MEDICAL INVENTRY MANAGEMENT

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Abstract

As the rapid advancement and wide application of computer hardware, software and network, Health Care Management System (HCMS) have entered almost all hospitals in India and are becoming more important and covering more parts in daily hospital operations. Most functions in a HCMS provide the users an easier and faster way in doing their medical tasks with graphic user interface. But the HCMS is a management information system focusing on daily operations within hospital to improve efficiency of work by using online clinical data acquisition and processing.

So, to some extent, a HCMS improve quality of health care services, but it cannot measure and evaluate the quality of health care services. At present, hospitals in India are in a competitive environment. In order to attract more patients, high customers' satisfaction is most important for a hospital in the competition. Health Care Management System (HCMS), which is an information system of health care management system in hospital can improve quality of service and lead to cost reduction, high customer's satisfaction and great attractability to other hospitals' customers. The main work as follows: review services management and HCMS, analyze the contents of health care management and the functions of ordering medicine, design the framework of a HCMS. Use of smartphones to relay data over internet reduces the total cost of the system.

Keywords: **Medical Inventory, Analysis, dashboards.**

1. Introduction

As we well know, what patients need hospitals to do is to provide health care services. Services mean the most to all persons working in hospital, such as doctors, nurses, and administrators. In order to continuously improve the quality of health care services, services management should be introduced in hospital. Services management focuses on service quality management. Service quality management, which has been well recognized, includes customer satisfaction, top management leadership, organization coordination, staff competence and process analysis. Service quality management in the health care industry is a structured organizational process that involved all care givers in planning and implementing continuous improvement. It also recognizes opportunities for health service process improvement. The purpose of service quality management in hospitals is to establish a system that measures and manages patient care in a way that provides an optimal medical service for all patients. But service quality management in the health care services has not been as successful as in other industries.

2. Literature Survey

The inventory and monitoring models with quantity, pricing and budgeting receives few research attentions for the past few years. In contrary to this, the existing technological development promises a wide variety of opportunities for the young and skillful programmers and system developers if only they were given the chance to produce a much better output through conducted research. One of the most notable applications of inventory and monitoring model or system is in the medical and health purposes, specifically in monitoring the medical supplies within barangays. Often the most ignored area in which the improvement of inventory and monitoring system is badly needed, barangays classified as rural areas suffered the difficulties in monitoring the quantity of their medical supplies. This research focuses on different difficulties encountered in which each barangay suffered to inventory and monitoring system problems such as insufficient database for storing the medical supplies inventory, unstandardized inventory system, and manual monitoring of medical supplies being distributed and received. These problems may cause further complications, whereas the barangays may suffer difficulties in finding past transactions, uneven distribution of stocked medical supplies and even problems in expiration of medical supplies.

Analysis of inventory management system in healthcare:

Due to the rapid growth in healthcare expenditure worldwide and simultaneous growth of demand for healthcare services, developing efficient and effective healthcare systems has become an essential area of concern for governments and healthcare decision-makers (Ahmadi-Javid, Jalali, & Klassen, 2017). The core competency of a healthcare system reflects its ability to provide treatment and care to the patients. The prime focus has always been towards providing highly knowledgeable and experienced physicians, surgeons, well-trained nurses, and medical staffs with well-established infrastructure, advanced medical equipment, the right quality medicines, and medical and surgical supplies (De Vries, 2011). However, of late, the focus has driven towards the management side of the healthcare systems. Healthcare management systems include capacity planning, resource allocation, inventory management systems, demand forecasting, scheduling, and other operational activities (Brailsford & Vissers, 2011).

A significant part of the healthcare system is the hospital system. Hospital systems consist of multiple departments, such as pharmacy, operating rooms, emergency rooms, intensive care units, wards. These departments provide services like diagnosis, medication treatment, critical care, surgery, etc. to the patients. Each department has specific functions to carry out. For example, the pharmacy maintains the optimal stock of healthcare items to distribute to individual patients and various locations within a hospital system (Gebicki et al., 2014, Maestre et al., 2018). Emergency rooms try to minimize the time between prescribing and administering of life-saving medicines and other vital healthcare items (Duclos, 1993). Reducing the number of staff members leaving the room for supplies and maintaining schedules for medicine delivery are the main functions in the operating room and wards (Rappold et al., 2011, Roni et al., 2015, Saedi et al., 2016). The overall performance of a hospital system is dependent on the performance of all the departments.

An important factor that affects the managerial and operational performance of healthcare systems, in general, and hospital systems, in particular, is the inventory management system. Inventory management refers to managing and controlling a large number and great variety of items stocked in a healthcare system (Gebicki et al., 2014, Nicholson et al., 2004). Essential healthcare items, directly or indirectly, are required in the patient healing process and its monitoring and control. Hence, inventory control systems are recommended to be aligned with the patient condition (Vila-Parrish, Ivy, King, & Abel, 2012). Technically and scientifically, the demand for healthcare items is closely linked to physician recommendations based on patient conditions

(Abdulsalam, Gopalakrishnan, Maltz, & Schneller, 2018). Even though inventory management systems use cost-based models, hospitals need to focus on the patient service level. Availability of healthcare items of high quality in an uncertain and continuously fluctuating environment is challenging (Bijvank & Vis, 2012).

Overall, inventory is held to maintain confidence in the system. If stock-out occurs regularly, patients and medical personnel may lose faith in the system. On the other hand, holding a high level of inventory can lead to substantial investments on the excess inventory and create unavailability of capital for other purposes (Maestre et al., 2018). Therefore, it is necessary to hold inventory to ensure availability at the time of requirement. However, it is very challenging to accurately predict the demand in a healthcare system due to uncertainties and randomness, such as changing patient conditions, dynamics in physicians' prescriptions, and variation in responses of the individual patient to treatment procedures (Montoya et al., 2010, Vila-Parrish et al., 2012). Therefore, the development of optimal inventory control policy which allows absorption of such uncertainties and randomness is essential.

Inventory and monitoring process control system of medical supplies:

According to Mondal (2014), there are five key application of inventory management: demand forecasting, warehouse flow, inventory turns/stock rotation, cycle counting, and process auditing. The Management Science for Health (2012) explained that inventory management serves as the heart of pharmaceutical supply system as it helps to monitor the number of drugs and medical supplies to order, store, and procure, especially some items are limited in supplies and numbers in the market.

Awaya et al. (2005) discussed that automating and upgrading the drug distribution process provide innovations and advantages in terms of the services offered by pharmacists in most clinics. According to Wojcik et al. (1993), the arrangement of their creation oversees client orders utilizing supplier provided programming frameworks interfaced consistently to contact the information in every framework consistently. In a system developed by Vogler et al. (2002), tracking tagged items is the key component of monitoring the level of inventory, and even if an item is removed or added in the stocks. The items are tagged with unique digital identifier so that the operator or user of the system can monitor and track the arrival and destination of the items being inventoried. Muhammad (2016) enumerated two stages on the implementation of an automated inventory control system: programming stage and user training stage. In the programming stage, the programmer uses a specific program language and codes the necessary instructions to the program. On the other hand, user training stage aims to train and orient the concerned users. Irene (2011) highlighted that computerizing most of the businesses and service providers can maximize the profit, sales, and performance of the concerned organizations.

A proper implementation of systems is necessary to accomplish the desired goal of an inventory system. Nuyda et al. (2012) established an online inventory and monitoring system in Cagayan de Oro City that monitors the stock level and availability of medical supplies and medicines that will ensure an efficient and easier response to the requests sent to the health office. In Zhou and Olsen (2017) research, it was determined the perishability of medical supplies, which include gloves, masks, and medicines should not be ignored as it may affect the performance and serviceability of most health centers. Mustaffa and Potter (2009) identified two main issues; first, the urgent and immediate demand of medicines and other pharmaceutical needs, secondly, is the availability of stocks at the wholesaler. These issues led in the proposal of a new and improved design of supply chain system to address the problems encountered during the distribution of medicines from its suppliers.

Application of medical material inventory model under deep learning:

With the accelerated pace of China's social transformation and system transformation, Chinese society is in a stage of development where opportunities and risks coexist. Due to climate and geographical factors, the incidence of natural disasters in China is also severe. Human-caused events and various natural disasters are entangled, making China continue to have large-

scale and influential emergencies in recent years. In the past ten years, there have been countless large-scale emergencies, including the "SARS" epidemic in 2003, the "12.23" blowout incident in Kaixian, Chongqing, the Songhua River water pollution incident in 2005, the cyanobacteria outbreak in Taihu Lake in 2007, the low-temperature rain, snow and freezing disasters in southern China in 2008, the devastating earthquake in Wenchuan, Sichuan, in 2008, the devastating torrential mudslide disaster in Zhouqu, Gansu, in 2010, and the explosion of the oil pipeline in Qingdao's Huangdao, Shandong, in 2013. These emergency incidents have caused significant losses to national property and people's lives. In emergency management, the guarantee of emergency supplies has always been a critical link. The occurrence of all emergencies is challenging to predict accurately. When the incident occurs suddenly, the emergency materials used to respond to the incident are difficult to meet both time and space requirements. Therefore, it is usually impossible to achieve immediate responses and efficient processing to emergencies. Therefore, the guarantee of emergency supplies involves many aspects, such as emergency supplies logistics and inventory management. Significantly, the inventory management of emergency supplies directly impacts the effectiveness and efficiency of emergency treatment. According to China's practice in emergency material inventory management in recent years, there is a lack of scientific systems and efficient and economical emergency material inventory models to support emergency material inventory management.

The emergency material inventory model is researched, and a scientific and reasonable material inventory model is constructed, which is of great significance for ensuring the optimal level of the material reserve under the condition of limited funds. The materials are classified scientifically. The emergency material inventory model can reasonably classify materials and control the storage quantity, which is of positive significance for improving material storage capacity and reducing material storage costs. The differences between this model and previous studies are summarized in Table 1. The advantages of the proposed model are explained in terms of research objects, algorithm models, processing methods, classification characteristics, and model advantages and disadvantages.Emergency management is the management of risks. The Chinese government's definition of emergency management is the activities taken by the government and other public institutions by establishing necessary emergency mechanisms, taking a series of necessary measures to ensure the safety of public life and property, and promoting social harmony and healthy development during pre-prevention, emergency response, in-event handling, and after-care management of public emergencies. On the whole, emergency management is the process of management of public emergencies. It is a dynamic management process that includes four stages: prevention, preparation, response, and recovery.

In handling emergencies, the scope and types of emergency materials involved are enormous, and emergency materials need to be classified scientifically and reasonably for effective management. Emergency materials are for emergencies; hence, compared with traditional materials, they have many characteristics. The first is uncertainty. The quantity, scope of distribution, and transportation of emergency materials are directly affected by the unpredictability of emergency events, leading to substantial uncertainty. The second is the suddenness. The demand for emergency supplies will rapidly expand in a short period due to the sudden impact of emergencies, showing sudden characteristics. The third is irreplaceability. Emergency materials are directly used to deal with emergencies; they have particular purposes and must be activated, which can hardly be replaced by other materials. The fourth is timeliness. Emergency materials can play their best role within a time limit and are extremely sensitive to time. The fifth is hysteresis. Emergency supply initiation occurs after the emergency event, which already lags behind the event .

Developed countries have researched the management of public emergencies earlier. The United States has accelerated the establishment of the Department of Homeland Security (DHS) as early as after the Terrorism Attack. Regarding natural disasters

in the United States, the Federal Emergency Management Agency (FEMA) was responsible for the "anthrax" incident. Afterward, the United States quickly developed a three-tier system for responding to public health emergencies: the federal disease control and prevention system Centers for Disease Control (CDC), the regional/state hospital emergency preparedness system Health Resources and Services Administration (HRSA), and the local urban medical emergency system Metropolitan Medical Response System (MMRS). In terms of international disaster relief, the United States is under the Office of Foreign Disaster Assistance (OFDA) responsibility. The emergency response regulations in the United States are complete, including the Disaster Relief and Emergency Assistance Act, the National Earthquake Disaster Mitigation Act, and the National Emergency Law . As a country with more disasters, Japan has also developed more mature emergency management. Its three-level disaster prevention and relief system includes the Disaster Relief Bureau of the Central Land and Resources Agency, local prefectures, cities, towns, and counties. In general, developed countries have constructed emergency management systems earlier, which are comparatively complete.Most of the existing emergency material management models are similar to modern logistics management.

It mainly includes the following aspects command center, logistics center, and information management center. The emergency command center is responsible for emergency material planning, coordination, and control, including the specific demand analysis, material financing, formulation of specific support plans, total allocation of emergency materials, and information collection on material feedback. The logistics center includes four significant parts: material procurement, storage, transportation, and distribution management. The information management center includes four major sections: emergency material database, query and search, real-time material monitoring, and optimization decision system. The logistics center and the information management center will build an information feedback system and establish contact with the emergency command center through this part. The modern response to emergencies requires analysis from three aspects, including the number of emergency materials, the quality of emergency materials, and the structure of emergency materials. The existing emergency material management model has two contradictions in the management of material inventory. The actual situation is that emergency material management generally requires huge costs, followed by the continuous decline in the quality of services in response to emergencies. Therefore, reducing the cost of emergency material inventory and improving the service level of material response is the key to scientific inventory management. It is necessary to achieve the best combination between inventory costs and service levels.

2. METHODOLOGY

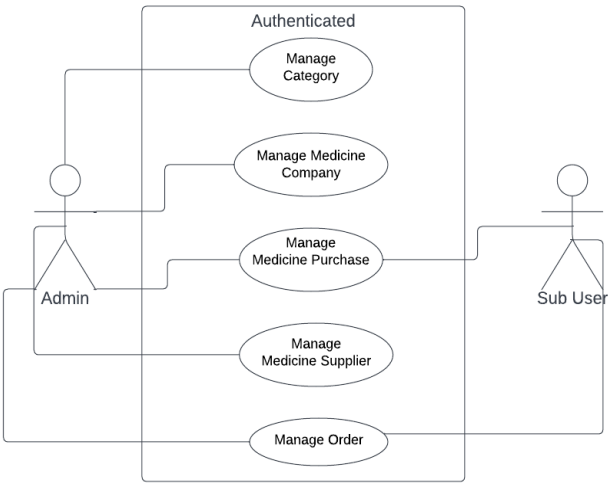

Fig.1. Work flow

1. Define the Scope: Determine the scope of the inventory management system. Identify the medical products that need to be managed, the locations where they are stored, and the users who will access the system.

2. Analyze the Requirements: Gather the requirements for the system by interviewing stakeholders and conducting a needs analysis. Identify the features and functionalities required, including inventory tracking, order management, expiration date tracking, and reporting.

3. Design the System Architecture: Based on the requirements, design the system architecture, including the database schema, user interface, and integration with other systems (if required). Choose appropriate technologies for the development.

4. Develop the System: Develop the system using an iterative and incremental approach. Develop core functionalities first and gradually add additional features. Ensure that the system is secure, reliable, and scalable.

5. Test the System: Test the system to ensure that it meets the requirements and performs as expected. Conduct unit testing, integration testing, and user acceptance testing. Fix any defects or issues found during testing.

6. Deploy the System: Once the system is tested and approved, deploy it to the production environment. Ensure that the system is properly installed, configured, and integrated with other systems (if required).

7. Train the Users: Train the users on how to use the system, including how to add, update, and track inventory, how to generate reports, and how to troubleshoot issues.

8. Maintain the System: Maintain the system by conducting regular maintenance, such as backing up data, upgrading the system, and fixing defects. Monitor the system to ensure that it continues to meet the requirements and performs as expected.

3. Output:

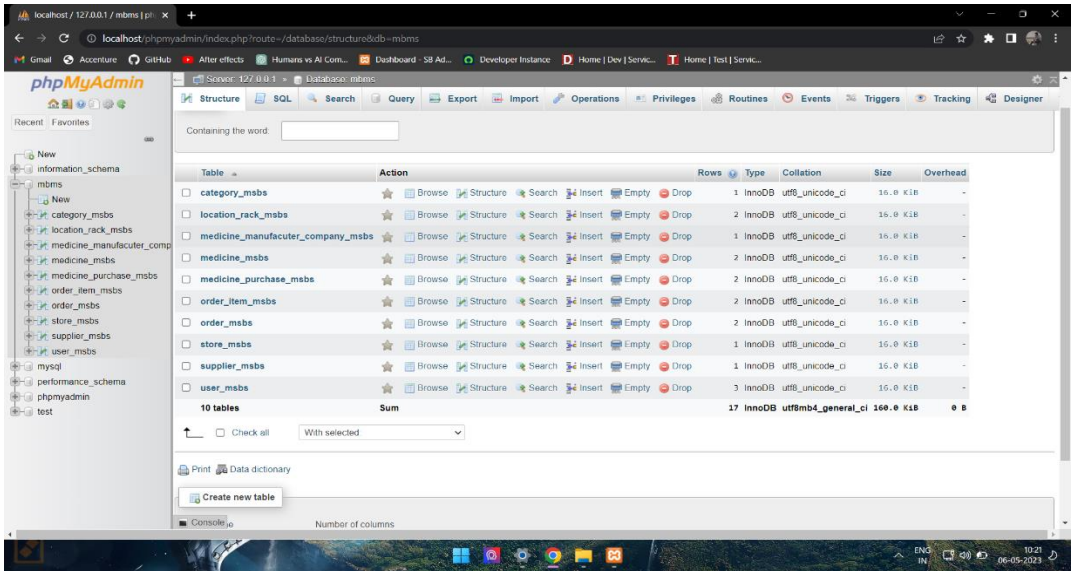

Fig.5. Dashboard

4. CONCLUSION AND FUTURE WORK

Preventing inventory pitfalls removes time, cost, and staffing pressures so that hospitals can work in a proactive manner to provide optimum healthcare and run financially sound businesses. Effective inventory management is not an aspiration, it is achievable. In order to have a medical inventory supply chain that works for all parties and copes with the complex and unpredictable healthcare setting, the ideal solution is a bespoke inventory management system for hospitals. Healthcare inventory management needs a product that can meet its complex requirements, including high numbers of individual suppliers, high volume and a vast range of inventory items, and last-minute, urgent demands.

Conflicts of Interest

Authors must identify and declare any personal circumstances or interest that may be perceived as inappropriately influencing the representation or interpretation of reported research results. If there is no conflict of interest, please state "The authors declare no conflict of interest."

REFERENCES

1. Katsikas, Sokratis K., Health care management and information systems security: awareness, training or education? International Journal of Medical Informatics, 2000,60(2): 129 – 135.
2. Li L.X., Relationships Between Determinants of Hospital Quality Management and Service Quality Perfomce--a Path Analytic Model, Omega, 1997,25(5): 535-545.
3. Sakamoto, Norihiro, Availability of software services for a hospital information system Intemational Joumal of Medical Informatics.
4. Pietka, Ewa, Large-Scale Hospital Information System in clinical practice, International Congress Series, 2003, 1256(2003): 843-848.
5. Gierl L., Feistle M., Muller H., etc.. Task-specific authoring functions for end-users in a Hospital Information System Computer Methods and Programs in Biomedicine, 1995,48(1-2): 145-150.
6. Chang Z.J., Mei S., Gu Z., etc., Realization of integration and working procedure on digital hospital information system Computer Standards
7. Dong lun, Wang Xiaozhong. Quality Management of Health Services in Hospital, Chinese Hospital Management. 2001,21(7): 31-32.
8. Gcdefridus G. van Merodea, Siebren Groothuisb, etc-, Enterprise resource planning for hospitals, International Joumal of Medical 1998,49(1): 89-46 . and Interfaces, 2003,25(5): 529-537 Informatics, 2004, (70) 493-501.