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DETAIL GUIDE FOR PHARMACY AUTOMATION AND AUTOMATED MACHINES IN PHARMACY

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ABSTRACT

In pharmacy system various process such as tablet counting, iv dosage fillings, medicine dispensing etc. were done manually. The manual method used many workers, extra time in completion of the work, errors were common in these processes. With increase in the demand of more medicine in the current world, the production and dispensing of the medicines has increased in large amount and this increase has made the need for the introduction of automation in the production and dispensing unit of pharmacy system. Pharmacy automation is defined as a mechanical system that performs operations involving the storage, packaging, dispensing, or distribution of medications while enabling control of the operation and electronic documentation of transactions. Pharmacy automation involves the mechanical process of handling and distributing medication. Any pharmacy task that may be including counting small objects (e. g. tablets, pills, capsules); measuring and mixing powders and liquids for compounding; tracking and updating customer information in databases (e.g. personally identifiable information (PII), drug monitoring, medical history, drug interaction risk detection), and inventory management. Pharmacy automation has primarily been incorporated into hospitals, community, and mail-order settings. Automation has many advantages with it such as reducing errors, increasing the accuracy, speed and documentation. Various pharmacy technologies are involved in pharmacy automation. They are Clinical decision support system (CDSS), Picture archiving and communication technology (PACS), Radio frequency identification (RFID), Automatic dispensing machines (ADMS), Electronic material management (EMM), Electronic health record (HER), Computerized physician order entry (CPOE) and bar coding. Different automated machines involved in pharmacy automation are tablet counters, iv compounding systems, medicated dispensers etc.

KEYWORDS: Pharmacy automation, pharmacy automation technologies, medicated dispencers.

INTRODUCTION

Selecting pharmacy automation is a serious decision, followed by major changes to your workflow as the installation process gets underway. While installation is thought of as the actual build of the automation in your facility, implementation of that technology is a process that unfolds over several months. Being well-prepared for this process is vital to minimizing disruption to your operations and ensuring on-time completion. This paper provides definition for pharmacy automation, information about pharmacy technologies and various pharmacy automated machines. Pharmacy automation has primarily been incorporated into hospitals, community, and mail-order settings.

Pharmacy automation started in the late 1960s with the use of tablet-counting machines-units that held medication and had a dial for setting the number to be counted. The medication container was placed below an opening in the device that delivered the tablets into a container. During the 1980s, the first automated unit dose filling machine was available in the early 1990s. Many automated medication use products are available.

Advantages of Automation

1. **Improved Speed:** Microprocessors in automated equipment are able to process information at lightning speed. This speed is needed in the medication process so the time from when the physician writes the medication order until the patient receives the first dose is the shortest possible.
2. **Improved accuracy:** computers are flawless at computing and processing information, unless there is a human programming or intervention error. This is needed in the medication process to remove errors.
3. **Improved documentation:** the major advantage of computers and automated medical devices is their ability to document what has taken place in clear format. Who ordered the drug, who dispensed it, who checked it, who gave it, how much they gave, and when it was given is automatically recorded.
4. **Improved efficiency:** pharmacy automation can do the work of many people. Automation can save the salary cost, can free pharmacy technicians to do their important tasks, and can free pharmacist to do pharmaceutical care.

Disadvantages of Automation

1. **Cost:** the major challenge to using pharmacy automation is cost. Pharmacy automation is expensive. The benefits must outweigh the cost.
2. **Space:** one problem with pharmacy automation is squeezing the equipment into pharmacies that are already too small to do what they do. Some renovation of space may be needed to house some types of automation. The equipment manufacturers have been working to decrease the size of their equipment.
3. **Fear of being replaced:** when automation first arrived, pharmacy technicians and some pharmacist feared that they would be replaced when pharmacy automation became available. However, with time this fear has been reduced with the increasing volume of work and the shortage of pharmacists.
4. **One error can become many errors:** pharmacy automation can either decreases errors or make them worse. If automated preparation and dispensing device is not set up correctly, the same error can be repeated many times until the error is discovered. Soon after automated compounding devices that make TPN solutions became available, it was discovered that these devices, when set up incorrectly, can make repeated and potentially lethal errors.

AIM

The automated system or device should provide the following features of unit dose drug distribution systems:

- Medications are present in, and administered from, single-unit or unit-dose packages.
- Medications are dispensed in ready-to-administer form to extend possible.
- Medications are there for administration to the patient only at the time at which they are to be administered, according to the institution's policy.
- An electronic patient medication profile is daily maintained in the pharmacy for each patient and made easily accessible to the pharmacist.
- Medications are available to different categories of health care professionals with the ability to limit access based on policy or law.

Goals and Objectives

Specific objectives related to this topic may include the following:

- Information is necessary for appropriate medication management and patient care is accurate, accessible, and timely.
- Appropriate medications are readily available and accessible to meet patient needs within the safety and security controls.
- Vulnerabilities to medication error are minimized, and those that remain are identified, documented, and mediated.
- Staff members that are involved in the medication-use process are safety conscious, accurate, and productive.
- Patients are satisfied and happy with the quality and delivery of care.
- Medication distribution services are facilitated across the continuum of practice settings in the healthcare system.

- Resources management is improved by linking supply ordering channels to the medication distribution system.
- Billing accuracy is improved a lot by allowing charges and credits to post when medications are dispensed from or returned to the automated dispensing device.

Guidelines
American society of health system pharmacist (ASHP) guidelines on the safe use of automated dispensing devices:
The purposes of these guidelines are to:

- Provide goals and objectives for the safe use of automated dispensing devices in the medication-use process.
- Provide guidance on the how to safely use the automated dispensing devices by pharmacists and others involved in the medication-use process.
- Advice vendors of automated dispensing devices about the safety needs of healthcare professionals who use their systems.
- Recommend standardization for health level 7 (HL7) interfaces between pharmacy information systems and automated dispensing devices.

Centralized and Decentralized Automated Medication Distribution Systems
Centralized

- Centrally located automated dispensing devices are designed to automate the entire process of medication dispensing, including medication storage, dispensing, restocking, and crediting of unit-dose medication.
- An interface must be created with the pharmacy information system to provide the centralized dispensing device with access to each patient's medication profile.

Decentralized
Decentralized automated dispensing device are secured storage cabinets capable of handling most unit-dose and some bulk medications. The device are also referred to as automated dispensing cabinets (ADC), automated dispensing machines(ADM), automated dispensing units(ADU), and unit-based cabinets(UBC). Automated dispensing device store an electronically dispensed medications in locations remote from a centralized or satellite pharmacy.

Pharmacy Automation Technologies
Pharmacy automation involves the mechanical process of handling and distributing medication. Any pharmacy task that may be including counting small objects (e. g. tablets, pills capsules); measuring and mixing powders and liquids for compounding; tracking and updating customer information in databases (e.g. personally identifiable information (PII), drug monitoring, medical history, drug interaction risk detection), and inventory management.

Types of Pharmacy Automation Technologies
1. Clinical decision support system (CDSS)
2. Picture archiving and communication technology (PACS)
3. Radio frequency identification (RFID)
4. Automatic dispensing machines (ADMS)
5. Electronic material management (EMM)
6. Electronic health record (HER)
7. Computerized physician order entry (CPOE)
8. Bar coding

Clinical Decision Support System (CDSS)
CDSS is a healthy information technology system that is designed to provide physicians and other health professionals with clinical decision support (CDS), that is, assistance with clinical decisions-making tasks.

A clinical decision support system can be defined as an "active knowledge systems, which use two or more items of patient data to generate case specific advice". This implies that CDSS is simply a decision support system that is focused on using knowledge management in such a way so as to achieve clinical advice for patient care based on multiple items of patient data.
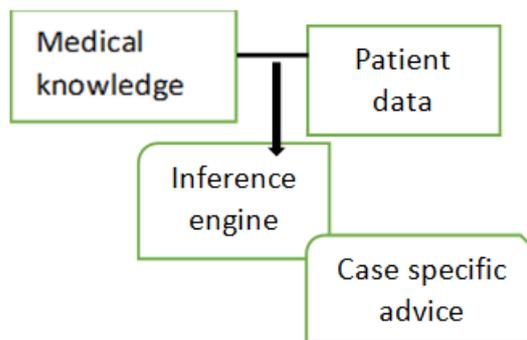
There are two main types of CDSS:
- Knowledge-based
- Non knowledge

Picture Archiving and Communication Technology (PACS)
A picture archiving and communication system (PACS) is a medical imaging technology which provides economical storage and convenient access to images from multiple modalities (source machine types). Electronic images and reports are transmitted digitally via PACS; this eliminates the need to manually file, retrieve, or transport film jackets, the folders used to

store and protect X-ray films. The universal format used for the PACS image storage and transfer is DICOM (digital imaging and communications in medicine.
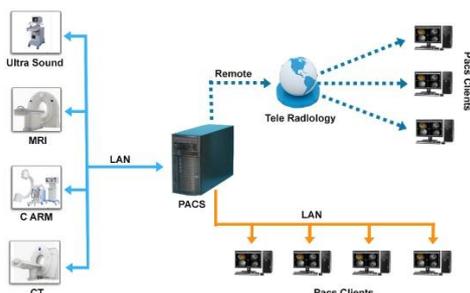
Radio Frequency Identification (RFID)

Radio frequency identification (RFID) is a technology defined as that which uses electronic chips embedded on tags to transmit radio waves. These tags can be used to identify products, assets, medical records, and even individuals with embedded security cards or wristbands.
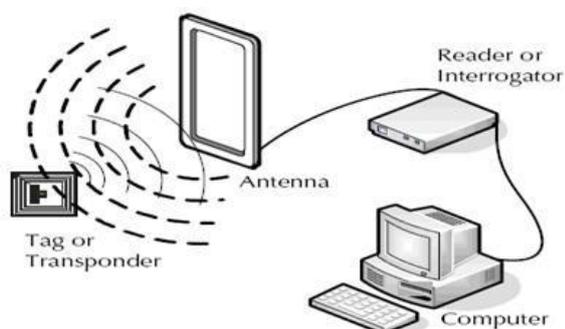
Automatic Dispensing Machines (ADMS)

Automatic dispensing machines (ADM) or (automated drug cabinets) are a computerized drug storage and dispensing device used in the health care settings like hospitals and musing homes, and are located at the point of care (the ward, ICU, ED) rather than in Central pharmacy.

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Electronic Material Management (EMM)

In the health care sector, the term material management refers to the procurement, distribution and inventory control of supplies with the purpose of providing high quality of care at reduced cost. Electronic health care management automates the work involved in ordering, receiving, matching invoices and expediting, in fact, most task involved with purchasing, inventory and accounting. It allows the users to track their usage accurately and calculates 'reorder quantities' so that materials are ordered only when they are needed.

Electronic Health Record (EHR)

A electronic health record, or electronic medical record, is the systematized collection of patient and population electronically – stored health information in a digital format. These records can be saved and shared across different health care settings. Records are shared through a network – connected, enterprise – wide information systems or other information networks and exchanges.

An electronic health record is a unique digital version of a patient's paper chart

Computerized Physician Order Entry (CPOE)

A Computerized physician order entry, sometimes referred to as computerized provider order entry or computerized provider order management, is a process of electronic entry of medical practitioner instructions for the treatment of patients under his or her care.
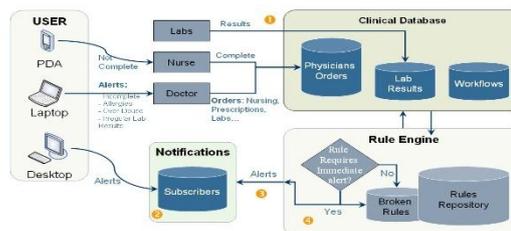
Types of Pharmacy Automation

There are three types of pharmacy automation.

- **Tablet counters –** these devices count oral solids i.e., tablets and capsules.
- **Intravenous (IV) compounders-** most of the devices are for compounding total parental nutrition (TPN) solutions.

Dispensing machines – dispensing automation is the largest category of equipment.

Tablet Counters

Tablet counters devices count oral solids (tablets and capsules). The first such device was the banker cell. Today, many other kinds of these devices. Some pharmacies have as many as 100 to 200 counting cells to count and dispense their top 100 to 200 drugs. Once the medication order is placed in the computer, a message is send to the counting device for the drug, and the device counts and dispenses the drug into a prescription container. A label is created by the pharmacy computer, but it must be placed on the container manually. These devices became known as tablet counter, capsule, pill counter, or drug counter.

This new counting technology replaced manual methods in many industries such as vitamin and diet supplement manufacturing. Technicians are needed to a small, affordable device to count and bottle Medications.

Different Types of Tablet Counters
o   Kirby Lester 1
o   Kirby Lester 1 plus
o   Kirby Lester 7
o   Kirby Lester 8
o   Kirby Lester 20
o   Kirby Lester 60
o   Kirby Lester 100

IV room workflow systems

IV room workflow systems are used to compound anything from high-risk, high-cost medications to single-drug antibiotics and even oral medications. IV room workflow systems follow a similar process as described in the previous robotic example, but manual steps are replaced by automated steps that are completed by robot. When doses are ready to be verified, a pharmacist access the system reviewing each step the technician took to prepare the product and verifying the images associated with each dose for accuracy. Verified doses then can be scanned during every steps of the delivery process which then creates an audit trail and allows pharmacy staff to view status of dose.


Dispensing Machines
Automated medication dispenser

An automated medication dispenser is programmed to the individual member's Prescribe medication and dosages. These dispensers are initially approved for a rental period of 60 days. These are items which releases medications at specified time. Their purpose is to help senior citizens and other people who may suffer from impaired ability to adhere to their medication regime. When time comes to take the drugs or medication, the device automatically releases the pre-measured dose into a small compartment that is easily opened and sounds a loud signal that it is time to take the medication. If a patient doesn't take the drug or medication out of the dispenser door, the pill dispenser will send a signal to a monitoring station who can easily contact the patient, family, or caregiver who can address the situation.

Different Types of Medication Dispensers
- Med-e-lert pill dispenser
- MedReady automated medication dispenser
- McLaughlin dispensing system
- Pyxis Medstation dispensing system
- MedCenter 31-Day dispenser
- Ezy dose organizer
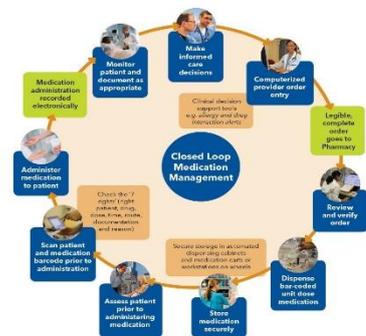
Medication Management, Dispensing and Administration System
- Despite efforts in recent decades to improve medication safety, the rate of medication error remains high even in technologically advanced countries like the USA.

- US FDA defined, a medication error is "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".

MeDAS includes computerized physician order entry (CPOE), clinical decision support system and electronic patient health and medication administration records (ePHR and eMAR).

Barcoding
Barcode
A barcode is an optical, machine-readable, representation of data in parallel lines by varying the widths and spacing referred to as linear or one dimensional (1D) and may be rectangles, dots, hexagons and other geometric patterns referred to as two dimensional (2D).

Objectives of Barcoding
The main objective of barcoding documents in a library are:
- To achieve accuracy.
- Time saving of users.
- To reduce overall cost.
- To make stock verification an easy process.
- To improve operational efficiency.
- To control inventories.
- To manage entry and exit of goods.

Types of Barcodes
Barcodes are of two types, they are
- One dimensional or 1D
- Two dimensional or 2D

One dimensional or 1D
One dimensional or 1D or linear barcodes are the barcodes which consists of parallel lines by varying the widths and spacing. Some of the types of one dimensional barcodes are as follows.

Type of Barcode	Barcode
Uniform product code (UPC)	
Code39 (or code 3 of	
Code 128	

Two dimensional (or) 2D
Two dimensional (or) 2D barcodes are the barcodes which may be rectangles, dots, hexagons and other

geometric patterns. Some of the types of two dimensional barcodes are as follows:

TYPE OF BARCODE	BARCODE
QR CODE	
DATAMATRIX CODE	

The Barcode Scanner

In general the barcode scanner "scans" the black and white elements of a barcode by illuminating the code with a red light, which is then converted into matching text. Down below are a few of the available barcode scanners with a little insight into how each works.

- **Pen-type reader:** consists of a light source and a photodiode on tip of the pen.
- **Laser scanner:** it works similarly to a pen-type reader but uses a laser beam.
- **Camera based reader:** it is installed with camera and image processing techniques in the reading of barcodes.

Applications

- In laboratories
- In libraries
- In pharma industries
- In retail stores
- Monitoring attendance
- In hospitals
- In transport and logistics.

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