"Significance of

Utilizing Unit Dose Medication System:

Perception of Various Stakeholders"

A dissertation submitted in partial fulfillment of the requirements

For the award of

Post-Graduate Diploma in Health and Hospital Management

By

Preeti Upadhyay

Roll No. PG\10\092

International Institute of Health Management Research

New Delhi- 110075

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Finally, an honorable mention goes to my family and friends for their understanding and support on me in completing this project.

Thank you
Preeti Upadhyay
PGDHHM
IIHMR, New Delhi

Certificate of Internship Completion

Date:……..

TO WHOM IT MAY CONCERN

This is to certify that **Ms. Preeti Upadhyay** has successfully completed her 3 months internship in our organization from January 02, 2012 to March 30, 2012. During this intern she has worked on **"Significance of Utilizing Unit Dose Medication System: Perception of Various Stakeholders"** under the guidance of me and my team at **Dell Services, Noida**.

We wish her good luck for her future assignments.

(Signature)

Sahil Maken

Business Systems Sr. Analyst

Dell Services

Certificate of Approval

The following dissertation titled **"Significance of Utilizing Unit Dose Medication System: Perception of Various Stakeholders"** is hereby approved as a certified study in management carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite for the award of **Post- Graduate Diploma in Health and Hospital Management** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation.

Name	Signature
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Certificate from Dissertation Advisory Committee

This is to certify that **Ms. Preeti Upadhyay** a graduate student of the **Post- Graduate Diploma in Health and Hospital Management** has worked under our guidance and supervision. She is submitting this dissertation titled **"Significance of Utilizing Unit Dose Medication System: Perception of Various Stakeholders"** in partial fulfillment of the requirements for the award of the **Post- Graduate Diploma in Health and Hospital Management**.

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

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ABSTRACT

"Significance of Utilizing Unit Dose Medication System: Perception of Various Stakeholders"

The traditional system of drug distribution in hospitals has identified as a system which possess some shortcomings with reference of medication errors, inventory losses, large amount of time to be spent by nurses on medication-related activities, drugs to be prescribed by physician for more than one day which obviously resulted in high drug returns. These limitations, singly or in combination, have been demonstrated to be responsible for increase in healthcare cost as a result of prolonging of patient stay in hospital and also affect quality of patients' care.

The features of unit dose drug distribution system have made it possible for pharmacy department to keep control over the drugs usage in hospital and consequently reduce the problems linked with traditional drug distribution system. Implementing an appropriate dispensing system has become an essential need for hospitals, which has recognized by other developed and developing countries. For Indian healthcare market, this is only a beginning to switch from their conventional method to a new dispensing method. The study aimed to assess perception of nurses and pharmacists about Unit Dose Drug Distribution System which is implemented in Super specialty Hospital, Delhi. The quantitative, comparative cross-sectional design of study utilized questionnaires for evaluating perception of nurses and pharmacists. Also an observation approach used to capture changes in work flow of dispensing process. Nurses and pharmacists have identified the system beneficial in context of quality of care, drug inventory management, medication error, and drug returns from IPD. Apart from benefits perceived by end users, they also identified few limitations such increased workload and dispensing time for pharmacists and increased receiving time for nurses. Overall, nurses have perceived the system more positively than pharmacists. The unit dose drug distribution system appeared to be safer, with fewer medication errors and accepted by the users.

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Abbreviations

CPOE	Computerized Physician Order Entry
DEO	Data Entry Operator
GDA	General Duty Assistant
HIMSS	Healthcare Information and Management Systems Society
IPD	Inpatient Department
IT	Information Technology
OT	Operation Theatre
SPSS	Statistical Package of Social Sciences
SSN	Secure Subscriber Number
UDDDS	Unit Dose Drug distribution System
USFDA	United State Food and Drug Administration

Part I: Internship Report

(Jan 2nd 2012 – Mar 30th2012)

1.1 Organizational overview:

Dell Services is an information technology services provider based in Plano, Texas, USA. Peter Altabef has served as president and chief executive officer since 2004. For more than 26 years, Dell has empowered countries, communities, customers and people everywhere to use technology to realize their dreams. Customers trust it to deliver technology solutions that help them do and achieve more, whether they're at home, work, school or anywhere in their world.

On September 21, 2009, Perot Systems agreed to be acquired by Dell for $3.9 billion. The acquisition resulted in a compelling combination of two iconic information-technology brands. H. Ross Perot and eight associates founded Perot Systems in June 1988 after having sold Electronic Data System (EDS) to General Motors. Before its acquisition by Dell Inc., Perot Systems was a Fortune 1000 corporation with more than 23,000 associates and 2008 revenues of $2.8 billion. Perot Systems maintains offices in more than 25 countries around the world, including the United States, Europe, India, China and Mexico

As a top-five finisher for the third consecutive year, Perot Systems was named to the Fortune magazine "Most Admired Companies in America" list for IT Services in 2008. Dell Services is the No. 1 healthcare information technology services provider in the world according to the latest IT services worldwide market share report by Gartner, Inc. The report also ranks Dell second for computer hardware support in the Education market.

The expanded Dell is better positioned for immediate and long-term growth and efficiency driven by:--

- Providing a broader range of IT services and solutions and optimizing how they're delivered

- Extending the reach of Perot Systems' capabilities, including in the most dynamic customer segments, around the world
- Supplying leading Dell computer systems to even more Perot Systems customers.

It provides a portfolio of services to help hospitals identify and take advantage of EHR through the implementation of EHR.

Healthcare delivery and administration continues to become more complex. Uncompensated care is on the rise, demographics are changing, and patients are demanding more for their healthcare dollars. All the while, there continues to be a shortage of healthcare professionals to address the ever-demanding needs of consumers and patients.

To meet these challenges, Dell Perot Systems provides the right combination of clinical and business process improvements, coupled with technology to help hospitals and health systems achieve an environment that is interconnected, streamlined, efficient, and patient-focused. Its vision for the healthcare industry is simple: It wants healthy people to successfully interact with a safe, efficient, and consumer-friendly healthcare system.

Their team of physicians, nurses, and clinicians, as well as healthcare consultants and technologists are experienced in end-to-end hospital operations and understand how to develop, design and implement processes and technologies that bring about real provider transformation. They apply their extensive experience and expertise for:

- Clinical Transformation - Healthcare providers today are facing the challenges of increasing the quality of care delivery and enhancing services while reducing costs. By implementing advanced clinical systems combined with care transformation programs, organizations are finding ways to fund new change initiatives while improving quality. Dell Perot Systems joins with the staff to improve care delivery processes and achieve measurable results.

- Information Technology Solutions — Operational performance can be improved only when information technology is planned, designed and implemented to support an

efficient way of doing things. Dell Perot Systems can help improve the productivity and quality of your services, as well as enhance the usefulness of clinical, HR, patient accounting, and administrative applications. Their global technology capabilities and Solution Centers deliver concentrated expertise for Cerner, McKesson, Meditech, Lawson, and Siemens solutions to name a few. Implementing, integrating, and supporting the right infrastructure automates clinical and administrative processes and in turn enhances the quality of care delivery

- Revenue Cycle Solutions — Whether the organization is financially distressed, has limited access to capital, high volumes of low-yielding accounts, or simply wants to improve the overall performance of their revenue cycle, Dell Perot Systems has the expertise and solutions that improve all revenue cycle metrics, with the realization that increasing cash is key because it provides the financial resources that allow for improving patient care.

It delivers the best healthcare possible. Whether it is a hospital, health system, or physician practice providing care, a health plan paying for care, or an integral part of the healthcare supply chain, delivering the best healthcare possible requires being responsive, efficient, accurate, and innovative in a constantly changing industry.

Every day around the globe, its mission is to provide the full spectrum of infrastructure, application, and business process solutions that are the best service possible. By leveraging its extensive expertise, they are able to provide the organizations with creative, integrated, and innovative solutions that best meet their tactical and strategic objectives. For 20 years, other organizations have put their trust in Dell Perot Systems to deliver solutions that improve the business of health so they can transform care.

1.2 Learning:

The internship period was from 2nd January 2012 to 30th March 2012. During this internship period worked as an intern in VistA Project.

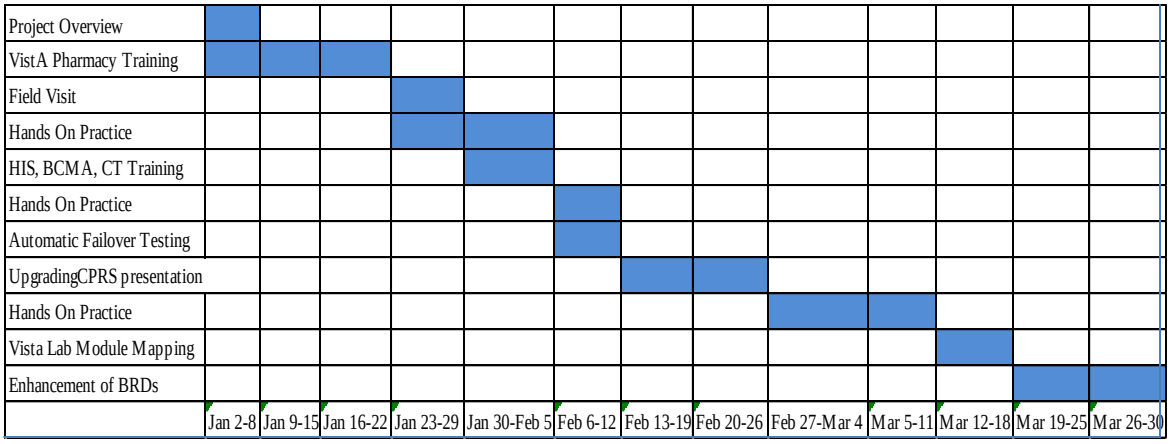


Figure 1: Gantt chart showing work done during Internship period

Internship Report

The internship period was from 02nd January 2012 to 30th March 2012. During this internship period worked as an intern in VistA Project. Received training on various modules of VistA and also Hospital Information Systems (HIS). The training was for a period of forty five days which was then followed by Hands on Practice sessions.

VistA Project overview

The Veterans Health Information Systems and Technology Architecture (VistA) is an enterprise-wide information system built around an electronic health record, used throughout the United States Department of Veterans Affairs (VA) medical system, known as the Veterans Health Administration (VHA).VistA, is an integrated system of software applications that directly supports patient care. By 2008, the VHA was the largest single medical system in the United States, providing care to 5 million veterans, employing 180,000 medical personnel and operating in 163 hospitals, over 800 clinics and 135 nursing homes. By providing electronic health records capability, VistA is thereby one of the most widely used EHR in the world.

The VistA system is a public domain software, available through the Freedom of Information Act directly from the VA website, or through a growing network of distributors. The VistA software alliance is a non-profit trade organization that promotes the widespread adoption of

versions of VistA for a variety of provider environments. VistA is a collection of about 100 integrated software modules. Name of few modules of VistA are mentioned below.

- CPRS – Computerized Patient Record System
- BCMA – Bar Coded Medication Administration Module
- Pharmacy Module
- Lab Module
- Diet Module
- Radiology Module

Initially received training on VistA Pharmacy module which included front end and back end operations. The front end operations included the verification of the orders prescribed by physicians from VistA CPRS. Verification process for inpatient, outpatient, and emergency drug orders were taught. The back end operations included drug build up, mapping of the drugs & wards etc.

After the training on VistA Pharmacy module, the ordering/ indenting process for the drugs which has reached reorder level and also general pharmacy work processes were taught. The entire VistA Pharmacy module training was for a period of 3 weeks which was followed by 4 days of hands on practice session.

At the end of first month, a field visit to the Customer site was organized to give an exact idea about the work processes and also the optimum space utilization in the department. This field visit gave the idea about the work process before Go Live. A mini knowledge assessment test was conducted by the Pharmacy Subject Matter Expert (SME).

After the training on Pharmacy process and VistA Pharmacy module, training on other modules like BCMA Module (Bar Coded Medication Administration), HIS(Hospital Information System), CPRS (Computerized Patients Record System), Diet and Laboratory module etc was given. This was followed by training on Clinical Transformation and Down Time policies.

BCMA training gave an overview about how the nurse will administer drug to the patient with Bar Code Scanner at patient bed side. The training session demonstrated most of the

possible scenarios which a nurse can face while administering drug to the patient. HIS training gave entire idea about the features & functionalities present in it.

CPRS training gave idea about how the Physician works on the system. It explained how a physician enters chief complaint, allergies, examination details, places medication, lab, radiology, Admission, Discharge & Transfer orders etc. This training also included how nurses enter Assessment details, vitals and other details into the system.

After the training was completed on various modules explained above, one week of time was given for exploring and practicing on the same. This helped to understand more about the modules and the functionalities & features present in it. This Hands on training sessions gave an in depth knowledge about the various features and also to understand more about the application.

All the training sessions were very interactive which gave a chance to critically analyze various scenarios and ask questions to the trainers. Discussions during training sessions helped to actively participate during the training sessions which helped to increase interest on VistA.

Knowledge assessment tests were conducted at the end of the training session and feedback was given on it. Feedback about the training sessions was taken after the training sessions were completed.

Support Team Operations

After implementation of VistA at the Customer site, it is important to keep it alive. It takes time to stabilize an application in any organization. It's the same with EHR. EHR deployment requires routine care and maintenance. There are numerous tasks that need to be undertaken on daily or weekly basis. Integrating EHR into an organization after a successful launch presents its own unique challenges. Continuing to ensure system integrity, organization compliance and overall usability decides the eventual outcome of this huge investment. Eventually Success or failure largely depends on the amount of support an organization provides.

During Internship it was observed, how the support team provides support to the customer's end users. Support team quickly resolves the incidents affecting the Customers' business. For this project a tool called OPAS is used.

The following types of support were observed:

1st line support : Project executes Service Desk function.

2nd line support : Project receives Tickets (Incident or Requests) from the Service Desk and works on the Tickets or, if needed, sends them to 3rd line support, which in this case can be the customer or another supplier.

3rd line support : Team gets involved only if specialist application knowledge is required. This is often done when the case requires changes in coding.

Automatic Failover testing

Automatic failover is automatic switching to a redundant or standby computer server, system, or network upon the failure or abnormal termination of the previously active application, server, system, or network. Failover and switchover are essentially the same operation. The mild difference is that failover is automatic and usually operates without warning, while switchover requires human intervention.

Systems designers usually provide failover capability in servers, systems or networks requiring continuous availability and a high degree of reliability.

As VistA Project team member was involved in Automatic failover testing to check whether failover is working in the right way.

Upgrading CPRS training material presentation

After 45 days of Internship which included rigorous training on various VistA modules, task was assigned to upgrade training materials of VistA CPRS module. This task was really challenging as the objective was to add animations to the existing presentation and also to

use new screen shots of the CPRS application wherever required. The old CPRS presentations were prepared on the basis of US scenarios. For this upgrading work new screen shots were taken and new presentations were made to demonstrate step by step process which user has to follow. Animations were added to the presentations to make presentation user friendly. For doing this MS Power Point was used.

Enhancement of BRDs

After receiving training on various modules of VistA, a task was assigned for making enhancement in the existing business requirement documents (BRD). If customer wants any alteration in existing process, vendor has to present an enhancement of business requirement document to the customer for their approval. BRD contains details of existing process, changes in process and its effects. I was involved in making BRD enhancement of pharmacy module.

1.3 Project work plan:

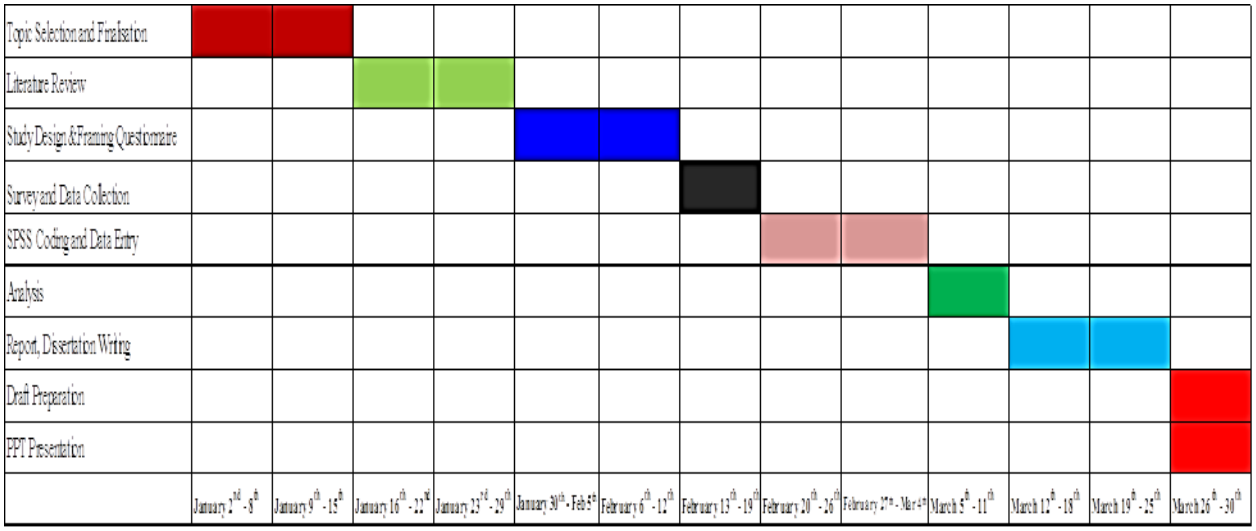


Figure 2: Gant chart showing work done during dissertation

Besides getting training on various modules of VistA, the dissertation project was also done. The dissertation topic was selected based on the topic which will benefit the organization and its customer. The topic was selected after doing complete research on ongoing project of the organization. The selected topic was approved by the mentor in the organization & Institute. When the final approval was received from the Institute, an in depth literature review was

done on similar topics and also topics related to the objectives of the study. This literature review gave an idea about the real need of the study, what studies has been conducted on it till now etc. Based on various literature reviews questionnaire was framed.

Once the questionnaire was approved by the mentors, survey was conducted in hospital. Physicians and Nurses were interviewed and responses were collected in the pre designed questionnaire. This survey continued for five days.

The responses received from the survey were then entered into SPSS for analysis. Then the analysis was done and documented in the reports. All the other requisites were added in the report and the draft of report was made. After that print out was taken. Then finally the presentation was made from that draft of report.

II. Dissertation overview

1. Introduction

1.1 Background:

Healthcare providers play an important role in establishing the better health status of the population. In terms of modern healthcare delivery, it needs involvement of multidisciplinary expertise for achieving the ultimate goal of better health care. Pharmacy is that health profession which links clinician with the patients by providing safe & effective medication care. Hence it is identified as one of the major healthcare providers & its importance has recognized in many developed countries, but still it is needed to be recognized in developing countries. Pharmacists' professional roles and responsibilities have evolved historically from a focus on medication compounding and dispensing to extended pharmaceutical care services.[1] 'Pharmaceutical Care Services' term has given by Hepler and Strand in 1990, which has brought a significant shift in pharmacy practice.[2] Pharmaceutical care concept has transformed the pharmacy profession from only dispensing and compounding drugs to involve in patient care, especially to ensure that a patient achieves positive outcomes of drugs. In many parts of the world, pharmacists have played a significant role in provision of pharmaceutical care services. In addition, it is also widely believed that pharmacists can make a great contribution to the provision of the primary health care, especially in developing countries. [3, 4] The scope of hospital pharmacy practice has expanded over the past several decades beyond drug-product-oriented tasks to include patient-oriented clinical pharmacy services, investigational drug research, and pharmacist services in the emergency department. However, in most countries, pharmacists still devote considerable time to the dispensing and preparation of medicines.

1.2 Drug Distribution system

The hospital pharmacy service is taking care of procurement; warehousing and issuing of medicines in healthcare facility. Apart this one of the primary responsibilities of the hospital pharmacy practitioners is to carry out 'Distribution Services' in the hospital to make the availability of right drug in right dose & form, at appropriate time to the patients. Although this sounds simple, but performing this task is relatively complex and involves considerable management. Distribution services are one important aspect of the comprehensive hospital pharmacy activities. Clinical pharmacy insures that what is delivered through distribution service is appropriate and distribution services ensure that clinical intent is delivered at appropriate site. The two services are inter-related and complementary and both are required to deliver the safe, effective and accountable use of medicine. This inter-relation is represented through Medicine Management Pathway.[5] (Figure 1).

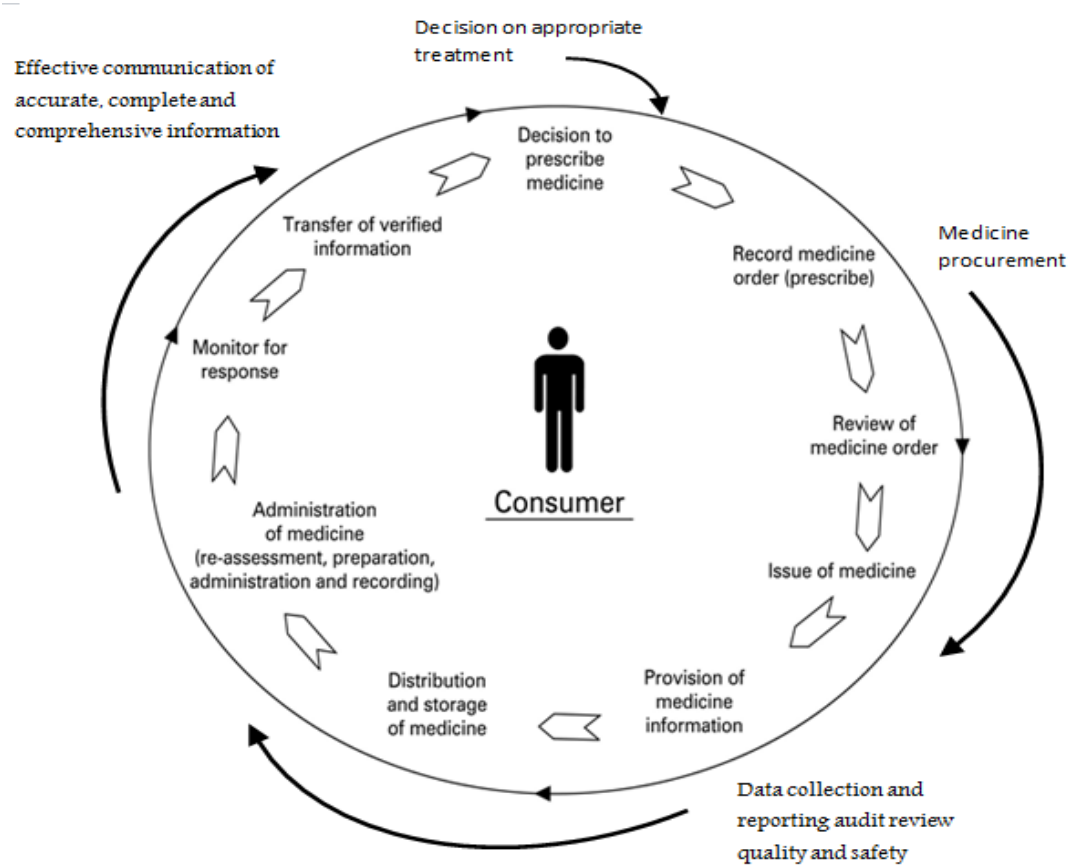


Figure 3: Medicines Management Pathway

Design of drug distribution system requires an in-depth examination of the activities which can affect the efficiency, cost and safety of the system. In any hospital, drug distribution system is one of the significant systems to carry out the routine processes involved in patient care. It includes those steps which occur between the prescriptions of a drug to administration of that drug.

An ideal drug distribution system should:

- ✓ Provide medicine in a timely manner to the patient as they are needed.
- ✓ Carry the lowest medication error rate i.e. be the safest system.
- ✓ Minimize the wastage.
- ✓ Minimize the cost of medicines throughout the facility.
- ✓ Identify unusual medicine usage pattern.

Various drug distribution systems are being used across the world but with the same goal: to ensure that each dose of each drug is administered to each patient exactly in the same dose which was intended by the prescriber.[6]

Four basic types of drug distribution systems:[7]

(i) Ward stock system

(ii) Individual medication order system

(iii) Combination of Individual prescription order system and complete floor stock system

(iv) Unit dose medication system

(a) Centralized unit dose system

(b) Decentralized unit dose system (Automated medication dispensing)

All four systems can be used in same facility depending upon the strategy developed. Each system has its own benefits and shortcomings, so combination of all can give an almost

perfect drug distribution system. For example a facility can use a ward stock system for low cost and frequently used drugs like paracetamol, antacids that do not require high drug control for preventing theft and medication errors. For expensive drugs which require high level of control can be distributed by individual medication order system or unit dose medication system. Additional automated medication dispensing has emerged as a new system which is currently using in developed country and will become more common in future.

(i) Ward stock system

In a ward stock system, a nurse maintains the drug stock and responsible for administering and recording the drug usage. Pharmacy works only for warehousing and dispensing the bulk drugs to nursing station on the request without reviewing the individual prescription. The main advantage is the shorter turnaround time between prescribing and administering the medication. But there are more chances of committing medication error because nurses do not have much knowledge about drugs and can administer wrong substitution in case of absence of prescribed medication. The use of ward stock medication should be minimized but it is useful and desirable in some situations like-

- In emergency department and operating room, the medication is required immediately after it is prescribed by physician. Unfortunately the medications used in these scenario are often expensive, thus control from pharmacy side is always a challenge.
- In life-threatening emergency condition, medications need to be kept in patient care area, so that there should be no delay in saving patient's life.
- High-volume and low-cost medicines can be dispensed from ward stock if the patient safety risk is low.

(ii) Individual medication system:

The individual medication system resembles the dispensing to outpatient: a course of therapy is dispensed according to the written prescription to an individual inpatient. This system is generally used by the small and/or private hospital because of the reduced manpower requirement and the desirability for individualized service. Compared to the ward stock

system the advantage of that system is pharmacist can review the appropriateness of the therapy, a separate patient profile for each inpatient can be maintained, and closer control of inventory is possible. The limitation of the system is only high turnaround time.

(iii) Combination of Individual prescription order system and complete floor stock system

This is the most common method of medication distribution. In this system most drugs are dispensed on an individual pre-scription basis. The remaining drugs are obtained via limited floor stock. Included in the drugs found on floor stock are those that are frequently used, and comprise analgesic controlled substances, non-prescription medi-cation like Paracetamol, pre-operative anesthetic agents, and others not suited for individual prescription orders. Falling into this category are those hospitals which use the individual prescription or medication order system as their primary means of dispensing, but also utilize a limited floor stock. This combination system is probably the most commonly used in hospitals today and is modified to include the use of unit dose medications.

(iv) Unit dose medication system:

A preferred system from a patient care perspective, since fewer chances of medication errors. Medication is dispensed in unit dose packages i.e. separate package for each medicine and in separate drawer for individual patient. Each package is labeled with the name of medication, batch number, and expiry date and along with another label which contains patient's information like name of patient, ward, room number, bed number. Commonly, a 24 hours supply is provided. Returned medication can be put back in stock and reused without concern for identity and contamination. The system is also efficient and beneficial for a facility but requires a large initial capital outlay for purchasing repackaging machine and med cart for keeping separate medication for patient. But this increased cost can be compensating by reducing drug wastage.

(a) Centralized Unit Dose dispensing:

Centralized unit dose drug distribution system is more common than decentralized system in many countries. A single inpatient pharmacy is responsible for dispensing all

ordered medicines to every ward. Every physician's orders are received in the central pharmacy and dispensed from the same for each ward. A central pharmacy personnel receives orders direct from physician and record it manually or electronically. Nurses need not to be preparing medications, because well prepared and labeled drugs sent to the nursing stations for administration to patients.

(b) Automated medication dispensing:

Technology has always improved the existing system. In drug distribution system, again technology proved its significance by improving medication dispensing and lower error that can lead to adverse drug reaction. Each ward contains a dispensing machine by which nursing personnel can receive her patient's medicine at the point of use. The use of automated drug dispensing become a common method in many countries but still a high cost is remained a big hindrance for implementation of the system. The mechanism is founded on a computer interface between hospital pharmacy computer terminals and dispensing machines at clinical ward. This system electronically controls and tracks the dispensing of unit dose for each patient.

Table 1: comparison matrix for different pharmaceutical dispensing system

Factor	Ward Stock system	Individual medication system	Unit dose system	Automated drug dispensing
Material and supply cost	Low	Medium-low	High	Very high
Pharmacy Labor costs	Low	Medium	High	High
Nursing labor cost	Medium-low	Medium-Low	Low	Low
Pilferage risk	High	Medium	Low	Very low
Medication error risk	High	Medium-low	Low	Low

1.3 Problem statement

The traditional drug distribution system does not adequately provide necessary drug use control. The nurse has full responsibility for entire medication system, which involve administering hundreds of doses of medicine along with paper-work, inventory control and dose preparation. Thus half of their time is spent in performing those tasks which are not specifically related to patient care. This leads to committing errors in their routine work specifically to the administration of drugs which sometimes can be fatal for the patient. Apart from it they have to engage in returning the unused medication of patient, which consumes significant time of both nurses and pharmacists. Sometimes this results in inaccurate billing and increasing waiting time of discharged patient. Unused medicines are returned back to pharmacy and cannot be reused if they are in unidentifiable form, which leads to drug waste. The drug wastage is one of the significant ways of revenue loss. A system which addresses and eliminates all the above problems is needed, which can fill all the gaps present in existing system. Nurses need a simplified distribution system which provides them medication in ready to administer form, and require less manipulation effort for prepare final dose. Pharmacists need a system in which they can be better utilize as a resource person regarding drug therapy instead of just issue the medication to the wards.

1.4 Scope of study:

The study comprises of benefits & barriers of using unit dose medication system from different user perspective. By implementing a new system each and every user gets affected from the changes in regular workflows and processes. Utilization of unit dose drug distribution system makes tremendous changes in work process of pharmacists, inventory managers, physicians and nurses. The study mainly covers perception of pharmacists and nurses towards the new drug distribution system because they are more involved with the usage of medications, whether it is dispensing or administration. The study also covers barriers that were felt by the end users during implementation and difficulties in using the unit dose medication system.

1.5 Need of the study:

Unit dose medication system is very common in developed countries since a long time. Besides providing better patient care, it is economical, efficient and very effective method for making optimum utilization of professional resources. Despite knowing this fact, very fewer studies have been conducted on this concept. Also very rare attempt has been made to rise & make the concerned people aware about its benefits. It is high time to understand the needs of healthcare facility and improve their quality of services by implementing such system. Thus, this study will highlight the benefits and explain its application in a Super Specialty Hospital in the Indian scenario. Moreover, we are very well aware of the fact that this concept is being implemented for the very first time in the Indian Healthcare setting. So, this study will also highlight the barriers which can be taken care of and resolved to prevent its occurrence in future. This will help in the success of further implementation of such concept in the future.

2. Review of literature

Unit dose system of drug distribution is not a new concept as far as developed countries are concerned. It was started in 1960's in USA to reduce the work load of nurses and better utilization of pharmacists. Now, unit dose dispensing method has become a standard practice in hospitals of United States. In a 1994 survey of pharmacy directors, it was reported that 92% of the acute care hospitals in US were using unit dose dispensing.[8] It is a system in which medications are dispensed to wards for administration to a specific patient, in a specific dose, at a specific time, on a regular basis. In this system, each dose is individually prepared, packaged, and labeled.[9] The final packaged drug contains all the necessary information like trade name, generic name, lot number, expiry date which is visible on the label.[10 11] In other words a unit dose medication system is defined as any physical quantity prescribed by the physician to be administered to the patient at one time and not require much physical or chemical alteration before being administered.[12] A unit dose system is therefore, "a system which uses pre-calculated, prepared, pre-labeled, dose of medication in a ready to administer form for one patient and for one specific time of administration."[13]

It is the drug distribution system recommended by the American Society of Hospital Pharmacist.' Studies published from 1960 to 1990 showed that the UDDD system had overall medication errors rates from 1.7% to 42.0%, with 8.9% to 19.6% AE rates lower than the traditional drug distribution systems. In Thailand, the UDDD system has been the standard drug distribution system endorsed by the Hospital Accreditation (HA) program under the Ministry of Public Health and the Association of Hospital Pharmacy.[14]

2.1 History of Unit Dose Drug Distribution System:

The decentralized unit dose system was reported to be implemented at the Memorial Hospital in Long Beach in 1961,[15] then University General Hospital at the university of IOWA in 1964[16] and the University of Wisconsin Hospital in 1965.[17] The decentralized system utilizes satellite pharmacy or substation unit at patient care area of the hospital. Centralized pharmacy is one where all physicians' orders reach and dispense from the same location to the whole hospital. The first total centralized unit dose system was implemented at the University of Kentucky Medical Center in 1965.[18]

2.2 Need of UDDDS:

Traditional drug distribution system is still using in hospitals instead of having many limitations. Prescription is written on paper by physician and indent is sent to pharmacy by the nurses. Error can happen at any step from prescription writing to dispensing. A study tells about the distribution of medication errors at different stages, ordering (49%), transcription (11%), dispensing (26%), and administration (26%).[19] Ordering errors can be committed due to incomplete prescription, wrong drug name, wrong dose (mg, mcg etc), and unreadable handwriting.[20] Administration errors might be committed by nursing personnel due to some following reasons like, giving wrong medication of wrong dose to wrong patient at wrong time by wrong route. One of the studies has told that 'wrong time' error was frequently observed in that hospital followed by 'wrong dose' errors and 'wrong drug' errors. However 'wrong patient' and 'wrong route' errors were negligible.[21]

Some studies have shown tremendous improvements in medication errors after implementing unit dose medication system. In the comparison of the unit dose system at the University of Kentucky Medical with four hospitals operating traditional distribution systems Hynniman[22] reported an error rate of 3.5 percent in the unit dose system against a rate from 8.3 to 20.6 percent in the traditional systems. Similarly a study at the University of Arkansas Medical Center an error rate of 31.2 percent was observed during traditional system, which was reduced to 13.4 percent with implementation of unit dose distribution system .[23]

Limitations of tradition drug distribution system are:

- Large quantities of medicines required to be maintained at patient's location or at nursing station.
- Nurses spend almost their half time in performing the tasks which are not specifically related to patient's care.
- Expiration or deterioration of unnoticed drugs which are kept at nursing station can become a threat to patient safety as well as to the organization in terms of revenue loss.
- Risk of medication errors.
- Risk of more medication wastage.
- Risk in reduction of patient safety and quality of care.

Most developed countries have implemented unit dose drug distribution system, including Canada, Australia, New Zealand, and other countries in Europe and South America.[24] Unit dose system is commonly in general medication ward and intensive care unit, but is not using in OT and emergency wards. These locations require bulk medication stock, because patients' condition is generally critical in these wards and hence they cannot wait for getting the drugs from pharmacy. The shortcomings of tradition drug distribution system, if not overcome completely, can be improved by using of UDDDS.

The Unit dose drug distribution system helps in -

- Reducing nursing time spend in medication related activities.

- Reduction of medication error particularly administration error.
- Each individual unit is labeled with both generic and trade name, ensuring positive identification.
- Better utilization of nurses' and pharmacists' time[25, 21]
- The sealed package prevents contamination of the contents and reduces its degradation.
- Since the sealed package can be safely returned to stock even if it has been dropped on the floor, medication waste is virtually eliminated.
- More accurate patient billings for drugs.
- Improved overall drug control and drug use monitoring.[24]
- Reduction in revenue losses [25, 26]
- Better utilization of space.[25]
- Reduction in drug stock from patient's location.
- Reduction in dispensing time of pharmacist[27]

2.2.1 Dispensing time:

One study was conducted on Time saving associated with unit dose system, which included comparison of dispensing time between unit dose drug distribution system and bulk packaging. It was found that the time required for preparing the set of 50 prescription orders with unit dose packaging was 20 minutes average. Whereas average 42 minutes was required to prepare same set of 50 prescription orders by another team which was using bulk packaging. The time saved by UDDDS is more than 27 seconds per prescription. The reasons of less time needed for prepare prescription through unit dose medication system because it reduces the pharmacy workload by dispensing medicines directly to the patient without any modification except for the addition of prescription label.[27] Unit dose system can reduce pharmacy workload by eliminating some of the tedious dispensing tasks. Examples of these are, returning stock bottles to storage shelves, retrieving dispensing vials, and measuring dosage units.

2.2.2 Drug wastage:

Total drug expenses are correlated to mean drug usage within a hospital. When the drugs used in nursing unit and pharmacy drug inventory are compared to the actual cost of drugs administered to the patients or credited returned drugs, a factor known as "shrinkage" (pilferage, wastage and drug deterioration) becomes readily apparent. A study on University Hospital in Saskatoon revealed that a reduction in drug cost of about 36 percent due to decreased pilferage and wastage resulting from the use of unit dose packaging.[28] Increased pharmacy control in unit dose system has also affected drug wastage. At the western Carolina center, North Carolina showed the results that purchasing of diazepam tablets had reduced from 54,000 to 16,500 which represent potential cost savings of $1575.[29] Similarly, reduction in insulin purchasing from 80 to 90 percent had also noticed .[30]

2.2.3 Medication errors:

In hospitals, medication errors occur during every step of the medication administration process, but they occur most frequently during the prescribing and administering stages.[31] In fact, when all types of errors are taken into account, a hospital patient can expect on average to be subjected to more than one medication error each day". Medication errors are recognized as an important indicator of quality of drug therapy from the patient's perspective. "Adverse drug events" are defined as an injury from a drug-related intervention, which can include prescribing errors, dispensing errors and medication administration errors. The National Coordinating Council for Medication Error and Prevention defines a medication error as "... any preventable event that may cause or lead to inappropriate medication use or patient harm, while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems including: prescribing; order communication; product labeling, packaging and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use." Medication errors are typically viewed as being related to drug administration while dispensing errors refer to mistakes made by staff in the pharmacy when distributing medications to nursing units or directly to patients in an ambulatory

pharmacy setting. Medication error has been defined to include errors in the process of ordering or delivering a medication, whereas errors by the prescriber when ordering have typically been labeled prescribing errors.

One way to prevent some types of medication errors is to administer medications in unit-dose packages since this ensures that the medication name, dosage, and other characteristics are available to the administering professional (typically, a nurse) right until the time the medication is administered. As a result, administering medications in unit-dose packaging is not only considered a best practice, but is also near universal in its application, with millions of unit-dose medications dispensed in hospitals and health systems daily.[32]

2.2.4 Unused medicines return:

A study was conducted in UK in 2007 regarding returns of unused medications from the inpatient ward over 2 months. The author has concluded that total returned medication were 3765 drugs from 910 patients worth pound 33,608. Among all drugs 1248 drugs were suitable for reuse, but in UK reuse of returned drugs is considered unethical, so returned medication needed to be destroy regardless their conditions.[33] Another study conducted in New Zealand for 4 weeks and concluded that 1605 bags were returned for disposal. They searched the main reasons of returning the medicines and found two main reasons which were either medication had passed the expiry date or physician had changed the medications.[34] The Albert study found some reasons of drug return are: main reason was found that the patient had died for whom the prescription was given. Other reasons were expired medication, physician had changed the drugs, allergic reaction, and patient did not want to take medicines .[35]

Few more studies were carried out regarding the unused medication return from inpatients. One study was conducted at Canada and another at Oman. The results found the cost estimation of unused return drugs were $60,350 in 8 weeks at 58 pharmacies[32] and $14,319 in 5 months in a tertiary care hospital respectively.[36]

A study by Heaton et al supports the fact that implementation of UDDDS reduces dispensing time and additionally it can decrease overall inventory costs. This is due to requiring fewer units in stock at any given time therefore, increases inventory turnover and cash flow. A downfall of unit-of-use packaging is the increased need for storage area needed, which is limited in many pharmacies.[37]

2.3 Components of unit dose medicine:

Medication carts: Medication carts are primarily used in a unit dose medication system. When the physician writes order for inpatient, these orders are sent to the pharmacy (by pharmacist, nurse, other personnel or computer). Pharmacist verifies the orders and places the drugs in to the medication carts. These carts have drawers in which each patient's medication was placed pharmacist- one drawer for one patient. The drawer is labeled with the patient's name, ward, room, and bed number. The pharmacist checks the medication cart before sending it to the ward to insure the accuracy. A medication administration recording form is attached on the cart and is used by nurse to check-off the medication name at the time of administration of each medicine. The next day, carts are retrieved from the wards and replaced by a fresh and updated medication supply. Those medications which are returned to the pharmacy are credited to the patient's account.[38] The mobile medication carts proved very satisfactory in their day-to-day use and did fulfill all the criteria established for their use.[4]

Bar-coded unit dose: Information technology has proved itself very useful in healthcare system also. In 2008, annual HIMSS Leadership Survey placed high priority in using IT to reduce medication errors and improve quality of care.[39] After issuing many guidelines and rules for improving patient safety, in February 2004 USFDA has issued Barcode Rule that requires drug manufacturers, re-packagers, re-labelers to apply unit dose barcode containing National Barcode Number, batch number, expiry dat.[40] Today, in US, a substantial majority of medications are available in bar-coded unit dose form, including more than 80% of the top 500 most commonly used oral solids. Barcoded drugs provide benefits in number of areas including patient safety, supply chain, return and recall processes.

Labeling:

Additional labeling of the prescribed drugs confirms the safety of the patient by providing the particular medicines to the particular patient. Sometimes medicines can be exchanged by mistake between the patients and it counts in the administration error. Labeling provides double check for the nurse to confirm the right patient.

Labeling for unit of issue packages contains the following information:

(1) Brand Name and strength of medicine.
(2) Patient's name, ward, room number and bed number.
(3) Schedule of drug and quantity to be taken and route of the prescribed drug.

2.4 LIMITATION OF UDDDS

2.4.1 Cost:

The major single factor determining the feasibility or success of the implementation of a unit drug distribution system is the economic consideration. This evaluation is based upon the cost of a drug in a single unit package, the expenditure for additional equipment and supplies and an increased budget for pharmacy personnel.[41] Medicines are sent in a package which is ready-to-administer form to the inpatient, in unit dose medication system. Unit dose drug distribution requires a mediator for repackaging of bulk drugs into unit dose packages i.e. one pill per packet, which contains label regarding information of drug. The cost consideration is high for implementing this system to those hospitals that wants to do in-house repackaging of bulk drugs in to unit dose packets, because it requires some repackaging equipment and adequate space for performing the task.[42, 43] If in-house repackaging does not include repackaging equipment, then manual process is required for repackaging and relabeling processes.[43]

In UDDDS, for identify a single drug, its necessary to have a barcode on that drug, otherwise it will be of no use for pharmacy. To attain minimum drug wastage, a barcode should be pasted on each drug, so that each inventory can be recognized. Although it increases initial cost of implementation because it requires barcode printer and other stationary for packing, labeling of the unit dose. Some studies refute the statement that the unit dose distribution

costs more to operate than the traditional system. A study reported an estimated annual savings of $23,168 from the result of unit dose system. Their figure was based on savings in nursing labor cost compared to additional expenditures for pharmacy labor and equipment.[44] A hospital converted to total unit dose system, an appended study revealed that it contributed significantly to hospital savings more than $100,000 per year.[45] Hynniman and co-workers[46] calculated the cost benefits of various drug distribution systems in a study. It was proposed that the ultimate criterion for evaluating the expense of a medication system should be the cost per dose delivered correctly. The unit dose system had a cost per dose of $0.33 with an error rate of 3.5%. The hospital with a floor stock system had a similar cost per dose of $0.32, but had an error rate of 11.5%. Cost comparisons between drug distribution systems provide additional support to the proposition that the unit dose system is the least expensive to operate when nursing and pharmacy costs are considered.[47, 48]

2.4.2 Missing Doses:

'Missing dose' is the medicine which supposed to be reached at patient's site through med cart schedule at specific time, but not available for the patient or found in tempered condition. In cases of unavailability of drugs for inpatient, such as less number of doses are received from pharmacy because of manual error of pharmacist, medicine is vomited out by patient etc, the incidences of 'missing dose' are increased in UDDDS which can be become a burden for nurses, because it requires reordering of the same medicine.[49] Unit dose system has become the prominent drug delivery system in healthcare facility, but problem of 'missing dose' has become more evident than traditional drug distribution system. A quality assurance audit was conducted to identify the reasons for missing doses and identify the responsibility for them. The results were found which shows 227 incidents of missing doses among 54,082 doses of medications. When responsibility for the missing doses was examined 13.3% were pharmacy generated and 45.8% were nursing generated.[50] Another study was conducted at The Buffalo General Hospital in Buffalo, New York, identified some causes of missing dose. The causes were found to arise from misuse of the unit dose system by nurses,

misunderstandings between the Nursery and Pharmacy Departments, or from oversights on the part of nurses or pharmacy personnel. Missing doses can be prevented in the future by instructing nurses in the use of the system, improving communication between the Departments of Pharmacy and Nursing.[51]

2.4.3 Increased Workload for pharmacists:

Although unit dose drug distribution system has lots of advantages itself, but it also brings some barriers for the end users. For pharmacists, the system is cumbersome to some extent. As compare to traditional drug distribution system, some extra steps need to be added in unit dose medication system. For proper identification of the individual dose, each and every drug should have an identifier like a barcode which is having NDC number. Other than a barcode it also should have a label for right patient identification. To enable a nurse with all these information, pharmacists need to perform these tasks so that administration errors can be reduced. Increased work load on pharmacists leads to increment of dispensing time, which again leads to increased receiving time of drugs for nurses.

3. Objectives:

The general objective of the study is to analyze the significance of the unit dose medication system in Super Specialty Hospital, New Delhi and assess the perception of the stakeholders towards the same.

Specific Objectives

1) To study the changes in drug dispensing work flow after implementation of unit dose drug distribution system.
2) To compare the knowledge and attitude (perception) of different stakeholders towards unit dose drug distribution system (UDDDS).
3) To study the comparison of benefits and barriers of UDDDS among stakeholders.

Based on above mentioned objectives the **hypothesis** to be tested is:

H_0: There is no significant difference in the knowledge, attitude and perceived benefits between nurses and pharmacists towards unit dose drug distribution system.

H_1: There is significant difference in the knowledge, attitude and perceived benefits between nurses and pharmacists towards unit dose drug distribution system.

4. Methodology:

4.1 Study design & setting:

This was a quantitative, comparative cross-sectional study, comparing the perception of pharmacists and nurses of Super Specialty Hospital. They were using Unit Dose Drug Distribution System as a new dispensing system in their hospital. Observational approach aimed to gather an in-depth understanding & need for implementation of the new drug distribution system in inpatient department and study the changes in the dispensing procedure. Quantitative approach aimed to compare the perception and perceived benefits of the nurses and pharmacists of the same hospital towards the new drug distribution system. The Super Specialty Hospital was one of the largest hospitals in Delhi, which consists of about 490 beds. The hospital was using traditional drug distribution system previously and switched to UDDDS from past 6 months.

The Unit Dose Drug Distribution system was being used in all departments of that hospital except emergency, OT and labor room as these departments are known as critical patient care wards, where medication administration cannot be delayed even for a fraction of second. So the study was conducted on the nurses of all departments except mentioned above.

4.2 Study population:

Respondents of the study were the regular staff of the Super Specialty Hospital. The study sample included total population (*n=30*) of inpatient pharmacists of the super Specialty Hospital, in which clinical pharmacists and head of the pharmacy department were also included. Head of the pharmacy performed managerial tasks while other pharmacists performed routine hospital pharmacy activities. On the other hand, 30 nurses were taken as

sample from the same hospital, which included only nursing team leaders of the ward. The sample was selected by the Random Sampling Method.

4.3 Data collection method:

The mode of data collection chosen was a self-administered questionnaire which contained close-ended questions. Pharmacists and the nurses of the super specialty hospital was the target population for the study. The questionnaire mainly contains questions concerned with assessing participants' perception and knowledge. Separate questionnaires were used for pharmacists and nurses to assess perception regarding benefits and barriers of unit dose drug distribution system which was contained 17 questions and 11 questions respectively. An observation approach was used to study the changes in the workflow of drug dispensing.

4.4 Data analysis & statistics:

The data was analyzed using SPSS (Statistical Package of Social Sciences) software program version 16.0 and Microsoft Office Excel 2007. Descriptive and inferential statistics both were used to analyze the data obtained from the survey. Descriptive statistics was used to define respondents' characteristics such as their clinical experience, gender ratio, their age distribution and a chi square test was applied on the data to find the difference of knowledge and attitude by testing the null hypothesis. Also to find out the differences between perception of pharmacists and nurses towards those common benefits which are perceived after implementation of UDDDS in target hospital by testing null hypothesis.

5. Results:

5.1 Characteristics of respondents:

Out of 60 sample size 30 were pharmacists and 30 were nurses. Overall, female respondents were higher than male i.e. 63.3% were female and 36.7% were male participants. Same gender distribution is also applied for nurses. Female nurses were 86.7% whereas as only 13.3% male nurses were constituted their 30 sample size of nurses. Among pharmacists, the gender ratio was different (Figure 4). Here, more male pharmacists (60%) were found than female pharmacists (40%).

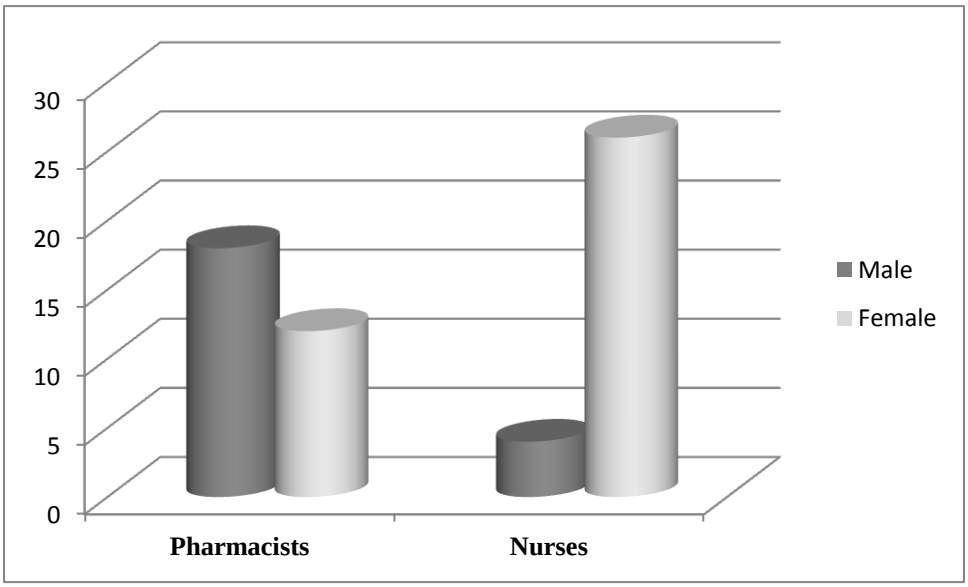


Figure 4: Gender distribution among nurses and pharmacists

Age distribution was very unpredictable among the sample. Out of the 60 sample size, 58 were in the range of 18-30 years and remaining 2 were 31-40 years. In which all 30 nurses were in age group of 18-30 years, while 28 pharmacists were in the same age group and remaining 2 pharmacists were in 31-40 years age group (Figure 5).

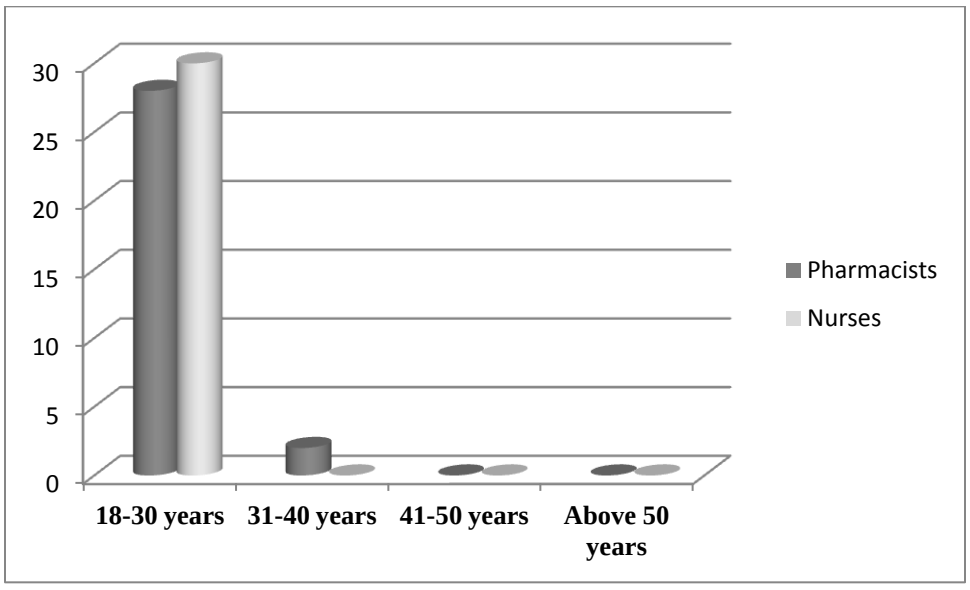


Figure 5: Age distribution among nurses and pharmacists

On the other hand, clinical experience was very distributed among the respondents. Highest respondents were having 2-5 years of clinical experience i.e. 46.7% respondents. 40% and 10 % participants were having ≤2 years of experience and 5-7 years of experience respectively. Only two participants had ≥7 years of clinical experience. In case of pharmacist, 60% respondents were from less than 2 years clinical experience and 33.3% pharmacists were from group of 2-5 years of clinical experience (Figure 6). Remaining 2 pharmacists were found each from 5-7 years and more than 7 years of clinical experience respectively.

Highest respondents (60%) were found from the 2-5 years of clinical experience category, followed by less than 2 years (20%), followed by 5-7 years (16.7%) and only 3.3% nurses were having more than 7 years of clinical experience.

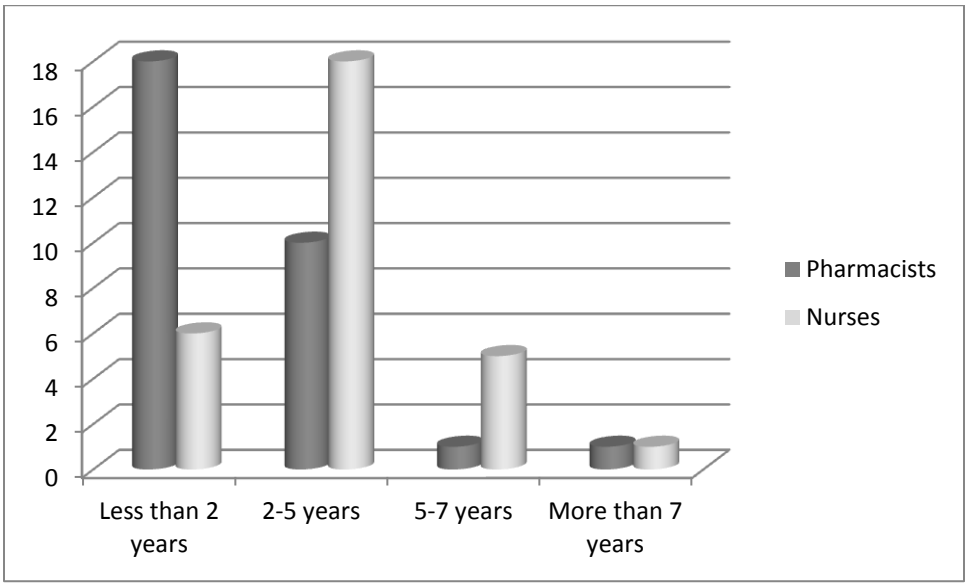


Figure 6: Clinical experience among pharmacists and nurses

5.2 Perception of respondents:

5.2.1 Knowledge and attitude:

The results revealed that knowledge and attitude about the unit dose drug distribution system is very scattered among nurses and pharmacists. The responses showed that almost all nurses (96.7%) and pharmacists (93.3%) knew that the medications are dispensed for 24 hours to inpatient in their hospital. It was found that chi square value (χ^2) was 3.01 and p value was >0.05 (Table 2). Hence null hypothesis was accepted i.e. there is no significant difference between the nurses and pharmacists regarding knowledge of frequency of drugs dispensing in unit dose system.

Table 2: Comparison of perception between pharmacists and nurses regarding frequency of drug dispensing in UDDDS

Variable	Pharmacist		Nurse		Chi-square value	*p*-value
	Number	%	Number	%		
UDDDS is medication of 24 hours					**3.01**	**0.221**
Disagree	2	6.7	0	0		
Neutral	0	0	1	3.3		
Agree	28	93.3	29	96.7		

But when talk about the doses dispensed in one day under the new drug distribution system, pharmacists were found to be more aware (80%) than the nurses (56.7%) and 16.7% were not having any opinion about the same, the difference was statistically significant ($\chi^2 = 25.7$, p = 0.000) among both stakeholders (Table 3). Drugs are dispensed according to its schedule given by a physician in unit dose drug distribution system. Nurses have very limited knowledge about the schedule, because they did not get a proper training. As name of unit dose suggests unit of dose, so they might be considered that only one dose is dispensed in a whole day.

Table 3: Comparison of perception between pharmacists and nurses regarding schedule of drugs dispensed in UDDDS

Variable	Pharmacist		Nurse		Chi-square value	*p*-value
	Number	%	Number	%		
Number of dose dispensed in UDDDS is based on single dose a day					**25.7**	**0.000**
Disagree	24	80	5	16.7		
Neutral	0	0	8	26.7		
Agree	6	20	17	56.7		

The pharmacists knew the fact better than nurses that implementation of unit dose medication system requires a high initial cost, but only about half of the pharmacists (53.3%) were able to recognize the requirement of UDDDS in terms of cost (Figure 4). However, most nurses (43.3%) were not having enough knowledge about it, and even some of the nurses (26.7%) were not agree with the fact ($\chi^2 = 10.82$, $p = 0.004$) (Table 4).

Table 4: Comparison of perception between pharmacists and nurses regarding implementation cost of UDDDS

Variable	Pharmacist		Nurse		Chi-square value	*p*-value
	Number	%	Number	%		
Implementation of UDDDS requires high investment					**10.82**	**0.004**
Disagree	12	40	8	26.7		
Neutral	2	6.7	13	43.3		
Agree	16	53.3	9	30		

When compared, the overall impact of the unit dose system on their routine practices, both pharmacists (80%) and nurses (73.3%) perceived it as positive impact ($\chi^2 = 1.23$, p = 0.53). There is no significant difference among their perception (Table 5). Overall impact found positive in terms of ease in their regular tasks and also beneficial for organization.

Table 5: Comparison of perception between pharmacists and nurses regarding impact of UDDDS

Variable	Pharmacist		Nurse		Chi-square value	*p*-value
	Number	%	Number	%		
Overall Impact Positive					**1.23**	**0.53**
Disagree	2	6.7	1	3.3		
Neutral	4	13.3	7	23.3		
Agree	24	80	22	73.3		

When ask about the level of satisfaction with the new drug distribution system, no significant difference was found among those stakeholders. Both of them were not fully satisfied with the system however some nurses (56.7%) were satisfied but most of the pharmacists (60%) showed their neutral attitude ($\chi^2 = 3.34$, p = 0.187) (Table 6).

Table 6: Comparison of perception between pharmacists and nurses regarding satisfaction from UDDDS

Variable	Pharmacist		Nurse		Chi-square value	*p*-value
	Number	%	Number	%		
Satisfied with UDDDS in hospital					**3.34**	**0.187**
Disagree	2	6.7	1	3.3		
Neutral	18	60	12	40		
Agree	10	33.3	17	56.7		

Most of the nurses (76.7%) were ready to continue with the new drug distribution system, but more number of pharmacists (60%) was not having a strong opinion and they decided to keep their response as neutral about the continuity of the new drug distribution system in the hospital (Table 7). However same number of nurses and pharmacists were not like to continue with that system i.e. 6.7% ($\chi^2 = 12.46$, $p = 0.002$). It proves that null hypothesis is rejected; hence there is significant difference between their perceptions.

Table 7: Comparison of perception between pharmacists and nurses regarding continuity of UDDDS in hospital

Variable	Pharmacist		Nurse		Chi-square value	*p*-value
	Number	%	Number	%		
Like to continue with Unit Dose Drug Distribution System					**12.46**	**0.002**
Disagree	2	6.7	2	6.7		
Neutral	18	60	5	16.7		
Agree	10	33.3	23	76.7		

5.2.2 Perception of Benefits and barriers of UDDDS between nurses and pharmacists: The chi- square test was conducted to test the null hypothesis that there is no significant difference in perception of nurses and pharmacists regarding benefits and barriers associates with unit dose system implemented in the target hospital. Different perceptions were found about implemented new drug distribution system of both stakeholders. When both were asked about drug returns minimization from inpatient, difference were found in their responses ($\chi^2 = 4.207$, $p = 0.122$) (Table 8). More nurses (73.3 %) were agree that there is minimization of drug returns from IPD, but only 50% pharmacists were agree upon that and 40% were showed disagreement for the statement (Figure 7).

Table 8: Comparison of perception between pharmacists and nurses regarding drug returns from IPD

Variable	Pharmacist		Nurse		Chi-square value	p-value
	Number	%	Number	%		
Drug returns from IPD minimized					**4.207**	**0.122**
Disagree	*12*	40	5	16.7		
Neutral	*3*	10	3	10		
Agree	*15*	50	22	73.3		

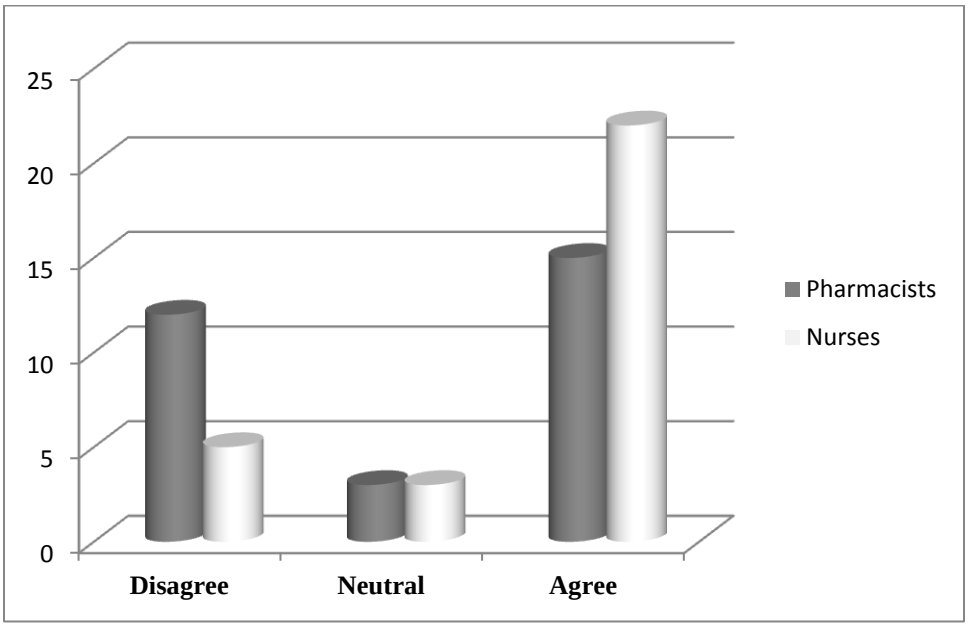


Figure 7: Drugs returns from IPD minimized

As illustrated in table 9, more pharmacists (56.7%) were not satisfied with the reduction in drug wastage and pilferage reduction through UDDDS, while more number of nurses (53.3%) were agree that drug wastage was reduced and the difference between both stakeholders in this regard was statistically significant ($\chi^2 = 14.95$, $p = 0.001$) (Figure 8).

Table 9: Comparison of perception between pharmacists and nurses regarding drug wastage in UDDDS

Variable	Pharmacist		Nurse		Chi-square value	p-value
	Number	%	Number	%		
Drug wastage or pilferage reduced					**14.95**	**0.001**
Disagree	17	56.7	3	10		
Neutral	2	6.7	6	20		
Agree	11	36.7	21	53.3		

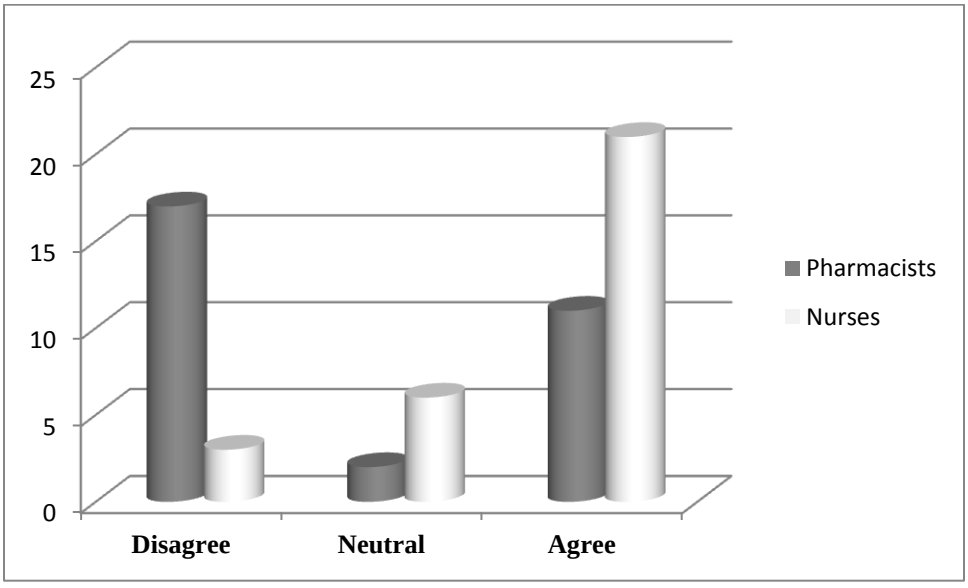


Figure 8: Drug wastage and pilferage reduced in UDDDS

Nearly half of the pharmacists (46.7%) were found to be convinced with the drug recognition has become easy and another half (46.7%) were not agree with that (Figure 9). In contrary, nearly 67% of nurses were reported that they were satisfied with the ease of drug recognition ($\chi^2 = 16.78$, p = .000) (Table 10).

Table 10: Comparison of perception between pharmacists and nurses regarding drug recognition in UDDDS

Variable	Pharmacist		Nurse		Chi-square value	p-value
	Number	%	Number	%		
Drug recognition became easy					**16.78**	**.000**
Disagree	14	46.7	1	3.3		
Neutral	2	6.7	9	30		
Agree	14	46.7	20	66.7		

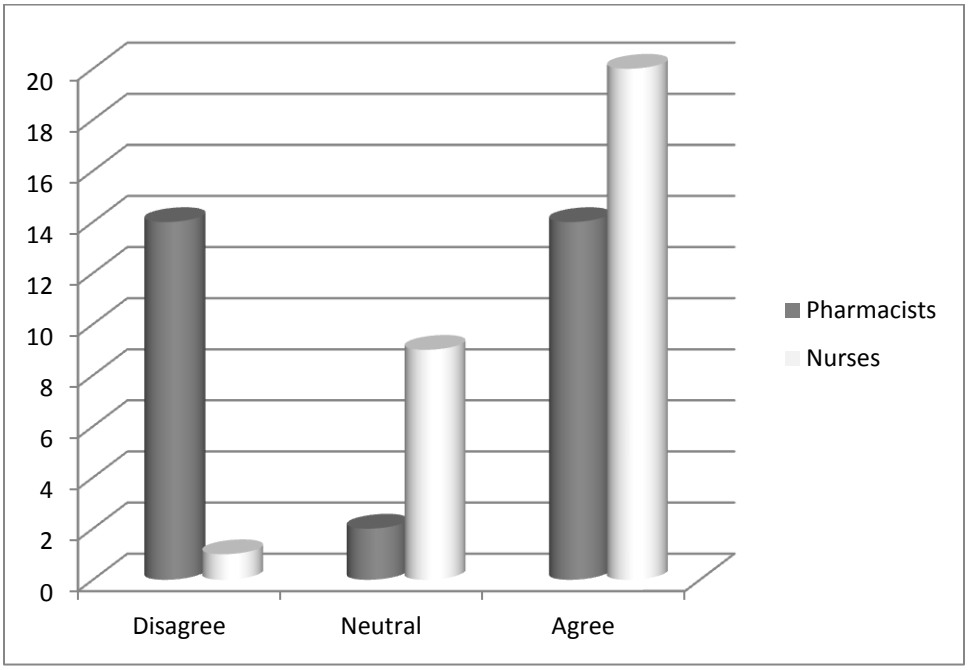


Figure 9: Drug recognition became easy in UDDDS

Almost all the pharmacist (86.7%) in target hospital reported that by implementing unit dose system their workload has increased, with the statistically significant difference ($\chi^2 = 12.56$, p = .002) regarding this, only 65% nurses that their workload has increased and 20% nurses did not find any increment in their workload, while 36.7% nurses reported that workload is same as in conventional drug distribution system, no need to put extra effort (Table 12) (Figure 10).

Table 11: Comparison of perception between pharmacists and nurses regarding increased workload

Variable	Pharmacist		Nurse		Chi-square value	p-value
	Number	%	Number	%		
Workload increased					**12.56**	**0.002**
Disagree	2	6.7	13	65		
Neutral	2	6.7	11	36.7		
Agree	26	86.7	6	20		

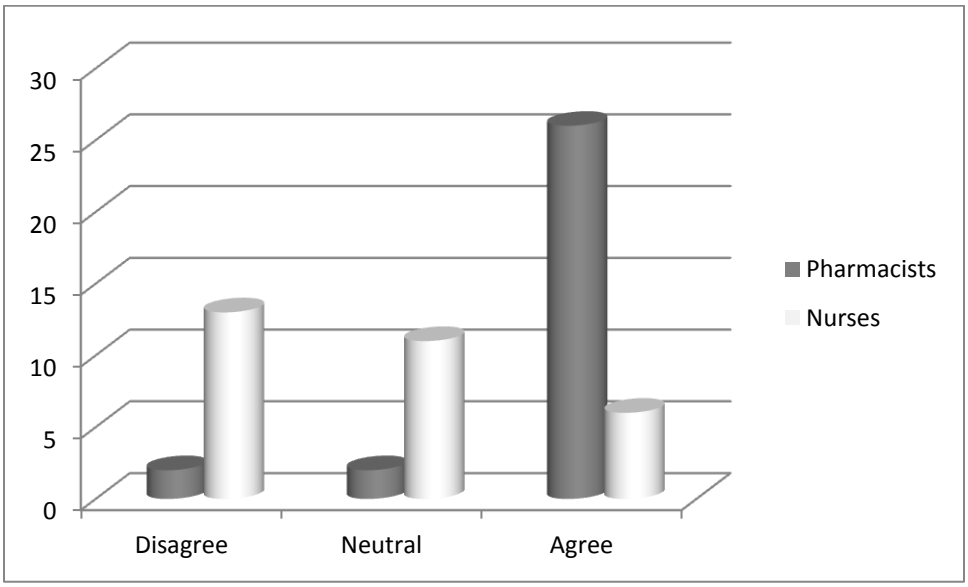


Figure 10: Workload increased in UDDDS

When it was asked that overall quality has increased by utilizing unit dose system, almost every pharmacist (86.7%) was experienced increased quality of care at the target hospital. But nurses were not completely satisfied with unit dose system regarding increased quality of care (Table 12). 60% of nurses were agree of that and 36.7% were thought quality of care is same as it was in the conventional drug distribution system, with the statistically significant difference between both stakeholders ($\chi^2 = 8.019$, p = .018) (Figure 11).

Table 12: Comparison of perception between pharmacists and nurses regarding increased quality of care by UDDDS

Variable	Pharmacist		Nurse		Chi-square value	p-value
	Number	%	Number	%		
Quality of care increased					**8.019**	**0.018**
Disagree	2	6.7	1	3.3		
Neutral	2	6.7	11	36.7		
Agree	26	86.7	18	60		

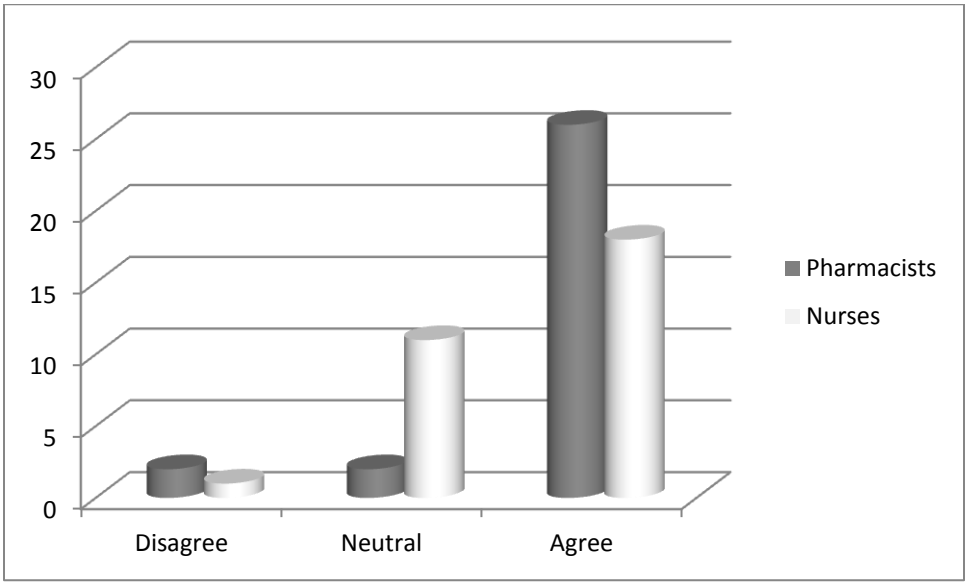


Figure 11: Increased quality of care in UDDDS

5.2.3 Other benefits for pharmacists from UDDDS:

Unit dose drug distribution system also provides some extra benefits to each stakeholder other than those which are common advantages for both. Pharmacists keep on doing such works which are not associated with nurses, and vice versa. Therefore, each end user demands such changes from implementation of new system that would affect their own routine practices in positive manner, unit dose proved it advantageous for its all end users. The results revealed that the pharmacists were not fully convinced with the advantages which they experienced from UDDDS in their hospital, but they showed little improvement in the practices contributed by new drug distribution system. In the survey, 50% pharmacists said that improvement has seen in revenue losses (Figure 14). Due to reduction in drug wastage and pilferage by the unit dose system, revenue for organization can be increased. When they asked about the change in billing process of inpatient, 60% of total pharmacists were satisfied with the ease of billing process imparted by unit dose system (Figure 12). The reason could be reduction in unused drugs returns from inpatient department which led to improve one's efficiency of making bills.

Drug inventory is being misplaced and misused by hospital staff and these incidences are very common in any healthcare setting. Unit dose is proved beneficial to prevent such unethical incidences to some extent. In target hospital more than half of the pharmacists (66.7%) found that UDDDS proved beneficial regarding prevention of missing inventory in their hospital.

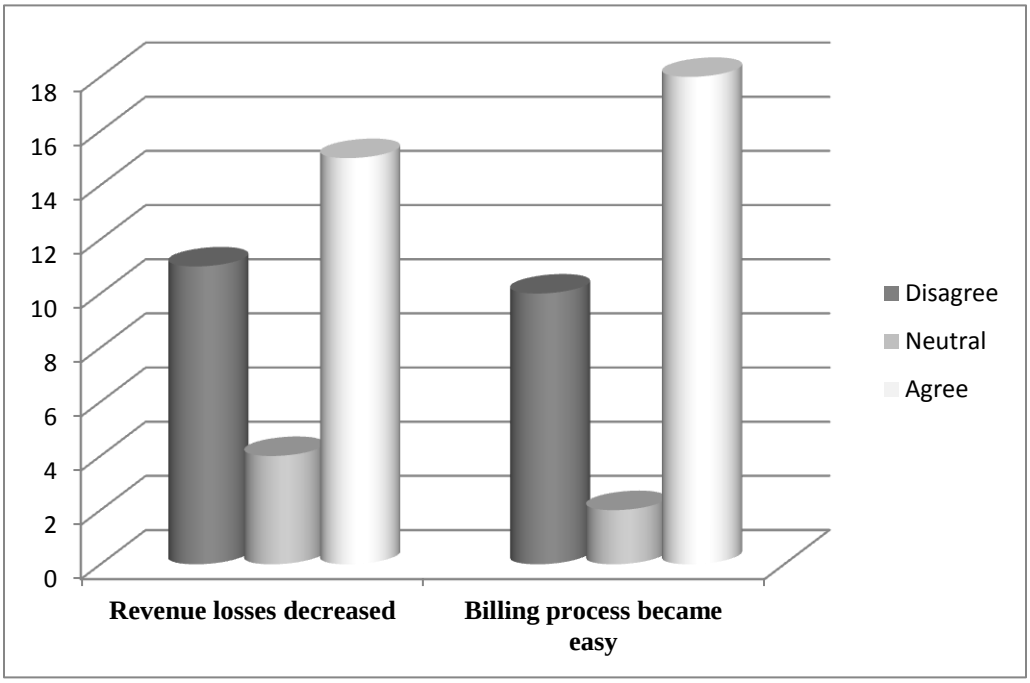


Figure 12: Benefits for pharmacists in UDDDS

Forecasting of inventory became easy by the unit dose system according to 66.7% pharmacists. UDDDS had helped pharmacists in utilizing the pharmacy space in a better way for easy and comfortable approach for dispensing medicines. More than half (60%) of the pharmacists were agreed with the statement (Figure 13).

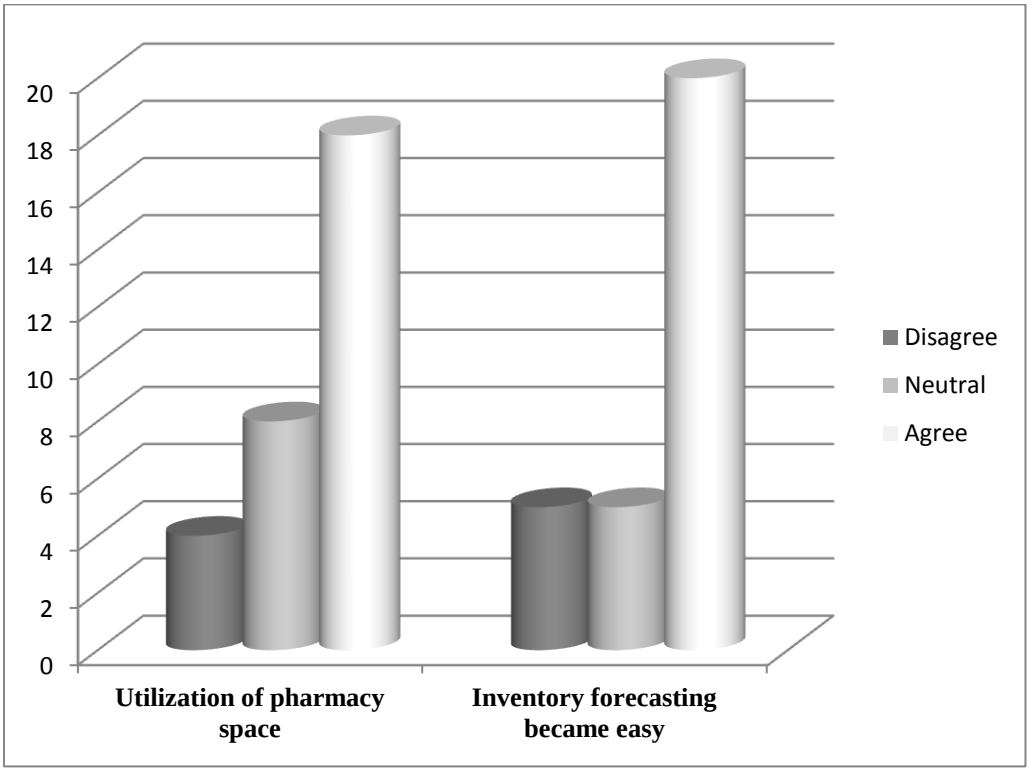


Figure 13: Benefits for pharmacists in UDDDS

5.2.4 Barriers for pharmacists from UDDDS:

With the implementation of unit dose system in the target hospital, as mentioned in the table 3, 86.7% of the total pharmacists were experienced increased workload which resulting in increased dispensing time for them. Negative response was found from 63.3% of pharmacists who said that increased dispensing time is one of the major disadvantages of unit dose system (Figure 14). Also high initial investment was another barrier for implementation of the unit dose system, which was found from pharmacists of the target hospital. More than half of the pharmacists (53.3%) considered that commencing of unit dose drug distribution system requires heavy cost from organization, although in later stages it would be compensated by the saving of money from reduction of drug wastages.

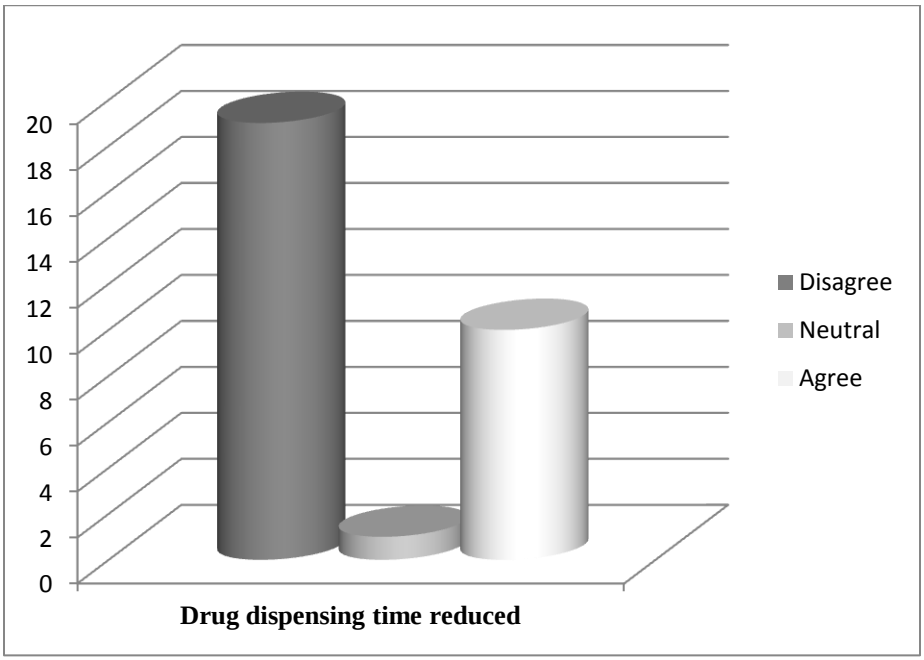


Figure 14: Barrier for pharmacists in UDDDS

5.2.5 Other benefits for nurses from UDDDS:

As discussed earlier nurses also experienced some other benefits from UDDDS which are not concerned with the pharmacists. When asked to nurses about any difference found in quantity of medicines kept at patient's bed side in UDDDS when compared with the old traditional system, the result was very surprising. All nurses (100%) showed their negative response regarding the reduction in drug inventory from patient's bed side (Figure 15). It means they have not experienced any change in the number of medicines kept besides patient. It is a significant benefit of the unit dose drug distribution system according to nurses. But the targeted nurses did not find any benefit regarding quantity of medications kept on patients' bed side. 63.3% nurses said that ordering of missing dose of a patient was minimized due to the new system but 30% nurses considered that there is no significant difference from traditional drug distribution system (Figure 15). Unit dose system has proved to minimize medication error in healthcare setting. The same result was found from nurses (80%) of target hospital that unit dose system has reduced medication error to a large extent (Figure 13).

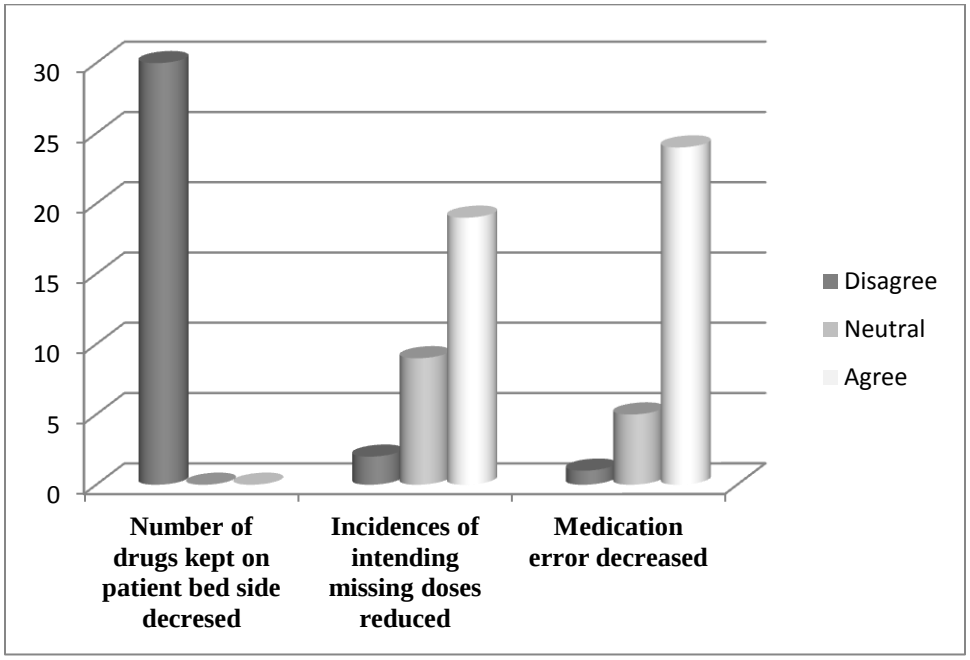


Figure 15: Benefits for nurses in UDDDS

5.2.6 Barriers for nurses from UDDDS:

As illustrated in figure 5, that dispensing time has increased for pharmacists by implementation of unit dose system, which spontaneously affects receiving time of the medicines in an inpatient ward. A mixed response was found from nurses' side. 36.7% nurses said that drug receiving time was decreased by new system; it means they get their medicines within time. While 30% nurses revealed that no difference is brought by unit dose system, the receiving time is same as it was in the traditional drug distribution system (Figure 16).

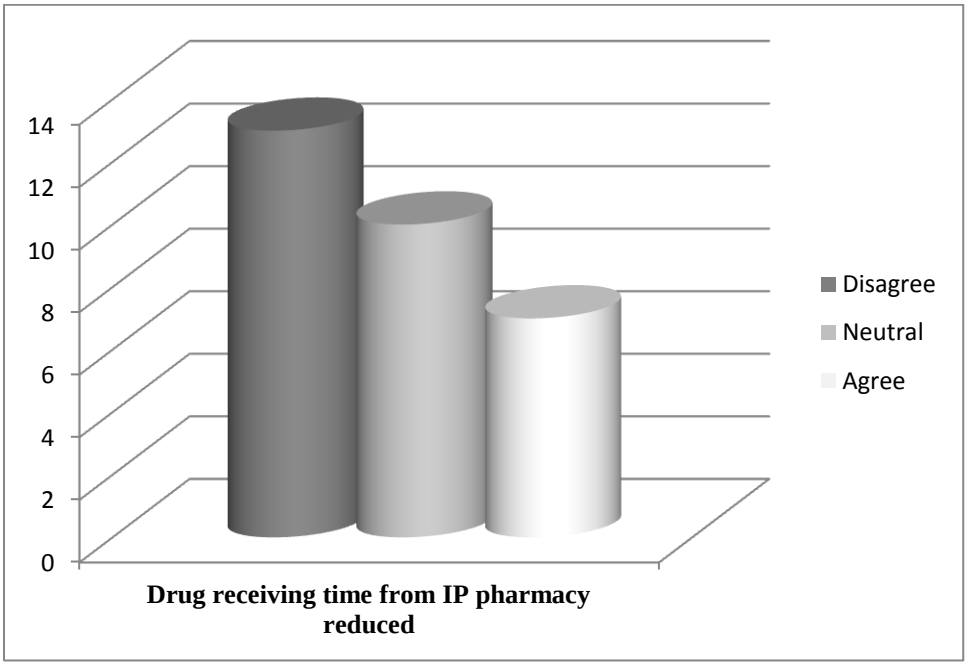


Figure 16: Barrier for nurses in UDDDS

6. Discussion:

6.1 Drug dispensing process before UDDDS implementation in Super specialty Hospital:

The Super Specialty Hospital inpatient pharmacy was working in the same manner which is so common throughout Indian hospitals. Conventional method of drug distribution was using in the hospital, in which physician writes orders for the patient, they are then transcribed by the nurse and sent to the inpatient pharmacy (Figure 17). After receiving indent of an inpatient, pharmacy sends medications for minimum of 3 days. Some inexpensive medicines are kept as ward stock drugs at each nursing station. Upon patient's discharge, unused drugs

are sent back to the pharmacy credit. After completing 3 days, nurse again send an indent to pharmacy. Role of a pharmacist in conventional drug distribution system is limited only to read prescription and dispense medicines to the ward.

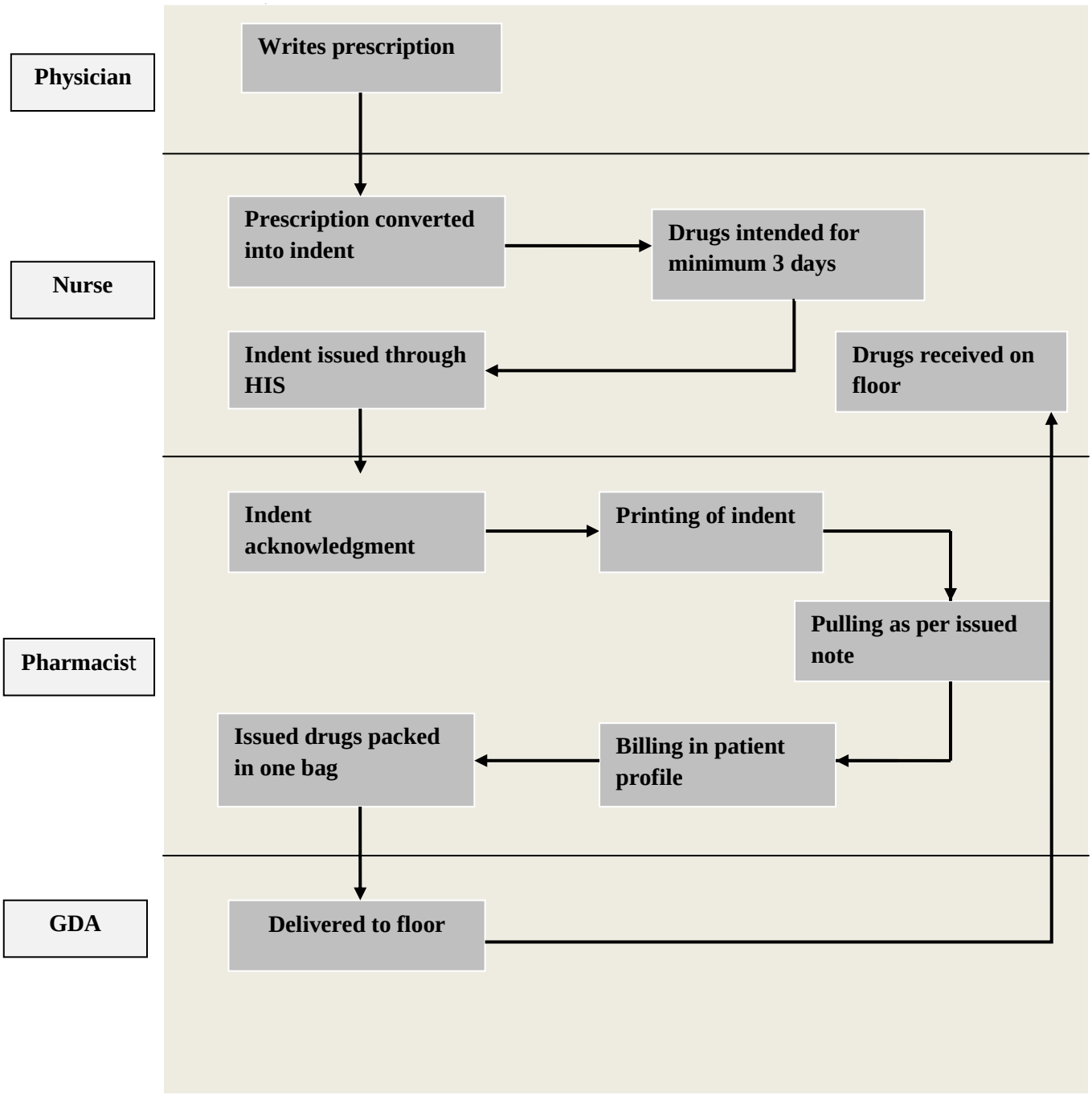
6.2 Drug dispensing process after UDDDS implementation:

Commencement of unit dose medication system in Indian healthcare setting has brought many changes in routine clinical practices. These changes are applied to all steps which involve in drug dispensing pharmacy to administering same to the specific patient. Clinicians are not at all affected from the system while nurses and pharmacists affect largely from implementation of UDDDS. The sequence of steps from prescription to administering of medicines in new system are as follows: physician orders through CPRS for the new patient and this order reaches direct to the inpatient pharmacy, so nurse doesn't need to transcribed it and thus one step has eliminated here for nurse. Pharmacist verifies the orders and as soon as verification of orders is done, labels are started to printing. During drug verification, a pharmacist checks the drug for allergy, any drug-drug interaction, any drug-food interaction. Also he checks dosage form, dose, route of a drug to insure patient from any mishap. According to the labels, pharmacist pulls the drugs from the cupboard and cut them into unit and packed into the separate bag, on which that label is sticked. Label consists of patient's name, his SSN number, ward, room, and bed number, name of medicine, dose and schedule of medicine. Other than patient's details and clinical information, it also contains date of the drug order and registered pharmacist's name. Some drugs which do not have barcode on them, pharmacist simultaneously print those barcode and paste them on particular drug unit for easy identification. Similarly, all the medicines of a patient are pulled and packed them into separate bag with label (Figure 18).

All packed drug are handed over to the billing person (DEO), who scans all medicines by their name and billed them according to their quantity in patient's draft bill. After that a checking pharmacist checks medicines for the accuracy, where he assures that right barcode and label are sticked on the right drug and dose of medicine is same as mentioned on the label. The checked drugs are kept in to the medicine cart and handed over to GDA who takes all the drugs to the respective ward and delivered to the nurse (Figure 16). The next day, carts

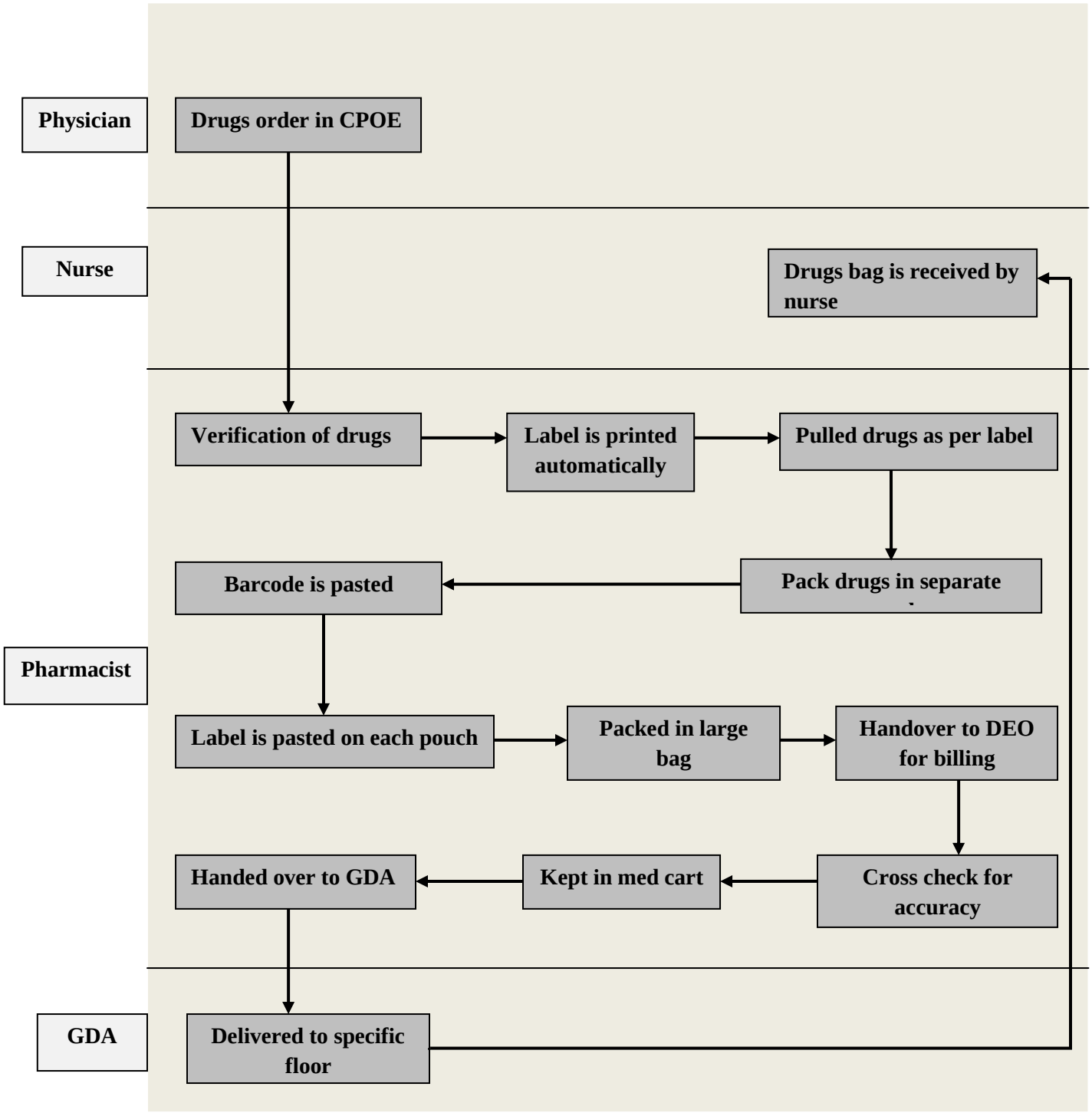
are retrieved from the ward and replaced with fresh medication supply. Medications that have been returned to the pharmacy are credited to the patient's account

Figure 17: Drug dispensing workflow before UDDDS



***HIS** = Hospital Information System **GDA** = General Duty Assistant*

Figure 18: Drug dispensing workflow after UDDDS Implementation



**CPOE=Computerized physician order entry *DEO= Data Entry Operator*
**GDA=General Duty Assistant*

6.3 Perception of respondents:

In the study, among 60 samples, more female respondents were participated in survey than their male counterparts; the reason might be more preference is given to nursing profession by female candidates. As the time passes, better education opportunities are being provided to encourage women education. It helped in movement of women in various fields. Now they are not restricted to only nursing domain in fact entered into almost every field. In this study also pharmacists contained 40% female staff, which is a great progress for woman power. Almost all the staff irrespective of their domain was in the age group of 18-30 years. This shows involvement of young generation into the healthcare sector. This young generation provides an opportunity for the health care system in term of investment in capacity-building.

The study showed that adequate knowledge and nearly positive perception were found in target population. But among both end users, pharmacists were found to be more knowledgeable than nurses regarding routine practices of unit dose system (Table 2). The reason might be proper training was not given to nurses on UDDDS. The end users of the target hospital were partially satisfied with the new implemented system. Our result was not fully consistent with the literature that says UDDDS is safer, more economic and more positively perceived by the staff.[38]

Several studies are published which states that implementation of UDDDS needs high cost, our results corroborate the findings from these studies[40, 42, 43, 44] and showed more responses of involving high cost in new system. The implementation cost for unit dose medication system involves cost for equipment for those hospitals which wish to do in-house packaging. Usually pre-packaged unit dose packets are available by manufactures in other countries and the other way is to working with a third party for repackaging of the medicines. In Indian scenario, as the unit dose system is new concept for the country, it is difficult to find any repackaging third party or such manufacturer, so for smooth running of unit dose drug distribution system, healthcare setting should employ more manpower for repackaging of drugs in unit dose before dispensing and loading into carts. Any one of the above ways makes the healthcare setting to incurred high cost for utilizing the new drug distribution

system. The results of the study showed that nurses are obtaining more benefits and are more satisfied with the UDDDS than pharmacists in the target hospital. Our study showed that drug returns from IPD was more positively perceived by the nurses than pharmacists (Figure 7).

Collectively, both have positive perception about that one of the benefits of the new drug distribution system. Positive change brought by unit dose system was experienced by the nurses in respect of recognition of the drug packet but pharmacists could not found any major change (Figure 9). Drug recognition has become easier than it was in time of conventional drug distribution system according to nurses. Drug wastage and pilferage is one of the major means of revenue loss for a hospital[28, 29, 44] (Figure 8). Again the nurses were more convinced by the system in terms of drug wastage, while pharmacists negatively perceived it. The reason might be that the target hospital yet not supported the process of pasting barcode on unit dose before it comes to hospital pharmacy, which leads to increased pharmacists' workload and increase dispensing time. The practice of pasting barcodes on the time of dispensing not only affects their workload but also involves high drug wastage. Because any unidentified leftover drug without barcode cannot be used and has to be discarded by the pharmacy. While nurses receive those medicines for administration to patients which have proper identification measures unlike conventional system in which if a half strip does not contain its name, then nurses had to refuse it for administration. Hence for nurses unit dose system proved better for control drug wastage.

UDDDS has become a hindrance for pharmacists in terms of workload. To provide better safety and quality of care by providing medicine, pharmacists have to pay more attention on accurate dispensing of medicines which has become more time consuming due to unit dose system and resulted in increased workload (Figure 10). Although some nurses also found that it has increased their workload, but altogether nurses' workload was not highly affected by the new system. The result of this study illustrated that both nurses and pharmacists were experienced the increased quality of patient care (Figure 11). It was evidenced that performance of pharmacy department can be a significant element in the success of a health system and health of its patient. The first priority of a healthcare setting is always to provide

better patient care and safety. The results of this study is also supporting the fact that implementation of UDDDS is better in terms of patient care and safety than other drug distribution system, which is similar to a study stated that the quality of patient care had improved markedly by unit dose system.[25] But if compare perception of both end users then it was found that pharmacists were more agreed on the increased quality of care than nurses in target hospital.

6.4 Other benefits and barriers of nurses and pharmacists:

The study showed positive perception to some extent of pharmacists and nurses towards unit dose medication system, and many benefits are experienced by them in such a short period of post implementation. The result clarified that pharmacists were getting so much advantages in terms of easy billing process (Figure 12), proper control on missing inventory, easy to forecasting drug inventory (Figure 13) which helps in avoiding unnecessary storage of other drugs. Less number of medication returns from wards leads to less time to make patient bill, which is satisfactory for pharmacists and also for discharged patient. Another positive consequence of returned medicines is that these medicines can be reused because of their identity is being intact and can be dispensed for other patient. In unit dose medication system, pharmacy sends optimum number of drugs which is sufficient for one day and also tracks each dose dispensed from pharmacy to the patients, this keeps restriction on drug pilferage by nurses, which in turn control missing inventory. Other reason might be barcodes which help to recognize any drug. Pharmacy head also declared that revenue losses have been decreased by the utilizing unit dose system (Figure 12). It is because of no need of storing large amount of inventory at a given time which leads to increase inventory turnover and cash-flow.[37, 25, 26] Also by reduction in drug wastage and pilferage in drug dispensing method leads to decrease revenue losses. It was found from the result of the survey that workload on pharmacists has been increased (Figure 10) due to addition of many steps in the dispensing procedure, which also affects their dispensing time (14). Many studies concluded that it always being a limitation of unit dose medication system for pharmacists[25, 49] related with the drug turnaround time. Contrary to one study conducted by Earlene E. Lipowski which states that unit dose drug distribution system reduces the time needed to perform

dispensing activities.[27] The result obtained for control over the missing inventory is consistent with a comparative study for drug dispensing system conducted in two hospitals in Gaza .[21]

Several studies[14, 21, 22, 23, 52] conducted on reduction of medication errors by implementing a unit dose system, this study also found similar result in terms of medication error. Almost all nurses in the target population found the new system beneficial regarding decreasing medication error (Figure 15). The nurses were fully unsatisfied with the one of the advantages provided by the UDDDS that is reduction in number of drugs kept at patient's bed side (Figure 15). Medicines for a single day are kept in the unit dose system unlike the traditional system in which minimum of three days prescription was compulsorily dispensed from pharmacy. A study by William W. Tester on patient care involving unit dose system found that pharmacy space was conserved in a better way by use of unit dose medication system.[25] The result of conducted study in target hospital also showed same result, pharmacists perceived that unit dose system is a better way to utilize pharmacy space in a optimize manner (Figure 13). Every step of process has allocated a specific area such as for pulling drugs and packing in unit dose, and then separate area pasting barcode and label, then another space for billing and then a specific area is provided to checking the accuracy of drugs again and for store the drug into the med carts. Dividing the space in to small area for each step provides better utilization of place and also provides pharmacists to work in a more comfortable environment. In the conducted study nurses was not experienced missing dose as a burden for them (Figure 15), contradicted to a study[49] which resulted that in unit dose medication system ordering of missing dose, in case of unavailability of drug, could be a barrier for the nurses, because it adds an extra step in their routine work. Another barrier emerged from the survey in target hospital that is drug receiving time from the pharmacy has increased (Figure 16), which is the result of long dispensing time taken by pharmacists for packaging drugs in unit dose packets.

7. Limitations:

Although the research has reached its aims, but still there are some unavoidable limitations.

(i) The sample size was small in case of nurses; only thirty nurses might not represent the population. On the other hand, thirty was the population of inpatient pharmacists in the Super specialty Hospital. So, to match with the pharmacists' population, nurses' sample was restricted to kept that small.

(ii) The responses of sample population were not so reliable because difference between the period of implementation of the new system and the study conduction was only six months. In this short period of time it was difficult to capture their real perception because they might not understand the whole system very well and could not realize all the benefits from every faces of new system.

(iii) As the unit dose drug distribution system is not common for Indian hospitals, hence it was difficult to find out scenario of unit dose medication system acceptance by its end users at other sites in India.

8. Conclusion:

The study concluded that the end users i.e. pharmacists and nurses of the Super Specialty Hospital perceived that unit dose drug distribution system has brought positive changes to their routine practices and proved beneficial for patients as well as for organization. Collectively, both end users found the system satisfactory, although nurses perceived it more positively than pharmacists. Although they perceive increase in workload and more time consumption in daily operational tasks, still they have accepted the new system. This study has depicted that the unit-dose drug distribution system is associated with more rational drug use and better patient safety, perceptions & practices by nurses and pharmacists. This implies that the unit-dose drug distribution system is appropriate and needs to be adopted as the standard dispensing practice in all Indian hospitals.

9. Recommendations:

- Indian Healthcare Sector should support the unit dose drug distribution system in hospitals. This is a positive step since the system has been proved to be beneficial for reducing medication errors and increase economic value of organization. This can be achieved by making clinical professionals aware about its benefit and providing proper training on the usage of unit dose drug distribution system.
- The Super Specialty Hospital should apply the process in which drugs are available in ready to be dispensed state for pharmacists. At the time drugs are received from vendor and stored in central pharmacy, all drugs should be cut down in unit dose, packed and barcoded before sending them to hospital pharmacy. This step will reduce the work load of pharmacists and reduce dispensing time.
- In Indian healthcare System unlike other developed countries, pharmacists are still involved only in dispensing medicines. Their clinical knowledge can be utilized in a better way for assisting physicians by tracking adverse drug reaction & involving them in medicine-dependent disease management. Direct interaction with patients also helps them to give proper counseling about usage of medication which leads to maintain patient safety. There is a need for concerted efforts from all stakeholders and people to change their perception about the pharmacists from being a trader or shopkeeper to that of a true health professional as in many developed countries.
- Another option for reducing workload of hospital pharmacists like other developed countries is that there should be a provision for availability of medicines in ready-to-dispense unit dose packaging, either from the direct production of pharmaceutical companies or by establishing a third party vendor which can perform the tasks like packaging and barcoding of unit dose medicines. This may contribute in reducing the workload of pharmacists and economic burden of hospital pharmacy related to repackaging of pharmaceutical products. Manual errors of pasting wrong barcodes on medicines can also be decreased by outsourcing the repackaging. Although it will add on some monetary value on the drug purchasing for hospitals but patient care is more significant than economic value.

- The method of barcoding drugs may show the incidences of medication errors in case nurse is not able to scan drug barcode number. To avoid this, it can be strongly recommended to use RFID system for tracking drugs during dispensing and administering depending upon the affordability of the hospital. It may prove to be a better option than bar coding drugs.

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APPENDICES

QUESTIONNAIRE FOR PHARMACISTS

Significance of Utilizing Unit Dose Medication System: Perception Of Various Stakeholders

I am a Post Graduate student of International institute of Health Management Research, Dwarka, New Delhi pursuing Healthcare IT Management and conducting study on 'Significance of Utilizing Unit Dose Medication System: Perception of Various Stakeholders' as a part of my dissertation. Kindly spend some of your valuable time to fill up this questionnaire. All responses will be kept strictly confidential. Please check (√) one option for your question and give your honest opinion.

Thank You Preeti Upadhyay

Name (Optional): _____

Age group □ 18 – 30 □ 31 – 40 □ 41 – 50 □ Above 50

Gender: □ Male □ Female

Clinical Experience: □ Less than 2 years □ 2-5 years □ 5-7 years □ More than 7 years

Your designation:_____

	Unit Dose Drug Distribution System - UDDDS			
1	UDDDS is the 'Medication doses for 24 hours'	Disagree	Neutral	Agree
2	Number of dose dispensed in UDDDS is based on Single dose a day	Disagree	Neutral	Agree
3	Implementation of UDDDS requires high investment	Disagree	Neutral	Agree
4	After introduction of UDDDS, billing process has become easy	Disagree	Neutral	Agree
5	After introduction of UDDDS, Incidences of missing inventory has reduced	Disagree	Neutral	Agree
6	After introduction of UDDDS, Revenue losses has	Disagree	Neutral	Agree

	decreased			
7	After introduction of UDDDS, Inventory forecasting has become feasible	Disagree	Neutral	Agree
8	After introduction of UDDDS, utilization of pharmacy space has been optimized	Disagree	Neutral	Agree
9	After introduction of UDDDS, drug returns from IPD has minimized	Disagree	Neutral	Agree
10	After introduction of UDDDS, drug wastage or pilferage has decreased	Disagree	Neutral	Agree
11	After introduction of UDDDS, dispensing time has decreased	Disagree	Neutral	Agree
12	After introduction of UDDDS, Drug recognition (while dispense and returns) has become easy	Disagree	Neutral	Agree
13	After introduction of UDDDS,Workload has increased	Disagree	Neutral	Agree
14	After introduction of UDDDS, quality of care has increased	Disagree	Neutral	Agree
15	The overall impact of UDDDS in routine practice is Positive	Disagree	Neutral	Agree
16	Satisfied with Unit Dose Drug Distribution System	Disagree	Neutral	Agree
17	Like to continue with Unit Dose Drug Distribution System	Disagree	Neutral	Agree

QUESTIONNAIRE FOR NURSES

Significance of Utilizing Unit Dose Medication System: Perception Of Various Stakeholders

I am a Post Graduate student of International institute of Health Management Research, Dwarka, New Delhi pursuing Healthcare IT Management and conducting study on 'Significance of Utilizing Unit Dose Medication System: Perception of Various Stakeholders' as a part of my dissertation. Kindly spend some of your valuable time to fill up this questionnaire. All responses will be kept strictly confidential. Please check (√) one option for your question and give your honest opinion.

Thank You
Preeti Upadhyay

Name (Optional): _____

Age group □ 18 – 30 □ 31 – 40 □ 41 – 50 □ Above 50

Gender: □ Male □ Female

Clinical Experience: □ Less than 2 years □ 2-5 years □ 5-7 years □ More than 7 years

Your designation:_____

	Unit Dose Drug Distribution System - UDDDS			
1	UDDDS is the 'Medication doses for 24 hours'	Disagree	Neutral	Agree
2	Number of dose dispensed in UDDDS is based on Single dose a day	Disagree	Neutral	Agree
3	Implementation of UDDDS requires high investment	Disagree	Neutral	Agree
4	After introduction of UDDDS, number of drugs kept at patient's bedside has decreased	Disagree	Neutral	Agree
5	After introduction of UDDDS, Incidences of intending missing doses has decreased	Disagree	Neutral	Agree
6	After introduction of UDDDS, medication errors	Disagree	Neutral	Agree

	has decreased			
7	After introduction of UDDDS, drug returns to IP Pharmacy has minimized	Disagree	Neutral	Agree
8	After introduction of UDDDS, drug wastage or pilferage has decreased	Disagree	Neutral	Agree
9	After introduction of UDDDS, drug receiving time from IP Pharmacy has decreased	Disagree	Neutral	Agree
10	After introduction of UDDDS, Drug recognition (while administration) has become easy	Disagree	Neutral	Agree
11	After introduction of UDDDS, Workload has increased	Disagree	Neutral	Agree
12	After introduction of UDDDS, quality of care has increased	Disagree	Neutral	Agree
13	The overall impact of UDDDS in routine practice is Positive	Disagree	Neutral	Agree
14	Satisfied with Unit Dose Drug Distribution System	Disagree	Neutral	Agree
15	Like to continue with Unit Dose Drug Distribution System	Disagree	Neutral	Agree