# Computer applications in pharmacy

## 🖑 Computer System in Hospital Pharmacy:

The computer has become a very common tool in all areas of science and technology. With the proliferation of the Internet and the developments in computer technology and manufacturing, the ratio of price to performance of computers continues to decrease. This has resulted in the development of number of computer applications.

The field of pharmacy has immensely benefited by the use of computer and will continue to benefit as the pharmacist's gain more familiarity with computers. The complete field of pharmacy requires computers. Some of the important areas where computers are useful are new drug discovery, drug design, analysis, manufacturing of drugs and hospital pharmacy. Other than these, computers helps pharmacist collaborate with other professionals, which is very essential in today's research work. It also provides solutions for time consuming manual task.

## Use of computers in hospital pharmacy

- In receiving and allotment of drugs
- Storing the details of every individual
- Professional supplies
- Records of dispensed drugs to inpatient and outpatient
- Information of patients records
- Patient monitoring (blood pressure, pulse rate, temperature)

# Patterns of Computer use in Hospital Pharmacy:

For years now, whenever it has been suggested that pharmacy could do more to improve patient outcomes, reduce General Practitioners(GP) workloads and make a bigger contribution to the healthcare system, one of the barriers that invariably gets mentioned is IT and, in particular, access to patient records. Recent trends suggest that pharmacy professionals are starting to utilize the benefits of computer systems and databases.

## Patient record databasemanagement:

Slowly but surely, pharmacies are trialling access to electronic information about patients – with their consent, mostly pulled from GP records, and on a read-only basis.

Computer databases for information about medicines, and medical treatment in general, are used within pharmacies. These database systems allow pharmacy staff to find out information about any potential conflicts or health-care problems in a prescribed treatment, as well as information about the details of any particular medicine the pharmacist needs to know more about. This information may include ingredients and potential effects as well as research and scientific data.

The access of patient record database also proved beneficial in identifying prescribing errors – and the pharmacists feel they had been able to reduce the risk of patient harm. The pharmacies would mostly be accessing patient records to assist in the provision of emergency supplies to confirm what a patient was taking and at what dose.

| ● Category | Order | Date/Time | Status | Stop | |
|---|---|---|---|---|---|
| MEDICATIONS (8) | | | | | |
| Aspirin EC Tab (Aspir...)<br>PO 81 MG DAILY<br>Last Admin: 08/30/12 0800 | | 08/29/12 1530 | Active | | |
| Furosemide Tab (Lasi...)<br>PO 80 MG BID<br>Last Admin: 08/30/12 0800 | | 08/29/12 1600 | Active | | |
| Digoxin Tab (Digit...)<br>PO 0.125 MG DAILY<br>Last Admin: 08/30/12 0800 | | 08/29/12 1632 | Active | | |
| Metoprolol Tartrate Tab (Lopres...)<br>PO 25 MG Q12H<br>Last Admin: 08/30/12 0800 | | 08/29/12 1635 | Active | | |
| Nitroglycerin SL Tab (Nitroqu...)<br>SL 0.4 MG Q5MIN PRN | | 08/29/12 1640 | Active | | |

Allergies | View/Change | Renew/Repeat | Hold | Resume | Discontinue | Undo | Orders | Order Sets | Meds/Fluids | Notifications | Reconcile Meds | Transfer | Discharge | Submit | Return

Help | Print | Review | Order | Document | Sign

Example of a computerized prescriber order entry (CPOE) system.

## Some of the advantages of Patient record database:

- Pharmacists review the data with several key pharmacy-related aspects in mind; this will permit concise data collection while providing the pharmacist with adequate information to develop recommendations to optimize pharmacotherapy.
- Clinical pharmacist may dive right into the chart to seek out antibiotic orders and laboratory data for serum drug concentrations and renal function assessments, whereas a cardiology pharmacy specialist may initially search for blood

pressure values from the physical examination in order to assess the effectiveness of a patient's antihypertensive drug regimen.

- The pharmacist may find data lacking in some areas, which will require clarification via additional patient interviewing. For example, a patient's chart may indicate an allergy to penicillin, but the specific reaction not be identified.

- The pharmacist can identify pertinent positive and negative components that are key to the development of an assessment and plan.

- Security - Electronic medical records are stored within secure databases where they can never be lost or misfiled. For additional protection, tools like data backup ensure files are never destroyed due to fire, disaster or other unforeseeable events. In addition, only authorized users may access files.

- Safety - Efficient regulation of medications can improve a patient's quality of care and helps prevent dangerous and avoidable oversights. When a prescription is written, the advantage an patient medical record system provides is the automatic initiation of drug-to-drug and drug-to-allergy interaction checks. These checks reduce the risk of improper prescriptions and related issues that can compromise quality of care.

# Medication order entry:

Prescription processing is invariably one of the main activities going on within a pharmacy on a day-to-day basis, and computers are used to make this process more reliable and efficient. Both the customer service side of pharmacy operation and the dispensing aspect are today carried out through the use of computing systems. Pharmacy computers also handle customer service activities such as sales and cash handling within the retail operation.

**Medication Order Management System** is a electronic-based, automated order management and robust clinical intervention tracking tool that enables hospital pharmacies to identify key safety, quality, productivity and clinical improvements.

For hospitals implementing Computerized Medication Order Management Systems, Medication Order Management System is designed to supplement a Medication Order Management Systems environment, so that your hospital truly benefits from a complete affordable order entry solution.

- Improve productivity, quality and nursing satisfaction with advanced, real-time productivity, clinical and quality reporting metrics
- Complement Medication Order Management Systems technology, utilizing flexible contract and billing terms to shift pricing models
- Improve operational efficiency and patient safety

The process of prescribing and administering a medication involves several steps, each of which has vulnerabilities that are

addressed—to greater or lesser degrees—by Medication Order Management Systems:

1. **Ordering:** the clinician must select the appropriate medication and the dose and frequency at which it is to be administered.
2. **Transcribing:** if handwritten, the prescription must be read and understood by the recipient (usually a pharmacy technician or pharmacist).
3. **Dispensing:** the pharmacist must check for drug–drug interactions and allergies, then release the appropriate quantity of the medication in the correct form.
4. **Administration:** the medication must be received by the correct person and supplied to the correct patient at the right time in the right dosage. In hospitalized patients, nurses are generally responsible for this step, but in the outpatient setting, this step is the patient's or caregiver's responsibility.

Medication Order Management Systems are generally paired with some form of clinical decision support system (CDSS), which can help prevent errors at the medication ordering and dispensing stages and can improve safety of other types of orders as well. A typical CDSS suggests default values for drug doses, routes of administration, and frequency and may offer more sophisticated drug safety features, such as checking for drug allergies or drug–drug or even drug–laboratory (e.g., warning a clinician before ordering a nephrotoxic medication in a patient with elevated creatinine) interactions.

**Entering information into computer system:**

a. Information required is prompted.
b. Quantities are expressed in metric units.
c. Input the correct dispense as written (DAW) code (e.g., DAW 1 would indicate the prescriber wants the brand name drug dispensed).
d. Calculate a day's supply of medication.
e. Third-party adjudication: Submitting prescription for payment by third-party drug insurance provider. If the prescription drug insurance company denies payment, the patient is responsible for full payment of the prescription unless the rejected claim is corrected and resubmitted to the third-party prescription drug provider.
f. Drug utilization evaluation (review): Process of verifying that the prescription being processed does not interact adversely with the other medications on a patient's profile. If a warning is observed, the pharmacist is to be notified immediately to determine the proper course of action in filling the prescription, such as contacting the physician or to continue filling the prescription. The pharmacist makes a decision based on the information on hand.

## Drug labels

Computerized Medication Order Management Systems allows prescribers to create a structured sig but also offers two additional fields: "Special Instructions" and "Comments." "Special Instructions" are transmitted to the pharmacy and are intended to be printed on the label, such as "do not drive while taking" or

"avoid sun exposure." However, prescribers sometimes enter comments that contradict the sig. For example, they might order a medication with frequency "once daily" and then add the comment "take two times a day on Monday, Wednesday, and Friday." This ambiguity can lead to confusion for pharmacists (and patients), resulting in callbacks for clarifications, significant dispensing delays, and dispensing and labeling errors.

### 📥 Drug Lists:

Some Computerized Medication Order Management Systems list drugs alphabetically. Most systems have support for both browsing (e.g., picking a drug from a list) alphabetically and searching for a specific drug by entering a search string; however, the latter method is by far the more common paradigm. Auto-complete is a term used for a functionalities that try to predict what the user is typing and includes both auto-suggest and auto-fill capabilities. Auto-suggest presents users with suggestions that they may choose as they are typing in the first few letters of a drug name.
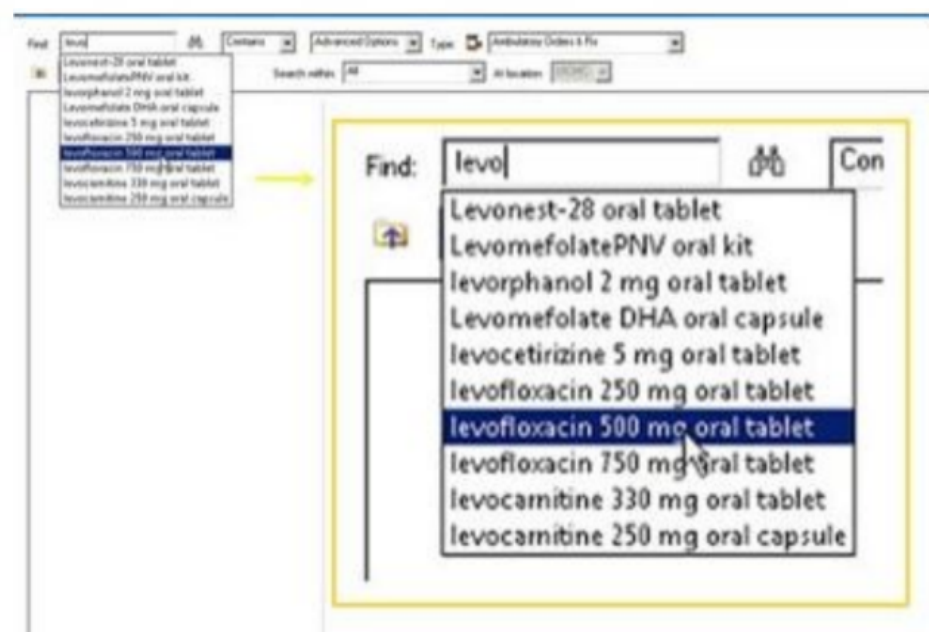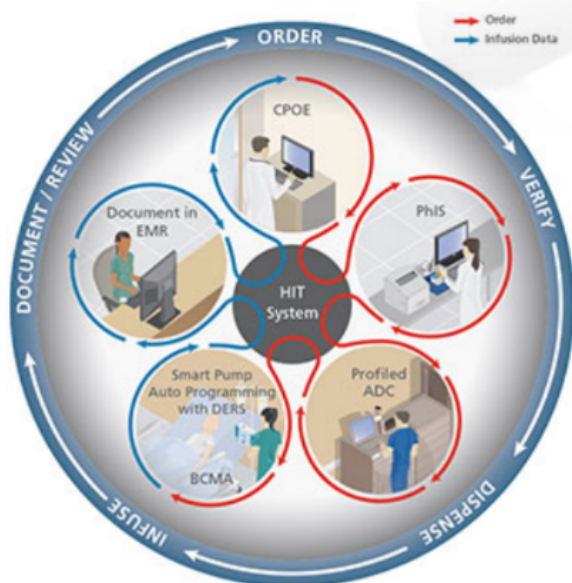
## Administration—Electronic Medication Administration Record (eMAR):

### ⬇ Intravenous solution and admixtures

The combination of bar code verification technology with an eMAR was implemented to further reduce administration errors. The eMAR system electronically receives patient profile information from the pharmacy system. This process eliminates the need for nurses or unit secretaries to transcribe physician orders, therefore potentially reducing transcription errors. At the bedside, bar code/eMAR allows for real-time confirmation of patient identification, medication, dose, and time of administration by automatically checking the scanned medications against the patient's eMAR profile.

By the help of this computerized system Intravenous solution and admixtures can be rationally prescribed and administered. Together, barcode scanning in the pharmacy and bar code/eMAR systems on the inpatient units have the potential to improve medication safety by reducing post-ordering medication errors.



Including **smart pumps** in a closed-loop, point-of-care medication administration system can further improve medication safety. The goal is to provide seamless digital pathway from Computerized Medication Order Management System to the patient vein.

## ⬇ Patient medication profiles:

A patient medication profile is a comprehensive summary of all regular medications taken by a patient, including prescription, over-the-counter and complementary medicines. Current medication profiles may vary in format and the level and type of information provided.

The aim of the Patient Medication Profiling Program is to reduce the risk of medication-related adverse events by assisting people to understand and manage their medications, including prescription, overthe-counter and complementary medicines.

The provision of a medication profile to patients is expected to improve their awareness of their medications (i.e identifying them, understanding why they have been prescribed and when and how they should be taken). The medication profile will also give patients confidence in self medication management, and support communication between the patient and other health professionals, especially on admittance to hospitals or aged care homes.

Pharmacists participating in the program will be subsidised to provide patient medication profiles to a specified number of patients who would benefit from the provision of a profile.

**Patient medication profile usually includes:**

- o medication brand name;
- o list of alternative brand names;
- o medication generic name;
- o medication strength and form;

- o dose and frequency;
- o special directions or cautions;
- o reason for use; and
- o a coloured pictorial representation or product description for items not on the system (eg complementary medicines).

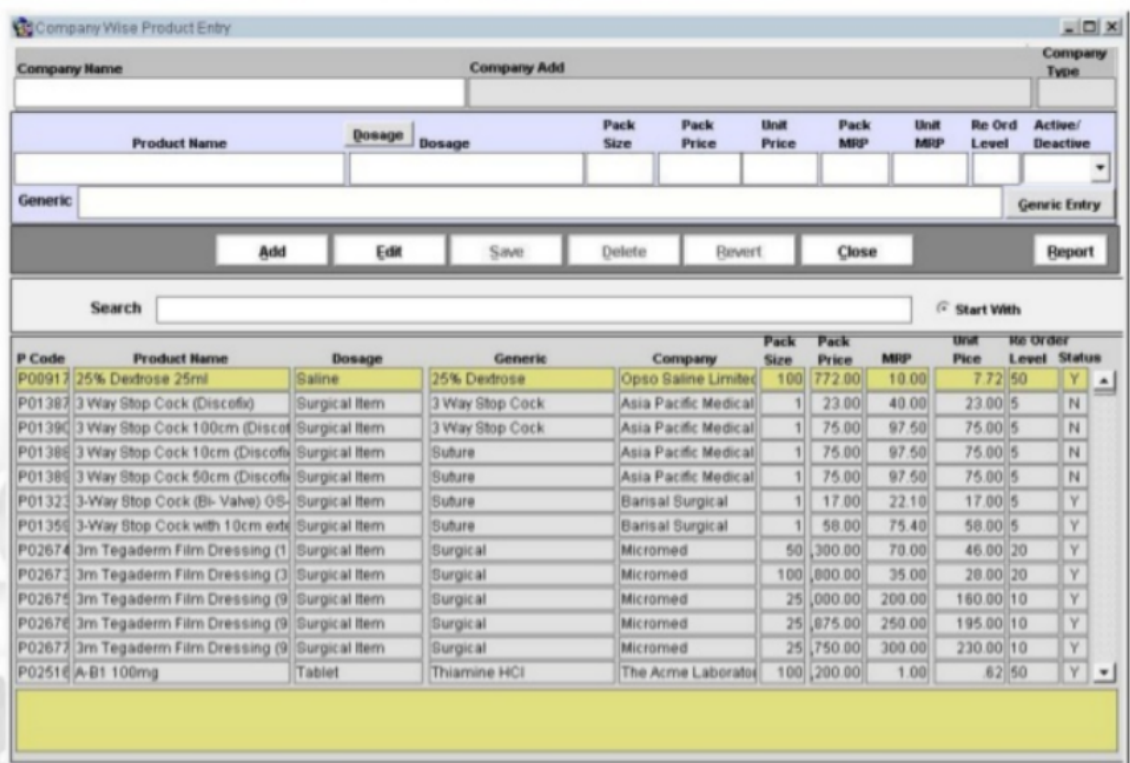## Example of Patient Medication Profile:

# ↓ Inventory Control:

It is extremely difficult to maintain inventory details manually especially with several thousand items like drugs, instruments, linen and furniture, etc. in the hospital. The result is that most hospitals are regularly throwing away large quantities of expired drugs and by the time, one is able to do the stock checking the status gets changed entirely.

Thus, computerized systems are helpful in checking billing and accounts, obviating long line, totaling mistakes, wrong entries and quarreling of patients are the hallmarks of manual accounts. Bills of patients, staff and other things are computerized and such scenes are averted.

So in all these fields, computers are of immense help and save manual labor, time as well as money.



Pharmacy Inventory: Product Entry

# ⬇ Management report & Statistics

The pharmacy management reports include information about the drugs that are being dispensed to gain new insight into what you dispense, to whom, how much, and from where. These reports help in

- ❖ Learning more about your drug pricing and billing workflow by facility and price options. Understanding the ins and outs of your pricing structure and the way you bill is a great way to help make more of your margins.
  Understand more about the patients you serve through searchable prescription histories. Narrow them down based on the selected criteria.

- ❖ Create reports on billing payments, prescription revenue and profit margins.
  Generate daily logs, claims reports, compliance reports and so many more.
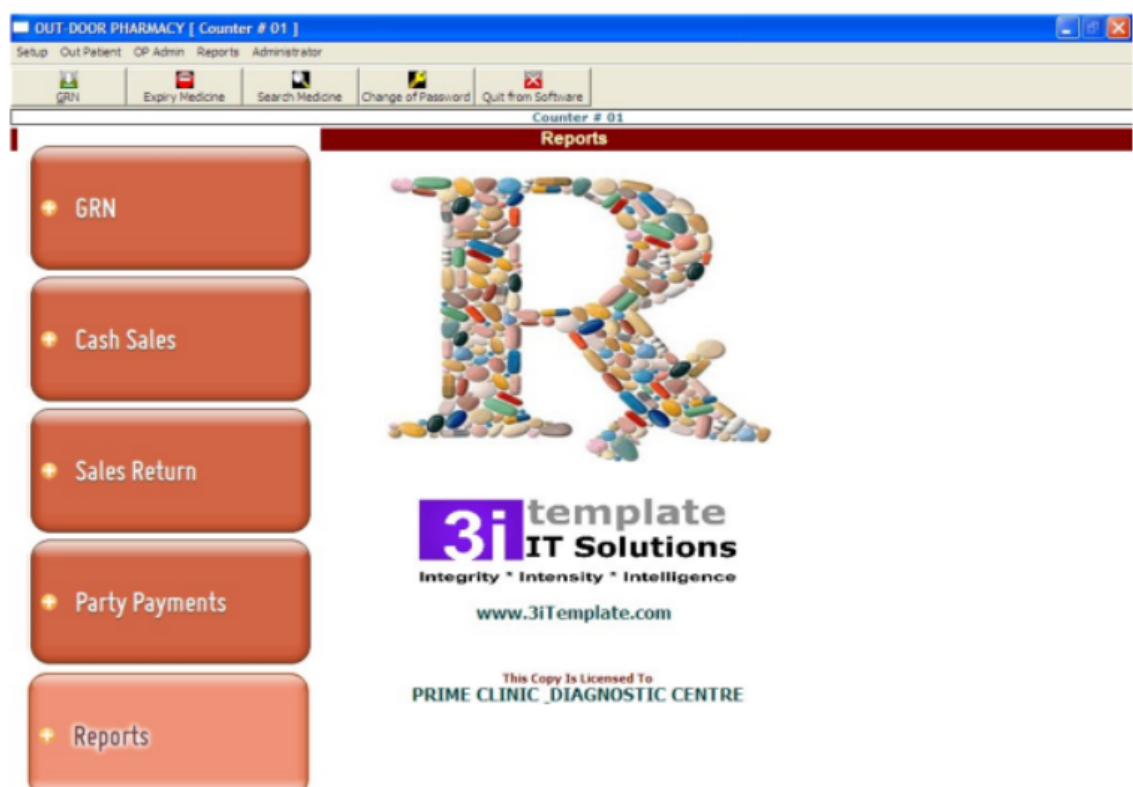
# Computer in Community Pharmacy

Automation of the dispensing process in community pharmacy is nothing new. Computer systems for pharmacy management have been on the market for many years, and almost all community pharmacies now use computers to manage the processing of prescriptions.

Although both pharmacists' use of computers and the capability of computer systems themselves have increased dramatically during the past few years, most pharmacies have either failed to utilize their computers to their fullest or have not kept up with the rapidly changing applications that are available.

In the past, community pharmacy computer systems have been developed to support the transaction-processing approach used in dispensing, wherein only information about the prescriptions being dispensed and limited demographics about the patient were entered and retained in the computer system.

**Usage of computers in the Community Pharmacy:**

- Providing a receipt for the patient
- Record of transaction of money
- Ordering low quantity of products via electronic transitions
- Generation of multiple analysis for day, week, month for number of prescription handles and amounts of cash.
- Estimation of profits and financial rational analysis
- Printing of billing and payment details
- Inventory control purpose

- Whenever the drugs or medicaments are added to the stock or else removed from stock; the position of stock gets updated instantaneously.
- Records of various drug data, i.e., drug data information
- Computers are useful for getting the complete drug information which is used to satisfy the queries by patients about toxicology, adverse drug reactions, and drug-drug and drug-food interactions.
- Drug Bank Data Base gives complete and detailed description of drug (pharmacological and pharmaceutical action) and also involves bioinformatics and cheminformation.

## ↓ Computerizing the Prescription Dispensing process:

Prescription processing is invariably one of the main activities going on within a pharmacy on a day-to-day basis, and computers are used to make this process more reliable and efficient. Both the customer service side of pharmacy operation and the dispensing aspect are today carried out through the use of computing systems. Pharmacy computers also handle customer service activities such as sales and cash handling within the retail operation.

### Process:

This system is so designed to assist the pharmacist with various tasks. These include receiving prescriptions, dispensing of medicines, checking for accuracy, and payment. This system consists of automated dispensing devices, a tray-transfer line, a reception number indicator screen installed in the waiting room,

and a terminal to provide patients with additional information. The prescription data are instantly transmitted to the respective dispensing positions and the prescriptions are dispensed simultaneously. The trays travel efficiently on the tray-transfer line. The host computer performs such functions as input of information of prescriptions, accounting calculations, integrating prescription audit, and preparation of printing data for medicine bags. The control computer, which receives prescription data from the host computer, sorts and sends instruction data on prescriptions to the automated dispensing machines, outputs instructions on the preparation of medicines in the manual dispensing sector, and controls the tray-transfer line, the turn tables and the reception number indicator screen.

The computerized dispensing system has produced the following results:

1) Improvement in the quality of the dispensing work;
2) Reduction in the time required for dispensing medicines;
3) Improvement in the quality of service to patients;
4) Improvement in the efficiency of the clerical work in non-dispensing work;
5) Improvement in work efficiency.

# Use of Computers for Pharmaceutical Care in community pharmacy

Pharmaceutical Care is a patient-centered, outcomes oriented pharmacy practice that requires the pharmacist to work in concert with the patient and the patient's other healthcare providers to promote health, to prevent disease, and to assess, monitor, initiate, and modify medication use to assure that drug therapy regimens are safe and effective. The goal of Pharmaceutical Care is to optimize the patient's health-related quality of life, and achieve positive clinical outcomes, within realistic economic expenditures. Computers play a vital role in pharmaceutical care and thereby promoting patient's health.

- Pharmacists must collect and/or generate subjective and objective information regarding the patient's general health and activity status, past medical history, medication history, social history, diet and exercise history, history of present illness, and economic situation (financial and insured status). Computers make this process more easy.
- Computers help in development of an outcomes-oriented drug therapy plan based upon a thorough understanding of the patient and his/her condition or disease and its treatment.
- Patient Counseling:   Pharmacist can print counseling handout, prescription label and invoice.
- Computers help in monitoring the patient's progress in achieving the specific outcomes according to strategy developed in the drug therapy plan.

- Patient Profile: Pharmacist can updated patient profile whenever a new prescription is filled. Also if the patient might have any symptoms like allergies, it can be added to patient profile.
- Computers help the pharmacist coordinate changes in the plan with the patient and the patient's other healthcare providers as necessary and appropriately to maintain or enhance the safety and/or effectiveness of drug therapy and to help minimize overall healthcare costs.
- Drug-drug interactions: many software vendors offer programs for drug interaction. The pharmacist must check the patient's profile and prescription to determine if there is interaction.
- Patient progress is accurately documented in the pharmacy record and communicated to the patient and to the patient's other healthcare providers as appropriate using the computer database/record management systems.
- Computer assist the pharmacist in sharing information with other healthcare providers as the setting for care changes thus helping assure continuity of care as the patient moves between the community setting, the institutional setting, and the long-term care setting.
- Using computers pharmacist can record the conclusions of the Information evaluation in the medical and/or pharmacy record.

# Accounting andGeneral ledger system:

## Accounting:

There are three basic accounting methods used by health-care organizations: cash basis, accrual basis, and fund accounting.

1. **Cash based accounting:** Cash-basis accounting recognizes income and expense only when cash is received or disbursed. It is a simple method of accounting that ignores liabilities for purchases made but not yet received, and assets earned but not yet collected. Financial reports generated by cash-basis accounting can be grossly misleading and inaccurate. Cash-basis accounting is typically limited to individuals or small community organizations.

2. Accrual basis: The accrual basis of accounting is used for most businesses. This method seeks to "accrue" revenues and expenses to the proper period in which they are earned. This is a large part of the monthly close process for the controller and staff. For the monthly fi nancial statements to be accurate, the controller and staff must ensure that all transactions for the month are properly recorded, regardless of whether cash has been received or paid.

3. **Fund accounting:** This is typically used by governmental entities and academic medical centers. Fund accounting establishes specific funds for a variety of uses. Two examples include an equipment replacement fund and the

general fund. The equipment replacement fund would be used to replace specific equipment in the future. The general fund serves as the operating fund for the entity.

## General Ledger

The general ledger uses a set of accounts organized according to their type. The term chart of accounts simply refers to the listing of all available general ledger account numbers. The number of digits varies by the pharmacy, but a typical number is six. The following table demonstrates a typical configuration for organizing the chart of accounts:

| Account Range | General Account Category |
|---|---|
| 1xx.xxx | Assets |
| 2xx.xxx | Liabilities |
| 3xx.xxx | Equity or Fund Balance |
| 4xx.xxx | Revenues |
| 5xx.xxx | Deductions from Revenues |
| 6xx.xxx and 7xx.xxx, if needed | Expenses |

General ledger accounts are further organized within the category listed above. For example, 100.000 may be used for the general cash account, whereas 120.000 may be used as a patient receivables account. Some hospitals maintain detailed general ledgers using a separate account for tracking specific details. Other pharmacies organize the general ledger in a broader manner and use subsidiary ledgers to provide detail.

# Drug Information Retrieval&Storage

## ↓ Introduction:

Availability of authentic drug information is the key to promote rational use of drugs, a well accepted concept in clinical practice in the developed world. Drug information is an essential element in achieving health goals and information is an aid to decision making. The objectives of drug information center is to collect information, to evaluate and compare drugs, to provide an education and teaching aid for health care personnel, to assist clinicians in the selection of safe and effective medication and to enable pharmacists and pharmacy students to develop their abilities in providing information on drugs and medicines.

Large hospitals develop and staff a new division of the department of pharmacy which is commonly referred to as "Drug Information Center". This new concept in hospital pharmacy operation is usually located in a separate section of pharmacy, containing large number of reference texts, journals, reprints and brochures. They are also equipped with electronic data processing equipments and staff. Now computers have possible networking of regional drug information centers made located in different hospitals. Networking on regional, national, sub continentals, intercontinental levels had placed Drug Information Services at a global level.

Drug information is both a body of data and information about medications and a set of skills and tools that provide pharmacy professionals with the ability to find, access, understand, interpret, apply and communicate information and acquire knowledge. The

body of facts and information pertaining to medications is generally referred to as "the drug literature". The literature of pharmacy and pharmaceutics encompasses all aspects of drugs, beginning with isolation or synthesis, including physical analysis, bioactivity, toxicology, clinical research, market research, and economic and social considerations. The drug literature, reflecting all the individuals who create it and use it, such as chemists, biomedical scientists, all the various health care professionals, attorneys, and patients, is vast and complex. Different kinds of publications are available in the library like journals, abstracting and indexing publications, books, compendia, monographs, patents proceedings, reviews, FDA-approved labeling (package inserts), house organs, newsletters, promotional literature, government documents, and analysis by consulting services.

Drug information skills coupled with the processes and technology offered by informatics are part of the solution to mastering information overload and maintaining the knowledge system that improves patient care outcomes.

# ↙ Drug InformationRetrieval Systems:

As a drug moves along the path from discovery to the market and into worldwide use, data and information about the agent are created and accumulate. When this information is published, its value and usefulness to scientific, professional, and patient communities becomes known. Publication of research results at each step of the path is essential. The path of drug development and marketing offers a structure that is useful to scientists and practioners concerned with compounds of potential therapeutic value.

The resources themselves are classified as: primary (original research), secondary (indexing and abstracting services), and tertiary (textbooks and evaluated information). Individual resources are now generally available in more than one physical format; for example, a journal may be available as a paper publication or as an electronic publication (either individually or as part of a publisher's electronic journal collection or content collection). Primary, secondary, and tertiary resources are available for each step in the path of drug development, but reporting time increases from each step to the next.

## 1. Preclinical Drug information:

At this point a compound is recognized and then considered for potential pharmaceutical or therapeutic usefulness; researchers will be both consumers of and contributors to the data information-knowledge cycle that characterizes science. Initially, in the synthesis and purification phase of drug development, information about the compound's chemistry and

physical properties may be both sought and created. Whether or not the compound has been of interest to other researchers may be determined by searching public records of grant and contract awards and also by searching resources that cover preliminary and early research results. The patent status of the compound may need to be established.

a) **Physical and chemical data**: AIDSDRUGS, Beilstein, CAS Registry, Chemcyclopedia, ChemFinder, Chemical Abstracts, ChemID plus, Chemindex plus and The Merck Index.

b) **Patents**: U. S. Patent and Trademark Office Web Patent Databases offer free WWW access, http://www.uspto.gov/main/patents.htm, to a bibliographic patent database that uses the most current patent classification system. The Delphion Intellectual Property Network (IPN) is a research tool for patent information.

## 2. Phase IV Studies and Post Marketing Drug Information

During the Phase IV Studies and Post Marketing Drug Information stages a thorough literature search is required to find material relevant to the clinical use of the drug. This will require not only searching the basic bibliographic databases such as Biological Abstracts, EMBASE, IDIS, IPA, MEDLINE, and Science Citation Index, but also searching the patent literature, using Patent and Trademark Office Web Patent Databases.

The following bibliographic databases provide access to the full span of life-science periodical literature, including all stages of a

compound's development from early brief reports to comprehensive assessments after years of clinical use.

- ❖ BIOSIS
- ❖ EMBASE
- ❖ International Pharmaceutical Abstracts
- ❖ MEDLINE
- ❖ Pubmed Central
- ❖ Science Citation Index

| S. No. | Resources/sites for Drug Information and related information | Information provided |
|---|---|---|
| 1 | www.ashp.org/s_ashp/sec_drug_shortages.asp | **American Society of Health-System Pharmacy – Shortages:** Drug Shortage Resource Center with updates/ management of shortages |
| 2 | www.cdc.gov | **Centers for Disease Control:** Public health guidelines, vaccine and travel information, and CDC publications |
| 3 | www.fda.gov | **Food and Drug Administration:** Drug and Biologics information (approvals, shortages, Orange Book, news, etc.). Be sure to click CBER for biologics and CDER for drug information. |
| 4 | www.home.mdconsult.com | Full-text books and journals, drug information, news, CME, and patient leaflets. Requires fee and password |
| 5 | www.guidelines.gov | **National Guidelines Clearinghouse :** Public resource for evidence-based clinical practice guidelines established by the governments Agency for Heathcare Research and Quality. |
| 6 | www.health.nih.gov | **National Institutes of Health:** Information on disease states, research, and federal health programs from the NIH |
| 7 | www.ncbi.nlm.nih.gov/entrez | **National Library of Medicine:** PubMed - a searchable listing of abstracts of medical literature |
| 8 | www-medlib.med.utah.edu | **Spencer S. Eccles Health Sciences Library:** Library catalog, full-text journals, searchable databases, etc. |
| 9 | www.uuhsc.utah.edu/pharmacy/druginfo | **The University of Utah Hospital & Clinics Drug Information Service:** Information about our service, publications, and drug shortage updates. Many links are for internal use only. |

| | General Drug Information | |
|---|---|---|
| | | |
| 10 | www.medlineplus.gov | Site links to patient drug category and health monographs, medical dictionaries, health professional directories and other resources such as organizations and health libraries. |
| 11 | www.health.nih.gov | **National Institutes of Health:** Information on disease states, research, and federal health programs from the NIH |
| 12 | www.Csmwm.org | **Specialize in Depression Help , Drug Reaction , Depression Drugs , Allergy Medicines , Drug Safety** and an array of other products and services |
| | **Investigational Drugs** | |
| 13 | www.clinicaltrials.gov | **National Institutes of Health--Clinical Trials:** Directory of clinical trials in progress. Can search by disease state or specific agent. |
| 14 | www.phrma.org/newmedicines/ | Information on drugs in the pipeline. Can search by disease state and therapeutic categories. Good summary articles on topics related to drug development. |
| 15 | www.cancer.gov/clinicaltrials | **National Cancer Institute:** Specific for clinical trials to treat cancer |
| 16 | www.patientadvocate.org/ | **Patient Advocate Foundation** : Patient resource i.e. it means to participate in clinical trials and use investigational drugs. |
| 17 | www.bioscorpio.com | Lists of investigational drugs in pipeline by disease state. Major limitation is must pay for additional information. |
| 18 | www.centerwatch.com | Provides trial data and email-notification services to patients interested in participating in clinical trials. Professional investigation drug information can be found after subscribing to the service for a substantial fee. |

# Drug Literature:

The concept of drug information service or drug information center is an attempt to document drugs by abstracting information about them. The information about drugs is collected from various sources which are available. In 1972 Walton et al modeled the drug literature as a pyramid with the primary literature forming the base of the pyramid, the secondary literature interfacing and serving as a bridge from the primary literature to reference works (tertiary literature).

1. **Primary Literature:**
   Primary literature contains the first written accounts of original research. In terms of size, the primary literature is probably larger than either the secondary or tertiary literature. It is the original information presented by the author without any evaluation by the second party, for example, articles published in journals, dissertations, conferences, etc.

2. **Secondary Literature:**
   In this original information is modified, condensed, commented upon by other persons like review articles, abstracts, text books, etc. These include - Indexing and Abstracting services, Evaluated Secondary Resources and Internet search engines.

3. **Tertiary Literature:**
   In this information is gathered from primary and secondary sources and arranged in such a manner to give coupled

information. The tertiary literature is a distillation and evaluation of data and information first presented in such primary literature sources as research reports, meeting presentations, and journal articles. But just as characteristic, the tertiary is the most accessible, easiest to use, and perhaps the most used of all information resources. Information searches generally start with a perusal of books, reviews, and handbooks. These include - Aggregated and linked references such as MICROMEDEX Systems and StatRef.

## Advantages of Computerized Literature Retrieval:

- ✓ Save time, space, money
- ✓ Save effort, person-hours and greater efficiency.
- ✓ Online Computerized services offer Term Searching of Fields, Controlled vocabulary and Indexes.
- ✓ Online Computerized services offer Search Commands for Creating search sets, Boolean operation, Word searching and Search limiting.
- ✓ Online Computerized databases offer Computerized greater Precision.
- ✓ Qualitatively different kinds of searches are possible.
- ✓ Easier to assess quality of information found More cues: authorship, institutional affiliation, reputation, references, ...
- ✓ Processing of search results: Sort, rank, report, export, integration with Intranet/portal, ...
- ✓ Highly Focused information that is actionable
- ✓ They offer evidence for their claims.

- ✓ Provides great reading with a wealth of knowledge.
- ✓ Broadened perspective.
- ✓ Most articles contained in journals include graphs, tables, images & photographs, videos, etc., which help illustrate the information being portrayed.
- ✓ Unlike in the print copies days when you could only access information physically in libraries, academic journals online come with the option of free downloads which allow you to save material to your PC or Smartphone.
- ✓ Online journals are like encyclopedias, offering information in large quantities to scholars. There's a wide variety of databases to source information from, but it's so much easier to access this information online because all you need is a computer and internet.
- ✓ Academic journals include real life case studies which are excellent sources of in-depth information and knowledge.
- ✓ Academic journals online come with several research options, which helps widen your scope. They allow you to explore both quantitative and qualitative research, for optimum results. With both, you can analyze statistical data, opinions, verbal data, etc.

# Use of Computerized Retrieval

Today computers provide us with powerful tools for drug information handling - for collection, organisation, classification, retrieval and distribution. Computers have been used since the late 1960s for the storage of large databases such as library catalogues and bibliographic references. Development of optical storage media such as CD-ROM has given us the possibility of storing large quantities of text, graphics, pictures, and sound at a low cost. These new optical memories can function as distributed stores for encyclopedias, databases, books etc. This has stimulated the development of local information systems.

These three aspects of computerized information retrieval:

- Library catalogues.
- Online databases.
- Databases on CD-ROM.

## Types of databases

There are a number of types of databases:

1. **Library catalogues** - catalogues covering the holdings (books, reports, journals conference proceedings, etc.) of one or more library.
2. **Bibliographic databases** containing bibliographic references, with or without abstracts.
3. **Reference databases**, for example, current research projects, handbooks, encyclopedias, product suppliers, etc.

4. **Factual databases or data banks** containing information, often in numerical form, which can be used directly, e.g. chemical structures, tables, terminology.
5. **Full-text databases** which contain the complete version of the text of given publications.

## Computerised library catalogues

Computerised library catalogues were first introduced during the late 1960s. The online catalogue, known as the Online Public Access Catalogue, or OPAC, has gradually become more user friendly with the use of menus and simple commands. Access for users is now often in the form of a Web (World Wide Web) interface.

The computerised library catalogues allow you to:

- Check to see if a certain book or journal is available at the library or
- See which books are available on a specific subject
- See whether or not a book is currently available or out on loan.

## Access to databases

Information from the primary sources has been collected together and organised under subject headings and authors in reference databases. These can be accessed in a number of ways:

- Searching online from a database mounted on a host computer from a commercial information retrieval service (IRS). This requires a password.
- By means of a searchable compact disk CD-ROM database.

- From a database with WWW interface mounted either locally or available from a remote server.

Online information retrieval from databases is the acquisition of information from a distant computer via a terminal or PC, involving an interactive dialogue between enquirer and computer. The computer handles a number of databases stored in electronic form, consisting of references to journal articles, conference papers, reports, books etc, which the Information Retrieval Service (IRS) or 'host' makes available to interested parties, such as university libraries, on a commercial basis.

CD-ROMs and WWW interfaces have been designed for end-users. They are relatively user-friendly and the search software is (more-or-less) self explanatory. Today, CD-ROMs often are mounted on a server so in reality the user will not be able to notice any differences between using online databases or a CD-ROM.