun to invest in financial resources and organizational efforts to improve care delivery andinnovations. This can be defined as a practice, policy or technology.

On the other hand, it is essential to ensure compliance with the new technologies in full use of the systems, as well as the need to feed and control the databases to ensure the reliability of the information. Many hospitals still use the capacity of their IT resources in a limited way. New computing technologies of integration and mobility, such as: cloud computing, internet ? and big data driven by the technological advances,in the society which begin to allow the possibility of the hospitals to become professional and to experience the technological resources for its business.

One of the critical processes in public and private hospitals is the management of bed, since they have characteristics that distinguish them within their nature and administrative processes. In this case, it was decided to verify the processes within the private hospitals, including: implantation processes, interfac with other areas, time

management, software used, and indicators by contracting information systems (outsourcing or insourcing) even by self-development. The analyzes in this study have provided examples of how it was possible to initiate or improve bedmanagement, favoring not only the routine of the hospital institution but also giving direct benefits to the client with the support of IT.

References

ALSHAWI, M. *Rethinking IT in Construction and Engineering: Organizational Readiness*, New York, Taylor & Francis, 2007.

AMMENWERTH, E.; ILLER, C.; MAHLER, C. IT-adoption and the interaction of task, technology and individuals: a fit framework and a case study, *BMC Medical Informatics and Decision Making*, Vol. 6, pp. 1–13, 2005.

ARAÚJO, C.; BARROS, C. P.; WANKE, P. Efficiency determinants and capacity issues in Brazilian for-profit hospitals. *Health Care Management Science*, v. 17, n. 2,126–138, 2014.

BHATTACHERJEE, A. Understanding information systems continuance: an expectation-confirmation model. *MIS Quaterly*, 25:351–370, 2001.

BITTAR, N.V.; OLIMPO, J. Gestão de processos e certificação para qualidade em saúde. *Rev. Assoc. Med. Bras.*, v.46, n.1, jan./mar, 2000.

BRITO, M. J. M. *A configuração identitária da enfermeira no contexto das práticas de gestão em hospitais privados em Belo Horizonte* [Tese]. Belo Horizonte (MG): Faculdade de Ciências Econômicas, Universidade Federal de Minas Gerais, Belo Horizonte, 2004.

BRYAN, K.; GAGE, H.; GILBERT, K. Late transfers of older people from hospital: causes and policy implications. *Health Policy*. Cross Ref Medline Web of Science Google Scholar, v.76 (2),p. 194 – 201, 2006.

CHANG, Ching-Sheng.; CHEN, Su-Yueh.; LAN, Yi-Ting. Motivating medical information system performance by system quality, service quality, and job satisfaction for evidence-based practice. *BMC Medical Informatics & Decision Making*. 12:135, p. 1-12, 2012.

CUNNINGHAM, P.; SAMMUT, J. Inadequate acute hospital beds and the limits of primary care and prevention. *Emergency Medicine Australasia* (EMA), 24, 566–572 doi: 10.1111/j.1742-6723.2012.01601.x, 2012.

DABHOLKAR, P. A.; BOBBITT, L. M.; LEE, E. J. Understanding consumer motivation and behavior related to self-scanning in retailing - Implications for strategy and research on technology-based self-service. *International Journal of Service Industry Management*, 14:59–95, 2003.

DELONE, W. H., MCLEAN, R. E. Information Systems Success: The Quest for the Dependent Variable. *Information Systems Research*. 3:60–93, 1992.

DESPONT-GROS, C.; MUELLER, H.; LOVIS, C. Evaluating user interactions with clinical information systems: a model based on human–computer interaction models, *Journal of Biomedical Informatics*, Vol. 38, pp. 244–255, 2005.

FALCÃO, P; REPETTO, S.; GELONESI, A. P. O Impacto do Gerenciamento de Leitos Baseado na Metodologia Lean Six Sigma. *Anais Qualihosp*, 2015. Disponível em: http://site.qualihosp.com.br/mac/upload/arquivo/QUALIHOSP_2015_COMPLETO_COM_LINK.pdf. Acesso em 12.08.2016.

FREZATTI, F.; BIDO, D. S.; CRUZ, A. P. C.; MACHADO, M. J. C. O Papel do Balanced Scorecard na Gestão da Inovação. *Revista de Administração de Empresas*. vol. 54 no. 4, p. 381-392, 2014, doi: http://dx.doi.org/10.1590/S0034-759020140404

FONSECA, C. P.; FERREIRA, M. Investigação dos Níveis de eficiência na Utilização de Recursos no setor de saúde: uma análise das microrregiões de Minas Gerais. *Revista Saúde e Sociedade*. V.18, n2, p. 199-213, 2013.

GARTNER, R. I.; ZWICKER, R.; RODDER W. Investimentos em tecnologia da informação e impactos na produtividade empresarial: uma análise empírica à luz do Paradoxo da Produtividade. *Revista de Administração Contemporânea*. 13(3), 391-409, 2009.

GODDEN, S.; MCCOY, D.; POLLOCK, A. Policy on the rebound: trends and causes of delayed discharges in the NHS. *Journal of The Royal Society of Medicine*, v.102 (1), p.22-8, 2009, doi: 10.1258/jrsm.2008.080202

GÜRSEL, G.; ZAYIM, N.; GÜLKESEN, K. H.; ARIFOGLU, A.; SAKA, O. A new approach in the evaluation of hospital information systems. Tu*rkish Journal of Electrical Engineering & Computer Sciences*. 22: p. 214-222, doi:10.3906/elk-1110-15, 2014.

HANAEUS, A.; TOLIC, B. Technology and Logistics in Health Care Services a Case Study of Länssjukhuset Ryhov. *Jonkoping International Business School*. Master Thesis in Business Administration, 2015.

HENDY, P.; PATEL, J. H.; KORDBACHEH, T.; LASKAR, N.; HARBORD. M. In-Depth Analysis of Delays to Patient Discharge: a metropolitan teaching hospital experience. *Journal of the Royal College of Physicians*. V. 12, N. 4, p. 320-323, 2013. Disponível em: http://www.clinmed.rcpjournal.org/content/12/4/320.full. Acesso em: 20.04.15.

JONES, R. Emergency admissions and hospital beds British. *Journal of Healthcare Management*. v.15 (6), p. 289-296, 2009. Disponível em: www.bjhcm.co.uk. Acesso em: 02.04.15.

KEIZER, N. F.; AMMENWERTH, E. The quality of evidence in health informatics: how did the quality of healthcare IT evaluation publications develop from 1982 to 2005? *International Journal of Medical Informatics*, Vol. 77, pp. 41–49, 2008.

KEEGAN, D. P.; EILER, R. G.; JONES, C. R. Are your performance measures obsolete? *Management Accounting*, v. 70, n. 1, p. 45-50, 1989.

KUMAR, S.; SAWANSON, E.; TRAN, T. RFID in the healthcare supply chain: usage and application. *International Journal of Health Care Quality Assurance*. v. 22(1), p. 67-68, 2008.

LI, Y. N., TAN, K. C., XIE, M. Measuring web-based service quality. *Total Qual Manage*, 13:685–700, 2002.

LIN, W.; STEAD, B. The Business value of information technology and inputs substitution: the productivity paradox. Revised. *Decision Support Systems*, v. 42 (2), p. 493-507, 2009.

LYNCH, R. L.; CROSS, K. F. *Measure Up - The Essential Guide to Measuring*. Business Performance. London: Mandarin, 1991.

MENDOZA-GIRALDO, D.; NAVARRO, A.; QUIJANO-SÁNCHEZ, A.; VILLEGAS, A.; ASCENCIO, R.; LISSEN, E. Retraso Del Alta Hospitalaria por Motivos no Médicos. *Revista Clinica Española*, v. 212, n. 5, p. 229-234, 2012, doi: 10.1016/j.rce.2011.12.009

MYERS, B. L., KAPPELMAN L. A., PRYBUTOK, V. R. A comprehensive model for assessing the quality and productivity of the information systems function: toward a theory for information systems assessment. *Inf Res Manage* J, 10:6–25, 1997.

NEELY, A.; MILLS, J.; PLATTS, K.; GREGORY, M.; RICHARDS, H. Performance measurement system design: Should process based approaches be adopted? *International Journal of Production Economics*, 46/ 47, 423-431, 2015.

PARASURAMAN, A., ZEITHAML, V. A., BERRY, L. L. A conceptual model of service quality and its implication for future research. *J Marketing*, 49:41–50, 1985.

PARASURAMAN, A, GREWAL, D. The impact of technology on the quality- value- loyalty chain: a research agenda. *J Acad Marketing Sci*, 28:168–174, 2000.

PEREIRA, S. R., PAIVA, P. B., SOUZA, P. R. S., SIQUEIRA, G, PEREIRA, A. R. J. Sistemas de Informação para Gestão Hospitalar. *Health Inform*. Outubro-Dezembro; 4(4): 170-175, 2012.

QUEIROZ. S. A. C, ALBUQUERQUE, G. L., MALIK, A. M. Gestão Estratégica de Pessoas e Inovação; estudos de caso no contexto hospitalar. *R. Adm.*, São Paulo, v.48, n.4, p.658-670, out./nov./dez, 2013.

SCHLAIRET, M. C. Complex Hospital Discharges: *Justice Considered. HEC Forum*, v. 26, n. 1, 69-78, 2014.

SOUZA, A. A.; XAVIER, A. G.; SILVA, S. D. G.; AYALA, L. C.; MOREIRA, F. R. Avaliação de Sistemas de Informação: Um Estudo em Organizações Hospitalares. *Revista Sociedade, Contabilidade e Gestão*, Rio de Janeiro, v. 7, n. 1, 2012.

TEIXEIRA, J. C.; NASCIMENTO, M. C. R.; ANTONIALLI, L. M. Perfil de estudos em Administração que utilizaram triangulação metodológica: uma análise dos anais do EnANPAD de 2007 a 2011. *Revista de Administração*, São Paulo, v. 48, n. 4, p. 800-812, Oct, 2013.

VRIES, J.; HUIJSMAN, R. Supply chain management in health services: an overview. *Supply Chain Management: An International Journal*, 16(3), 159-165, 2011.

WINKELMANN, C.; FLESSA, S., LEISTEN, R.; KRAMER, A. Relevance of economic efficiency analysis of decentralized versus centralized reprocessing of patients' beds in a maximum-care hospital. *Hygene und Medizin*, v.33(6), 239-245, 2008.

YIN, R. K. *Case Study Research: Design and Methods* (Applied Social Research Methods). SAGE Publications, Inc. 5 edition (May 10, 2013), 2013.

Revista Administração em Diálogo
ISSN 2178-0080
Programa de Estudos Pós-Graduados em Administração
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