

# The role of Computer Systems in Pharmacy

By F.R. Oyegbile

Department of Pharmaceutics and Clinical Pharmacy,  
University of Ibadan, Ibadan.

In dynamic societies such as exist in Germany, Sweden, Australia and the United States, the use of computer systems in pharmacy profession is increasing due to the expanded roles and informational needs of the pharmacist, and the increased amount of paper work required in practice. Also there is a need for efficiency and the viability of computer technology and expanded data bases to provide the necessary support.

In all my six years of full time involvement in electronic data processing (EDP) I am never more convinced than now that it can find its use in every profession, even those considered to be the least important jobs such as household chores. Robots have been developed to perform certain chores such as getting some food out of the refrigerator or freezer and setting the dinner table. Programs have been written on personal computers to instruct the computer to open or shut the window curtains at some specified time of day. How much more would we find it useful in Pharmacy.

To enhance the understanding of this subject, I will talk briefly on the basic terminologies of computer and then consider the role of computer systems in hospital and retail pharmacy in industry, and in education and research; the disadvantages of computer systems; the type of hardware and software, cost and where to get them and finally I will discuss the computer application to Nigerian pharmacy practice.

Some computer terminologies:—

INPUT	Information to be processed by the computer. It could be on cards, tapes, display terminal or others.
OUTPUT	Results of computations as indicated by the programme is communicated to people (display terminal), printer, other devices or stored in the computer for subsequent processing.
MEMORY	Defined simply as storage in the computer where programs and data are stored during processing.
ON-LINE	Direct access system—data is stored on disk which is similar to a stereo record—any song on one side of its could be assessed. Therefore questions could be asked on a display terminal or console and the response will be sent immediately to the same device.
OFF-LINE	Sequential or serial access system—data is stored in magnetic tape unit which in many ways is like the domestic tape recorder, where access requires running through many feet of tape to find the specific recording.

Response to questions in this case, is delayed usually routed to a printer.

HARDWARE	Physical components of computer—the computer machine itself, display terminal, console, printer etc.
SOFTWARE	Non-hardware components of the computer—programs and programming languages.
PROGRAMS	Set of computer understandable instructions in sequence of computational steps needed to solve a problem.
DATA BASE OR DATA BANK:	A file of data derived from a variety of sources and stored in a manner suitable for ready access by a number of users.

## Computer systems in hospital and retail stores.

The functions of the two areas of pharmacy practice are basically the same. Generally computerised systems in pharmacy are utilized in four areas:

1. Prescription dispensing and associated record keeping,
2. Information generating,
3. Drug surveillance, and
4. Business management and accounting.

## Community and hospital pharmacy practice

In prescription dispensing labels must be prepared singly or multiple copies, prescription number must be assigned, the price of the drug must be calculated, receipt needs to be prepared, special record keeping data entry such as the name of dispensing pharmacist, the drug cost and product dispensed, and other special notations must be performed. It takes time for the pharmacist to complete each of these functions per patient, especially if the pharmacist is located in an area which generates high volume of prescriptions.

Furthermore the pharmacist's informative role is increasingly more important than ever. The pharmacist informs the patients of possible side-effects and interaction of the medication dispensed. In many of the countries where computer systems is vastly used, patient education and counselling by pharmacist are very important. Therefore the role of pharmacists has drastically changed in professional performance, in the last decade. Although the principles remain the same. It is still his responsibility to ensure that the right medication, in the right dosage, in the right quantity, in the right form of administration, in the right packing is delivered to the right patient at the right time. The number of old tasks of a pharmacist has decreased and new ones are presented under the term of



### Drug Surveillance.

*Drug Surveillance*, a more clinically oriented aspect of pharmacy practice includes among other things, the check on dosage, investigation of possible interactions and a check on possible contra-indications and allergies. In order to achieve an effective drug surveillance, it is essential to record a certain quantity of data concerning the patient and his use of medication. Such data includes name of drug, quantity dispensed and date dispensed. In pharmacies where 50 or more prescriptions are filled daily, there is bound to be a great work load, of recordings to be done. Such a system obviously requires some considerable maintenance and is prone to numerous errors when performed manually. Also by tracking the quantity and date the drug is dispensed, patients compliance can be monitored.

In addition to these functions the hospitals and retail pharmacies also need to keep track of some accounting and business management information. They need accounts receivable, accounts payable, sales analysis, payroll records, employee records, inventory control and ordering, daily summary of business, general ledger and third-party drug claims processing and records (when paid by insurance company or government). The computer could also provide information on prescription analysis such as retrieval information on daily, monthly, yearly prescription totals, and cost/profit per prescription filled.

The system required must be able to record, keep and retrieve large amount of data. The software which comprises of the data bank and programmes is the most important in the application of computer systems into pharmacy. The software determines the way in which the computer can be used and its ease and speed of operation. In pharmacy practice interactive system is essential, this means it must be an online system where the data is stored on disk which can be assessed directly. The pharmacist or his assistant can therefore, communicate directly with the computer and it also means that any transaction involving medication can be checked and recorded immediately so that the system and data are always up to date within seconds. This is similar to the system the Flight attendants at many airports such as Heathrow and New York use. For example, in order to get a boarding pass, the name on your ticket will be input into the system and within seconds the message is displayed to O.K. the pass, and it updates the list of name of passengers already checked in and other statistics of passengers kept by the airways.

To demonstrate this I will now go through an example of what such a computer system can do in filling a prescription for a regular patient. The computer system normally contains the names, addresses and the number if assigned. When a patient presents his prescription the hospital will have the patients hospital number on the prescription, else if it were in a community pharmacy which does not assign a number, the name or street name of the patient will be used as the search key. The patients record is accessed directly when number is used. But in the absence of this, the pharmacist keys in the name of street name wholly or partially, the system responds by displaying a list of the patients who meet that description. From this listing the patients record is selected by depressing a single key. The more detailed data given to the computer, the more accurate the response. For example, if the last name is Adanu, keying in "A" alone will give the listing of all names beginning with "A", if "ADAMU" is entered, only patients having this name will be displayed. Only few key strokes are required to get the error-free name/address data. Immediately

the computer identifies the patient it looks up all other data relating to this patient in the memory.

Next the pharmacist keys in the medication. The display will be all forms of administration and posological data of the drug. The pharmacist only need to respond by the corresponding consecutive number.

After the choice of medication has been communicated to the computer, it displays the complete patient profile as presented on this chart. The latest medication dispensed is at the top of the list and the oldest ones at the bottom. Occasionally an asterisk appears after a medication which indicates that there is a possible interaction with a medication that is dispensed to the patient in the past. The pharmacist would have to decide if the drug should be delivered, depending on how long ago the previous medication was dispensed. In cases where there might be a definite interaction the prescribing doctor might be informed. The main point in this discussion is that the essential checks have been made, this can only be possible because the computer operates at such a tremendous speed. This is impossible with manual system.

More than that the computer also produces error-free single or multiple labels prepares, the receipt, assigns the consecutive prescription number, this eliminates duplicate or loss of number, calculates the price of drug, updates the file of dispensing pharmacist and related information, updates the inventory control, account receivable, general ledger, accounts payable, third party drug claims processing and record (Health Insurance), updates analysis and the daily summary of business. All these functions are achieved within seconds. Invariably, this eliminates one or two employee jobs—a great saving for the pharmacy.

Not only the hospital and retail pharmacies use the system but also the drug wholesalers. They use the computer system in a similar fashion to retail pharmacies. In place of patients file, they have files for each of the pharmacy they supply. The credit and account information replaces the medication information of patients. Inventory control and reordering is a major part of the functions of the wholesalers. Therefore software is available to store, retrieve and process all these information. Informations Inc.'s Data Services Operations of Columbus, Ohio has developed the software for this purpose and many drug wholesalers in the area are in their net work system.

### Industrial pharmacy practice

Merck Sharp & Dohme Pharmaceutical Company in United States is one of the well established companies that has the entire tablet manufacturing process, based on a wet granulation method, under computer-controlled system. The computer system weighs the ingredients, blends, granulates, dries and lubricates to prepare a uniform granulation of a specified particle size and distribution. The computer system directs the compression of the granules into tablets with specifications for thickness, weight and hardness. The facility represents an innovation in pharmaceutical manufacturing. A computer system is also used to control sterilization and autoclaves because it can increase capability, accuracy, repeatability in monitoring, controls calculation and record keeping, while reducing time labour and the possibility of error. Functions such as displayed here can be achieved through the computer system. The user of the system employed can automatically control cycles, gather and record data, perform studies and statistical analysis.

The pharmaceutical industry also uses the computer system



for the business record keeping and management functions discussed earlier.

#### Education and research in pharmacy

Up to a point these two areas overlap, therefore they will be examined together, in most of this section. However, first let us look at one specific education aspect.

Computer system used in teaching and evaluating students' knowledge of a subject is titled "Computer Aided Instruction (CAI). In some pharmacy schools in United States, Computer Aided Instruction is an important diagnostic tool for students. For example in the University of Minnesota, quite a few courses especially in Clinical Pharmacy use the CAI. At the completion of a topic in class, the student would study and then attempt the objective questions of the CAI system. The CAI is an interactive system which uses teletype or display terminal, which connects to the system, by telephone. Objective questions, one at a time, are displayed to the student. His responses are evaluated. After the test, computer system diagnoses the weakness or strength of the student and informs him of the area he should put more effort.

At the University of Ohio, a pilot medical school scheme called "Independent Study Programme" is based on the Computer Aided Instruction system. Students with advanced degrees such as Masters or Doctorates who are accepted into the Medical School are mostly selected for this programme. It is assumed that they can work independently, therefore no lectures are given for most of the subjects, thus they can accelerate their work. They usually spend three years instead of the normal four years programme. After full preparation, using the notes and references they are given, they will attempt the CAI tests, and if the computer diagnosis is good, they are then allowed to take the real test for the course.

We will now examine the overlapping area of Education and Research. In the process of reaching the market a typical pharmaceutical product generates an extensive amount of data such as chemical structures and properties, biological and toxicological potential and information of its pharmacology and therapeutic studies. Educators and Researchers of different disciplines will need to assess these data on its merits and in relation with other pharmaceutical preparations. The management of such a huge data requires the ability of the computer to file, store, select and retrieve the information quickly and precisely.

Most of this extensive data is found in published literature. Therefore indexing and abstracting this information is essential and the enormous task is done by three major information services. The organization responsible for most of this are Chemical Abstract Service (CAS), National Library of Medicine (NLM) and the Biological Abstracts. Each of these organisations is committed to the use of computers as an integral part of their services. CAS has computer services available on many of their printed abstracts and periodicals. To name a few of these, we have Basic Journal Abstracts, Comprehensive list of Periodicals for Chemistry and Chemical Engineering.

Also CAS creates computer readable files and stores information for several organisations in the health care field. Among them are American Society of Hospital Pharmacists, National Cancer Institute and the National Library of Medicine. Each of these organisations has one or more data bank which the CAS maintains. For example, the American Society of Hospital Pharmacists has a computer readable file of Inter-

national Pharmaceutical Abstracts which the CAS maintains. The file not only include information on pharmacy practice, legislation, laws, regulations, history, economics and education in pharmacy, but also adverse drug reactions.

The new trend of CAS is to have most of their services on-line. An example of this is the CAS-online, which is a chemical structure search system. For example, a researcher in the network at any part of the world could draw on a terminal, benzene ring with one methyl group attached, and inform the system to search for all compounds with this structure. A long list of such compounds will be displayed on the terminal and he could choose all or part of the list he is interested in. He has a choice of scrolling and working on it at the terminal or request it to be printed and sent to him just by one key stroke.

CAS also maintains several files for National Library of Medicine such as TOXBIB file which includes information on drug interactions, and occupational diseases or disorder. The National Library of Medicine (NLM) has the greatest information available on the on-line system as displayed. The MEDLARS (Medical Literature Analysis and Retrieval System) was developed to achieve rapid bibliographic access to the library's collections of biomedical information. This enables an individual associated with a University in the NLM network system to search for literature on a specific subject within specified number of past years. Extensive search, is done at night. Now MEDLINE, which is the same search but it is on-line is available. List of literature available on the specified subject within the last three years is displayed on the terminal.

NLM also has the TOXICON (and TOXLINE) which is a computerised information on human and animal toxicity studies and other data on drug reaction, poisons and chemical pollutants. All these services are available on fee for service charge, a computer time charge, a subscription or combination of all these.

Other systems available are DRUGDEX and POISINDEX by MICROMEDEX in United States. DRUGDEX system is a computer-generated microfiche information system which makes available consultation on drugs and diseases states to subscribers. The data base can be accessed through generic name, brand trade name, chemical names, OTC preparations, therapeutic indications, disease state and others. POISINDEX is similar except it is an emergency ingredient informations for pharmaceuticals, industrial and botanical items. The poison information includes symptoms, pharmacology, toxicology and treatment procedures. In United States the trend now is to have the Physicians Desk Reference (PDR) equivalent of the Medipharm, and the American Hospital Foroulary in an on-line system for easy access.

#### The disadvantages of automation in pharmacy

It is a well established fact that freedom and easy accessibility to information could conflict with confidentiality. Data such as an account listing the various products and medicines supplied to a customer, and wholesaler's accounts could yield much private information to competitors in pharmaceutical industries. Each of these industries is anxious to know its market share and geographical usage of its products. Therefore getting access to such a record will be of great value to the competitors. Also a great deal of insight into the patients medical record and a doctor's prescribing habit could be derived from such data.

In case of product liability for defective pharmaceuticals, there will be a marked increase in the number of claims for



compensation, because the patients records stored in the computer is readily available and could be used as a concrete evidence in court.

In keeping accounts and entry of data, an employee in charge of this must be trustworthy. Fraud in computer manipulation is a regular occurrence and often reported in computer journals. Computer World, a news weekly for the computer community in United States reported a case of fraud sometimes last year which involved a couple.

#### Computer hardware and Software

The hardware suitable for this purpose are mainly the mini-computers or microcomputers, except in the industry where these and microprocessors could be used. Hardware that might be used are:

IBM Series 1	128K Storate	Microcomputer
WANG	64-512K	Microcomputer
WANG VS 2200		Minicomputer
IBM 5285 Tabletop		Microcomputer
Z80		Microprocessor
Steritrol 2 (by Scientific Industries Inc.)		Microcomputer

It is worthwhile to note that the software developed in other countries will not exactly be suitable for Nigeria because of the variation in the Brand/Trade name. The software will have to be modified in that respect. Also not all the drugs in the software is available here. The following software are available in United States:

ADIM by the American Druggist Blue Book Data Centre, a Unit of the Hearst Corporation, 875 Mahler Road, Suite 200 Burlingame CA 94D10.

PDI (Pharmacy Dedicated Information System) by DIGI-MEDICS Corporation, 501 Cedar Street, Santa Cruz CA 95060.

DATASAT by National Data Corporation, Health Care Data Services One, National Data Plaza, Georgia 30329.

SAINT by Systems Associates Inc., 412 East Blvd., P.O.Box 36305, Charlotte, N.C. 28236 (Supplies Hardware as well).

#### Potentials in Nigeria

Finally, a question we may ask at this point is—will such a system be feasible in Nigeria today? To this I will respond with an emphatic, YES, it is feasible if we are willing to accept the challenge.

Obviously not all pharmacies could justify such a system considering the number of prescriptions filled per day, but our hospitals and many pharmacies could. Also, in Nigeria, just as in United States, patients visit more than one doctor and different pharmacies, therefore, we may justifiably feel that it is more difficult, and, maybe virtually impossible to create patient profile. Yet I believe that it is of special importance in such a situation for pharmacist to start drug surveillance. The pharmacist will also see that the patient understands the value of drug surveillance, and the patient will have a good reason for visiting the same pharmacist. This is a smart and effective method to get a satisfied customer and retain him.

To illustrate this point further, there are two pharmacies located in an area in Ibadan, and only three houses apart. I have visited both pharmacies, mainly to compare the price of prescriptions and non prescriptions. Overall pharmacy A is less expensive than B, but also A has better service. Couple of weeks ago, while discussing with some friends, I ask for their opinion on both pharmacies, each of them prefer pharmacy A, because of its service. I then asked them about the prices of both pharmacies, but they all prefer to fill their prescriptions

and buy non-prescriptions items at Pharmacy A. This confirms the fact that Nigerians do understand what good service means when there is a choice. Therefore patient education and counselling, which we will have time for, if computer system is used, could bring the customers back and retain them.

Secondly, we all learnt the specific standard of labelling prescriptions, as stated in pharmacy textbooks and in school. But rarely do we follow this in practice. The computer system is a way out in this case. We only need to input some of the information once, the system stores and retrieves it anytime it is needed, and prints the label in seconds.

Thirdly the management of the huge data required by research and clinical pharmacy needs a computer system. It is interesting to note that there was a great emphasis on clinical pharmacy at the seminar held here by Pharmacy students couple of weeks ago. This indicates that clinical pharmacy will be an important aspect of pharmacy in the very near future in Nigeria. Also the more educated Nigerians are, the greater the demand for information from pharmacists. Information and easy access to it are important in giving effective and accurate patient education.

In additional, it cannot be overemphasized that all aspects of pharmacy require the accounting and business management functions. Among the functions discussed earlier, inventory control is of a greater importance. Many of our business presently close for a day or more in order to take inventory. This amounts to loss of business on those days. But if computer system is used, the inventory is always up to date within seconds. Also it is an error free inventory and could save us one or two non-pharmaceutical employees.

As we start thinking of computer-system in pharmacy practice, in Nigeria, we must consider some important points. First we need interested individuals to develop a data-base for all the drugs available in Nigeria. This is where the Pharmacy (or Drug) and Therapeutic Committees of hospitals (if they exist) are of great value. This will be a step towards compiling a National Formulary for the whole country.

Without going into details on how to choose a computer system these are some of the questions a potential user will want to consider:

- (1) Will the hardware fit into the store environment?
- (2) How do costs compare with other similar systems and with different approaches?
- (3) Will the computer supplier be able to survive as a business?
- (4) Do the various information files (e.g. drug interactions) contain the correct information?
- (5) Are reports in useable and timely form?
- (6) Are the privacy issues well handled?
- (7) Does the supplier have a viable customer support function to handle training and solve problems?

Without doubt, the computer system is viable in all areas of pharmacy. It is used in Hospital and Retail Pharmacies, in Industry and also in Education and Research. In order to fit into the new roles for pharmacists, computer system is vital. Are we willing and ready to fulfil these important roles and accept the challenge?

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