CLINIC MANAGEMENT SYSTEM:
DRUG INFORMATION MANAGEMENT SYSTEM

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ABSTRACT

Drug Information Management System is a system that provides electronic drug references data in the pharmacology field. The doctors and pharmacists always refer to the drug references data in order to know the details about the specific drug data. At the government hospital, the process of finding the drug references data still done in manual way by drug references books. Other than that, the drug references books are outdated. There are no standard drug references systems that can be refer by the doctors and pharmacists. To solve these problems, a system to transform the manual process of finding drug references data into the computerized system is implemented. By transforming the manual drug references data into the management system, the doctors and pharmacists time for searching the drug data for references can be reduced. Beside, the drug references data can be updated as soon as possible if the immediate update is needed and doctors and pharmacists are able to view the updated data.

ABSTRAK

Sistem Pengurusan Informasi Drug adalah sebuah sistem rujukan data drug di dalam bidang farmasi secara elektronik. Doktor dan ahli farmasi sering merujuk data rujukan drug untuk mengetahui maklumat sesuatu drug itu dengan lebih mendalam lagi. Di hospital kerajaan, proses untuk mencari data rujukan drug masih lagi dilakukan secara manual dengan merujuk buku-buku rujukan mengenai drug. Selain itu, kebanyakan bahan rujukan drug yang sedia ada adalah informasi drug yang tidak terkini. Doktor dan ahli farmasi tidak mempunyai sebuah sistem rujukan drug untuk mereka rujuki. Untuk mengatasi masalah ini, sebuah sistem untuk menukarkan proses mencari maklumat rujukan drug secara manual kepada cara elektronik dengan menggunakan sistem perisian komputer telah dibangunkan. Diharap dengan adanya sistem rujukan drug data secara elektronik ini dapat mengurangkan masa untuk doktor dan ahli farmasi mencari maklumat rujukan drug. Selain itu, data rujukan drug boleh dikemaskinikan dengan lebih cepat jika sebarang pertukaran segera data diperlukan untuk dirujuki oleh doktor dan ahli farmasi.

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LIST OF ABBREVIATIONS

APha	-	American Pharmaceutical Association
ARCCOP	-	Atlanta Regional Community Clinical Oncology Programme
CMS	-	Clinic Management System
CMS-DIMS	-	Clinic Management System - Drug Information Management System
DIC	-	Drug Information Centre
DIMS	-	Drug Information Management System
EDI	-	Evaluation of Drug Interaction
HTAA	-	Hospital Tengku Ampuan Afzan
ICU	-	Intensive Care Unit
IIUM	-	International Islamic University of Malaysia
JAD	-	Join-application Development
JSP	-	Java Server Pages
MIMS	-	Malaysia Index of Medical Specialties
OO	-	Object-Oriented
OPD	-	Out Patient Department
PC	-	Personal Computer
PDA	-	Personal Digital Assistant
PDC	-	Personal Drug Contents
PEPID	-	Personal Electronic Professional Integrated Design
PMS	-	Protocol Management System
RAD	-	Rapid Application Development
US	-	United State of America

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CHAPTER I

INTRODUCTION

Providing efficient management service become the main focus for every organization nowadays. One of the ways to move towards efficient management is moving from the manual task to the electronic system. In the government hospital, majority of the management task are done manually such as registration process, doctors' prescription for patients, and beds arrangement in the wards as well as the drug references for doctors and pharmacists to refer to. The same scenario happens at the Hospital Tengku Ampuan Afzan (HTAA) in Kuantan. The quality service at the hospitals can be improved by transforming manual task into the computerize system. The management system in the hospitals which focusing into the management task in the hospital is known as Clinic Management System (CMS).

There are many departments are exist in the hospital including the pharmacy department. The drug references data for all drug that available in the pharmacy department at the hospital are always be the reference material for the doctors and pharmacist. Doctors need the drug reference data in order to prescribe the drugs that are needed for the patient treatment. While the pharmacists used the drug references to verify the doctors' prescription for drug weather the drug suggestion is suitable or not. Unfortunately, the drug references data in the government hospitals still using the manual way. Doctors and pharmacists use the drug reference books while they need to refer into drug data references. As a result, the idea to develop an electronic Drug Information Management System (DIMS) will produce a revolution for doctors and pharmacists about the new way to access the drug information as their references in an electronic medium.

There are lot of advantages by implementing CMS-DIMS in the hospital. This implementation will provide doctors and pharmacists from all departments in the hospital accessing the same standard and drug references data. The drug searching in electronic way will be faster rather than using manual reference books that doctors and pharmacists have to turn page by page until their find the particular drug information.

Besides, the CMS-DIMS also provide the doctors and pharmacists to give their suggestion for the new drug info or any unavailable drug data that they are needed to search. Further more, if the doctors or pharmacists detected any error for the drug data, they are able to report the error to the administrator immediately by using CMS-DIMS. As a result, the administrator will be able to update the required drug data or fix any drug data error immediately.

The CMS-DIMS also provides updates for the drug data. As another way to say, the administrator can manage the drug data by himself in order to make the CMS-DIMS always up to date and fulfil the doctors and pharmacists needs for any drug references. Other than that, the CMS-DIMS accessibility is not limited in the hospital area only. It can be access outside the hospital as this CMS-DIM is going to be implemented in the web-based application. As there are many advantages about the idea of CMS-DIMS, it shall be developed to gives better facilities for doctors and pharmacists to increase their job qualities.

1.1 Problem Statement

Doctors and pharmacist in the hospital nowadays still referred the drug data in manual approach. They use MIMS books (Malaysia Index of Medical Specialties) as it is the official drug reference of Malaysian Medical Association. This approach will create another problem that affects providing efficient service to patients such as:

i. Doctors and pharmacists waste their time by turning pages to pages of MIMS in order to search the particular drug information.

ii. The doctors and pharmacists are not able to find the latest drug data as the MIMS latest volume is published annually per volume.

iii. The MIMS book is not mobile and doctors and pharmacists have to always bring MIMS copies with them as their references to refer.

iv. If any latest drug information are available, there is no immediate update can be made and informed to all doctors and pharmacists.

Based on the problems that occur while using current manual MIMS as a drug references by doctors and pharmacists, the main factor has been detected that contribute the problems. The main factor is there is no an electronic system for drug references that can be viewed by doctors and pharmacists. And if any updates for the latest drug data must be made, there is no faster way to update it so that the doctors and pharmacist can only referred to the up to date drug data as their references.

1.2 Objectives

The objectives for developing the Drug Information Management System are:

i. To transform the manual processes of drug references data into computerize system.

ii. To develop a prototype for drug data references management in web-based application.

1.3 Scope

The Drug Information Management System will focus on the management of drug data. The scope of the DIMS stated as below:

i. The system is developed in Windows environment.

ii. The system must be resided in the user PC.

iii. The system is a web-based application.

iv. The users of this system are doctors and pharmacists as the front-end users while administrator as the back-end user to manage and update the drug data.

v. The software to be used developing this system are JSP language, Oracle 9i for database, Jakarta Tomcat as the platform and the Macromedia Dreamweaver MX for the interface design.

vi. The system consists of four main modules which are log in module, drug reference module, suggestion module and the error report module.

CHAPTER II

LITERATURE REVIEW

In Malaysia, the CMS is applied widely especially in the small clinic as well as at the some of the hospital departments. Majority of the CMS are developed in the stand-alone system and not integrated to other CMS system. For example, the patients registration system only has been applied at the Out Patient Department (OPD). While the patient from the OPD is submitted at the ward, the patient's data in the registration module at the OPD cannot be captured at the ward because this registration system is the stand-alone. This scenario will avoid the hospital to give better services to the client. The implementation of CMS will improve the service performance in the hospital departments such as pharmacy department.

2.1 Overview of the Existing CMS in Hospital

As there are many departments in the hospital, the implementation of management system will lessen the administrative burden for the medical staff. There are lots of CMS are implement in hospital weather the systems are integrated to each other or just a stand-alone system. For example the CMS that has been developed by the Dynacrates provides doctors appointments modules, medical billing, patients' treatment history and patients' lab analysis. These features that consist in the Dynacrates CMS have been mix up by involving many departments. Doctors' appointment and patient treatment history features can be combined in the OPD department while the patients' lab analysis can be implementing in the hospital lab department.

2.2 Overview of the Existing CMS in Pharmacy Department

At the pharmacy department in the HTAA, the existing systems that available are inventory system and the drug ordering system. While in the market, the CMS that are implemented in the pharmacy depends on the how far is technologies applied at the particular pharmacy.

As for the CMS-Pharmacy that developed by Rx30, the system provides the online prescriptions processing. The approach means that while the doctors prescribed the prescriptions transcribe, the pharmacy department will capture the prescriptions data and prepare the required drug. By the time patient arrive at the pharmacy department after checked by doctor, the drug for their medication are already available.

Another example of CMS available in the market is Pharmacy Management System by the RX Showcase. The features that consist in this system are pharmacy distributor and wholesaler. This system is used to make ordering stock to the distributor and wholesaler.

2.3 Manual Process of Searching the Drug Data In Government Hospital

Nowadays, in the government hospitals, clinic and pharmacies, the medical practitioners use MIMS as their main references for drug information. The MIMS is like a drug dictionary, which has been compiled in a book. Other than that, MIMS is announcing as the official drug references by Malaysian Medical Association. MIMS is established since 1968 and until now MIMS has published 98 editions of its volumes.

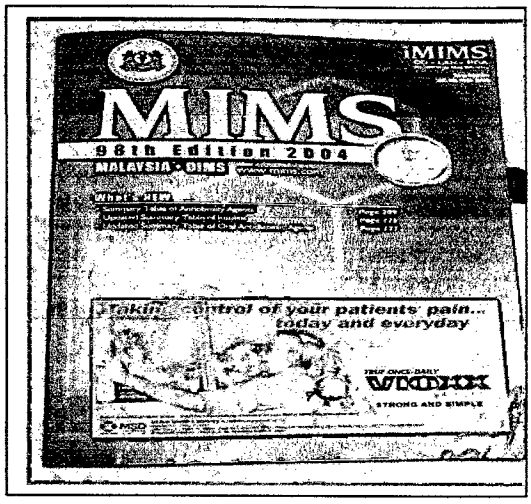

Figure2.1 Example One of the Main Drug Categories Available in MIMS (MIMS, 2004)

Basically, MIMS contains the drug data such as trade name based on its major classes and sub-classes of the types of drug has been categorized. For example, the Hormones are a major class and the sub classes of Hormones are Androgens and Related Synthetic Drugs. Besides, MIMS also include the new drug advertisement product in the market, the contact address for the Drug Manufacturer and pharmacies in Malaysia.

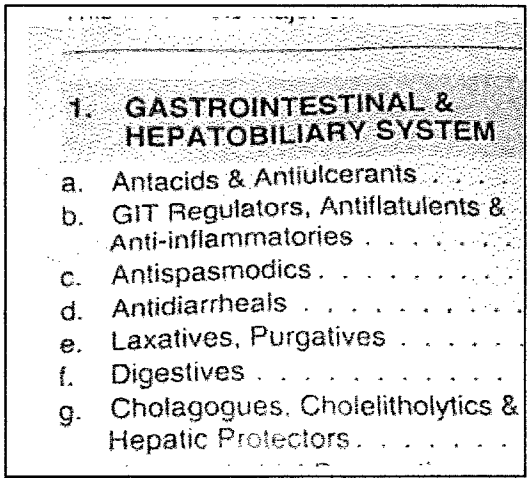

Figure2.2 Example One of the Main Drug Categories Available in MIMS (MIMS, 2004)

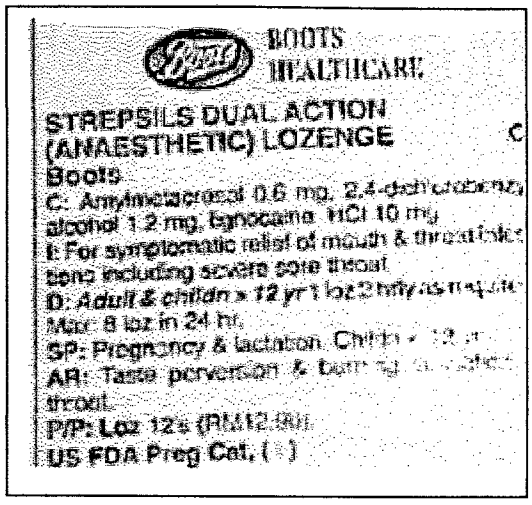

Figure 2.3 Examples One of the Drug Data Available in MIMS (MIMS, 2004)

The MIMS provide the drug references data by using the abbreviations. For example, C stand for contents, I for indications, D for dosage, SP for special precaution, AR for reverse reaction, P/P is the short form of presentation and packaging while the US FDA is mean that this drug is approve by the US FDA standard.

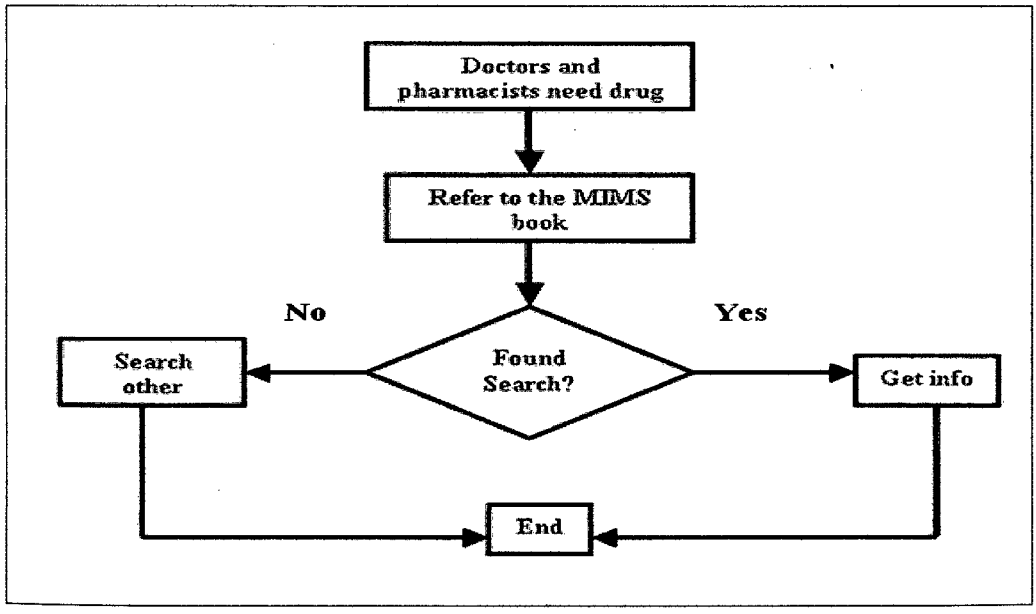

Figure2.4 The Manual Process Flow For Searching Drug Data References

Based on the Figure 2.4, the doctors and pharmacist need to search the particular drug data that they needed by turning pages to pages of MIMS until the data is found.

2.4 Drug Information Management System Definition

In general, the drug information management system is a system that provides drugs data for the doctors and pharmacists to be referred. The drug data include the drug categories, trade name, generic name, manufactured company, drug contents, indications, dosage, contradiction, special precaution, and drug adverse reaction and drug interaction. All these data are useful for doctors and pharmacists.

2.5 The Importance of Drug Data References

Based on the white paper 'Drug Information System in the country is still in its infancy' done by P K Lakshimi who is deputy director of Drug Information Centre (DIC) of Karnataka, India. She explained that drug data is not only useful for doctors and pharmacists to make drug reference. These drug data also useful for the alternative therapy recommendation for patients. Below are list of the importance drug data in medical field:

i. Avoid drug toxicity based on the drug contents and the expired date.

ii. Provide list of poison drugs.

iii. Educate the patients who are not in the medical field about the drug references to increase their caution about the specific drug especially for the patient with chronic diseases.

iv. Instruction for the drug dosage that have to be taken for adult and children.

2.6 Existing CMS-Drug Information Systems in the Market

The majority of available systems in the market using advance technologies which is online information access such as using PDAs as their system device. "The online information access is the ability to connect computers to one another by modem or network and communications lines to provide online information access as stated by Williams *et all.* (1999)".

2.6.1 Evaluation of Drug Interaction (EDI)

The EDI is originally developed by the American Pharmaceutical Association (APhA). It is developed in the web-based system. EDI contains over 43, 000 source of drug-to-drug interaction information. It covers drug interaction information both in the drug that need to have the doctors' prescription in order to buy them as well as over-the counter drugs.

By using EDI, user will get immediate access to clinically reviewed drug interaction monographs. A drug interaction monograph is a scholarly piece of writing of essay or book length on a specific drug data. In the EDI drug monograph, the information that available are:

i. Title which is to interact drugs with generic names.

ii. Severity Level which contains four severity levels indicate potential harm to patient, frequency and predictability of the interaction, and degree of available documentation.

iii. Summary about overall effects of the interaction, and synopsis of the available medical literature.

iv. Recommendations which are suggestions for patient monitoring and management of the interaction.

v. Summary Box, which contents most of the monographs, includes a synopsis of the potential effects of the interaction with recommendation.

This EDI system is updated online by the vendor itself six times each year for the web-based application.

2.6.2 PEPID PDC Pharmacology Suite

PEPID PDC Pharmacology Suite is developed by the PEPID. This system application is developed under the PDA platform. As the PEPID PDC Pharmacology Suite are implemented in the PDA, its only provide 5000 drug data references including generic, trade name, with build in dosing calculators and overdose management.

For the drug data in this system, the number of drug covered also include all dangerous drug overdoses as well as the Canadian Drug Trade Name. Other than that, for the drug interaction generator, the systems are able to interact 40 numbers of drugs at a time.

Another feature for PEPID PDC Pharmacology Suite is medical calculators and online tutorial and provides new information in the PEPID PDC.

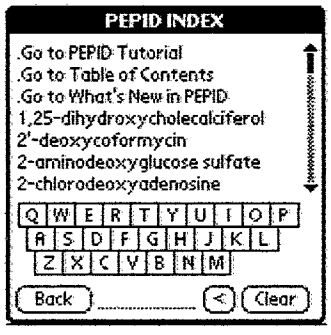

Figure 2.5 The PEPID PDC Pharmacology Suite interface on PDA (PEPID, 2002)

2.7 Comparison between the Manual Process and Existing Drug Information System in the Market

Based on the reviewing about the flows about the drug references that are made in manual process and the features that available in the current Drug Information System in the market, the comparison are made about the pros and cons about both of this approach.

In term of cost, the manual system of getting the drug references using MIMS or other drug references books are cheap but wasting the doctors and pharmacists times with the unnecessary task to manually search the data pages by pages until found the required data. As the information technologies are bursting, the service provide by the hospital is not efficient as the manual process is still used at the hospital. Furthermore, this manual process of finding the reference by using reference book increases the administrative burden to doctors and pharmacists.

While for the overall available Drug Information system in the market, in term of cost itself, the system is expensive as well as some of the system use PDAs application. Not all doctors and pharmacists in the hospital can afford to own a PDA on their own. Other than that, because the system provide detailed drug interactions, only the small number of doctors and pharmacist who are expert or senior are suitable to use this system although in PDAs application or web-based application. On the contrary, the available systems in the market are efficient but provide small number of drug data as the user references because of the limited storage in the PDAs.

For the comparison of the reliability to implement the manual system for searching the drug references using books, it is not fully reliable, as the latest data cannot be updated immediately. As a result, the doctors and pharmacists will use outdated drug references data in their practice.

Although the currents system using the latest technologies such as the web-based and the PDA application, there is no a Drug Information Management System

exist in the market suitable to be used as the drug references that available in the Malaysia. Majority of the existing Drug Information Management System in the market is based on the drugs data in the US and the Canada.

To simplify the pros and cons between the manual process and the available system in the market, below is the table that showed the comparison between the manual process and the existing system in the market.

Table 2.1 Pros and Cons Criteria Between Manual Approach and the Available Drug Information System

Criteria	Manual Approach	Available System In the Market
Cost	i. Price is cheap. ii. Wasting time. iii. Increase administrative burden to doctors and pharmacists.	i. Price is expensive. ii. Only involve the small number of expert. iii. Efficient but involve with limited data.
Reliability of implementation in hospital environment	i. Not fully reliable. ii. Cannot make immediate update of data.	i Using latest technology. ii. Not reliable to implement as the software and PDA cost are high.

2.8 Protocol Management System

Protocol Management System (PMS) is the guideline for developing management system. "The Protocol Management System, fondly referred to as the PMS program, was developed as the central tool for organizing, tracking, and maintaining all protocol data within the Atlanta Regional Community Clinical Oncology Program (ARCCOP). The PMS program has evolved from a single-user, text-based DOS application in 1987 to a multi-user Windows-based application today as described by Riley and Hice (2002)."

The Protocol Management System program can be subdivided into four modules: events, patients, protocols, and utilities. The four modules interact with each other to enable the program to effectively manage and track events for each patient as well as to provide the reports and tools necessary to administer the clinical trials program for the ARCCOP.

The descriptions for four modules of PMS are:

i. Events

An event is like an engine to generate the management system. Example of events is SQL statement that applied in the system coding to view the patients name by sorting the name in the alphabetical order.

ii. Patients Screen

Patients screen is like the interface of the system such as the registration form for patients.

iii. Protocol

Protocol in the PMS is the condition of the coding. For example report on number of admission patient in the hospital will be generating for every two weeks.

iv. Utilities

A utility is the level of user access that has been stated in the management system. For example admin has the authority to delete the data in the database.

2.9 Solution for the CMS-Drug Information Management System

Based on the comparisons of the pros and cons and the problems that have been detected among the manual process and the available drug information systems