Study on Automated Drug Dispensing System: Robotic Pharmacy

By

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Dissertation submitted for the partial fulfillment of the

MBA Pharmaceutical Management

Academic year, 2014-2016

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TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Ms. Huma Kausar Mallick** student of MBA Pharmaceutical Management from The IIHMR University, Jaipur has undergone dissertation training at **VPS Healthcare, Abu Dabhi, UAE** from March 3, 2016 to May 28, 2016.

The Candidate has successfully carried out the study designated to her during dissertation training and her approach to the study has been sincere, scientific & analytical.

The dissertation is in fulfilment of the course requirements.

I wish her all success in all her future endeavours.

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في بي إس للرعاية الصحية
VPS healthcare

The certificate is awarded to

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In recognition of having successfully completed her

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A Study on Automated drug dispensing system: Robotic Pharmacy

From 4th March to 28th May 2016

At

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She comes across as a committed, sincere & diligent person who has a

Strong drive and zeal for learning

We wish her all the best for future endeavors

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CERTIFICATE BY SCHOLAR

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HKallick

Signature

Acknowledgement

It is my immense pleasure to express my thanks and obligations to all those who have given their support in working out this project.

First of all, I would like extend my sincere thanks to **Mr. Rajesh Verma (HR Director- VPS Healthcare), and also to Mr. Vinay Batraand, Dr. Meena Vishwakarma** for providing me an opportunity learn and develop professionally.

I would like to express my sincere thanks to my mentor **Mr. Abhishek Dadhich** of Indian Institute of Health Management Research, (IIHMR University) Jaipur, for providing me the opportunity and all necessary Facilities to accomplish this endeavor successfully. I am greatly indebted to all of them for providing their valuable guidance at all stages of the study, their advice, constructive suggestions, positive and supportive attitude and continuous encouragement, without which it would have not been possible to complete the project.

To place on record, I owe a debt of gratitude to all my teachers for grooming me and my classmates for the inspiration needed to work with dedication and motivation throughout as an Intern at VPS Healthcare

I hope that I can build upon the experience and knowledge that I have gained and make a valuable contribution towards the industry in coming future.

Huma K. Mallick

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1. Introduction

Over the past 40 years, information technology has had a major impact on the working lives of millions of people. Many industries have embraced computer technology because of the benefits of automated information processing. These include enabling routine, repetitive and monotonous tasks to be conducted with consistent accuracy; standardization and consistent use of terminology and nomenclature; and mass customization (the capacity of information technology to provide services to a large population, yet in a way that can be customized to the individual).

Pharmacists remain in a state of change and are constantly expanding their practices. Pharmacists are being encouraged to become more involved in direct patient care activities. The first and most critical step in the process of expanding a dispensing practice to include patient care activities is to provide the pharmacist the time necessary to provide patient care. Pharmacists will always have the ultimate responsibility for ensuring that the right medicine reaches the right patient at the right time. This task is especially difficult now, due to manpower shortages being experienced across the nation. The number of prescriptions being dispensed each year continues to increase; however, the number of pharmacy graduates at this time is not keeping pace with the increased prescription volume. The resulting consequence is increased workloads for pharmacists. Thus, for pharmacists to meet the prescription volume demand and participate in patient care activities, they must utilize every available tool at their disposal to streamline their dispensing process.

Maximum utilization of pharmacy technicians is a necessity. Pharmacy practice acts in most states have legalized additional responsibilities for technicians in the past few years, but not all pharmacists have changed the role of technicians in their dispensing process. However, even when technicians are properly utilized, there still may be extended wait times and not enough time for pharmacists to counsel patients optimally.

For prescribers and pharmacists, IT can enable the storage of structured patient records, facilitate the electronic prescribing, dispensing and administration of medicines, automate the handling of medicines in the supply chain and provide tools for monitoring the efficacy and safety of medicines in use. IT can therefore improve patient safety, enable professionals to provide high quality care and help patients make the most of their medicines.

Pharmacists are already using IT systems to support their daily work and, when considering the IT requirements for emerging working practices, pharmacists should consider what functions could be provided by systems that they already use.

For example, all pharmacies use pharmacy management systems for medication records, dispensing, labelling, ordering and stock control. However, many pharmacies do not use all of the available functionality of their system, for example, modules to handle patient-centred services, such as medicines use reviews or prescription interventions.

Access to patient record systems will assist pharmacists with professional decision-making in providing patient-centred services. For example, the summary care record is now available in many areas, and has been shown to be beneficial for hospital pharmacists for medicines reconciliation. In future, it may be used by community pharmacists, for example with MURs and emergency supplies. As pharmacists deliver more patient-focused services in future, they will increasingly use national and local patient record services to do so.

As automated dispensing systems are integrated into community pharmacy practice, pharmacists need to be knowledgeable about the technologies and how to integrate them into practice. Of utmost importance is understanding the economics of buying different products and incorporating them into the dispensing process. There is little information to assist pharmacy owners in selecting an automated dispensing product appropriate for their prescription volume. Moreover, pharmacy leaders lack information needed to facilitate the diffusion of automated technologies into community practice. Further research is needed to demonstrate the productivity savings acquired through the use of automation.

2. Organization Profile

2.1 Overview of VPS Healthcare

VPS Healthcare, an integrated Healthcare provider with network of hospitals, chain of medical centers, pharmaceutical manufacturing and pharmacy retail across the global healthcare arena.

Dedicated team of over 7,500 employees, 750 Doctors including North American, European and Australian board certified are providing world class quality services complemented by personalized care.

VPS Healthcare offers fully integrated healthcare delivery system to provide primary, secondary and tertiary care with center of excellence in various specialties.With 42 operating rooms including a hybrid OR, our expert team of surgeons are performing over 50,000 surgical procedures per year.

VPS Healthcare reflects a brand image of excellence in healthcare delivery system by serving around 3 Million patients per annum.

Community awareness is our capital asset and our vision is to create sustainable community welfare model for different strata of the society .With a range of new projects coming up, we plan to meet the growing demands of healthcare in the region and create a sustainable healthcare system by achieving global benchmark.

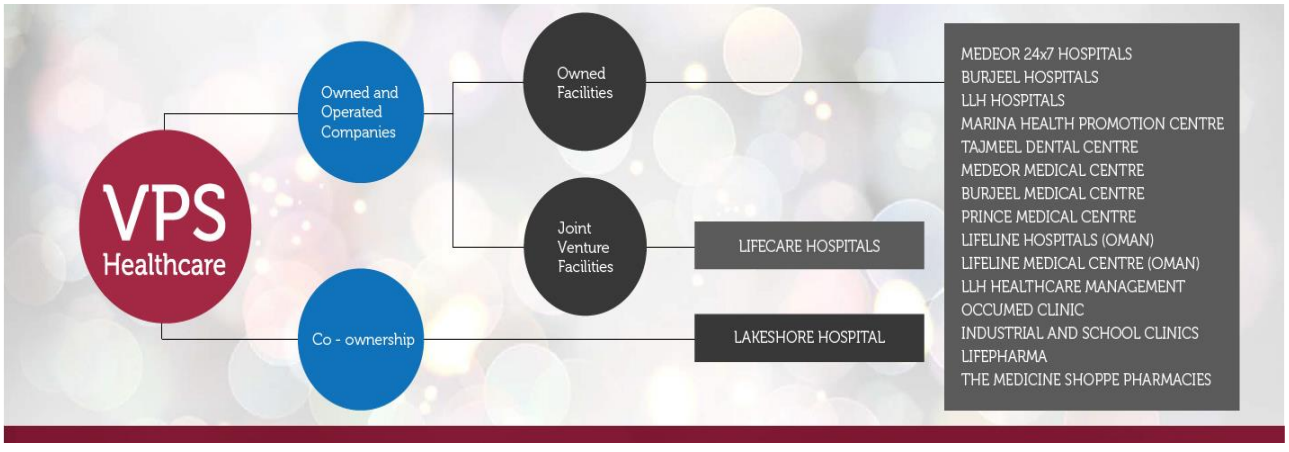

Fig 1:- VPS Healthcare

Medeor 24×7 – A Bold New Concept In Healthcare

Medeor 24×7 offers a new concept in healthcare – a multi-speciality family hospital that takes the best principles of the hospitality industry and combines it with state-of-the-art medical facilities, diagnostic equipment and hand-picked personnel, to scale new heights in healthcare excellence.

The breakthrough concept behind Medeor 24×7 is to provide a healthcare service with hospitality at its core, in order to raise the level of personalised attention at key points in the client's journey to total wellness. Each hospital represents a considerable investment in training and technology to ensure maximum efficiency while also offering hotel-like levels of comfort. This makes the journey to full wellness quicker, easier and more comfortable and thereby as stress-free for the patient as possible.

Medeor 24×7 personnel are all carefully selected to ensure that they not only offer the necessary skills and experience but also demonstrate a deep empathy for our patients as well as an unreserved passion for the calling. Our staff will always go the extra mile to ensure that each patient receives the individual care they need for a rapid and full recovery. It is a pro-active partnership between healthcare professional and patient, with the emphasis on taking a holistic and long term view on the patient's health.

Naturally, the '24×7' in our name is no coincidence and refers to the fact that all Medeor 24×7 hospitals are open '24 hours a day, 7 days a week'. We are also equipped with emergency rooms and on-site pharmacies to ensure that patients can get the care they need, whenever they need it.

Fig 2: Medeor Hospital

Facilities Constructed With Patient Care In Mind

Medeor 24×7 Hospital is centrally located in downtown Abu Dhabi, with easy access from the main routes. Housed in an ultra-modern facility – comprising 14 floors and covering over 11,000 square feet -we offer superior medical care combined with superior levels of comfort.The hospital has 100 beds to provide sufficient capacity without sacrificing the patient's personal space. Our patients' comfort is paramount at Medeor24x7 which is why we offer individual rooms on each floor.

All due care was taken in the design to ensure that our patients' safety is given equal priority. All flooring is therefore skid proof, and bacteria and fire-repellent fabrics were utilised throughout all rooms. Further to this philosophy, all materials and furnishings in the rooms have been selected for their bacteria-resistant properties in order to make the rooms as medically sterile as possible. The patient's state of mind is also important and all interior colours and furnishings were carefully selected by specialist decorators to create a welcoming environment that is as soothing as possible.

Not only are physical needs considered, but spiritual and cultural as well, with separate waiting areas for women and men as well as separate prayer rooms. Our customer care personnel are selected for their people skills as well as diverse language skills in order to aid and guide our patients and attendants.

Visitors to the hospital were also given due consideration in the design of the premises. Given that hospitals are typically large buildings that can be confusing to navigate, informational signage in Arabic, English and braille has been installed on every floor. There is ample parking in the vicinity of the hospital with free valet facilities available. A large cafeteria on the premises offers a variety of tasty and nutritious food and beverages.

Medeor Pharmacy

Often people consider Pharmacy as a means of storage and dispensing of medicines. But responsible pharmacy companies in Healthcare like Medeor 24×7 Hospital understand that they have a much larger role to play especially when the market is flooded with potent drugs, new drugs, costly drugs and non-conventional advanced drug delivery system. We are aware about the fatalities due medication-error, irrational drug therapy wrong handling of drugs, improper patient counseling, lack of quality assurance etc.

Medeor 24×7 Pharmacy is committed in delivering the highest level of satisfaction to patients. A Clinical Pharmacist is employed to assist those patients with the prescribed medication. Our systems ensure that expired medicines never reach the patient by mistake.

Our Pharmacies educate the patients about dosage, drug side effects etc. We use efficient medicine stacking and inventory management system to serve you faster and with the right medicines. Medicines that need to be stored under lower temperatures are stored under refrigeration so that the efficacy and potency of the drugs do not deteriorate

Fig 3: Medeor Pharmacy

Medeor 24×7 Pharmacy is part of the hospital facility. It ensures that there is adequate supply of most common medicines and is dispensed in a timely manner. Medications prescribed for use during your hospitalization are covered under your health insurance. Please bring your current medications into hospital as there will be a charge if your scripts need to be refilled. Pharmacy costs for medications or other items supplied for home use, if not covered under your insurance is payable on discharge.

Recent Trends in Robotic Pharmacy

1) Making the most of systems

Pharmacists are already using IT systems to support their daily work and, when considering the IT requirements for emerging working practices, pharmacists should consider what functions could be provided by systems that they already use.

For example, all pharmacies use pharmacy management systems for medication records, dispensing, labelling, ordering and stock control. However, many pharmacies do not use all of the available functionality of their system, for example, modules to handle patient-centred services, such as medicines use reviews or prescription interventions.

Pharmacists should also make the most of services that are available in their locality, for example, electronic prescription service release 2.

Adoption and use of EPS release 2 in areas where it is available has the potential to make dispensing and reimbursement processes more efficient for community pharmacists and the nomination process may help pharmacists to secure prescription business.

Access to patient record systems will assist pharmacists with professional decision-making in providing patient-centred services. For example, the summary care record is now available in many areas, and has been shown to be beneficial for hospital pharmacists for medicines reconciliation. In future, it may be used by community pharmacists, for example with MURs and emergency supplies. As pharmacists deliver more patient-focused services in future, they will increasingly use national and local patient record services to do so.

Fig4: Types of System

2) The power of the internet

The internet has been widely adopted for business and social communications. In future, as internet use becomes universal, there may be an increase in the number of internet pharmacies, and use of the internet to display and disseminate information on medicines and health from pharmacies.

Currently, secure web-based platforms are available from various providers to support enhanced pharmacy services and public health initiatives. The use of these will increase and also web platforms will be used as a communication portal to make information available to pharmacists from other care settings (eg, hospital discharge information).

3) Electronic prescribing and discharge

Electronic prescribing (EP) systems automate prescribing, supply and administration of medicines in hospitals, where they have been shown to reduce medication errors and have a major impact on patient safety. However, the effect on error reduction is dependent on system design and a poorly implemented system can actually increase error rates.

Timely and accurate transmission of a patient's discharge prescription from secondary to primary care is important to ensure seamless patient care, and also to prevent errors arising from mis communications. Recently, many hospitals have adopted electronic discharge systems (sometimes as a "quick-win" compared with a whole-hospital EP system). However, these systems may have inadequate decision support functions, and data fields that are not in a standard format. Furthermore, they route the discharge information to GPs, not to community pharmacists.

4) **Barcode medicine identification**

Barcode identification of medicines has been used with EP systems and has been shown to reduce medicine administration errors, as well as improve the completeness of the medication history. However, barcode medicine identification at the point of administration is an interruptive process and, for this reason, health professionals often develop "work around" to circumvent barcode scanning.

5) **Automated dispensing**

Robots have been used in logistics and distribution for many years, but only recently in pharmacy. In 2001, the Audit Commission's "Spoonful of sugar" report advocated the use of automation to transform pharmacy services and, since then, many UAE hospitals installed dispensary robots. Pharmacy robots have been shown to reduce the incidence of dispensing errors, improve the speed and efficiency of the dispensing process, and optimise use of space in the pharmacy.

Robot use in community pharmacy in the UAE is still relatively limited. However, robots have the potential to handle high volumes of dispensing in community pharmacies, or dispensing "hubs", and to release pharmacists to develop and deliver patient-centred services.

As newer, smaller and more efficient machines become available, robot use in all sectors of pharmacy is likely to increase. Similarly, automated methadone dispensing machines (eg, Methameasure, Methadose) offer accuracy and efficiency in the laborious methadone dispensing process and their use is likely to increase, too, especially in pharmacies with a high volume of methadone dispensing.

The use of electronic ward cabinets is the next level of automation in hospitals. These have been shown to provide benefits such as reduced number of medication errors, reduction in number of missed doses, supply delays and stock outages, and reduction of stock-holding and wastage.

However, installation of ward cabinets constitutes a considerable expense, a major implementation project and a significant change in working practice for both pharmacy and nursing staff. For these reasons, ward cabinets have not been installed in many UK hospitals to date.

6) Mobile technology

The use of mobile telephones is widespread in society. Some pharmacies are using text alerts to remind patients that repeat prescriptions are ready or to offer services, but sophisticated apps have been developed for disease monitoring, for example, recording of peak flow readings in asthma, monitoring of blood glucose levels, medication adherence support and health education. These apps will have a greater impact on pharmacy practice in future.

7) Adherence monitoring

Various technologies are now available to support approaches to adherence monitoring. A number of vendors have developed “smart” packaging, where a microchip-containing tablet blister pack is able to monitor when doses are popped out (not necessarily taken) and prompt the patient to record side-effect monitoring information for the medicine in question. These data can then be transmitted to a mobile telephone or tablet device.

8) Telecare

Telecare involves the use of digital communications technology (audio and visual) to provide healthcare consultations and services to patients remotely at home. Telecare has various potential benefits: it puts patients at the centre of their care and supports personalised medicine; it improves access to healthcare by reducing the need for hospital attendance (for people with poor mobility, or those in remote areas); and it can reduce the travelling times and costs of healthcare professionals.

However, the exact benefits provided by telecare vary between different applications and care scenarios, and, at present, the literature suggests that more evidence of outcome benefits, and more cost-effectiveness data are required to justify further investment in telecare.

In pharmacy, use of remote consultations, together with EPS release 2 and an internet pharmacy supply service, could transform the way that pharmacy services are provided. However, adoption of telecare in pharmacy would be dependent on the availability of reliable communications and integration architectures, the willingness of pharmacy operators to invest in these and also a critical mass of domestic use of digital technologies in all patient demographics.

It is evident that automation can be beneficial to community pharmacies. Depending on the goals of the pharmacy owner, automation can be used to free up pharmacist time for other patient care activities, to reduce service rates, or to maintain service rates without adding staff. When deciding whether to purchase a type of automation, it is necessary to consider: -

1) What is the purpose of the automation?
2) Are you trying to reduce staff?
3) Are you having trouble finding a pharmacist due to the shortage and looking for dispensing technology to reduce the number of pharmacists needed?
4) Are you trying to replace a technician?
5) Do you want to free-up pharmacist time to provide more patient care services?
6) Are you trying to improve service delivery time with the current staff?

All of this must be considered when deciding to purchase a dispensing automation.

Advantages of Industrial Robots:-

1) **Design Benefit:**

Slim, quick, and flexible, robots are well-suited for the pick and place and assembly work in a pharmaceutical environment. Vision technology allows industrial robots to put together customized orders and do things like assemble blood sugar kits.

2) **Safety Advantage:**

Robots protect the integrity of pharmaceutical products and the health of employees and patients. With industrial robots, toxic chemicals can be mixed safely. These particular robot models are designed to work in clean room settings. Sealed arm construction and decontamination with Hydrogen Peroxide Vapor (HPV) keep these models from ever contaminating product. Low payload picks and place jobs that would prove tedious for human workers are now the responsibility of tireless robots.

3) **Reliability:**

The Food and Drug Administration (FDA) requires all medication to be tracked and traced throughout the production process. Industrial robots make it easier for pharmaceutical companies to comply with these requirements. Along similar lines, robots minimize accidents and wasted material.

4) **Return on investment (ROI):**

There is quick turn-around with ROI. Plus, with the increase in quality and application speed, there are the benefits of increased production possibilities.

5) **Accuracy:**

Robotic systems are more accurate and consistent than their human counterparts.

6) **Reliability:**

Robots can work 24 hours a day, seven days a week without stopping or tiring.

7) **Affordability:**

With the advancements in technology and affordable robotics becoming available at less cost, more pick and place robotic cells are being installed for automation applications.

8) **Quality:**

Robots have the capacity to dramatically improve product quality. Applications are performed with precision and high repeatability every time. This level of consistency can be hard to achieve any other way.

9) **Safety:**

Robots increase workplace safety. Workers are moved to supervisory roles, so they no longer have to perform dangerous applications in hazardous settings.

10) **Savings:** Greater worker safety leads to financial savings. There are fewer healthcare and insurance concerns for employers. Robots also offer untiring performance which saves valuable time. Their movements are always exact, so less material is wasted.

11) **Speed:**

Robots work efficiently, without wasting movement or time. Without breaks or hesitation, robots are able to alter productivity by increasing throughput.

12) **Reduced chances of contamination:**

Removing people from the screening process reduces the potential for contamination and the potential for dropped samples when handling them in laboratories. Robotics performs these tasks much faster with more precision and accuracy.

13) **Increase Efficiency:**

Robotics can increase efficiency, which means the price of the drug itself will become more competitive. When it comes to pharmaceutical production, people are not as efficient as robots, especially when they are wearing a protective suit. People in protective suits also require more room to work in.

14) Can work continuously in any environment

Another advantage in the laboratory is that robots are impervious to many environments that would not be safe for humans. A robot can operate twenty-four hours a day, seven days a week without a dip in accuracy.

Safety & quality	Financial	Process efficiencies
Reduction in dispensing errors	Reduced stock holding	Faster dispensing process to reduce patient waiting times
Staff released from dispensary for direct patient care supporting new Clinical Pharmacy Model	Improved stock rotation and reduction in expired stock wastage.	• Out of hours activity • On call remote working • Improved space utilization

Table 1: Summary of robotic pharmacy dispensing system benefits

3. Need of the Study

Due to the potential hazards and high volumes, some hospitals and larger health care clinics utilize robotics to dispense medication. Robotic pharmacies are expanding rapidly within the hospitals and clinics. Several companies are servicing that market and the interest level will only increase. On the retail level, robotics in local pharmacies will be a challenge. The technology is available but regulation will pace the growth of robotic pharmacies more than the technology.

At the UCSF medical centre in California, such a system is already in place, and it is working wonders in terms of increasing efficiencies all around. Possibly the greatest benefit is the elimination of wrong dosage, wrong medication, and other errors largely contingent on human mistakes. Hospital pharmacies used to be centralized, but the model is increasingly opening up.

Larger hospitals have hundreds of beds and numerous divisions, and all the complexity basically means it can be difficult to keep track of medication's flow from pharmacy to patient. Automated systems mean such tracking can be made vastly more efficient. One problem, at least at this point, is that smaller hospitals do not have the capital at hand that's necessary to account for the high upfront costs of installing such automated systems. However, there is a general shift toward that, which means costs will be going down in time.

4. Review of Literature

(Simborg & Derewicz 1975, p. 342)The automated drug distribution systems (ADDS) in use today – such as those manufactured by Omnicell, Inc. and Pyxis, Inc. – are predicated on a transformation in drug distribution originating in the United States in the early 1960's known as unit-of-use packages, or unit-dose systems. These systems replaced a previous approach to drug distribution known as multiple-dose drug distribution systems (multidose systems). Multidose systems meant nurses had full responsibility for the entire medication system, which involved administering hundreds of doses of medicine along with paper-work, inventory control and dose preparation. Unit-dose systems on the other hand, provide nurses with individually packaged and labeled doses at eight or more hour intervals and are ready to administer according to the administration schedule determined by the nurse.

(Hynniman, Conrad, Urch, Rudnick, & Parker, 1970; Riley, Derewicz, & Lamy, 1973; Shultz, White, & Latiolais, 1973) Gaining widespread popularity, unit-dose systems substantially reduced the dramatic occurrence of errors, medication waste and the inappropriate use of nursing time.

Building on this success, Johns Hopkins Hospital introduced an automated feature into the unit-dose system making the entire process, from physician prescription entry to hourly dose administration, computer-assisted. As technology has evolved, the pharmacy automation trend that began in the late 1960s has continued, and been marked by the proliferation of automated drug dispensing systems into hospitals and healthcare systems such as the Vancouver Coastal Health Authority's Vancouver General Hospital.

The internet has been widely adopted for business and social communications. In future, as internet use becomes universal, there may be an increase in the number of internet pharmacies, and use of the internet to display and disseminate information on medicines and health from pharmacies.

Currently, secure web-based platforms are available from various providers to support enhanced pharmacy services and public health initiatives. The use of these will increase and also web platforms will be used as a communication portal to make information available to pharmacists from other care settings.

5. Objectives

1. To study the recent trends of Robotic Pharmacy in the community.
2. To understand the benefits observed by the proper usage of the Robotic Pharmacy.
3. To assess the impact of robotic dispensing machines in community pharmacies to the Patents.

6. Research Questions

- What are the recent trends observed during the usage of robotic pharmacy?
- Describe the various advantages seen during the usage of Robotic Pharmacy?
- What is the behavior/ feedback of the patients or the customer who comes under the usage of the robotic pharmacy?

7. Methodology

7.1. Research Design

Research design specifies the methods and procedures for conducting a particular study. A research design is the arrangement of conditions for collection and analysis of the data in a manner that aims to combine relevance to the research purpose with economy in procedure. Research design is broadly classified into three types as:

1) Exploratory Research Design
2) Descriptive Research Design
3) Causal Research Design

I have chosen the Exploratory research design.

Exploratory Research Design

Exploratory research study is also termed as formative research studies. The main purpose of such study is that of formulating a problem for more precise investigation or of developing a working hypothesis from an operational point of view. The major emphasis of such studies is of the developing of discovery of idea and insight.

7.2 Sample Design

A Sample Design is a definite plan for obtaining a sample from a given population. It refers to the technique to the procedure adopted in selecting items for the sampling designs are as below:

My sample size was 50 Patients for primary data collection

7.3 Sampling Method

- Non-probability sampling method : Convience Sampling.

7.4 Sample Technique

- Tabulation
- Graphical
- Percentage analysis

7.5Data Collection

For this study I have chosen Primary and secondary Data.

7.5.1Primary Data Collection

Focusing the objective of the study, a survey was done with the help of a structured questionnaire to collect data about Patient feedback regarding pharamacy. The structured questionnaire was designed to collect information.

Apart from the organised interviews, pharmacists, pharmacy store keepers/store officers/store superintendents will also consult for the study.

7.5.2Secondary Data Collection

The collection of data process will be conducted utilising all the available resources, including, official communications like orders, circulars and notifications, published literature both in scientific and non-scientific publications like news papers, journals, magazines etc.

8. Data interpretation

Time used for a Prescription

Data for several variables were collected from Medeor pharmacy. The mean times for the other variables are listed in Table 2

Variable	Mean
Time to enter new prescription	113 seconds
Time to enter refill prescription	92 seconds
Time to fill prescription	123 seconds
Time for prescription processing	316 seconds (5 minutes and 26 seconds)
Counseling Time (for new prescriptions)	50 seconds
Time prescriptions spend in the queue	734 seconds (12 minutes and 23 seconds)

Table 2: Mean Time for Variables Used to Generate Pharmacy Simulation Variable Mean

It is important to note that the time to enter prescription includes the time necessary to submit prescriptions electronically. Although some prescriptions can be entered at a faster rate than the average, some prescriptions require time to change insurance information, change personal data, resubmit due to modem problems, etc. However, the average time presented here does not take into consideration third-party problems (e.g., drug not on formulary, invalid birthday) and prescribing problems (e.g., need refill authorization, missing information on prescription) that must be corrected to continue entering the prescription. It was estimated that 10% of prescriptions filled in the Medeor pharmacy have some problem that needs to be resolved, taking an average of 90 seconds to resolve.

The average time the prescription was in the queue (i.e., waiting to be inputted into the computer) was over 13 minutes. This time represents the average time for all

prescriptions, including the refills called in during the morning but not filled until later in the day. For clients who dropped off their prescription and waited for it, the average time in the queue was 1 minute and 32 seconds. For clients who were not waiting, the time in the queue was over 30 minutes.

The time for prescription processing includes the total time; from time of computer entry to time of final check. This average time includes all prescriptions, with or without problems. In the model pharmacy, each client with a new prescription was counseled. The pharmacist spent approximately 50 seconds counseling on a new prescription.

The staffing level consisted of one pharmacist, one or two technicians, and one clerk in the prescription area. There were two computer terminals and one cash register. In this pharmacy, the pharmacist was the primary prescription order-entry person. When the pharmacist was being utilized, the technician would enter the prescription. The computer simulation was modeled so that both the pharmacist and technician enter orders, with the pharmacist being primary and the technician being secondary. However, based on state law, having the technician enter prescriptions and perform more duties should be considered.

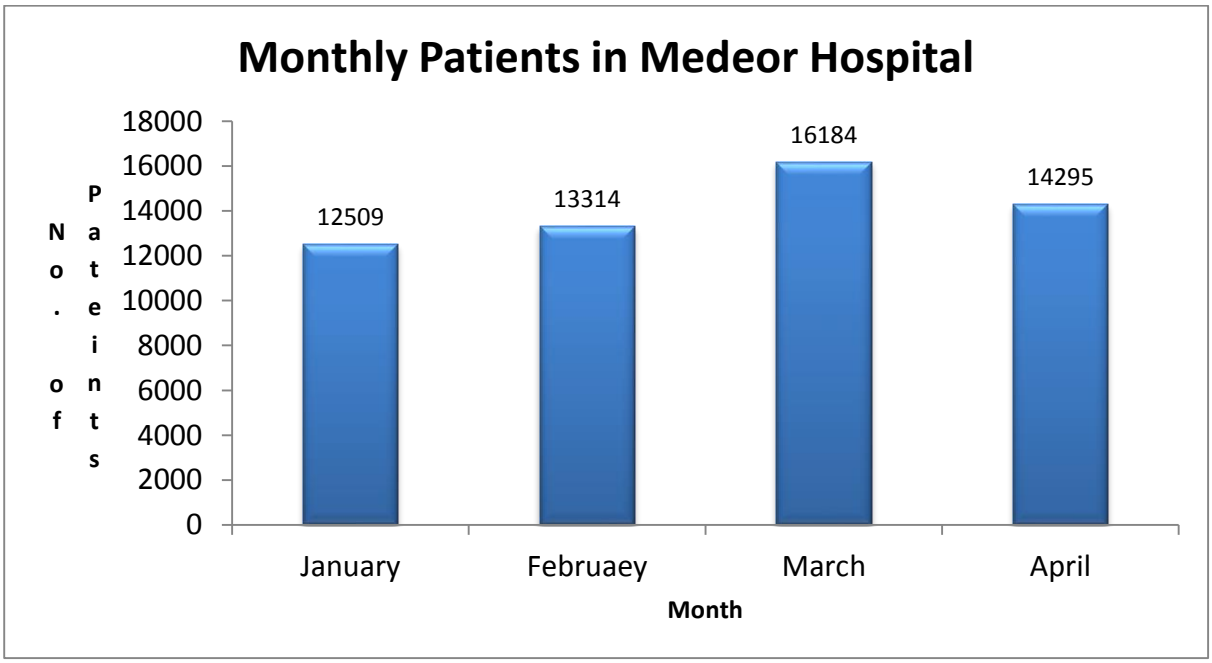

Fig 5: Monthly Patients in Medeor Hospital

From this graph in Medeor hospital average per day patient 470.

A survey was done with the help of a structured questionnaire to collect data about the Patient's Satisfaction towards Robotic Pharmacy . The structured questionnaire was designed to collect information.

8.1 Utilization of Time Management

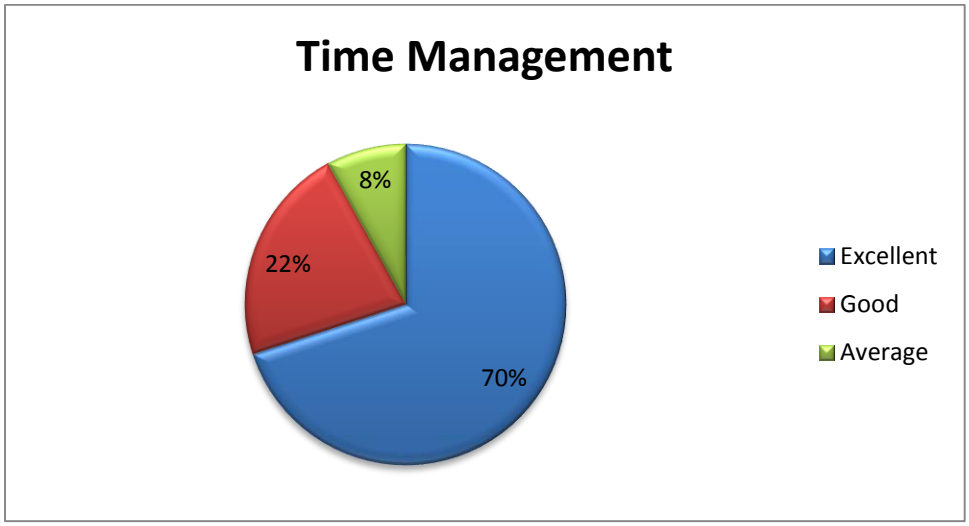

Fig 6: Time management

8.2 Suitability / Convenience towards the pharmacy location

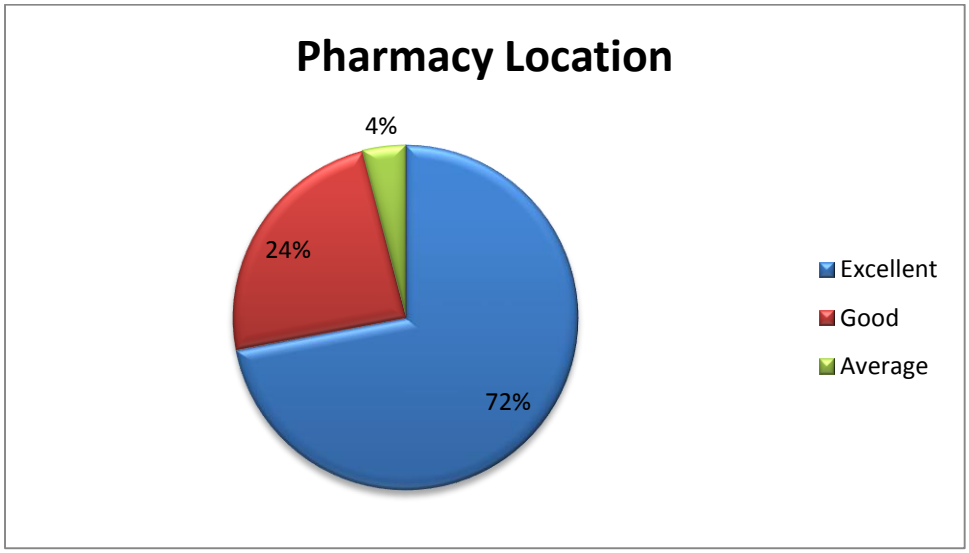

Fig 7: Convenience towards pharmacy location

8.3 Possibilities of error seen

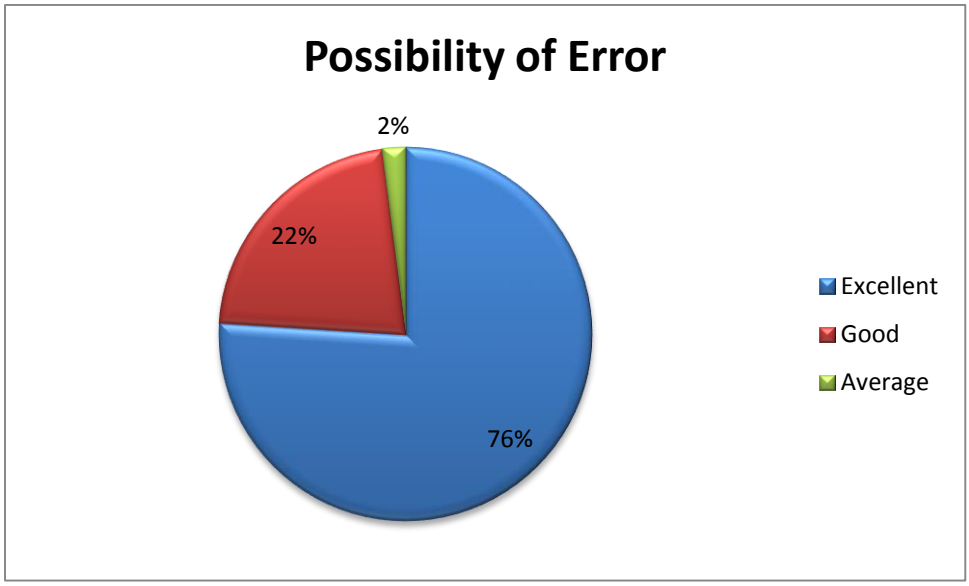

Fig 8: Possibilities of error seen

8.4 Satisfaction of the prescription report

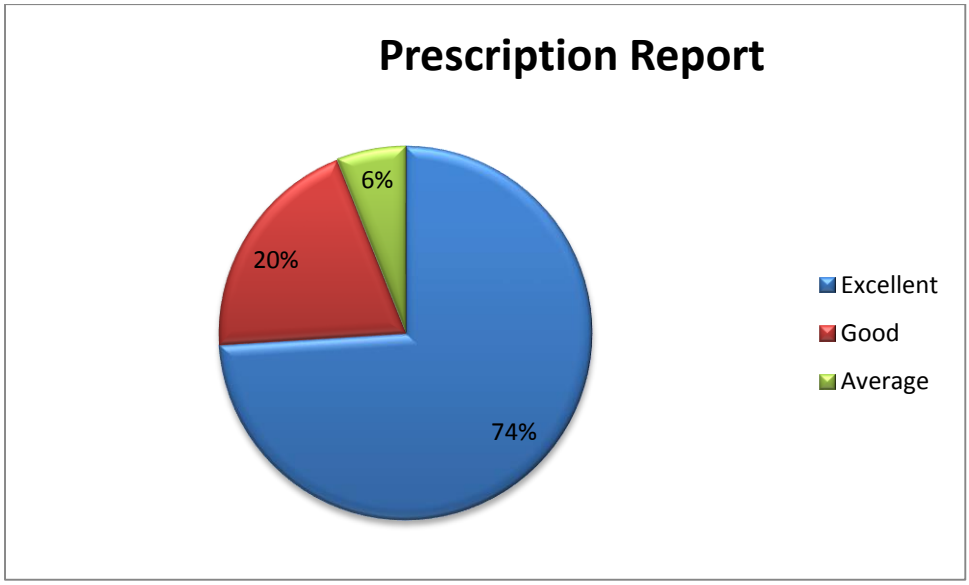

Fig 9 : Satisfaction of the prescription report

8.5 Overall Contentment/gratification

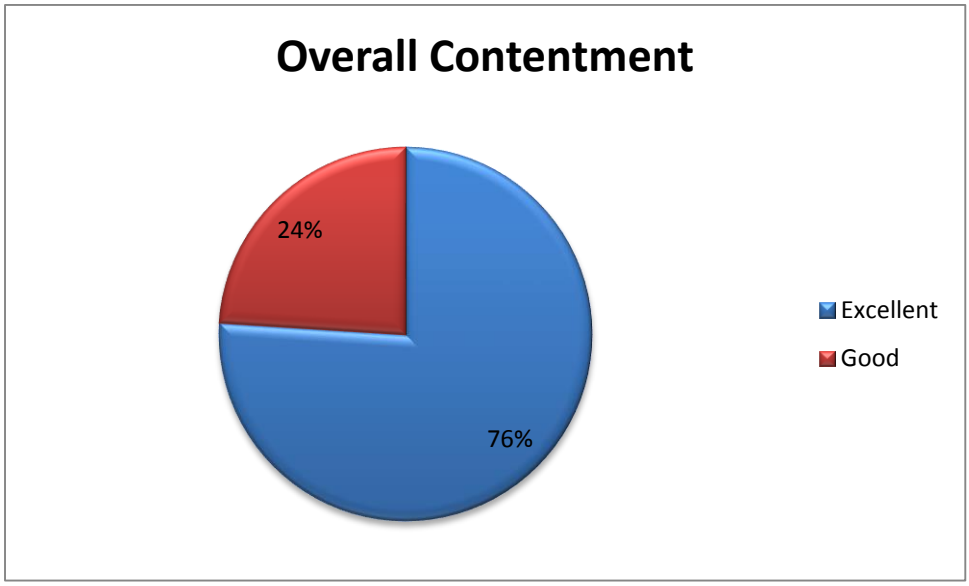

Fig 10: Overall Contentment/gratification

9. Recommendations

Each pharmacist must assess what his/her purpose is for adopting the use of automated dispensing technologies. Understanding the purpose will provide further insight into what type of technology is needed for a particular pharmacy. Furthermore, cost must be considered. The robot-type technology is of greater value when prescription volumes are greater than 400.

On average, robotic dispensing machines lead to modest savings in personnel costs and slight increases in sales of over-the-counter drugs. Substantial savings can be achieved only if the staffing level is adapted to the changed personnel requirements.

Robotic dispensing machines have advantages over the conventional storage system.

The savings in personnel costs after installation are rather modest, as is the increased sales volume in the OTC sector. The saving occurs only if the staffing level is adapted to the changed staffing needs. Reducing the staffing level by one pharmaceutical technical assistant appears to completely cover the annual costs of the robotic dispensing machine.

10.Conclusion

A range of systems and technologies is available to support the medicines supply and use processes. However, pharmacists will need to ensure that they harness technologies in a way that will support their professional aspirations and that they are not bypassed in the IT initiatives.

The pharmacy computer simulation is a useful model to study the impact of automation on prescription dispensing. The results of the study substantiate the claim that automation improves productivity and decreases utilization of pharmacist/technician time in the prescription dispensing process. However, an adequate staff of pharmacists and technicians is needed to wait on customers, enter and check prescriptions, and counsel patients. The three dispensing technologies included in this study do not improve all areas of service delivery.

As prescription volumes increased, it became more evident that automated dispensing is beneficial. The model was able to demonstrate that automated dispensing technologies could free up technician time, which indirectly frees up pharmacist time. This time could then be spent on other activities, besides dispensing. The automation improves service rates and was able to replace staff or prevent the hiring of additional staff.

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