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Overview of The Pharmacy Management System in a Hospital

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ABSTRACT

A pharmacy management system is, especially, to facilitate managing the supply of medicines needed by a hospital, which makes it easier to treat hospital patients in general. This system involves information technology and databases as a repository of information that is useful in managing the hospital, various tools needed to build a reliable system, and this paper discusses those interests. Compliance with data enhancements and manual drug supply activities being automated completes this brief review. However, there are different challenges in terms of both the internal and external interests of the hospital. It is usually accomplished by synchronizing through common hospital features in similarity, determining the historical control for drugs, and performing predictions.

Keywords: *Inventory control, supplying, sales, purchasing, predicting, activities, data, information, drugs, medicines.*

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INTRODUCTION

The placement and utilization of resources at its size in an organization, including hospitals, is necessary to consider administrative management and resource sustainability as a strategic approach to improving performance [1,2]. One of these resources is a work unit or a drug store such as a pharmacy that requires technological support in managing it [3]. On the one hand, although pharmacies have the support of the environment and the ease with which the parent organization carries out their activities, making decisions related to fulfilling the demand for drugs that support the hospital is always dealing with determining how to provide a number of these drugs [4]. One the other hand, consciously determining a strategic decision is difficult as a result of the diversity of interests of the various stakeholders [5].

Advances in information technology have contributed to the ease of determining decision making strategies, in addition to the old standard fields [6]. The application of the field of inventory control to drugstore management is one way, by developing a database that provides many opportunities for adjustments between demand and supply [7]. It also simplifies the multi-complex in various aspect of hospital management in general, in particular the need for demanding drugs. Especially concerning the prediction of the duration of a drug in needed according to the hospital environment.

BACKGROUND

The use of the current pharmaceutical management system is essential. It involves information technology, as stated by important from demand to supply, as well as the importance of information about drugs itself both from the point of use and the side effect or consequences of use [8,9,10,11].

This system contains an evaluation of the patient's opinion about medicines and hospital pharmacy services so that services bases on user perceptions [12], which can also develop through collaboration [13]. The implementation of this pharmaceutical management system also requires an appropriate design so that it can involve robotics in serving quickly and accurately [14], but also in emergencies during the Covid-19 pandemic [15].

Optimal control of pharmaceutical supplies is the first step in the healing phase of each patient from a treatment point [8,16], but it requires the application of information technology and computer [17] in addition to inventory theory [18,19]. The balance between supply and demand for medicines is a special consideration in each hospital based on the perspective of pharmacy management that protects two sides, namely the interests of the hospital and the interests of patients [12,20,21]. In the interests of the patient, every drug is affordable from the price. To keep prices inexpensive is to maintain drug supply chains, of course, in reverse from downstream to upstream [22]. Natural resources as medicine substance must have their maintenance, and factories produce medicines according to needs. On the other hand, for the hospital's interest, the available drugs do not accumulate, avoiding drug maintenance and drug expiration. Thus, several considerations of decision variables come along with alternatives regarding the criteria for drugs [23,24].

Controlling drug prices through a drug management system is very important in the information age. The depletion of natural resources may lead to higher prices for fixed medicines [25,26]. Studies related to the pharmaceutical world require specific management to reveal alternative raw materials for drugs [27]. Therefore, a pharmaceutical management system gets integration with others and then exchanges information. It requires an interface between one system and another. It is as a result that the different systems do not have the same data items [28]. There are differences in data collection according to the importance of developing a pharmaceutical management system. But each can complement each other. Thus, in the face of drug manufacturing resources, the drug recording and review systems are in systems that can have integration with the pharmaceutical management system [29]. Meanwhile, a system requires sufficient space to operate purely, i.e., the sets that involve data that is useful enough to reveal decisions. Generally, these all require an approach.

An Approach

The approach to the development of a pharmaceutical management system is first to build interface with other systems that provide input of user data or information. The hospital pharmaceutical management system is a part of hospital management. On that basis, data have integration into the system, and some other data is accessed through the system interface or extracted from information sources. In general, the pharmaceutical management system requires data related to figure.1:

1. Supplier: An entity referred to as custodian or producing a product, which is in the link between a drug source or manufacturer and user. Each drug product from the factory has information about the function and use of the drug, procedure for use, expiration period, ingredients, and drug side effects.
2. Customer: As entity has the opposite activity as a supplier. A customer is an entity that refers to a buyer of products prepared in a shop and store, namely has a warehouse. Also, for each customer or patient, either by a doctor or by a customer collects information into the system. It is information about the complaints and recommendations for medicines.
3. Warehouse: An entity called a stock, which means a storage area, so that market demand properly fulfills.
4. Inventory control is an abstract entity that contains object related to inventory, such as total annual costs, requests, and others.
5. Treatment: Part of a hospital that has activities related to money: debit-credit or payment/sales.

The interactions of entities in the pharmaceutical management system shown in Figure 1 where activities or processes in the system are related to verbs. Figure 1 is a brief, wordless overview to explain some conceptual relationship between data, information, and activities for managing a drugstore as part of a hospital [30].

Second, based on the data flow diagram, each process follows data entities that can have the implementation of each data item having a relationship with other data items through a logical formula, which mathematically forms a quantifier. For example, U is a purchase, j is the quantity purchased, P is the product, p is the quantity available as stock, and x is the decision variable, with the following rules:

$\forall j \in U \; \exists p \in P$ such that $x = p \Rightarrow p = x + j$

In addition, some rules are trivially available: request date >= order date (according to schedule), date of delivery >= date or request (according to schedule). The guide time to the production schedule is the different between the delivery date and the request date. With regards to inventory, shaking is done if the stock is properly or less than the average sales for the current month times the guide time multiplier, and the re-shedding rate is not zero.

RESULTS AND DISCUSSION

Every drug that is available and recorded in the pharmaceutical management system. When purchasing through the system involves a doctor's prescription by the user or the doctor will provide input after treating the use of the drug from time to time. The records provide additional information on each drug or the total drug administered.

4.1 Find the starting point of inventory.

The first critical context in the supply of medicines in a hospital is the initial operation of the hospital. During this period, the data collection for prediction is in effect. However, taking into account the environmental similarity concept of the hospital by extracting some information and locking in stock considerations from one information source, namely the related information from higher similar hospitals and based on calculations from [31]

$$N_c = 2|\Omega_x \cap \Omega_y|^2 / (|\Omega_x|^2 + |\Omega_y|^2) \quad (1)$$

where $|\Omega_x|$ is a collection of values based on the comparison hospital features, $|\Omega_y|$ is a collection of values from the original hospital features, whereas $|\Omega_x \cap \Omega_y|$ is a collection of values from the same features between the two hospitals. Accordingly, the initial stock of drugs in the pharmaceutical management system comes from the hospital, which is similar both in terms of operation and the surrounding environment, where the surrounding environment is the origin of hospital patients.

Furthermore, by following the sales data collection rules, i.e.,

$\forall y \in S \; \exists p \in P$ such that $x = p \Rightarrow p = x - y$

where S is sales, y is the quantity sold. It bases on the principle: The quantity of the product to be sold is less than or equal to the amount of stock, and if the customer only places orders, the amount of stock does not decrease, and if the customer makes a transaction, the quantity of the stock decreases.

1.2 Inventory model

The model has a basis on the assumption that the inventory hold for fixed items, the number of orders has a limit, the cost of ownership and the cost of ordering per unit are independent of the quantity ordered. The increase bases on scheduling to follow the arrival of definite deliveries as inventory levels approach zero [32]. As such, it assumes that there is never a shortage or excess of stock. Orders for different medicinal items are not the same or related to another medicinal items.

The total annual inventory cost for each recommended policy is the lowest total cost, i.e.

$$T_C = T_0 + T_H \quad (2)$$

That is, the total annual inventory cost is equal to the order cost total together with the cost total of ownership annually [33]:

1. The total annual ordering cost is $T_0 = NK$, N is the ordering number, and K is the ordering cost. The number of times the placing an order during a year is none other than $N = D/Q$, D is the total units of annual requests, and Q is the number of order items. It resulted in

$$T_0 = (D/Q)\,K. \quad (3)$$

2. The total annual cost of ownership is to multiply the daily cost of ownership by the number of units in year inventory each day rather than a year, and then add them up. When demand is constant, the inventory average becomes the midpoint between the highest and lowest inventory levels. So, if Q is the maximum inventory, the average inventory $Q = Q/2$. So, the annual cost total of owning an inventory is

$T_H = H(Q/2)$. (4)

Based on the substitution of Eq. (3) and Eq. (4) to Eq. (2), the optimal order number for a drug item in a year is

$Q^* = \text{sqrt}(2KD/H)$. (5)

The decision to supply certain drug items requires information based on the model in Eq. (5). That is N as the number of orders that must be made a year; Q^* and Q are the maximum inventory and average inventory level, respectively; The number of working days is d: Hospital set the working day is 365 days or less through the formula $d = 365/N$. Note, formally holds that the currency value, for optimal order payment and average inventory, is fixed throughout the year.

The optimal order number for each drug item based on sales per drug Q^* can use if the purchase of medical items offers per package. Determination of the number of ordered items determine by computation and can give as according to the alternative lower and upper limits of the number Q^*. For example, the supply per package is x, suppose Q^* bases on Eq. (4), while the upper and lower bounds of $b$are $ma < b < na$ form $< n$, then the computation for package items with the number of ma funds can do as shown in the Figure 2.

Predictions to ensure drug supply

If there are only one variable x and one variable y, the data in the form of pairs $\{(x_i,y_i), I = 1,2,\ldots,n\}$ has a regression line. Regression computation has the utility of predicting, with the formula model as follows: $\mu_{Y|x} = \alpha+\beta_x$, which can estimate the sample with the line $y = a + bx$, where $b = (n\Sigma_{i=1,\ldots,n}\ x_iy_i - (\Sigma_{i=1,\ldots,n}x_i)\ (\ \Sigma_{i=1,\ldots,n}y_i))/(n\Sigma_{i=1,\ldots,n}\ x_i^2 - (\Sigma_{i=1,\ldots,n}\ x_i)^2)$, $a = (\Sigma_{i=1,\ldots,n}\ y_i)/n - b(\Sigma_{i=1,\ldots,n}\ x_i)/n$. Figure 3, explains that when the line-y continues to increase, it means that the supply of a particular drug will be more critical as the patient's need for that drug increases [34]. When the regression line approaches parallel to the axis-x, it means that drug use is regular. Thus, the control inventory graphic, it is like in Figure 2, reveals the adequacy of drug supplies despite spikes in particular periods. The fulfillment of certain drugs in that period can overcome by the supply of drugs that were not sold in the previous period.

CONCLUSION

A review of some management requirements for the supply of medicines to the hospital is important from both the hospital and the patient's point of view. The challenges that come with the provision of drugs resolve by automating the activities of providing the drugs themselves. The preparation of drugs through inventory control is very important as well as making predictions of changes in the patient's needs. Of course, this study has not completely completed the need for a complete pharmaceutical management system. It still needs a study that involves comprehensive comparisons of all the interests of various parties, such as the government.

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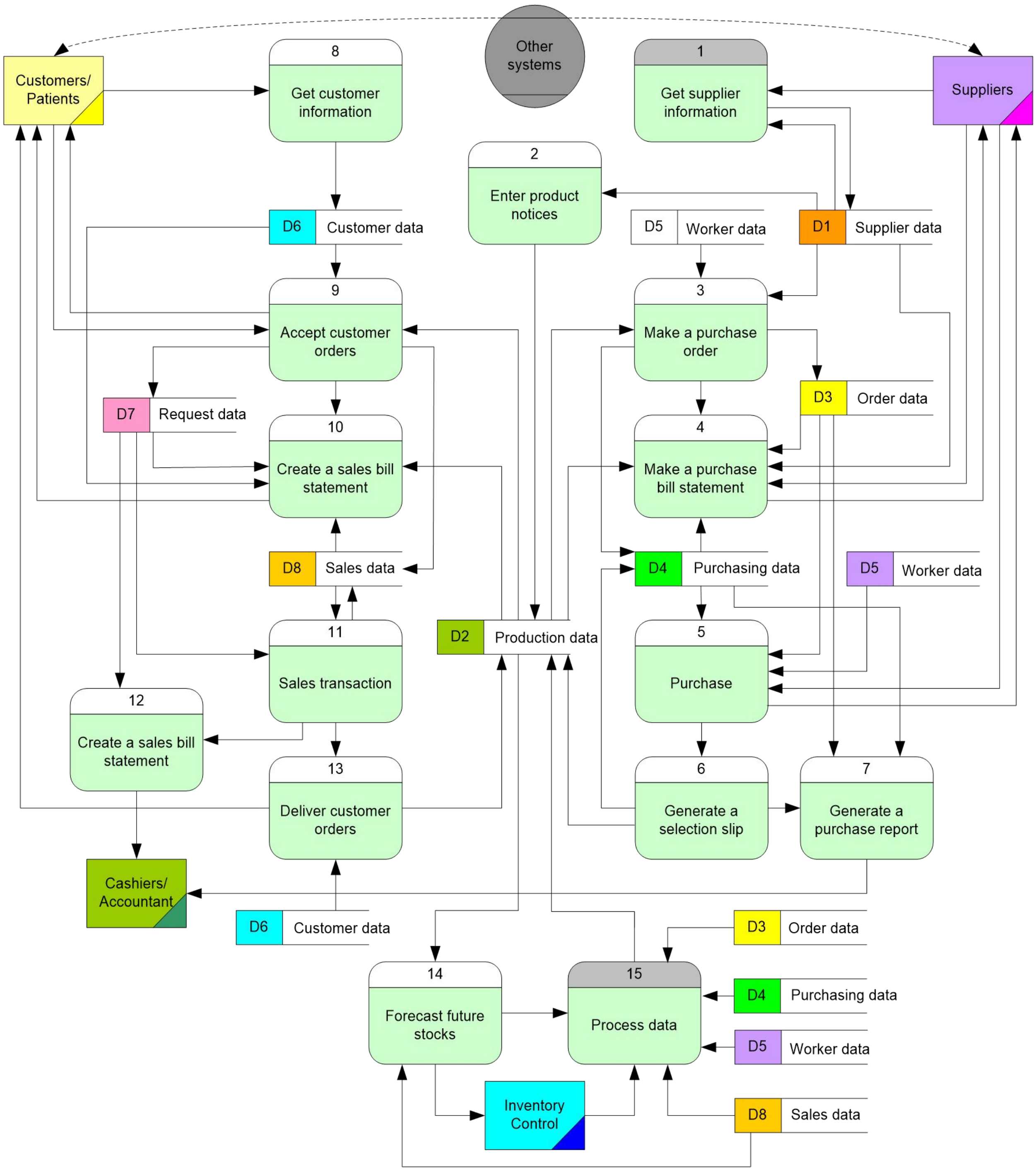

Figure 1. Activities for pharmacy management system.

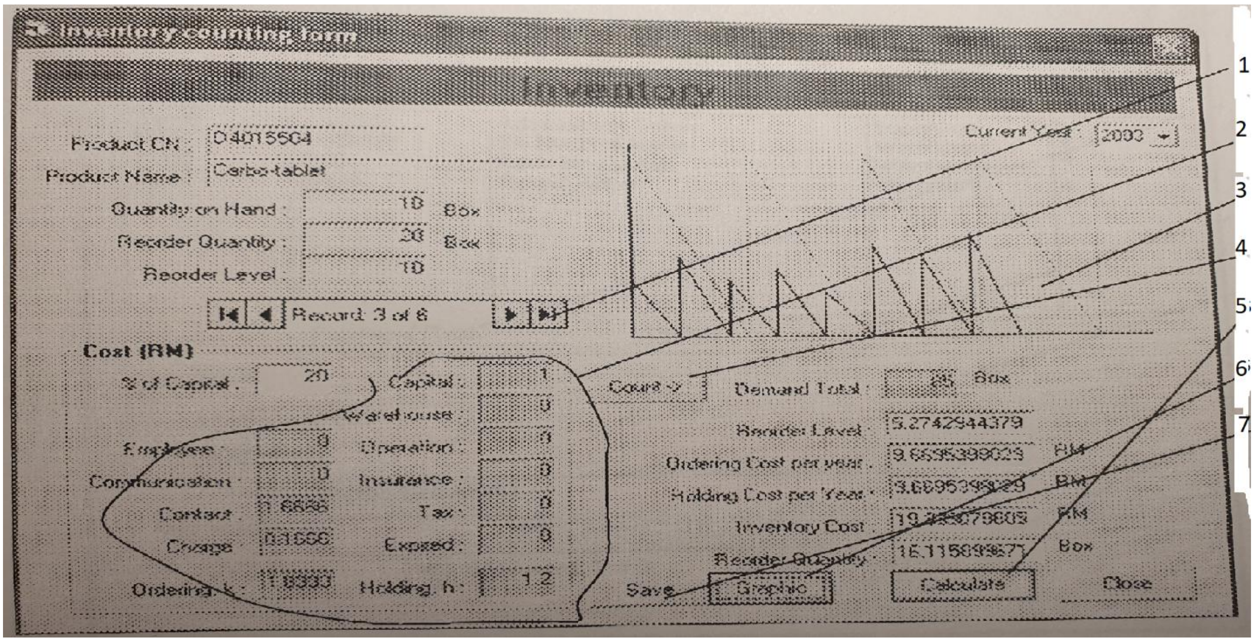

Figure 2. One of interfaces in pharmacy management system. That is Inventory control: 1. Moving item of drug; 2. Variables in considering cost; 3. Count button for generating the inventory graphic; 4. Inventory graphic in regular and implementation; 5. Calculate button for the inventory; 6. Graphic button for inventory.

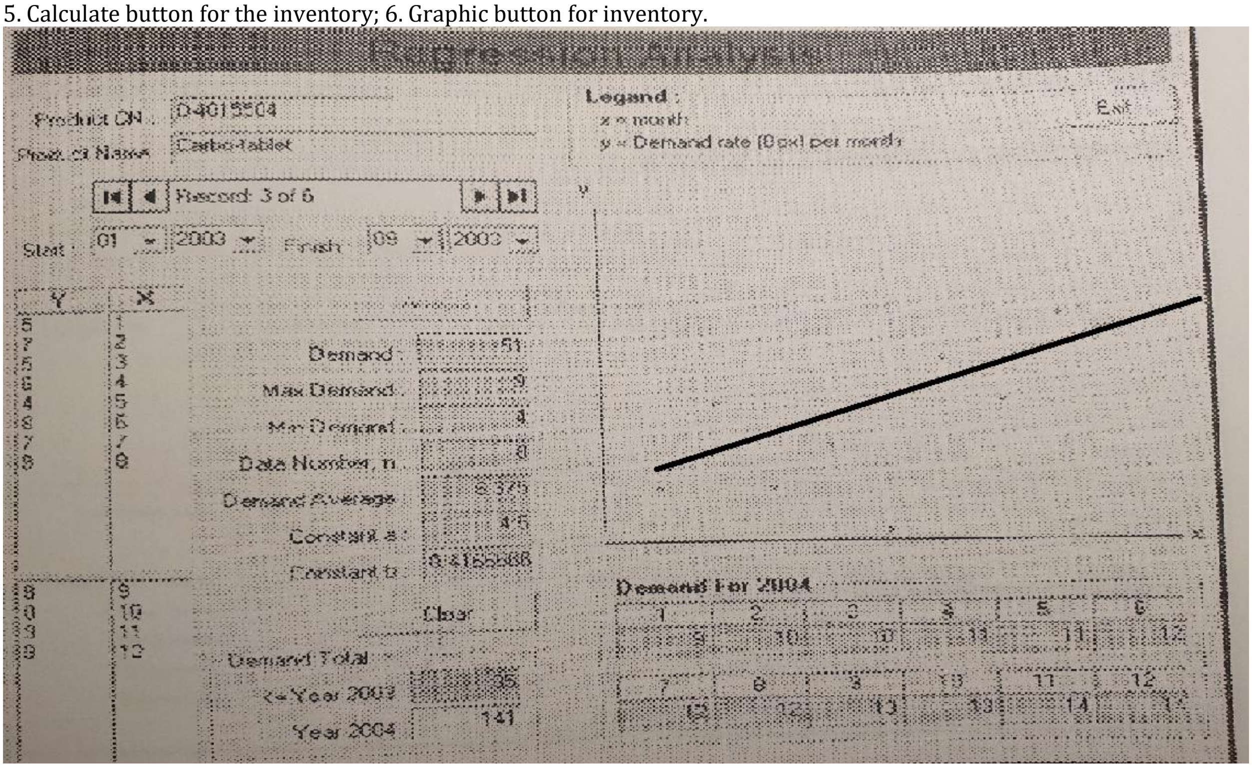

Figure 3. One of interfaces in pharmacy management system. Predicting one item of drug based on sales data per month.