SOFTWARE DEVELOPMENT OF AN ELECTRONIC MEDICAL RECORD SYSTEM FOR HEALTH SERVICES IN NIGERIA

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CERTIFICATION

This is to certify that this Research Project on Software Development of An Electronic Medical Record System for Health Services In Nigeria was carried out by Nwankwo, Donald Chidi of the Department of Project ManagementTechnology under the supervision of Prof. G.E. Nworuh in partial fulfillment for the Award of a Master of Business Administration (MBA) in Project Management Technology.

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DEDICATION

DEDICATED TO ALL MEN OF GOODWILL.

ACKNWOLEDGEMENT

This work, no doubt, posed a challenge that required a transition from Medical Science to Management Science and then Computer Science. I really thank God for sustaining me and my helpers all through this period.

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Finally, I thank God for my wife who also acted as my Personal Assistant. She typeset the work professionally free of charge.

I pray God to reward all these people adequately.

ABSTRACT

Almost all over Nigeria today, manual method of Hospital Record Keeping is the practice. No serious attempt has been made to join the Information Society by adopting new information technologies in a vital area like record keeping.

This project, therefore, set out to investigate the drawbacks of manual methods on health service delivery, and subsequently designed an automated system to replace the manual method. Through participant observation and personal interview, data were collected on waiting time at the card section, and running cost of the section. The study showed that over 35 minutes of patients' waiting time could be saved as well as over 60% of running cost of the unit. These would improve patient satisfaction and resource management in addition to exposing staff to modern methods. This research, therefore, recommends adoption of electronic medical record systems through parallel conversion from manual to electronic method to avoid abrupt disruption of work. Finally, a separate study to determine the cost of conversion is suggested.

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CHAPTER ONE

INTRODUCTION

1.1. BACKGROUND OF THE STUDY

Health, like the economy and security, touches deep on people's life and well being. Apart from the effect of biological factors and personal habit on one's health, environmental and occupational factors also affect health significantly. Thus, health is all-encompassing. This is why internationally health is regarded as a state of complete well being – physically, mentally, spiritually, socially and psychologically, and not just the absence of disease or infirmity (WHO, 1963). Also health is equated to wealth.

As important as health is to both individual and national development, health services in Nigeria appear to be very inadequate. Annual budgets at various levels of government in Nigeria give the health sector 2.5% of the budget generally as against the minimum of 5% recommended by the World Health Organization (WHO) for developing countries like Nigeria. Consequently, the downstream effect is suffered across population segments – children, youths, middle aged and the elderly.

The university community which consists essentially of students of youthful age and staff of young-to-middle age range is a center for highly intelligent, vibrant and restive citizens with very high expectations in life. Unfortunately, these high expectations are hardly met any where in the Nigerian socio-economic setting. But this sad situation is more sensitive and precarious in a hospital set up because time matters very much when life is ticking away. Therefore, any delay in attending to a sick person in the hospital may rightly draw his wrath in addition to truly worsening his health. In practical terms, undue time waste in rendering medical attention could cause misconception, misplaced aggression, anxiety, loss of confidence and distortion of the normal rapport necessary for effective treatment. Unfortunately, this is the commonly observed situation in most hospitals in Nigeria.

Beginning at the Reception or Card Room, frustrating delay is encountered at every station – Consultation, Pharmacy, Treatment Room Etc. This situation has persisted for ages because of the medical management system in operation. The system is essentially manual in all respects. The situation applies to FUTO the center of this study as well as to other high level care centers in Nigeria.

In FUTO, the Department of Health Services (DHS) is charged with the primary responsibility of providing medical service to a large community consisting of the university students, university staff and their families, staff school and the host communities that border the university. Apart from the surrounding communities that benefit from the university health services the university community per se had a population of about 25,000 students and staff with six medical doctors in the Department of Health Services as at the end of 2003/2004 academic session (FUTO NEWS, 2004).

This large clientele notwithstanding, medical records and all other procedures in the health service are done manually. There is no facility for internal communication or assured facility for external communication within the department or outside. Consequently, patients' cards or folders sometimes get missing, misplaced or untraceable even when most needed for vital information. Where the folder is available, record keeping is observed not to follow any identifiable pattern. Important information, data or laboratory results may be missing or not recorded at all. Legibility of individual writing is another problem. Often staggered sheets are maintained in the folder without file tags to secure them.

Again, after the normal morning work period, the medical records staff all go for the day and lock the records office. Thus there is no medical records service in the evening or night, public holidays or even emergency situations. As a consequence, the attending physician sees his patient as a fresh case each time because there is no reliable record to give hindsight. Of course, in Nigeria, medical record keeping is yet to gain recognition as a profession. Less than 5% of the existing universities offer courses in medical statistics and Record Keeping. As a result, there is hardly any professionalism or professional staff in the medical records unit which in all respects is just a “card room”.

Generally, the prevailing circumstances in university health care system cause avoidable delay, stress and even frustration to the patient, staff and hospital management. It is against this background that this project was conceptualized. The sole aim is to design a system that will replace the present manual and unsatisfactory medical record keeping with a more satisfying automated one that will aid instant retrieval of any patient’s medical record. The automatic system will be based on computer, the most recent electronic gadget for information and communication.

1.2. STATEMENT OF THE PROBLEM

In the present healthcare system, manual record keeping is the practice. This causes loss of record, delay in retrieving available record, occupies large storage space, and jeopardizes the security and accuracy of confidential medical information. It also makes transfer of medical information for referral purposes difficult. This situation does not encourage ill people to seek help in the established health facility nor does it motivate the health workers.

In view of this, this work aims to design a computer-based medical record system that will eliminate these problems and increase productivity.

1.3. OBJECTIVES OF THE PROJECT

The broad project is to design and develop software that will automate medical record keeping in the Nigerian health system using FUTO as the study center.

The specific objectives of the new system are to:

- Analyze the manual method in order to identify its problems.
- Design of the electronic method in order to solve problems of the manual method.
- Compare efficiency indicators of the electronic method with those of manual method.
- Make recommendations on the basis of findings of this work.

1.4. SIGNIFICANCE OF THE PROJECT

The findings of this work will expose the problems of long waiting time (delay), bogus application of human and material rresources and general dissatisfaction associated in the manual method of medical record keeping. The work will at the same time proffer solutions to the identified problems through designing an Electronic method that will assure a more efficient and effective service delivery.

Specifically, adoption of the new method will lead to:

- Zero patients waiting time for retrieving old records.
- Maximum of 15 minutes for opening new records.
- Optimum use of scarce resources through significant reduction in manpower and material costs.
- Timely generation, as well as reliable preservation of medical record.
- Strict maintenance of confidentiality in record management.
- Wholistic view of any patient's case history.
- Easy availability of management information for better planning.

1.5. SCOPE OF THE PROJECT

The project is about designing and developing an electronic or automated medical record keeping that will replace the present manual system generally operated in Nigeria. It is based on the study of the present system in FUTO.

CHAPTER TWO

LITERATURE REVIEW

2.1. Historical Development of Medical Records Management And Automation.

According to archeological findings, nature itself established and preserved records of events even before the art of writing was discovered in Egypt about 4000BC. Fossils revealed the earliest record of disease. Such diseases as bony tumours, including joint disfigurement, gall stones and even tuberculosis were evident in archeological findings. (Aremu, 1998). As man developed in his pre-historic environment, evidence of diseases, and attempts to treat them, became obvious on Egyptian mummies (preserved dead bodies) and drawings on cave walls. Skulls were discovered to have holes drilled in them with sharp objects in apparent attempt to manage some head problem surgically.

Thinking of a deliberate attempt by man to record and preserve medical records for posterity, the ancient Egyptians, Jews and Greeks laid the foundation. According to Aremu 1998, the Egyptians, upon acquiring the art of writing, wrote **"**extensively on papyrus which was kept in long scrolls. Their Hermetic Books on the god Thoth", had

36 sections, out of which six were devoted to medical matters. These books were so authoritative that they were regarded as textbooks and reference materials on medicine. The notable Ebers Papyrus discovered in a tomb in Thebes in 1862 and named after Professor George Ebers, the discoverer had lists of medical prescriptions.

The Jews, on the other hand, closely associated disease and healing with the Almighty God whom they worshipped. Their priests and worship centers were regarded as extensions of the hand of Jehovah God. Activities of disease and healing were extensively recorded in their worship book, the Bible. Physicians as we know them today, played little part in the art of healing in ancient Jewish times.

The first scientific attempt to organize and keep medical record was really made by the Greeks. Hippocrates, a Greek Philosopher regarded as the Father of Medicine dispelled belief in superstitions and focused on epidemiological observation and interpretation of disease patterns. He tried to keep accurate and systematic record of his observations as a basis for his enunciations and treatment of diseases. Hippocrates was born in 360BC in Cos, an island near Asia Minor. Another Greek, called Galen, born in 131AD in Pergamea

also in Asia Minor wrote many Medical Gospel books in the Dark Ages following Hippocratic methods.

The first real attempt to keep medical record in a hospital setup was in 1131 AD when the Hospital of St Bartholomew was established in the outskirts of London by a monk called Bahere following a divine instruction. Thus, according to Aremu 1998, St Bartholomew took the lead in keeping medical records, and was again in the lead when it established a medical library in 1667.

2.1.1. THE GROWTH OF MEDICAL RECORDS GENERALLY

Versalius, a Greek, and professor of surgery and anatomy in the University of Padua may be regarded as the Father of Medical Record Keeping for he was the first to practice dissection in Greece in order to advance knowledge and collect data. Before this bold attempt, the Greek mythology forbade dissection in the belief that one needed to resurrect whole. After the work of Versalius, the practice of dissection soon spread to all known universities thereby generating a great deal of knowledge and health data.

The spread was facilitated in 1662 by John Grant who published a book of observations titled “Upon The Bills of

Mortality". In the book, he highlighted the fact that the towns recorded more deaths than the country side; also that more males were born than females. However, these efforts were little appreciated because of the gross limitation of information storage and dissemination in the 18th century. But in the 19th century Dr. Cowan, a physician of Reading presented a paper on "Plan For Hospital Reports" in 1837 to the Provincial Medical and Surgery Association (Aremu, 1998) which was later transformed to the British Medical Association. In the paper, he draw attention to the need for uniform pattern of collecting facts, at least for easy understanding and comparison. He stressed the importance of adopting a system and order in taking "case histories" of patients in order to ensure that observers have a guideline and attach the same meaning to the various expressions used in case recording. Thus it became generally agreed that while taking case history, doctors should endeavour to capture important information as patient's age, sex, address, occupation, diagnosis and even time spent in hospitals for medical care. By this time too, the printing press had been invented. This replaced the manual labour in

copying information, and facilitated data printing, duplication and dissemination.

Also data came to be arranged and presented in a tabular form and practitioners were urged to follow this format and to present the salient points at the top of the tables. Following the work of Dr. Cowan, a diagnostic index was, about century later, recognized and established as an essential records feature of events in large teaching hospitals across the western world.

Another factor which influenced opinion as to the value of adequate and accurate medical records was the publication of the "First Report of the Registrar General in 1839 which tabulated the causes of death, and showed how they were related to the ages and conditions of the patient. Also in 1840, a committee on Hospital Statistics was appointed by an organization called Young and Flourishing Statistical Society of London. The task of the committee was to find the best means of obtaining a periodical enumeration of patients in the London hospitals.

2.1.2. GROWTH OF MEDICAL RECORDS IN NIGERIA

Medical work, and consequently medical records, came to Nigeria with the coming of missionary organizations. It was they who first established an organized medical care in Nigeria and West Africa. For example, the Roman Catholic Mission established health center in Sao Tome in 1593 and extended such services to the mainland by the 19th century.

Although Lagos had witnessed some features of medical care, the first true hospital ever to be established in Nigeria was that of the Roman Catholic Mission called Sacred Heart Hospital Abeokuta, which was completed in 1875. Some military hospitals had been established to care for naval squadrons, sailors and the colonialists. In these hospitals, the idea of medical records was initiated by the hospital nursing sister and the records were kept haphazardly even in a small make-shift temporary hospital established in Asaba In 1888. By the last decade of the 19th century, Medical Pioneers of the Anglican Mission in the form of Sudan Interior and Sudan United Missions had begun organized medical work. Through these efforts, medical services in well

established and organized form had begun both in missionary and government hospitals.

In the real sense, medical records was unknown in Nigeria before the second world war except in few missionary hospitals like Iyi-Enu Hospital in Anambra State which was established in 1907, Wesley Guide Hospital in Ilesha, Ogun State, established in 1913. In these places the basic function of the record keeper, the hospital matron or almoner was to issue cards and store them chronologically after use.

Interestingly, the Wesley Guide Hospital maintained a punch card system for coding according to disease classification under Prof David Morley. It would be worthy to note that one time Hon Minister of Health, Prof Olikoye Ransome-Kuti spent some time to do research work at the Wesley Guide Hospital in 1958 and found the punch card system very valuable. (Aremu, 1998)

Infact, it was not until the end of the Second World War in 1945 that decisive actions were taken to form an Association of Medical Records Workers in Britain. The post World War Two need, to take stock of the enormous costs in human and material resources, further gave impetus for well-organized medical record

keeping. Subsequently, medical records practitioners came together and formed an Association of Medical Records Officers of Great Britain in 1948.

By the establishment of a University College in Nigeria in 1955, which was an affiliate of the University of London, and the proposal to establish a medical school as well as a teaching hospital, the move to train indigenous officers to man the first Medical Records Department was approved by the government. The Ministry of Health in Lagos took appropriate steps to sponsor Nigerians in Britain. Prominent among them were Mr. Justice Akpobio, Miss Williams who later became Mrs. War-Toby, Messrs Jagun, kuruye-Alele and F.O. Omigie (Aremu, 1998). Some of them had received induction courses at Ibadan prior to their departure for overseas training. The premier teaching hospital was temporarily housed at Adeoye Hospital from 1955 but moved to the permanent site in 1957. When the trainees returned to Nigeria, they took over the management of Medical Records from Mr. R.P.Waye and his assistant, Mr. Lehan, both of them from England, who managed the department before independence.

Even with these initial personnel before 1970 was so small that their activities were only felt in teaching hospitals and few state Ministries of Health notably Lagos, Rivers, Imo, Anambra and Cross River states. Up to date there are still states in the country that do not have professionally trained Medical Records Officers despite the great need for their services in the present age of information and communication technology.

2.1.3. THE LINEAGE OF THE SIX OLDEST TEACHING HOSPITALS IN NIGERIA

1. University College Hospital Ibadan.

   The first indigenous Head of Medical Records Department was Mr. S.I. Ogbua.

2. Lagos University Teaching Hospital.

   This was established in 1962 and the indefatigable late Abiodun Onasanya was the first Head of Medical Records Department.

3. Ahmadu Bello University Teaching Hospital Zaria.

   The first Head of Medical Records Department was late A.O. Faponle in 1968.

4. University of Nigeria Teaching Hospital Enugu.

   The first Head of medical Records Department was Mr. Ben C. Okpala from 1971 – 1973.

5. University of Benin Teaching Hospital.

   The first chief Medical Records Officer and Head of Department from 1972 to 1993 was Mr. Francis O. Omogie.

6. University Teaching Hospital Ile-Ife.

   The first Medical Records Officer and Head of Department was late Kanmi Adisa in 1976.

2.1.4. AUTOMATION IN MEDICAL RECORDS MANAGEMENT

Medical Records keeping developed from the pre-historic, primordial stage through advances in the Middle Ages to the present sophisticated automation system management by the invention of computer and its interconnectivities called internet. Infact, the most recent technological change is in the field of Information and Communication Technology (ICT) and computer is the seed technology. From this emanated Electronic Medical Record (EMR)

which has equally led to the concepts of Electronic Patient Record (EPR) and Electronic Health Record (EHR).

According to Olapade – Olaopa et al (2005), Electronic Patient Record (EPR) describes the record of periodic care provided mainly by one institution while Electronic Health Record (EHR) describes the concept of a longitudinal record of patient's health and healthcare – from the cradle to the grave. These concepts ensure uniform record keeping pattern which will facilitate effective health care planning and management including inter-institutional comparison of performance. Unfortunately, information and communication systems in Nigerian hospitals have not yet been well developed in order to be useful for management functions . This is why Aremu (1998) emphasized that a medical Record System as an integral part of Health Information System is concerned principally with the systemic collections, collation, storage, processing, analysis, interpretation, dissemination and use of health information for decision-making and planning.

2.2. CONCEPTUAL AND THEORETICAL FOUNDATIONS OF MEDICAL RECORD SYSTEM MANAGEMENT

Medical record refers to the collection of data about a patient to assist in the clinical care of the patient. Clinical care is the totality of medical treatment and care given by doctors, pharmacists, nurses and others in the health team in an institutionalized place like hospital, clinic or health center. It is a clinical, scientific administrative, research and legal document relating to the patient. In it sufficient data are recorded according to the sequence of events to justify the diagnosis, mode of treatment and the outcome. Being a document, medical record should be regularly up-dated to be useful as communication vehicle between members of the health professionals. Therefore, the medical records staff must work co-operatively with the health professionals for prompt completion of patient record. Since different health workers may generate data on a particular patient, it becomes necessary to record their observations and care activities promptly and accurately.

According to the Christian history of creation God first created a world that was void; then He created an isolated biological environment called “Garden of Eden” before finally creating a human

couple (Adam and Eve) to inhabit and enjoy the garden. (Genesis 1[1-27]). From this theology emanated the first information on human health (and ill-health) based on the interaction of man and his environment. As the world became increasingly populated it became expedient to collect and analysis health data based on an individual person (clinical medicine), community (community medicine) or the environment (environmental health). Such data are useful for learning, research and management.

Health informatics therefore, may be regarded as that aspect of Information and Communication Technology (ICT) that focuses on health issues. Health informatics, medical informatics and clinical informatics may loosely be used interchangeably but strictly speaking, health informatics is the most embracing of the three terms and clinical informatics the least.

In general, health informatics is the link between ICT and the health sector. This view is corroborated in Van Bemmel and Musen's (2005) assertion that medical informatics is located at the inter-section of information technology and the different disciplines of medicine and healthcare. Such is the importance of medical informatics that it is regarded as completing the tripod of medicine

with physiology (science of normal body function) and pathology (science of diseased body parts). Van Bemmel and Musen (2005) aptly captured it in their expression that if physiology literally means the logic of life, and pathology is the logic of disease, then health informatics is the logic of healthcare.

2.2.1. HOW ICT, HEALTH INFORMATICS AND EMR ARE RELATED

Health informatics had earlier been described as a subset of ICT that focuses on health data. Information and Communication Technology (ICT) consists of the different technologies that make it possible to manage information and facilitate communication between human beings, between human beings and electronic systems, and among electronic systems.

Such technologies include:

- Capturing Technology
- Storage Technology
- Processing Technology
- Communication Technology
- Display Technology

All of above systems are involved in health informatics and Electronic Medical Record (EMR). A very important single piece of equipment in these systems is the computer – a machine specially designed with special features and programs capable of reducing to the barest minimum the effort involved in certain tasks including data management and dissemination.

Capturing Technology enables the computer to accept input data through various peripherals such as keyboard, mouse, joystick etc. The captured or input data are then stored and preserved by the Storage Technology for subsequent operations, which include processing and retrieval (display). While the Processing Technology transforms the stored data into meaningful and useful information as required, the Display Technology displays data on the screen for view or further operation e.g. more data manipulation and printing. Also the Communication Technology makes it possible for information to be transmitted from one computer to computers in other locations through the Internet Technology.

2.2.2. DIFFERENT APPLICATIONS OF HEALTH INFORMATICS

Different aspects of health informatics may be applicable to clinics and hospitals, healthcare personnel, regulatory bodies, patients, industry and insurance, and taxpayers all of whom are major stakeholders in the healthcare system (Tolentino, 2000).

In this project, however, only a few aspects relevant to the work are highlighted. These are;

i. HEALTH RECORDS:

For a long time, patients' records served as central tool for collecting data and extracting information about the patient. With time its structure and function changed from "case histories" in which each entry describes the condition of the patient at a given time (time – oriented) to records that are "problem oriented" and "patient centred". Also paper (manual) patient record with its major advantage of high degree of freedom or discretion in recording information, no special training, and no problem of machine or power failure changed to a well structured electronic system of patient records and the more inclusive electronic health record. This has led to world-wide initiatives to promote and encourage healthcare organizations to

adopt electronic patient records. Electronic Patient Record (EPR) describes the periodic care given mainly by one institution while Electronic Health Record (EHR) describes the concept of a longitudinal record of patients health and healthcare all through his life. Thus while EPR describes segmented or periodic care, HER describes a co-ordinated and more comprehensive life long record of a patient's health and care.

ii. INFORMATION DATABASE:

In view of the overload in the information super highway, it has become necessary to provide information in a concise, easy to understand form. Such information will quickly spread internationally through the internet and will describe practices adopted by some of the best known doctors.

iii. EVIDENCE-BASED PRACTICE

According to Olapade – Olaopa et al 2005), it is now accepted in developed countries that medical practice needs to be based on sound evidence which should be compiled and made easily accessible to medical practitioners following acceptable guidelines and protocols. Such evidence is usually assembled in a

database and stored in a computer for easy dissemination through the wide web.

iv. THE INFORMED PATIENT:

Evidence – based practice goes with the concept of informed patient whereby the patient is involved in discussions affecting lines of treatment, available options, and the outcomes.

2.2.3. SUPPORT OF WHO FOR HEALTH INFORMATICS

According to the World Health Organization (WHO,2005) resolution: " Recognizing that health and medical informatics is a very fast growing field which constitutes an essential component in the health information system of the healthcare services and in medical education, the organization (WHO) accordingly calls on member states to:

- Develop plans for the introduction of medical informatics in the health system so as to cover the needs of users.
- Allocate financial and human resources to support health informatics plans

- Conduct awareness campaigns to sensitize healthcare professionals on the importance of medical informatics and their specific role in its use.
- Make use of health informatics for development and administration of the health services and technical program.
- Invest in human resources development in the information technology area
- Ensure the development of a plan for systematic and institutional implementation of health and medical informatics in healthcare institutions.
- Initiate a model medical informatics curriculum for medical colleges, to be introduced during the early years of study.

  This attitude of WHO underscores the importance attached to health informatics in modern times world-wide.

2.3. THEORIES AND MODELS RELEVANT TO MEDICAL RECORDS SYSTEM MANAGEMENT

The Theories and Models of Medical Records refer to various methods of keeping and managing medical records from manual to mechanical of which electronic method is part.

As opined by BCA (2004), Electronic Medical Record System (EMRS) is a leading-edge windows-based comprehensive medical software application that is designed for physicians' group practices, hospitals, community health centers and clinics. "Infinity" runs over standard networks using the fastest database engine on the market and was created from the ground up by doctors for doctors.

Rehm. S. (2001), posits that Electronic Medical Records System is a complete medical record designed to replace the ambulatory paper chart and decrease the amount of paper flow in the office. Authorized users can assess the patient's record at any time, no matter where the record resides. The list of features and tools used to automate and integrate the wide array of patient data is extensive and has been fine-tuned by physicians."Infinity" will help you manage clinical information throughout your community health center, providing your healthcare team with the information they require, making effective decision and improving organizations accuracy and performance.

For Minnesota (1999-2005), Medical Records includes all information about patient's visits to hospital or doctors. For example, records include patient's symptoms, medical history and test results. They also contain X-ray, diagnosis and treatment plans. Health information technicians gather and organize all these information. They make sure records are complete and accurate. They also develop organized filing and storage systems that make it easy to store and gather files.

Occasionally, technicians talk to physicians to get more information about patients (Jerant, 2000). According to him, once records are organized, technicians enter some of the information into computer. For example, they enter the patient's age, gender, history and extent of disease and treatment. Then technicians assign a code to each diagnosis and procedure. They consult a classification manual to find the proper code. Experienced technicians remember the code. Next, technicians use a computer program to assign patients to a Diagnosis Related Group (DRG). The DRG determines the amount of money a hospital receives from Insurance Company.

Guyatt G.H, Sackett D.L, Cook D.J. (1994), outlined the merits of Electronic Medical Records as follows;

- Improving the quality of health care
- Reducing medical errors
- Reducing health care costs
- Replacing outdated and cumbersome administrative and financial systems with modern efficient approaches.

In the medical Industry, patients' records are sacred documents (Computer Mgt. Centre Inc 1996 – 2005). They further posit that Medical Records contain entire patient's medical history and information crucial to Medicare. Government regulation (Health Insurance Portability and Accountability Act) compliance requires that these records should be handled with utmost confidentiality. In order to manage the thousand and upon thousand of patients' Insurance Companies and Health Management Organizations (HMOS) accounts, doctors and hospitals rely on sophisticated electronic medical systems.

For Becker L. (2001), Electronic Medical Record automates the most common physicians activities. These include, prescribing, detecting, capturing, charges, ordering

labs and viewing results, providing patient education and documenting clinical encounters and offers electronic document imaging and management solutions, providing a pathway to paperless patient records.

Becker enumerated the benefits of Electronic Medical Records as follows;

- Timely access to records throughout the enterprises
- Expedited record completion and review
- Sophisticated real-time workflow routing based on individual health system needs
- Increased cash flow due to improved staff productivity, and expedited customer services for patient's payer and employees.
- Improved record security using precise audit traits and automated monitoring critical dates.
- Recovering of valuable filing shelf space
- Sophisticated Electronic routine of files and ability to print documents from personal computers.

2.3.1. MEDICAL RECORDS FILING SYSTEM

According to Aremu (1998), medical Records Filing System can be defined as a set of documents arranged in a prescribed form for convenience of reference and preservation. This has a method or plan of classification designed to perform a particular function, which for health records is to provide an information and retrieval service.

It is worthy to note that the prime responsibility of Medical Records Department is to undertake the custody, to classify and preserve, maintain confidentiality and retrieval of patient's case history, including radiographs.

Furthermore, the procedures within the filing unit, the method and accuracy, will reflect in the efficiency or otherwise of all various patient services throughout the organization, whether it be hospital or other institution.

An effective filing system should contain a number of fundamental features;

- Compactness to take account of the value and cost of storage space and also the need to reduce physical effort in working the system.

- Accessibility for speed of location and positive means of identification of the items contained in the system.
- Simplicity of operation to ensure that the method is understood by those who normally contact it, also by those who require occasional access.
- Economical both in cost of installation and operation.
- Elasticity – providing an ability to extend and contract according to future requirements and to ensure extraction and disposal of dead matter without much disturbance.
- Cross-referencing facilities when required
- Tracer system of documents in circulation.
- A method of classification e.g. Terminal Digit or Middle Digit etc.
- The equipment in use must be effective and efficient to the system.
- The personnel operating the system must be well trained as Medical Records Practitioners.

FILING SYSTEMS

There are three types of filing systems commonly used for filing Medical records viz;

1. Alphabetical
2. Straight Numerical
3. Terminal Digit

ALPHABETICAL

Placing surname first, middle name and other names. In the case of more persons bearing the same name, the cards are arranged according to date of birth or date of registration e.g. master index cards. This system is ideal for a small hospital especially specialist hospitals like Psychiatric hospitals where the volume of records involved is small. It does not require master index cards as back up for the system.

STRAIGHT NUMERICAL

This refers to the filing of records in exact chronological order according to the hospital numbers. E.g. 784921,784922 , 784923 etc. Diagnostic index cards and the system in the central library. It has the advantages of

- Easy to understand
- To pull say fifty case notes for study
- To pull records for secondary storage.

Disadvantages

- It is easy to misfile because a clerk must consider all digits of the record number at one time
- Transposition of numbers is common
- Heaviest filing activity is concentrated in the area of the file housing the medical records with the highest hospital numbers representing the newest or most recent records.
- Several clerks filing at the same time are bound to get in each other's way.
- Quality control of filing is difficult with this system.

TERMINAL DIGIT FILING

Usually a six-digit number is used and it is divided into three parts, each part normally contains two digits viz;

50 93 26

Tertiary digits Secondary digits primary digits

Under this system, there are 100 primary sections ranging from 00-99.

Advantages

- Evenly distribution of records throughout the 100 primary sections
- The congestion that results when several clerks file active records in the same area of the file is eliminated
- Clerks may be assigned the responsibility for certain sections of the file e.g. 00 – 24, 25 –49, 50 –74, and 75 –99 for evenly distribution of duties.
- Annual shifting of records is prevented
- It is possible to estimate
- It aids confidentiality
- Misfiling is substantially reduced
- The use of colour coding is possible.

Disadvantage

- Training period is necessary unlike the straight numerical

MIDDLE DIGIT

Filing is according to pairs of digits as in terminal digit filing. However, the primary, secondary and tertiary digits are in different positions. The middle pair of digits is in six-digit number and they are the primary digits. The digits on the left are the secondary while the digits on the right are the tertiary.

55	02	76	56	78	98
Secondary	Primary	Tertiary	56	78	98
			56	78	98

Advantages

From the example given, one can see that blocks of 100 files (i.e. 56 – 78 –00 –567899) are in straight numerical order. This has the advantages of;

1. Simple to pull up to 100 consecutive number of files for study purposes
2. Conversion from a straight numerical system to a middle digits system is much simpler than its conversion to a terminal digit.
3. Block of 100 files pulled from a straight numerical file is in exact order for middle digit filing.
4. Provides a more evenly distribution of records than straight numerical. Although, it does not have equal terminal digit system.
5. As in terminal digit filing, the clerk is doing the filing by pairs of digits, therefore, misfiling reduced.
6. Aids confidentiality.

2.3.2. DOCUMENTATION IN MEDICAL RECORDS MANAGEMENT

Medical Records Documentation according to the General Accounting Office Report (1999), is a process by which sufficient personal, identification particulars or clinical data, nursing and other diverse professional details are obtained from each and every patient or the next –of- kin during the first attendance at each particular hospital or clinic visits. These data are recorded in order of events and on prescribed forms to provide guidance for all future reference and up dating.

TYPES OF DOCUMENTATION

In medical records practice, there are two types of documentation. They are;

- Manual Documentation
- Mechanical Documentation

MANUAL DOCUMENTATION

This is what the layman will call Registration. It is the system where all the data as regards the patient who calls at the

hospital or clinics are written by hand in the registration book and all the essential documents pertaining to the patient. This system is rarely found in the developed countries such as United States of America, United Kingdom etc. It is a system that is being operated in all the Teaching Hospitals.

This system has so many flaws like;

- It takes a lot of time because of respective writing of patient's data on all the documents.
- It becomes boring with time.
- Sometimes, basic information is wrongly transcribed.
- Information may be sometimes incomplete or omitted entirely.
- Non-challant attitude and poor handwriting on the part of the staff.

MECHANICAL DOCUMENTATION

This is the system whereby mechanized system is used for documentation of patient's medical records. This may be done before or the very day of the clinic data of the patient.

TYPES OF MECHANICAL DOCUMENTATION

I. Addressgraphy

II. Electronic Transmitting Data

III. Duplication System

IV. Stencils

V. Photocopying Equipment

VI. Electronic Computer.

ADDRESSGRAPHY

This is one of the most important methods of documenting forms and this has been of great value in speeding up works and in ensuring greater accuracy. This is a machine that consists of a typewriter, keyboard plate embosser and a reproducer with listing attachment. The embosser is used for typing information on a small metal plate. This is then attached to a frame inserted in the reproducer and all necessary forms are printed. For maximum benefits, pre registration of out patient is advisable. All patient's personal particulars and doctor's request for new appointments are first checked against master index to ascertain whether or not the patient had previously visited the hospital. If he had, the

appointment is booked and the request is filled. If the patient is not registered previously, a number is allocated and a plate is embossed as follows:

UNIT NUMBER	
SURNAME	FIRST NAME
SEX	DATE OF BIRTH
CONSULTANT	

On the above plate it will be noted that some information is omitted. For instance, Next-of-kin is omitted. The reason is that having once shown this on the front sheet, it is not likely to require reproduction and therefore should be entered on the case sheet manually.

The embossed plate is attached to a frame inserted into the reproducer and it prints;

- Master Index Card
- Case Folder

- Appointment Card
- Gummed Label or Strips e.g. mounting sheet
- Sheets, which are common to every case folder.

In the case of pre-registration, form will be put in a standard layout into the plate from which all the forms in the case folders are printed clearly and accurately. If patient is for admission, detail information on each patient for admission is typed into a central embossed plate and filed in the ward while the patient is in the hospital. Here standardization of medical records forms and referral forms are very important in mechanical documentation.

IMPROTANCE OF MECHANICAL DOCUMENTATION

They are as follows;

1. It provides a simple means of reproducing data accurately
2. Less time is wasted on clinical days
3. No mistakes through bad hearing or hand writing
4. Ensures full and legible identification of each documentation
5. It reduces clerical work to a minimum
6. it ensures that patient's registration numbers appear on all documents

7. It ensures uniformity of data collection.

However, mechanical documentation is of great importance in Nigeria. But today, it is not in operation because of its high cost and lack of manpower. Before we can fully go mechanical, the best solution is that medical records personnel must take pains to document patient's data in block letters for easy reading.

IMPORTANCE OF PATIENT DOCUMENTATION

According to the National Research Council (1997), the most important aspects of the documentation of a patient is ;

1. To ensure at all times, that accurate and best possible information is obtained and recorded in each patient's case folder.
2. Again, documentation provides the prompt identification of the patient and patient's documents for treatment and all other reference purposes.

   If properly documented at all stages, a patient's record will tell all about the:

- Who was the patient that attended the hospital

- Who first saw, examined and treated him
- Who subsequently saw and treated him
- What was the patient's first and subsequent complaint
- What was found out to be his problem and findings
- What was done for him and the result of investigation, treatment etc.
- Why did the patient choose to come to the hospital
- Why was the treatment given
- Why did he leave the hospital, was he well enough
- Discharged at request, transferred out or absconded
- From where did he come to the hospital
- Where was he treated (clinical/ward)
- Where was he discharged or transferred to (disposal)
- When was he discharged/transferred out (date)
- How was he treated? If not treated, why?

How did he leave the hospital (discharged home/transferred out/dead/absconded?

3. Documentation stands as aids for providing cure, not simple memory aids but if scientifically prepared or written, such

records serve as a guide for making prompt and accurate diagnosis and selection of treatment.

4. A well-documented case folder provides a communication link between a doctor and a patient and between one doctor and another during future or follow-up.
5. For medico-legal purposes
6. As an aid to the hospital for planning purposes
7. For making all authentic enquiries
8. Statistically, good medical documentation will provide data for population projections based on recorded births and deaths.
9. Documented records are essential for research purposes, diagnosis, operations etc.
10. Documented records also serve as teaching/learning aid for those in the medical school and others in the health sector.

FACTORS MILITATING AGAINST DOCUMENTATION

1. Language Barrier:

Problems always arise when the two parties (the records officer and the patient) cannot understand their languages. To overcome this is only by involving a third person that will understand both languages and then do the interpretation.

2. Culture:

This is another factor that militate against documentation. In some parts of Nigeria, for instance (Northern part), the culture does not warrant purdahs to come out uncovered. The covering may be a barrier to hearing well. Some married women are forbidden to mention their husband's name and their first son's name in public. This is a peculiar case to Malumfashi women in Katsina state.

3. Religion:

Some religious belief (Islam) forbids women mixing up with men for whatever reason at least in public. Unfortunately, shortage of staff in the medical records department cannot help matter as either the women or the men would have to wait for the other to finish first. This always prolongs their stay in the hospital.

4. Inferiority Complex.

Those who are not exposed to the society, being in the hospital for the first time, may find it very difficult to cope with the system; hence they shy away from answering some questions that look personal.

5. Ignorance:

Some people due to ignorance may regard it as an insult for an unknown clerk to ask for their identity.

2.4. APPLICATION OF COMPUTER IN MEDICINE

Computer, according to John Peter (1999), is any electromechanical device capable of accepting, storing, processing data/information and outputting the result of the processing in such a way people, other computers and machines can make use of it, if need be.

Computer is used for many purposes in the business world. E.g. In the banking system, education, government law and enforcement agencies, military, sports, estate management, forecasting, medicine, broadcasting, record keeping, planning, statistics, designing etc.

Computer can perform many routines. There are thousands of tasks which computer can handle more effectively than ordinary human being. As Dunlop (1992) opined, problem for which a computer is ideally suited generally must be justifiable, definable, repetitive and volume data. For Akukwe and Uzoma (1999), the reason why the use of computer in health sector should receive

uninterrupted attention could well be understood with the points discussed below;

1. Shortage of Medical Personnel

In Nigeria Health Sector, there is shortage of medical personnel ranging from medical doctors to medical attendants. And the computer can effectively supplement this personnel shortage. By programming the computer and connecting it to patients to monitor and report certain health conditions of the patients, the medical personnel can then face other work under his/her control. Patient's monitor and report routine which would involve a reasonable number of health workers can be carried out by alone computer with a health worker thereby supplementing number, effort and effectiveness of medical personnel.

2. **Medical Research**

Medical research is a field as wide as the human body. Each part, with its function and anatomy is being researched upon. Research involves genetics/biotechnology disease process, pharmaceutics (science of drug production), phamarcognosy (study of plants for their medicinal value), and recently, biohybrid (combination of biological material and inorganic substance as human replacement part)

Biohybrids research focuses on ways to build human replacement parts similar to spare parts in engineering technology. Biohybrids, or bioartificial organs as they may be called, combine living cells with biologically inert (unreactive) materials like silicon and polymers to achieve a bio-replacement that will not be rejected by the body – the greatest problem in organ transplant or replacement. The hybrid organs get their structure from the inorganic material while relying on living tissue grown from cadaver (dead human body), animals, or one day, hopefully, from the patient's own body to do the complex tasks they do best such as production of chemicals and filtering of blood. Designed as implants, or seamless replacement parts, biohybrids are not expected in the market or body shops before five years (Webb 2005). Pioneering work presently is on the production of bioartificials of the liver, kidney, lungs and heart. It should be noted that biohybrids are different in concept and design from medical protheses which are 100% made up of inert, lifeless (inorganic) substances such as steel and plastics.

Computer programs have made it simple and quicker for medical personnel to embark on medical research works and arrive at result on real-time.

Such work includes;

- Causes of stroke (abrupt disruption of the normal blood flow in the brain) and its prevention.
- Analysis of brain waves to detect how brain stores and retrieves data/information
- Comparison of different ways drugs affect man
- Analysis of patterns of drug addiction
- Analysis of the brain pattern of epileptics and Parkinson's disease patients etc.

11. Medical Diagnosis

Computer is now used by medical officers to diagnose some body malfunctions like impaired vision, hearing, speech, and lung function. Electrocardiogram, X-ray, urine test, blood pressure, intra-ocular pressure/glaucoma. Certain equipment for the diagnoses has now been computerized. Data collected with each piece of equipment is analyzed with computer to get results on real-time. The results are compared against the standard of the prescribed limits. If difference occurs, the patient is treated to come to par within the standard limit.

12. Expert System

From the beginning of the practice of scientific medicine, the practitioner's professional training and acumen based on the use of endotramers (human dissection) and animals for learning, have been the forces behind recorded successes and progress in diagnosis and management of diseases. But in recent times, the computer can provide an objective and effective assistance in the form of Expert System.

The physician can now simply enter into a computer terminal, key in specific information about a patient's ailment and the computer provides a list of all possible diseases or ailments that match the input information. For each listed ailment or disease, the computer will suggest other tests that the doctor can perform, provide a list of people, references, or medical report that addresses the particular ailment, recommend certain treatments and describe the effectiveness of such treatment. (Osuagwu, 2004). The basis for this computer-assisted diagnosis is the medical databank structured as "expert systems" by human experts in the particular discipline.

Medical data banks electronically store a complete listing of diseases, their known symptoms (and signs), possible treatments and the contents of any professional article that deals with the latest test, experiment or result (Osuagwu, 2004). An example of such a database is the Medical Information Network (MINET), which allows healthcare practitioners access to four on-line database services. Also for the general public and for the purpose of first aid, “where there is no doctor”, medical emergency databases are available on subscription as a source of immediate medical help in the event of medical emergency.

13. Medical Image Modelling/Simulation

The Oxford Advanced Learner’s Dictionary gives over ten different versions of the meaning of the word “Model”. However, the concept of model used in this discussion is that of “a representation of something, usually smaller than the original, a design of something that is made so that it can be copied in another material” (Hornby, 1995)

Medical Image Modelling, therefore, is the artificial, virtual or “image” representation of real human anatomy (body structure), physiology (body function), and pathology (disease process) for the purpose of medical education and practice before doctors perform on

human patients. According to Delingette H and Ayache (2005), the advantages of medical image modeling are immeasurable. They include the ability to learn from mistakes or failures, to practice alone or with a mentor, and much greater versatility, allowing the simulation of various scenarios ranging from standard pathologies to extremely rare cases.

Tools for medical imaging include;

- Computed Tomography (CT)
- Magnetic Resonance Imaging (MRI)
- Electrical Impendence Spectroscopy (EIS)
- Microwave Image Spectroscopy (MIS)
- Near Infra-red Spectroscopy Imaging (NIS)

All of these methods are essentially various advances in X-ray and ultrasound techniques.

Medical image analysis and modeling are essential to many fields of medicine including radiology, surgery, and medical education. Traditionally, doctors have based their practice on 2D (2 Dimentional) images such as those produced from scanners and microscopes. This limits them from accurately seeing and understanding the 3-D (3 Dimensional) organ structure and function that is often crucial for the

timely diagnosis and appropriate treatment of disease. With the use of Computed Tomography (CT) and 3D Magnetic Resonance Imaging (MRI) including the new models like Optical Imaging, doctors will gain ability to visualize the body's internal structures and function in 3D, thereby improve their knowledge and practice.

14. Surgical Simulation

Simulation according to the dictionary means creation of certain conditions by means of a model for study or training purposes (Hornby, 1995). Simulation has been extensively used in navigation and aeronautics including undersea and space research projects. Introduction of simulation in medicine is bound to transform the practice of the profession.

Surgical simulation implies creating a dimulator for training physicians to perform minimally invasive surgical procedures. Also surgical simulations could be used to rehearse a complete procedure with the patient specific data. In this way, simulation becomes a natural extension of pre-operative planning. Simulators may equally be utilized to certify the skills of surgeons in a quantitative and objective way.

Currently, surgical simulators are applied in the following areas:

- Hepatic surgery (liver)

- Virtual Colonoscopy (in colorectal cancer screening and surgery)
- Heart modeling (for heart structure and function)
- 3-Dimentional Virtual Anatomy to provide near natural view of the human anatomy.

15. General Patient Monitoring And Care

Patients on hospital admission (in patients) especially those in intensive care units (ICU) often require their vital signs and general condition monitored closely. For a very long time, this function has essentially been performed manually with all the human and instrument pitfalls involved. But with a computer assisted monitor, the patient's respiration, temperature, heartbeat, blood pressure, chemical balances and even level of physical activity can be electronically monitored and an alarm set off when conditions deviate from the normal or set value. This also applies to the fetus (baby in the womb).

16. Electronic Medical Mail And Appointment

Healthcare providers differ in the methods they adopt in communicating with their patients. One such method is e-mail (electronic mail). Either in a contractual relation between patient and

healthcare provider or as an online discussion group in a public support forum, e-mail is intended to enhance patient/healthcare providers relationship.

Beverly and Sands (1998), defined patient/provider electronic mail as computer based communication between clinicians and patients within a contractual relation in which the healthcare provider has taken an explicit measure of responsibility for the client's care.

Positive characteristics of e-mail communication include;

- Speed
- Convenience
- Clarity of expression
- Ease of managing simple problems
- Efficiency
- Improved documentation
- Ease of writing follow up notes
- Avoidance of telephone tag

Apart from its use for minor or emergency consultation, and discussion, e-mail is useful in arranging medical appointments.

17. Patient Medical History

The old method by which medical personnel trace patient's illness to his or her parents, uncles and other relations by mere asking the patient series of questions about the illness is phasing out. This method wastes the doctor's time. Again, the patient sometimes feels shy and intimidated as wwell as hiding certain information about the illness. Today, what is common is a computer program which displays on the computer screen, medical history with multiple choice questions for the patient to respond either by the use of touch screen or light pen device to select the appropriate answer to the question and so on. Patients responses are automatically stored by computer which the doctor or any other person concerned can analyze at his or her own convenient time.

18. Blood Bank

Computer is not only being used to transfer the right blood to the right person at the right time, it is also used to control blood inventories of the bank, such as guiding the donation data, quantity, quality, group and expiry date of the blood in stock.

19. Medical Record

Computer can be used for medical records keeping, case notes, master index cards, ECG and EEC reports. The main advantage is obviously the amount of space that is saved, and it is also easier to retrieve the records from this source than from old manual record system in the subsidiary store. Tidiness can be maintained as well as confidentiality.

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2.5. COMPUTER- ASSISTED MANAGEMENT SYSTEM

The efficiency and quality of every sector of our society can be improved by increasing human efforts by technology. The application of computer in business can assist in a wide variety of their system management. With the advancing in technology and the resulting increase in the complexity of management in business organization, the quality and variety of information needed to support decision-making is also increasing. In this view, the complexity of any management can be easily reduced when a

database management system is introduced for a particular system.

Database Management System (DBMS) is a software package that frees us from concern about the physical particulars of data storage and allows us to think them in logical term (Steven, 1990).

It can also be defined as software package that performs the functions of defining, creating, revising and controlling a database. Alper B.S. (2001).

Odiari (1997), says DBMS is a collection of programs that store, retrieve and process data stored in files. He goes on to say that DBMS encompasses a unified, integrated model of file storage and its corresponding retrieval in order to reduce the labour associated with processing large amount of data.

A Database Management System provides;

- Query Facilities
- Host-Language Interface

- Program data Independence
- Data Security and Recovery.

There are three basic physical database designs upon which all DBMS are based:

1. Hierarchical model
2. Network Model
3. Relational model.

Hierarchical Model

Hierarchical model or tree model was the first developed. In this database model, Steven (1990) states that data are grouped into a major classification, which also are divided into sub classification and so forth. He posits also that relationship between data is often complicated to establish because the path up and down the tree from one data object to another must strictly be followed.

Odiari (1997), says in this model information is viewed as a hierarchical structure with a top and bottom when talking about information access. To access information about an employee he continues, we must search down through the level of the hierarchy. In

view of this, hierarchical database model tend to have limited flexibility because only single access point is available.

Network Database Model

This is principally a modification and improvement over the hierarchical model.

Odiari (1997) states that, “The network view uses links pointer to associate properties of employees with department and each other and so forth”.

Steven (1990), when considering the access level posits that it allows more than one path between object and these paths can go across the tree rather than just following the up and down pattern of the purely hierarchical data. The network view is quite flexible due to arbitrary linking, but it is not easily implemented at the physical level, Odiari (1997). Therefore network is also limited if a database management system has to be developed.

Relational Database Model

Both the hierarchical and network database require the logical structure of the database. The relational model is based on tables of objects (Steven, 1990). According to Odiari (1997), the relational view offers the most elegant organization; each relation is very similar to a table. The labeled columns are called domains and the rows are called tuples. Paul (1992), posits that one of the major attractions of the relational data model is its simplification. It is simple because it has only one data structure – the disciplined table or relation. A relation is a table, which obeys a certain restricted set of rules (Paul, 1992).

- Every relation in a database must have a distinct name
- Every column in a relation must have a distinct name within the relation
- All entries in a column must be of the same kind
- The ordering of columns in a relation is not significant
- Each row in a relation must be distinct in other words duplicate rows are not allowed in a relation
- The ordering of row is not significant, there should not be implied order in the storage of row in a relation

- Each cell or column/row intersection in a relation should contain only a so –called atomic value.

In other words multi-values are not allowed in a relation. However, there are some kinds of processing that a relational database management system cannot easily perform.

Objective of Database

The objective of a database is to provide centralized control over operation, reduction of redundancy, inconsistency in stored data, minimize conflicting requirements, make room for security restrictions, enforcement of standard and data independence.

Paul (1992) says, the overall purpose of such a system database is to maintain data for some set of enterprise objectives.

Advantages of Database

Once a database has been designed for particular business organizations, the management enjoys the following benefits;

- Information supplied to the managers is more valuable because it is based on a comprehensive collection of data instead of files, which contain only the data model for one application.

- There is an obvious economic advantage in not duplicating data. In addition, errors due to discrepancies between two files are eliminated.
- The amount of input preparation needed is minimized by single input principal.
- A great deal of programming time is saved because of database management system handles the construction and the retrieval of data.
- The use of integrated system is greatly facilitated Odiari (1997).

2.6. Project Management And Information Technology Context

A project may simply be regarded as any human activity that has a well defined start time, objective, scope, budget, schedule and finish time. According to Rolstades (1999), a project may be defined as a-one-kind event with clear goals to be reached within a time and cost frame. However, Akpan and Chiezea (1987) defined a project as a series of jobs that individual have to be completed in order for the system (project) to be satisfactorily consummated. He followed it up with the definition of project management as planning, scheduling, and controlling of a project so that the required resources are optimally

employed throughout a sequence of successfully completed tasks. Quoting the Project Management Institute (of London) in its Project Management journal of August 1986, Project Management may be defined as the art of directing and coordinating human and material resources throughout the life of a project by using modern management techniques to achieve pre-determined objective of scope, cost, time, quality and participant satisfaction.

Project Management is a crossbred of Engineering/Science and Management and it is structured under three specialized option areas (Akpan and Chizea, 2002).

These are:

i. Construction Management

ii. Industrial Management

iii. Information Technology

The reverse sometimes occurs where any of these option areas are programs in themselves with substantial project management content.

From this project management tripod, it is clear that information technology is an integral part of project management. On its own, according to Osuagwu (2002), UNESCO defined Information

Technology as the scientific, technological and engineering disciplines and the management techniques used in information handling and processing their applications, computers and their interaction with man and machines and the associated socio-economic and cultural matters. Infact, information practitioners regard information technology as the convergence of microelectronic, software engineering and telecommunication. It follows that modern industrial society developed pari-passu with modern information society. Hence, the relationship between project management and information technology is intimately interwoven.

Furthermore, since the advent of information technology in the 1960's the subject has permeated all fields of human endeavour with such speed and aggressiveness that is unparalled in history. From its initial almost exclusive reserve for mathematicians, it has become a very important tool for everybody especially for decision makers. That is why Osuagwu (1007) stated that it is not a coincidence that computer technology and management science developed in parallel. Infact, the tremendious data generating computational abilities of information technology have fostered many of the advances in management science. This is why after an extensive review of the

application of information technology to management science, Osuagwu (2007) rightly concluded that we can no longer divorce management from computational machinery and related technology. Collaborating this assertion, Akpan and Chizea (2002) stated that computer technology has greatly improved the quality of management in many organizations by improving the depth and horizon of management function such as planning, organizing and control system. Furthermore, decision making, which is the most important responsibility of the manager, is made easier by the supply of correct and timely information through the facilities of modern information technology.

The use of models and modeling in decision making by management scientists and technologists is a direct benefit of the vast computational capabilities and versatility of information technology. Such modeling software application as QM, STORM, SPSS, EXCEL and LOTUS SMART SUITE are useful aids in vast areas of project management as:

1. Game theory
2. Decision analysis
3. breakdown analysis

4. Quality control
5. Forecasting
6. Inventory
7. Materials requirement planning
8. Linear programming
9. Transportation
10. Assignment
11. Integer programming
12. Mixed integer programming
13. Goal programming
14. Network models
15. Project management (CPM/PERT)
16. Waiting lines
17. Simulation
18. Markov analysis

As a principal management function, decision making is based on modeling which in turn is facilitated by the use of information technology. This all inclusive relationship between decision making and modeling is illustrated by the similarity in the steps leading to both processes.

COMPARISON OF DECISION MAKING STEPS AND MODELLING STEPS (OSUAGWU 2007)

s/no	Decision making steps (management function)	Modeling steps (information technology)
1.	Clearly define the problem	Clearly define the problem
2.	Outline possible alternatives	Develop a model
3.	Identify possible outcome	Acquire input data
4.	Outline profit (pay off) of f alternatives and outcomes	Develop solution
5.	Select suitable mathematical decision theory (model)	Test solution and analysis result
6.	Apply model for decision making	Implement results

As long as decision making requires complex manipulation of data, several interactions before an acceptable results is achieved, frequent need for reanalysis such as sensitivity analysis then computer based models are indispensable.

2.7. The Context of information Technology Projects

The principle of information technology is based on computer, communication satellite, and internet. Simply stated, a computer is an electromechanical device that can accept date, store, process and

produce the processed data in a required useful form and which can communicate with other computers, electromechanical devices or human beings. Many other definitions exist but the key element in the definitions remains the same. However, the unique feature of computer is its stored program concept (Osuagwu, 2002). The acronym internet which stands for International Network of Computers is a network of (connected) computers which operates as a system for mutual exchange or transmission of data and information to and from any part of the world. This is made possible by the use of satellites which are space craft placed in orbit around the earth to receive and transmit radio signals over a wide area to both fixed and mobile locations. According to Osuagwu (2002), computers perform three broad functions:

i. Do all types of calculation, scientific and mathematic
ii. Communicate with other suitable devices including human beings and
iii. Control operations and other systems.

It follows that information technology projects are as varied as fields of human endeavour and a few examples can be mentioned in each category as stated below:

A. Scientific Systems

i. General

Engineering Design and Research

Solving of mathematical equations
Weather prediction
Satellite orbit analysis and Prediction
Reactor design
Cryptoanalysis

ii. Non Numerical

Flight Dynamics of missiles and aircraft
Economic research
Management games
training devices

B. Information (Data Processing) Systems

i. Numerical

Accounting
Payrolls
Inventory control
Billing and invoicing
Sales analysis
Budgetary control

ii. Non Numerical

Language translation
Library and scientific data
Reference
Personnel files
Data base development and use
Medical diagnosis

C. Control and instrumentation Systems

i. Control Systems

Industrial process control
Missile guidance systems

Command and control of military Forces
Traffic control

ii. Instrumentation System

monitoring of laboratory experiments
multimeters with automatic range Settling etc
Digital meters and gauges

Home robotics

D. Computers and Communications

i. Communication network control
   Message switching systems
   Electronic mail

E. Artificial Intelligence (AI) or "Human) Applications

i. Computer man "partnership"

Computer Aided Design (CAD)
Computer Aided manufacturing (CAM)
Computer Aided instruction (CAI)
Industrial robotics
Word processor and office Automation

ii. Computer based "Intelligent" system

AI Systems
Knowledge-Based systems
(The 5th Generation Computer)
Adaptive (self modifying)
Learning Systems
Pattern recognition and image processing
Speech or vision systems
Expert systems
Problem solving

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Sources of Data

This study made use of both primary and secondary sources of data to investigate the manual method of medical record keeping but adopted the international model of software design for the electronic method.

The primary source consisted of participant observation and personal interview while secondary source consisted of existing documents in form of internal data and external data. Internal data are data collected from medical records as contained in patients' folders and external data came from review of relevant texts in libraries, books, journals and internet.

Investigation of the manual method aimed to assess the major problem areas such as;

- Patients waiting time to obtain or retrieve patient's folder
- Cost of maintaining the medical records unit per annum based on the present level of operation
- Level of patient satisfaction with the existing manual service method.

In order to achieve the above data collection, classical tools were used as follows:

- Participant observation: The researcher himself got involved in the existing system to witness how it operates
- Personal interview: The researcher conducted a personal interview with potential resource persons- patients, staff and management in order to obtain necessary information directly
- Existing medical Records: Existing medical records/patients folders were studied for more data.

3.2. Method of Data Collection

Data were collected on;

- Waiting time of patients (Queue Time)
- Annual cost of manual method and electronic method of medical record keeping
- Patient satisfaction level as a measure of quality of service.

Waiting Time:

A Self Structured Data Collection Sheet was used to collect data on waiting time.

Six knowledgeable research aids were recruited, trained and adequately supervised by the researcher to collect data on each patient that came to the FUTO medical Clinic within the study period of two weeks. In each week, three days – Monday, Wednesday and Friday – were deliberately selected for the study to reflect early week, midweek and end-week attendance. Weekends were excluded, as these are not normal work/clinic days.

Each research aid worked for two days and retired. This was to eliminate work fatigue or undue interference with the aids of normal duty or schedule. Monitoring period lasted only for the normal work period between 8.am and 2.pm. After this time bracket, only emergency cases were attended to.

For every cold case (patient) i.e. non-emergency patient, data were collected on;

- Time of arrival at the University Medical Clinic
- Time it took the Medical Record Staff to issue a new card or retrieve an existing one as applied to a particular patient.

As soon as the folder was obtained, the patient was asked whether or not he was satisfied with the waiting time with simple "Yes" or "No" answer.

Data on Cost of Service

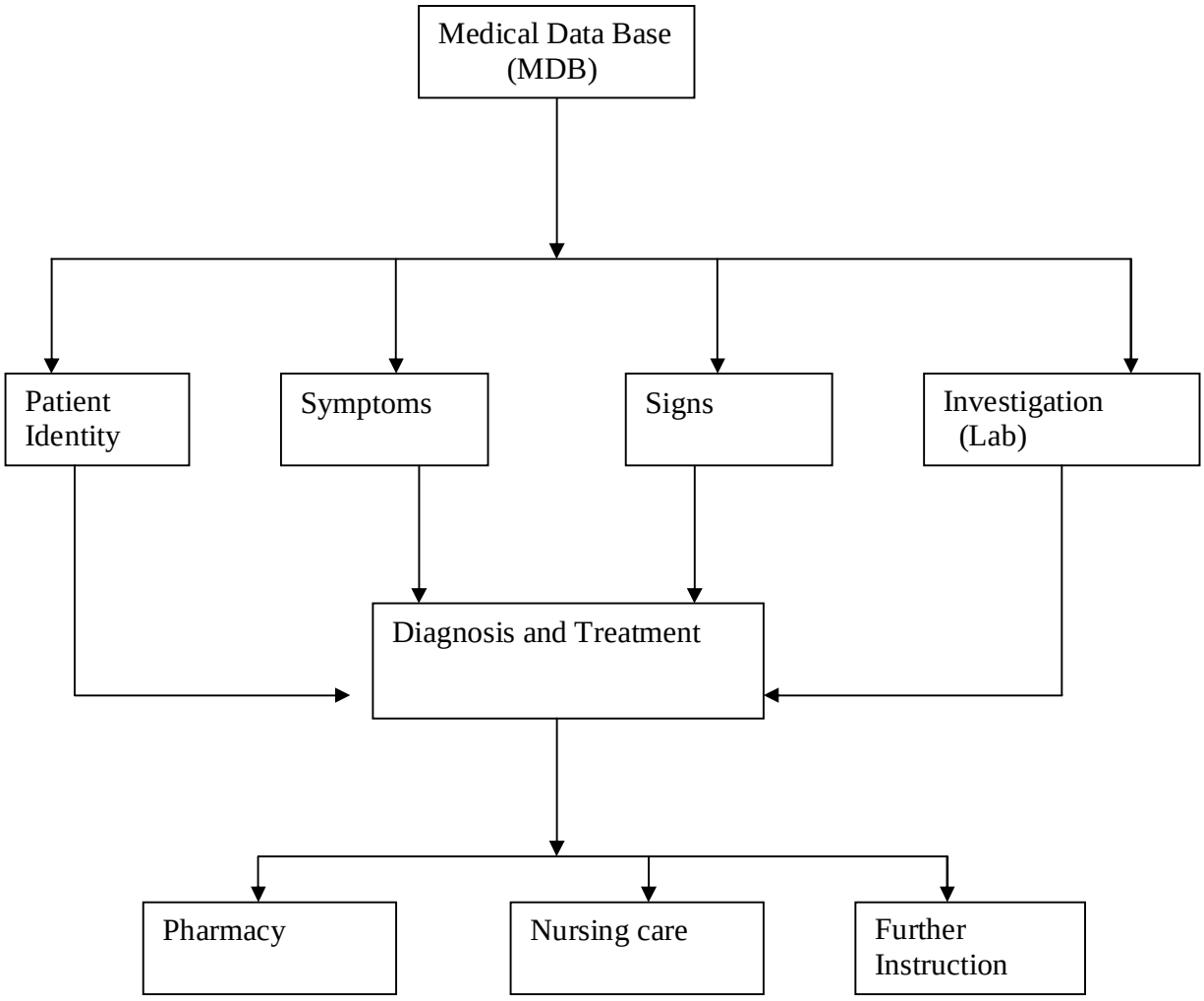
Cost of running the Medical Record Unit was obtained by studying the emoluments of each of the three staff of the unit for 2007, the year preceding the research. Also the Department's management supplied relevant data on recurrent material expenditure for the same period as the general office furniture and fittings would still be required for the electronic system.

Similarly, data were obtained from three different electronic equipment shops on cost of complete computer system with its accessories for one particular but standard brand (Compaq Computer). The Shops were chosen from three different but well distanced locations of Owerri – Ikenegbu layout, Owerri Municipal, and the Orji area.

3.3. Method of Data Analysis/System Design

The Data on the manual method were analyzed using suitable tables and simple percentages while the new design was achieved by means of appropriate design tools such as Program Flowcharts, Data Flow Diagram (DFD) and Algorithms, based on the structured Systems Analysis and Design Methodology (SSADM) globally applicable to software design.

Fig. 3.4. High Level Model of the Proposed Solution



This figure shows a comprehensive view of the sub-headings under which data can be entered in the new system. The user can access any of them through the main menu.

CHAPTER FOUR

ANALYSIS AND SYSTEM DESIGN

4.1. Analysis of the Present System

The present system was analyzed in two parts (Statistical and Theoretical) in order to identify problems inherent in the service delivery and management structure that could have given rise to the problems.

4.1.1. Statistical Analysis (see table 4.1. below).

Here the time taken to obtain a patient's folder was analyzed by recording patient's Time In (arrival Time) and Time Out (Service Time) at the Records Office for three days in the week: Monday, Wednesday, Friday. Their difference is the waiting (Queue) Time. Patient (Pt) level of satisfaction (Sat) … Yes/No… is also shown.

Table 4.1. Waiting Time And Patient Satisfaction (Week One).

	MONDAY				**WEDNESDAY**				**FRIDAY**			
	Time in	Time out	Wait	Pt	Tm In	Tm out	Wait	Pt	Tm In	Tm out	Wait	Pt
1	8^{00am}	8^{40am}	40	N	8^{10am}	8^{20am}	10	Y	8^{40am}	9^{15am}	35	N
2	8^{00am}	8^{42am}	42	N	8^{10am}	8^{19am}	9	Y	8^{45am}	9^{20am}	35	N
3	8^{00am}	8^{45am}	45	N	8^{11am}	8^{40am}	29	N	8^{50am}	10^{am}	70	N
4	8^{10am}	8^{55am}	45	N	8^{15am}	8^{50am}	35	N	8^{55am}	9^{10am}	15	Y
5	8^{12am}	9^{01am}	49	N	8^{15am}	8^{57am}	42	N	9^{am}	9^{28am}	28	N
6	8^{12am}	9^{05am}	53	N	8^{15am}	8^{30am}	15	Y	9^{10am}	10^{am}	50	N
7	8^{30am}	8^{42am}	12	Y	8^{21am}	9^{04am}	43	N	9^{12am}	9^{21am}	9	Y
64					52				45			
Ave			37.3		Ave		39.2		Ave		39.3	

Source: Research Survey, 2007. (see Appendix C)

Table 4.2. Waiting Time And Patient Satisfaction (Week Two)

	MONDAY				WEDNESDAY				FRIDAY			
	Time in	Time out	Wait	Pt	Tm In	Tm out	Wait	Pt	Tm In	Tm out	Wait	Pt
1	8^{00am}	8^{50am}	50	N	8^{07am}	8^{20am}	13	Y	8^{22am}	9^{59am}	37	N
2	8^{03am}	8^{45am}	42	N	8^{10am}	8^{18am}	8	Y	8^{27am}	9^{20am}	53	N
3	8^{10am}	8^{45am}	35	N	8^{11am}	8^{47am}	46	N	8^{50am}	9^{am}	10	Y
4	8^{10am}	8^{25am}	15	Y	8^{15am}	8^{32am}	17	N	8^{55am}	10^{06am}	71	N
5	8^{17am}	9^{01am}	46	N	8^{15am}	8^{57am}	42	N	9^{am}	9^{18am}	18	N
6	8^{21am}	9^{13am}	53	N	8^{15am}	8^{30am}	15	Y	9^{12am}	923^{am}	11	Y
7	8^{30am}	8^{43am}	13	Y	8^{25am}	9^{am}	35	N	9^{12am}	1006^{am}	54	N
73					50				57			
Ave			36.2		Ave		37.1		Ave		37.4	

Source: Research Survey, 2007. (see Appendix D)

Table 4.3. Overall Waiting Time Average.

Days	Week 1 Average	Week 2 Average
Monday	37.3	36.2
Wednesday	39.2	37.1
Friday	39.3	37.4
Total	115.8	110.7
Weekly Average	115.8/3 = 38.6	110.7/3 = 36.9

$$\text{Overall Average} = \frac{\text{Week 1 Average + Week 2 Average}}{2}$$

$$= \frac{38.6 + 36.9}{2}$$

$$= 37.8$$

Table 4.4. Group Data For Waiting Time.

Wait Time in minutes	Number of Patients								Overall Total
	Week 1				Week 2				
	Mon	Wed	Fri	Total	Mon	Wed	Fri	Total	
1-15	6	2	3	11	8	3	4	15	26
16-30	16	15	13	44	22	13	16	51	95
31-45	25	22	18	65	26	20	23	69	134
46-60	17	10	8	35	16	14	13	43	78
61-75	0	3	3	6	1	0	1	2	8
Total	64	52	45	161	73	50	57	180	341

Table 4.5. Patients' Satisfaction over Waiting Time

	Week 1			Week 2		
	Mon	**Wed**	**Fri**	**Mon**	**Wed**	**Fri**
No of patients seen	64	52	45	73	50	57
Ave. wait time	37.3	39.2	39.3	36.2	37.1	37.4
No of patients satisfied	Y(15) 27.8%	Y(20) 38.5%	Y(11) 24.4%	Y(26) 35.5%	Y(18) 36%	Y(21) 36.8%

Table 4.5. above shows result of a survey to find out whether or not patients' were satisfied with the time spent waiting to be served (waiting time) by indicating "Yes" (Y) or "No" (N). The survey was carried out on Monday, Wednesday and Friday for two weeks.

4.1.2. Cost of service

Cost of service was analyzed for the present manual method and for the electronic method based on 2007 estimates as follows:

A. Cost of Manual method (From study centre Admin. Office)

Table 4.5. staff Remuneration (salary + Allowances less Tax/deductions)

Staff	Annual Remuneration
1	N660,000=00
2	N576,000=00
3	N432,000=00
Total	N1,668,000=00

Table 4.6. Office Equipment (From study centre Admin Office)

Items	Cost
Storage facility for folders/maintenance	N102,000=00
Stationery	N216,000=00
Miscellaneous	N96,000=00
Total	N414,000=00

B. Cost of Electronic Method (Price Quotation from three shops)

Table 4.7. Cost of Electronic System at Three Shops

Items	Shop A	Shop B	Shop C
Computer System	N120,000=00	N115,000=00	N118,000=00
Accessories	N80,000=00	N82,000=00	N80,000=00
Stationeries	N15,000=00	N14,000=00	N16,000=00
Generator/maintenance	N120,000=00	N122,000=00	N121,000=00
Miscellaneous	N20,000=00	N20,000=00	N20,000=00
Total	N355,000=00	N355,000=00	N355,000=00

Average = Shop A + Shop B + Shop C/3 …… = N354,300=00

Staff Remuneration (One Staff) = **N576,000=00**
Total Cost = **N930,300=00**

Table 4.8. Application of the New Method (Week One)

	Monday				**Wednesday**				**Friday**			
	Time in	Time out	Wait Time	Pt Typ	Time in	Time out	Wait Time	Pt Typ	Time in	Time out	Wait Time	Pt Typ
1	8^{30am}	8^{32am}	2	Op	8^{46am}	8^{48am}	2	Op	8^{31am}	8^{33am}	2	op
2	8^{35am}	8^{40am}	5	Np	8^{50am}	8^{51am}	1	Op	8^{45am}	8^{46am}	1	op
3	8^{45am}	8^{46am}	1	Op	9^{00am}	9^{02am}	2	Op	8^{50am}	8^{56am}	6	Np
4	9^{05am}	9^{06am}	1	Op	9^{10am}	9^{11am}	1	Op	9^{00am}	9^{01am}	1	Op
5	9^{08am}	9^{10am}	2	Op	9^{30am}	9^{31am}	1	Op	9^{31am}	9^{32am}	1	Op
6	9^{15am}	9^{19am}	4	Np	9^{35am}	9^{36am}	1	Op	9^{40am}	9^{45am}	5	Np
7	9^{36am}	9^{38am}	2	Op	9^{50am}	9^{56am}	6	Np	10^{10am}	10^{11am}	1	Op
8	9^{30am}	9^{34am}	4	Np	10^{10am}	10^{11am}	1	Op	10^{15am}	10^{16am}	1	Op
9	9^{50am}	9^{51am}	1	Op	10^{15am}	10^{16am}	1	Op	10^{31am}	10^{32am}	1	Op
↓					↓							
20					18				15			
Ave			2.4				1.8				2.2	

Source: Research Survey. (See Appendix E)

From table 4.8. above and table 4.9 overleaf, it needed 1-2minutes to serve old patients (OP) who only needed to have their file recalled from the computer memory. But for new patients (NP) whose identity elements required to be first captured, it took 4-7 minutes to serve them. The overall average service time for old and new patients was 1.9. minutes.

Table 4.9. Application of New Method (Week Two)

	Monday				**Wednesday**				**Friday**			
	Time in	Time out	Wait Time	Pt Typ	Time in	Time out	Wait Time	Pt Typ	Time in	Time out	Wait Time	Pt Typ
1	8^{35am}	8^{40am}	5	Np	8^{46am}	8^{47am}	1	Op	8^{45am}	8^{47am}	2	op
2	8^{45am}	8^{46am}	1	Op	8^{50am}	8^{51am}	1	Op	8^{30am}	8^{36am}	6	Np
3	8^{47am}	8^{48am}	1	Op	9^{ooam}	9^{02am}	2	Op	8^{45am}	8^{52am}	7	Np
4	9^{10am}	9^{12am}	2	Op	9^{15am}	9^{16am}	1	Op	9^{05am}	9^{06am}	1	Op
5	9^{45am}	9^{46am}	1	Op	9^{30am}	9^{31am}	1	Op	9^{11am}	9^{12am}	1	Op
6	9^{58am}	10^{am}	2	Op	9^{40am}	9^{42am}	2	Op	9^{11am}	9^{13am}	2	Op
7	10^{10am}	10^{11am}	1	Op	10^{01am}	10^{02am}	1	Op	9^{31am}	9^{32am}	1	Op
8	10^{18am}	10^{20am}	2	Op	10^{05am}	10^{06am}	1	Op	9^{45am}	9^{46am}	1	Op
9	10^{30am}	10^{31am}	1	Op	10^{18am}	10^{19am}	1	Op	9^{45am}	9^{47am}	2	Op
↓					↓							
20					17				19			
Ave			1.7				1.4				1.9	

Source: Research Survey. (See Appendix F)

4.1.3. Summary of Statistical Analysis, And Problem Identification

Of a total of 341 patients monitored within the survey period of two weeks (see Appendices C and D) only 111 (32.6%) expressed satisfaction with service of the records unit. These were the people who were served within 15 minutes of waiting time thus the dissatisfied people (230) accounted for 67.4% of the monitored population.

Again, the average wait time for the survey period was 37.8 minutes with most people falling in the 31-45 minutes group (mode). The range was 70 minutes (75 minus 5 minutes). This implies that two people could arrive at the clinic together, while one person is lucky to be served within 5 minutes, the other might be delayed for up to 75 minutes just to have his folder brought out. In a tight academic environment with no conscious time provision for hospital visit, this delay could really be upsetting and might even kill the desire to seek medical attention again except in an emergency situation. Under this condition, naturally, the hospital management will be adjudged inefficient.

Causes of service delay include late start time due to staff lateness to work, folder misplacement, loss of folder, or outright

lazzey-affaire attitude to work by the staff. On the part of the patient, non presentation of identification number or trace card could cause delay to service. Also not conversant with the procedure on arrival may also cause delay.

On the other hand, an electronic system will completely eliminate waiting time for old patients (repeat visits) as these people will by-pass this stage and go straight to the doctor for consultation. However, new patients (first time visitors) will need to have their personal data keyed into the computer at the records office. But this could be done within 15 minutes which is the time generally accepted as the satisfactory waiting time.

Another pertinent point is that sometimes, the folder is given to the patient to take to the doctor. This is unethical, and even against the clearly written warning on the folder that it should not be handled by the patient. This lapse could break confidentiality and create opportunity for willful alteration of record or even outright destruction of what the patient may consider as unpleasant information in his record. The patient may even quietly take his folder away hoping to open a new folder subsequently.

Considering service cost, the electronic system will be manned by one operator whose remuneration and office requirement will amount to N576,000=00 annually as against the N1,668,000=00 required for the three members of staff plus office equipment for the manual system. The difference is a gain of N1,092,000=00 (65%) in favour of electronic system. Thus all the efficiency indicators applied showed that electronic system has overwhelming advantages over the manual system.

Application of the New System

The new method was applied by simulation to assess its workability. During the two weeks of its application, waiting time of 4-7 minutes was obtained for new patients who needed their identity to be captured. For old patients who only needed their file to be recalled in the electronic system, their waiting time was 1-3 minutes. This is not inclusive of doctor's consultation time. (Appendix E)

A similar study carried out at the Specialist Hospital, Minna Niger State where the electronic system was installed recently showed that patients could be served in5-7 minutes as against hours of waiting previously experienced with manual method.

Therefore, a comparison of the two maximum of 7 minutes, the manual method would take maximum of 15 minutes and any thing above 60 minutes.

Application of the Queuing Theory

Introduction

This work conforms to the Queue Theory or Waiting Line Theory in Project Management. The queue theory deals with the mathematical study of queues or waiting lines when limited service facilitates fail to satisfy all demands at the same time. These Queues build up whenever service facilities cannot meet service demands satisfactorily within a reasonable time. The problem of queues is a universal one and in modern times electronic systems are widely used to minimize queue buildup. Queues or service delays are easily observed in hospitals, banks, fuel/petrol stations, vehicle traffic points, industry assembly line, administrative offices and many other situations.

Definition

According to T. Lucey, 1980:

(i) Queue: A queue can be defined as an aggregation of items awaiting a service function. Queues may consist of people, cars, components in an assembly line, telephone calls, aeroplanes, office files etc.

(ii) Queuing Theory: This can be defined as the construction of mathematical models of various types of queuing systems so that predictions may be made about how the system will cope with demands made upon it. Queuing theory is best suited to relatively simple queuing systems. More complex situations are normally dealt with by simulation techniques.

The Basic Queue Problem

The basic queuing problem is to determine the optimum balance between costs of letting customers or items wait for a long time before receiving service and the cost of providing this service promptly. Frustrating long waiting time will discourage customers from patronizing that particular service while a well planned and prompt service delivery will increase costs unnecessarily with the

risk of some service facilities remaining idle. Either situation is bad for business. The queue theory aims to find optimum solution to the problem so that service capacity just equals service demand. The difficulty in finding an optimum solution lies in the fact that customers may arrive at different and unpredictable time intervals, thereby necessitating corresponding charge in the provision of service facilities or capacity.

Queue Discipline

Queue Discipline or Queue order is a term that describes the order in which items in the queue are served. The most common order is first come, first served. Other possible discipline includes:

- Last come, first served
- Length of service time
- Magnitude of waiting cost
- Promised delivery date or due date
- Customer rank
- Degree of emergency or priority

Any of the queue disciplines can be applied to any of the Queue Systems.

Simple Queue Characteristics.

The term “simple queue” is a technical expression which should strictly be only applied to a queuing situation with the following characteristics:

a. Single Queue and a single service point

b. The queue discipline is first come, first served

c. The queue has infinite capacity

d. Arrivals are random and follow a poisson distribution

e. No simultaneous arrivals

f. Service times are random and follow a negative exponential distribution

g. Discrete customers from an infinite population of potential customers.

h. Single, follow-on service discipline

i. The system must have been in operation long enough to settle down and the traffic intensity must be less than 1.

Components of a Queue System (fig. 4.1.)

Calling population (Arrival) Queue service facility Exit

The basic structure of the queue system consists of three elements: Customer or calling population (arrival), Queue, and Service Facility (Nworuh,2002). On arrival for service, the customer joins a queue or waiting line and awaits his turn for the desired service. When the service facility is free, the customer enters for service. When service is completed, the customer either leaves the system or returns to the calling population.

Basic Types of Queue System

(A) Single Queue-single service point

(B) Multiple Queues-multiple service points

(C) Single Queue-multiple service points

(D) Multiple Queues-single service point

The Traffic Intensity Factor

Traffic Intensity Factor is a measure of how busy or congested the queuing system is. It compares the rate of customer arrival which is represented by the Greek letter LAMBDA (λ) at the service facility and the rate of service delivery represented by MU (μ). Customer arrival time or inter-arrival time is the time between one arrival at the Queue and next arrival. But service time refers to the time that an individual requires to obtain service from the system.

So the relationship λ/u is known as the intensity factor. It is represented by RHO (P) such that P = λ/u.

Thus traffic intensity = $\frac{\text{Average Arrival Rate}}{\text{Average Service Rate}}$ i.e. P = λ/u.

The basic characteristic of the intensity factor is that the mean service rate should be greater than the arrival rate so that λ/u. must be less than 1 for efficient management of the system. A ratio of 0.8 for λ/u is regarded as optimum balance. (T.Lucey, 1980).

Interpretation of Traffic Intensity

The traffic intensity is the measure of “how busy” or “congested” the queuing system is (Nworuh, 2002). If there is no traffic in the system, the traffic intensity is zero. And a value close to zero indicates a large service capacity relative to those desiring service. If however, the traffic intensity is 1 or more the queue will theoretically, be of infinite length. In general, the traffic intensity should not be greater than 0.8, because above this value, the average time in the system increases dramatically (Lucey, 1998). Therefore, the only way that the traffic intensity can be kept at a reasonable figure is to arrival rate can not be controlled.

4.2. Theoretical Analysis of The Present System

Introduction

This Theoretical Analysis presents the establishment of University health Services (Centre of the study), origin and concept of medical records keeping as a necessary adjunct to the practice of medicine, development of the profession, and its focus in the healthcare delivery especially in the contemporary world.

4.2.1. Establishment of University Health Services

University education in Nigeria started with the establishment of a University College in Ibadan as a campus of the University in London in the pre-independence era. The first full-fledged indigenous and autonomous university was established in 1960, the independence year, as the University of Nigeria, Nsukka (UNN). In concept, Department of Health Services like Estate and Works Department is considered as essential adjunct to effective teaching, learning and research – the raison d'etre of university (CODHESNU, 2002). It follows that Health Services Unit is often established with university as an integral part. The primary role of the health Services Department therefore is to provide a sustainable and comprehensive health service to a vibrant well informed and health

conscious academic community through preventive, curative and promotive activities (CODHESNU, 2002). This role is markedly different from that of a medical school or Teaching Hospital which is purely an academic unit established primarily for the training of medical personnel – doctors, pharmacists, nurses, medical laboratory scientists, physio-therapists, medical records professionals etc.

4.1.6. STRUCTURE AND SCOPE OF UNIVERSITY HEALTH SERVICE IN NIGERIA:

The world over, medical service is rendered at three recognized levels: primary care level, secondary care level, and tertiary care level. Functionally, minor ailments are taken care of at the primary care centers, which are usually nearest to the grassroots' population. Moderate health problems advance to the secondary health care level while serious problems are managed at the tertiary levels.

Structurally, primary care is given at the community- based health centers, which are the expected first port- of -call for rural dwellers. Sometimes medical auxiliaries e.g. nurses render healthcare at these centers when there is no doctor. Secondary care is given in general hospitals while tertiary care is given in specialist

and teaching hospitals where medical specialists are concentrated. However, segmentation of health-care systems in accordance with structural and functional areas is mainly for academic and management convenience. In practice health problems – preventive, promotive, curative are handled anywhere facilities and management skill are available.

Generally, university Health System is structural to fit into the secondary healthcare level, which essentially is to provide:

- Daily out-put care
- In-patient care (within the capability of the attending doctor)
- Round the clock emergency coverage
- Preventive and promotive health activities
- Appropriate referrals
- Specialist care where possible including use of visiting specialists Medical advice and support.

4.1.7. ANALYSIS OF THE PRESENT SYSTEM OF HEALTHCARE DELIVERY IN FUTO

The purpose of this analysis is to gain an insight into the healthcare delivery system presently operating in FUTO, identify the problems inherent in the system and be able to design and develop a new system that will eliminate the identified problems and give a more cost-effective, efficient and satisfying service.

The university was established essentially in 1982 along with its service units (Health Dept, Estate and Works Dept etc) at a temporary site in Lake Nwebere area of Owerri Municipality. In 1993 the entire university re-located to its permanent (present) site at Ihiagwa in Owerri capital Territory. By this development, the Department of Health Services is now occupying its permanent site in accordance with the university master plan.

Constitutionally, the entire health of the university community is vested in the Department of Health Services of the university. The department is headed by a Medical Director otherwise designated as the Head of Department (HOD). The Department has major medical units such as :

- Clinical/ Consultation

- Pharmacy
- Nursing Unit
- Public Health
- Family Planning
- Medical Laboratory.
- Non-medical units and administration

At present, two large admission wards are in use. Each has about ten-bed capacity. In addition, there is a “private room” also for admission. Three medical consultation rooms are in use in addition to the Head of Department’s own consultation room. The Department has medical professional staff strength of 6 medical doctors, 3 pharmacists, 24 nurses and one laboratory scientist. When possible a Youth Corps doctor or pharmacist is engaged to assist. Apart from services at the permanent site, the Department runs a satellite medical center in the Extension Quarters of the University located in Owerri municipality. This outfit is supposed to cater for the university communities in Owerri town especially outside the normal civil service work period. This arrangement is necessary because most of the university staff live in Owerri town and the suburbs and normally retire there after the day’s work.

Also, students may find the arrangement more convenient during vacation.

The key medical staff plus the ambulance unit render 24 hours daily healthcare coverage including immediate and appropriate response to medical emergencies.

PATIENT'S ITINERY IN THE HEALTH CENTRE

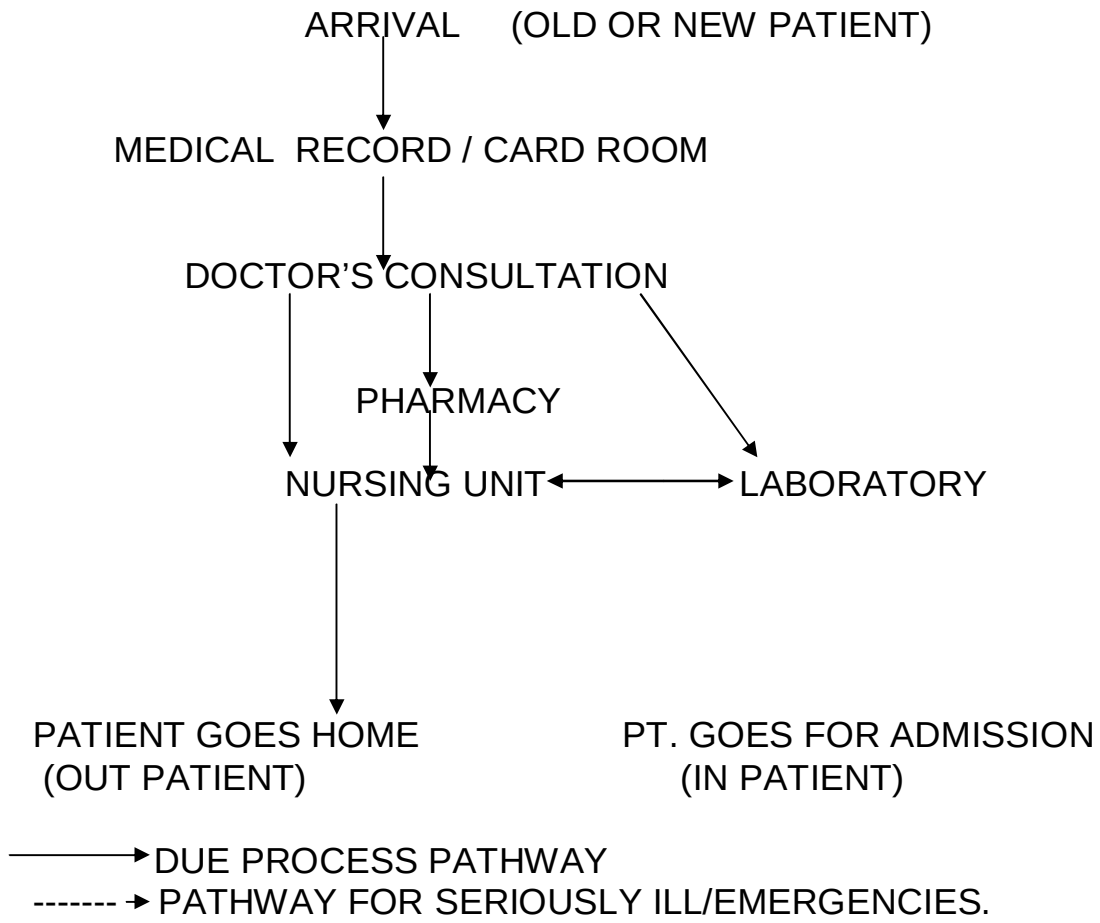
The Health Centre records about 80 patients a day. The number may get up to 100 at peak seasons when university examinations are approaching.

On arrival at the health center, a patient is expected to go first to the Records Unit (Card Room) where his folder (card) is retrieved or new one issued as the case may be. The folder is then taken to the doctor's Consultation Room by the medical records staff. Attention to patients is usually on first come, first served basis but this order is waved to accommodate seriously ill patients or emergencies when they arrive.

After consultation, according to "queue order", the patient takes his prescription to the next station – pharmacy, laboratory or treatment room as the case may be. Here again, the patient takes

his turn until the cycle is completed. For seriously ill patients or emergencies, this sequence is invariably followed but markedly quickened or initially altered for convenience.

Fig. 4.2. PATIENT'S MOVEMENT CHART



SCOPE OF SERVICE

By appropriate duty schedule, the Department ensures that health care is provided 24 hours a day including weekends and public

holidays for as long as school is in session. The services are mainly medical (non-surgical) because the department lacks facilities for surgical operations beyond minor cases. Most of the medical problems are those peculiar to the youthful period of life since the university community is largely of youthful age.

At present, the doctors operate as family physicians or general practitioners rendering essential care in almost all areas of medical practice and referring cases to higher care centers as appropriate

MEDICAL RECORDS LINKAGE

Medical Records Linkage which is the linking together of medical records of one patient as the patient receives medical care from different professionals is facilitated by the use of electronic information system.

The linkage is necessary to form a comprehensive and accurate view of a patient's medical history at any given time. In the present system the patient's medical record is fragmented. Bits of information remain everywhere the patient is attended to. But in a computerized medical record system all information about a patient no matter where and when acquired can be brought together to form

one complete record that will follow the patient from one care center to another.

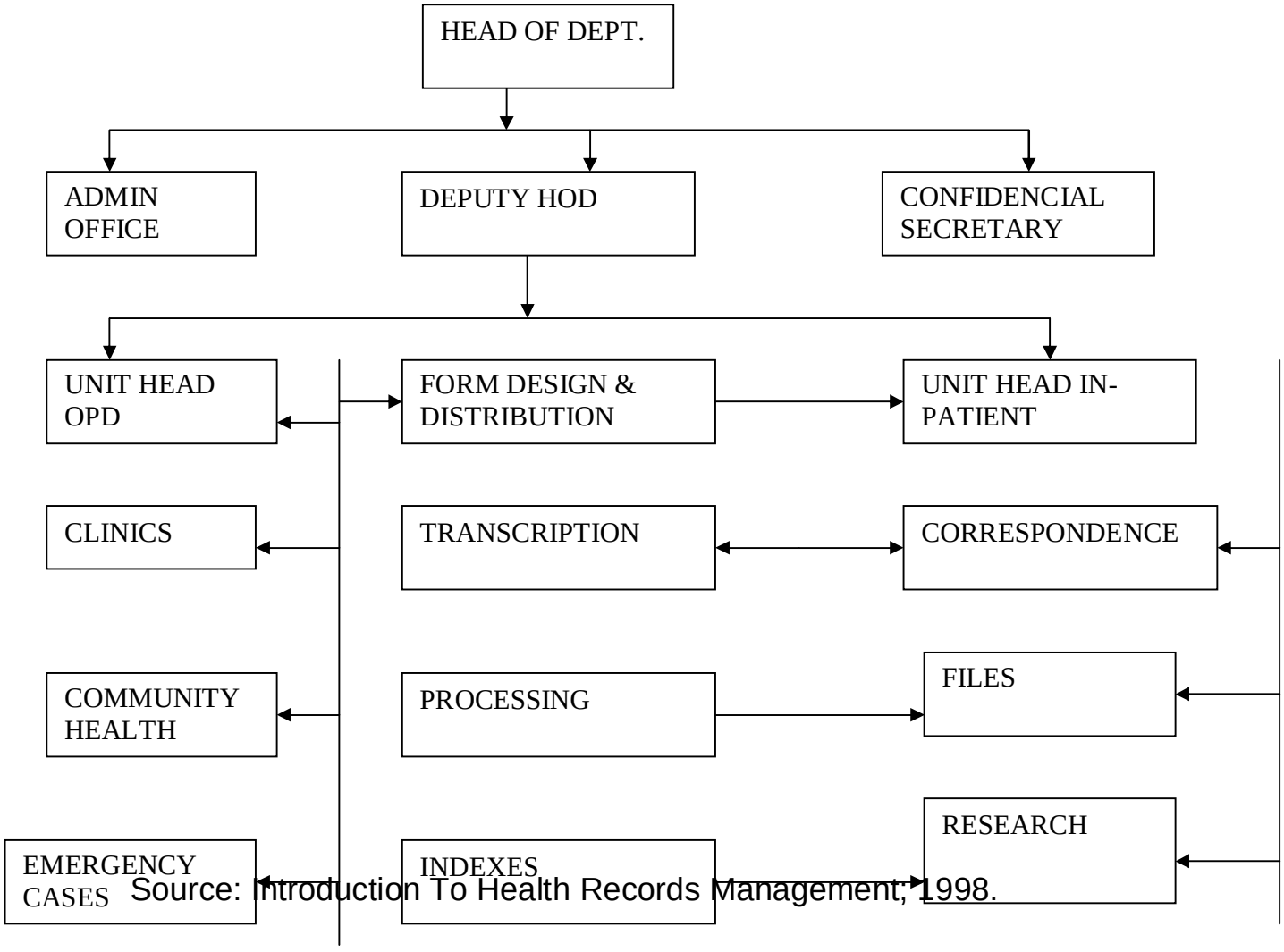
MEDICAL INFORMATION MANAGEMENT

Information management has assumed a very important status in the modern world. In all spheres of life, efficient information and communication management has facilitated contact so much that the entire world could reach out like one village without the necessity to physically travel or move out.

Medical Information Management is only a part of general information management which applies to health system. It is essentially managed by the Medical Records Department. This function can only be performed efficiently by professionals by use of modern information technology such as the electronic system.

Fig. 4.3. ORGANISATION OF MEDICAL RECORDS DEPARTMENT

The Medical Records Department needs to be well organized in order to achieve smooth co-ordination of activities and logical flow of information. A model organization medical record dept is shown below;



Source: Introduction To Health Records Management, 1998.

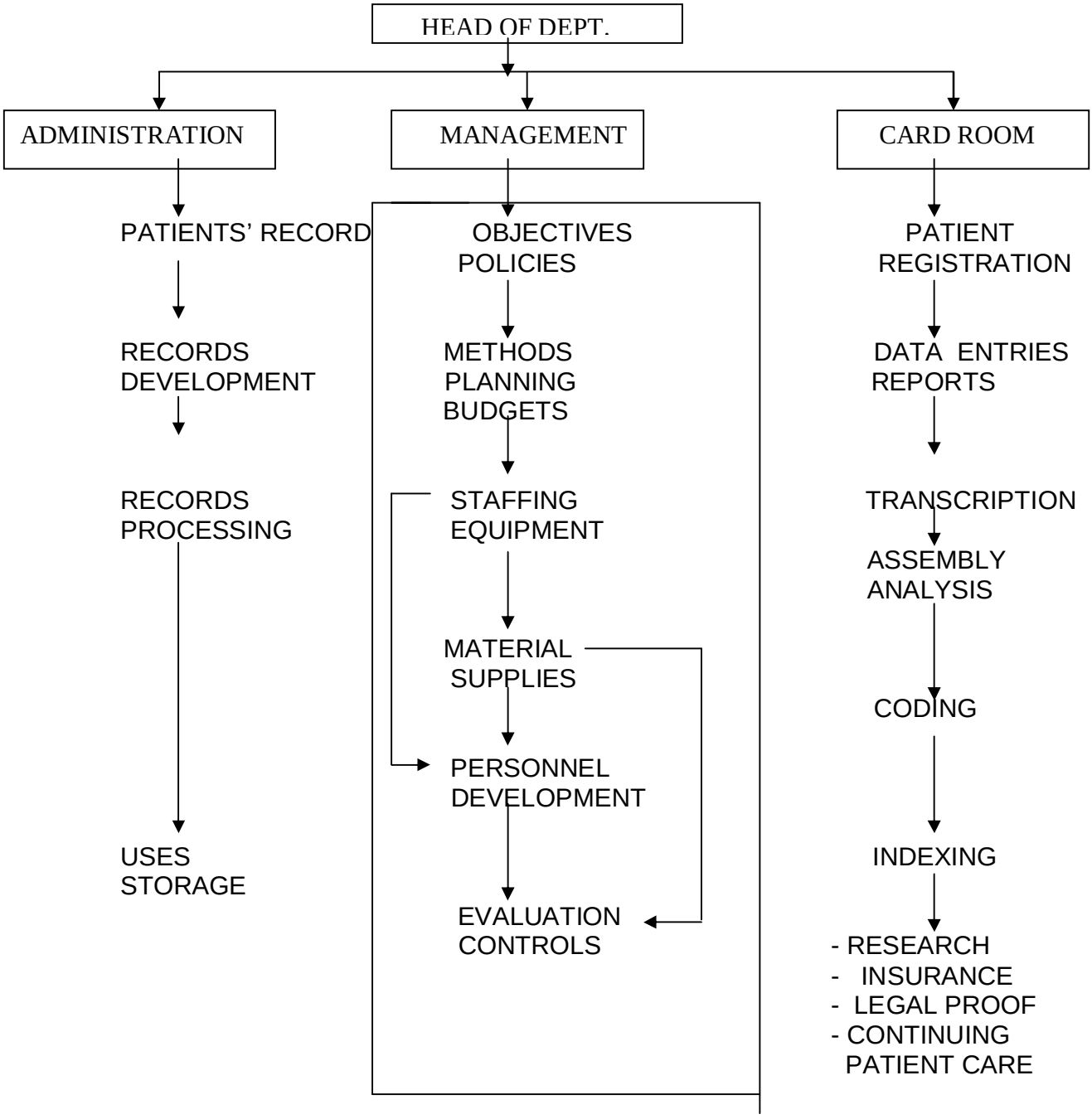
4.1.7.THE IMPORTANCE OF EFFICIENT MEDICAL RECORD KEEPING

An efficiently managed Medical Records Department ensures that medical records are maintained in standardization forms as contained in a report of the British Central Health Services Advisory Council published in 1965. This not only makes for convenience and uniformity in record keeping and reporting but also facilitates use of automated information processing equipment such as the computer. Standardization when so established compels discipline and conformity to a given practice too.

In principle, efficient record keeping implies keeping records in orderly, reliable and easily retrievable form for different purposes. Such purposes include:

- Professional interaction between healthcare providers to achieve co-coordinated care and enhancement of experience.
- Documenting and keeping track of a patient's medical history
- Performance assessment and medical auditing of both care institutions and individuals
- Research and education needs
- Planning, Resource allocation, legal needs etc
- Provision of accurate and important information to authorized third-party interest groups such as insurance companies, government statistical needs etc.
- Facilitation of patient and information transfer when necessary.

Fig. 3.3. INFORMATION FLOWCHART IN HEALTH RECORD:



Source; Introduction to Health Records Management, 1998.

STANDARDISATION OF MEDICAL RECORDS

The report of the Sub- Committee of British Central Health Services Advisory Council on the standardization of Hospital Medical Records was published in 1965. All hospitals are expected to follow the principles laid down therein.

Among other things, the report calls for standardization of methods and documents. It has been pointed out that there are clear advantages in standardization of records, not only for the convenience of the hospital staff moving from one post to another or doing sessions in different hospitals, but also to enable full use of automatic processing facilities e.g. computer.

ADVANTAGES OF STANDARDISATION

- It is of great value for retrospective research for epidemiology and social medicine.
- It will lead to easy compilation of statistics which is an aid to management in the allocation of resources and in the formulation of future policy
- It will reduce the bulk of paper records which have to be kept thus easing out the problems of storage

- Standardization is an advantage when a patient has to be referred to other hospitals
- It helps to achieve the desired discipline in the practice of medicine
- The stock of form kept is reduced to the minimum
- Comparison of bed use with other hospitals in the state is made possible

4.1.9. PRESERVATION AND DESTRUCTION OF MEDICAL RECORDS

All government departments and other authorities responsible for public records have a duty to make proper arrangements for selecting under the guidance of the Public Record Office (or any authority assigned with the responsibility) those of their records which should be disposed of. There should be provision also, for records that should be permanently preserved to be transferred to suitable places. From there, they would be made available for public inspection if required. Medical Records is not an exception. The storing of records if continued indefinitely, storage containers (steel cabinets, shelves etc) will become filled to the capacity and many records may have outlived their usefulness. So, periodic cueing of the stored materials is required. Do not "store and forget".

The life cycle of all materials consists of three stages viz;

a. Active use ------ quick access is important

b. Storage ---------- for possible use and

c. Elimination ------ no longer of use.

Worthless record, therefore, should never be stored. Records stored should be reviewed periodically to eliminate the useless ones.

No hospital could afford to retain health records of patients on a permanent basis. The reality of the problem of filing space compels the hospital to decide on the maximum retention period of medical records. The decision of the retention period largely depends on;

1. The amount of filing space available in the Medical Records Department
2. The yearly expansion rate of current files
3. Readmission rate for inpatients and outpatients
4. Volume of research
5. Statutes of limitation in the country
6. Technical know-how- and cost involved in microfilming.

FACT ABOUT PRESERVATION OF MEDICAL RECORDS

Information relating to previous admission or attendance to hospital is of great importance to the management of the case when the patient requires further treatment in the hospital. Many years after the conclusion of treatment and discharge of the patient, his medical records proper are required for various research projects. The prospect of advancement in medicine and surgery by means of research and publications depend to a very large extent on good medical records preservation. Medical records are used as evidence for the defiance of the hospital, its physicians and employees in law suits.

4.1.10. PROBLEMS OF PRESERVATION OF MEDICAL RECORDS

There is the practical problem of limited storage space for records. And this has been a serious and ever growing problem in all our hospitals. All the relevant information ought to be available and if it is filled with mass of documents containing information that are no longer relevant, the task of every person who looks at the record is made unnecessarily complicated every time he picks up the document. Sometime, there is a breakdown of linkage of patient's medical history as a result of blunt refusal of patient to give correct particulars (name, Age, Address etc.) when the personal reference

cards are misplaced; there is usually duplication of records if master index is not functioning efficiently.

There is no guidance on the preservation and destruction of medical records in this country (Nigeria) at present as it is in the European countries. In the USA, the period varies from one state to another. In Canada, it varies from one province to another. There is time limit during which law suits can be taken against a defendant. In order to make the medical records available for research and study purposes, the keeping of records on microfilms and computer have been the alternative means of keeping the same records in considerable reduced storage space e.g. microfilms will take only 2% of the original space.

ADVANTAGES OF MICROFILMING

1. Space saving----2% of the original space used
2. Accessibility ------ can be kept in the department
3. Security ---------- can be locked up and it is fire proof
4. Integrity ---------- no out file nor misplacement
5. Ease of conversion to paper by the use of Reader/Printer
6. Establishing duplicate record called Diazo
7. Versatility --------- can assume or supplement existing information.

TYPES OF MICROFILM

1. Roll Film:

Microfilm is most commonly used in roll film. Usually either 35mm or 16mm. The usable length on a standard camera pool is approximately 30. This is sufficient for 2000 single sheet exposures. Roll film is easily read when magnified on suitable viewer and the time taken to locate the required case is minimal.

2. Rotary Camera:

This is used for routine documents all of the same size and be fed automatically (a good example of this is computer).

4.1.11. RECORDS DESTRUCTION

At the third stage of the records cycle, it is due for destruction. Though, no medical records officer has the exclusive right to destroy medical records. The authority must come from the Medical Advisory Committee on the advice of the medical records Sub-committee. This approval will have to be conveyed to the Health Record Officer in writing by the medical records Sub-committee.

THE MODE OF DESTRUCTION

There are three modes of destroying medical records viz; Destruction should be done on the appointed day and at a specified location. It should be witnessed by an official appointed by the sub-committee.

1. Burning: This is an ideal method of destroying medical records
2. By Shredding: By this method, the materials are put in a shredding machine and shredded into the size of corn chuffs. The product is sold out as manure. This method is even perhaps better than the previous one, but in a country like Nigeria, this may not be an ideal method since shredding machines are unlikely to be available.
3. By giving away: By this method, the materials to be destroyed are given away to market women to wrap the wares they sell. This is a very poor method of destroying Health Records. It does not protect the confidentiality of the records and should be discouraged by all means.

4.1.12. CONFIDENTIALITY OF HEALTH RECORDS

Since the creation of the Hippocratic oath about 400 B.C. protecting the privacy of patients has been an important part of physicians' code of conduct. Linda (2003).

Over time, Health Information has come into use by many organizations and individuals who are not subject to medical ethics codes including employers, insurers, government program administrators, attorneys and others. As uses of medical information multiplied, so have regulatory protections for this highly sensitive and deeply personal information.

According to the Medical Records Privacy (2003), the regulatory regime for protecting privacy of health information is complex and fragmented. Some protections apply only to information held by government agencies. Some protections apply to specific groups, such as federal employees or school children. Some protections apply to specific medical conditions or types of information, such as information related to HIV/AIDS or substance abuse treatment. The first comprehensive set of federal regulation of health information, the Privacy Rule under the Health Insurance portability and Accountability Act of 1996 (HIPAA), came into effect in April 2003. The Security Rule, also required under HIPAA, was issued in final form on February 20, 2003 and will become effective in 2005.

The Privacy Rule establishes a federal mandate for individual rights in health information, imposes restrictions on uses and disclosures of individually identifiable health information, and provides for civil and criminal penalties for violations. The complementary security rule includes standards for protection of health information in electronic form.

Besides information about physical health, these records may include information about family relationships, sexual behaviour, substance abuse and even the private thoughts and feeling that come with psychotherapy. This information is often keyed to a social security number. Because of lack of consistent privacy protection in the use of social security numbers, the information may be easily accessible. Information from your medical records may influence your credit, admission to educational institutions and employment. It may also affect your ability to get health insurance or the rates you pay for coverage (OTA Report). More importantly, having others know intimate details about your life may mean a loss of dignity and autonomy.

Pledge For Members Of The Medical Records Profession

" I pledge myself to give out no information from any clinical record placed in my charge, or from any other source, to any person whatsoever, except upon order from the chief executive officer of the institution which I may be serving".

The position of Medical Records Practitioners is therefore one of trust. The patient has a right to privacy, and it is the ethical obligation of all those who handle patient information to uphold this right.

The information acquired in a doctor-patient relationship generally is considered to be a confidential or privilege communication. There, the hospital organization and its individual employees jointly share the responsibility for the best possible care of the patient. To fulfill this obligation, the hospital and the employees are both charged with certain reciprocal ethical obligations. Employees are obligated to safe guard confidential information regarding patients and the hospital, to avoid gossip and public criticism of the hospital, to develop a spirit of mutual friendliness with fellow workers and to be courteous to the public.

Occasions On Which Medical Information May Be Released

A. To the medical staff of the hospital in which they were made either to give guidance in treating a particular patient.

B. Patients records should also on request be made available to a specialist of another hospital who is treating the patient but in this case, it is advisable to send or retain copies.

C. Patient's case note must be produced on the order of court of law.

Policy For Release Of Medical Information

1. Any information of medical nature in possession of the hospital must not be revealed by an employee of the hospital, except as herein after outlined.
2. It shall be the general policy that the hospital will not voluntarily use the records in any manner, which will jeopardize the interest of the patient with the exception that the hospital itself will use the record if necessary to defend itself or its agent against unjust accusation made by patients or others.

3. Members of the resident and attending medical staff may freely consult in the medical records department such that pertain to their work. Unless there is suspicion that one of those individuals wishes to consult a record for purposes not favourable or to the interest of the patient or the hospital. Should there be such doubt in the mind of the medical records staff, access to the particular record may be refused and the matter be referred to the administration for decision.
4. Request by patient for information concerning their own records shall be referred to the attending physicians in charge of the case.
5. Verbal requests for information are to be discouraged. Individuals requesting medical information are to be referred to the attending physician.
6. Information on medical records shall be given out only on written authorization signed and dated by the patient, guardian if a minor, mental, incompetent or nearest relation in a case of death.

7. Information on medical records may be turned over to the hospital legal representatives to protect the interests of the hospital in cases involving liability or compensation.
8. Information may be released to other hospital without signed authorization by the patient upon receipt of a request from the hospital stating that the patient is now under the care of their institution.
9. Charges will be made for abstracts or summaries of all medical records except to the patients' physicians, Social Service Bureaus and attorney representing the hospital.

10 .The administration will out of its discretion permit use of the medical records for research purposes. Person other than member of the house and visiting staff asking this privilege must secure the written authorization of the administration and of the attending physician on those cases.

4.1.13. USES OF MEDICAL RECORDS

1. To document the course of the patient's illness and medical treatment as an inpatient or an outpatient.

2. To communicate between the physician and other health professionals contributing to patient care.
3. To provide continuity of patient care on subsequent admissions.
4. To provide data for third parties concerned with the patient- including other physicians, hospitals, insurance companies or pre-payment agencies, compensation carriers, attorney etc.
5. To provide data to assist in protecting the legal interest of the patient, hospital and the medical staff.
6. To provide clinical data for research, study and education.
7. To review, study and evaluate patient care by hospital or medical staff committee.
8. To provide basis for clinical auditing and assessment of personnel performance.
9. To provide invaluable data for planning and general administration.
10. Medical records may be an index of the health of a community and disease pattern.

4.2. EXPECTATION OF THE NEW SYSTEM

The newly designed electronic system of medical records is expected to overcome the problems inherent in the old manual system

and turn its disadvantages into advantages. It will achieve this by ensuring that:

- Computer systems replace manual operations
- The necessary staff are re-trained to adapt to electronic systems
- Time and paper wastage is markedly reduced
- Records are standardized and made accessible easily and on line
- Loss or defacing of records is checked
- The system is cost effective
- Overall efficiency is achieved

4.1.15. ENVISAGED PROBLEMS IN THE NEW SYSTEM

- Unreliable and ineffective electric power supply. Therefore, need for back up source of power
- The poor maintenance culture of the country may hamper full utilization of the benefit of the system
- Conversion cost from old to new system including re-training of personnel.

4.1.16. Weaknesses (Gaps) observed in the Present Method

As a result of the manual operation at every service station coupled with total absence of internal communication network (INTER-COMM) certain problems are unavoidably associated with the system. The problems include;

- Infuriating delay at every service station
- Loss or misplacement of patient's folder
- Retrieval of wrong folder as a result of mistaken identity especially when names are similar or sound alike
- Inaccessibility to medical records after normal work period leading to the creation of temporary records which may not be integrated into the existing record after all
- Illegibility of hand written records
- Poor and uncoordinated record writing/keeping
- Because all the medical units work in a modular form, there is no record linkage
- Handling of records by untrained/unauthorized persons leading to issues of confidentiality
- Pre-mature destruction of old records to create space (students' folders are destroyed soon after graduation)

- Inadvertent destruction of records by rough handling, poor storage, stain, rodents, insects etc.
- Zero inventory of stationery sometimes leading to use of any material available

4.2. DESIGN OF THE NEW SYSTEM

This chapter dwells on the design and development of a new system of medical records, which is intended to totally replace the present manual system. The new system will incorporate automated procedures through the use of computer. The design will include program module specification, program flowchart, database design and system control center.

4.2. Objective of the New System

The new system will incorporate automated procedures through the use of computer. The design will include program module specification, program flowchart, database design and system control centre, and it is based on the internationally acclaimed “Structured Systems Analysis and design Methodology (SSADM)” which is globally applied on software design. According to Osuagwu (2002), SSADM involves the following stages:

(i). Problem Identification: Here the problems or weaknesses inherent in the existing system are clearly identified with the new system

(ii) . feasibility Study: This means to study the socio-economic and technological viability of the proposed new system and the workability of a change from the present to a new system

(iii). Analysis: This aims to fully and objectively analyse the existing system in all aspects including management style in order to expose its weaknesses and justify the need for a replacement system.

(iv). Design: This is the crux of the matter. Here, a new system is designed and developed bearing in mind findings in the fore-going stages

(v). Implementation: This stage describes the implementation process of the new system

(vi). Maintenance: This provides for the regular maintenance of the new system including workability and relevance

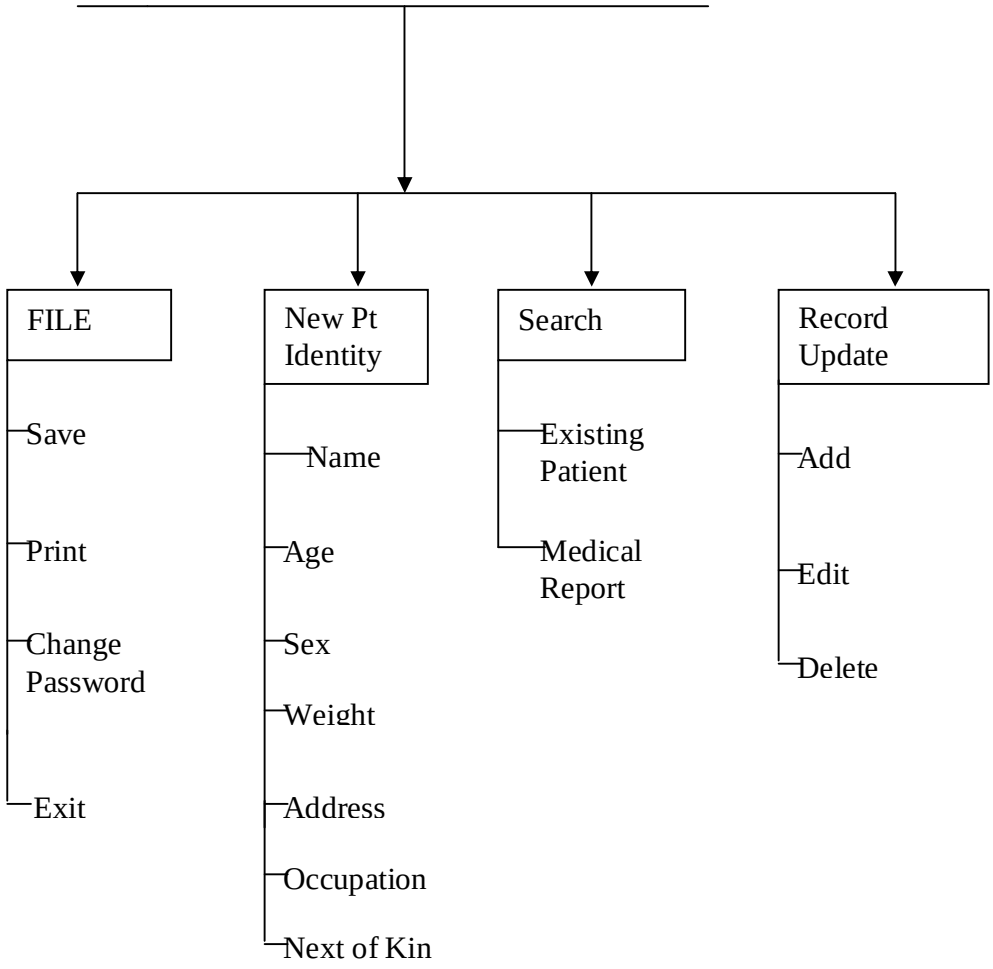
Objective of the New System:

- To provide an electronic method (Software Application) of Medical Record Keeping that will replace manual method
- Achieve automatic capture of patient's identity, illness, treatment, laboratory tests, visits etc.
- Integrate Medical Record Keeping Activities for wholistic view
- To hasten attention to patient through automatic search for needed information
- Provide an updateable information template for each patient
- Launch the health sector into the electronic medical age

4.2.1. CONTROL CENTRE (MAIN MENU)

This controls other modules and permits operation in specific areas of choice as shown in figure 4.1.

Fig 4.4. CONTROL CENTRE (MAIN MENU)



This program leads to, and controls, other activities (modules) of the system. It opens a new folder, retrieves an old one, and updates records as required. Afterwards, the information could be saved, printed or the operation ended (Exit). “Password” is the key that unlocks a file. So this program will permit change of the password (padlock) to keep off unauthorized persons from having access to the folder thereby maintaining strict confidentiality.

Program Specification

This consists of the components (different programs or activities) of the main menu as shown in figure 4.2.

Fig. 4.5. Program Module

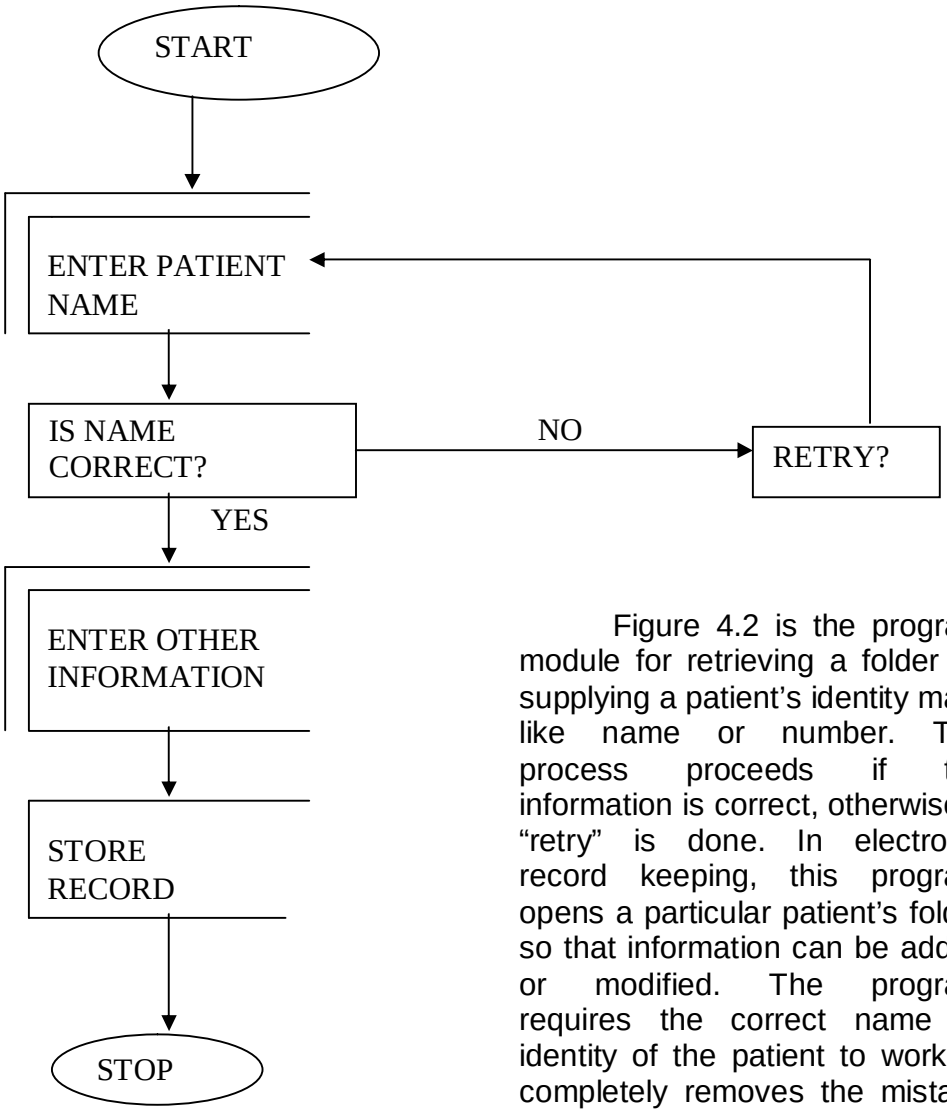


Figure 4.2 is the program module for retrieving a folder by supplying a patient's identity mark like name or number. The process proceeds if the information is correct, otherwise a "retry" is done. In electronic record keeping, this program opens a particular patient's folder so that information can be added or modified. The program requires the correct name or identity of the patient to work. It completely removes the mistake of wrong folder with respect to a particular patient.

Table4.1. DATA BASE STRUCTURE (PATIENT MDB, FILE ATTRIBUTE)

This is really the format that shows the specific information required on a particular patient. Such information includes name, age, address, complaints, treatment and others as shown in table 4.1.

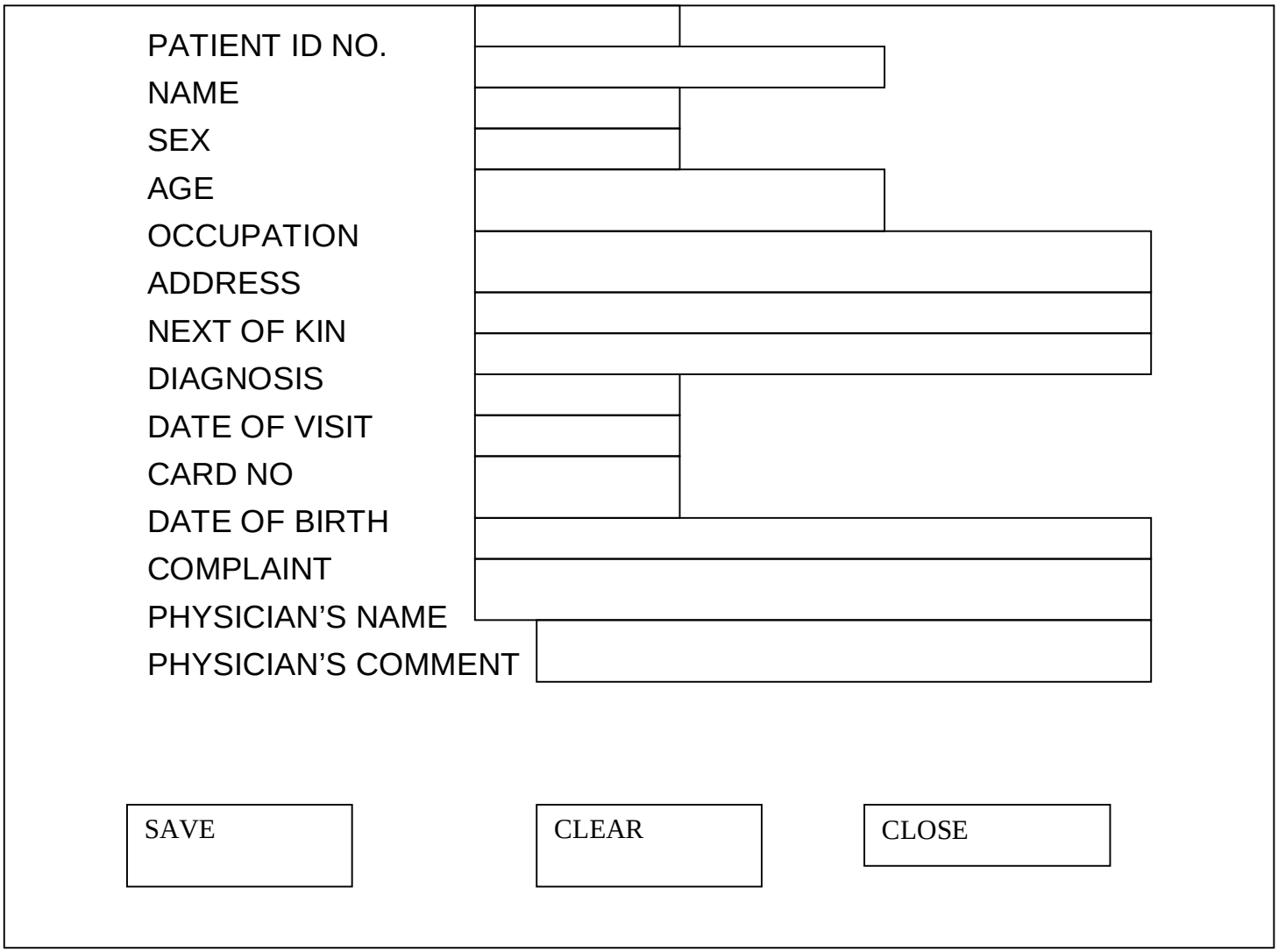
S/N	FIELD NAME	DATA TYPE	SIZE
1	PATIENT ID NO.	TEXT	10
2	PATIENT NAME	TEXT	40
3	SEX	TEXT	7
4	AGE	DOUBLE	4
5	OCCUPATION	TEXT	50
6	ADDRESS	TEXT	45
7	NEXT OF KIN	TEXT	40
8	DIAGNOSIS	TEXT	40
9	DATE OF VISIT	DATE/TIME	8
10	CARD NO	TEXT	15
11	DATE OF BIRTH	DATE	8
12	PATIENT'S COMPLAINT	TEXT	50
13	PHYSICIAN	TEXT	50
14	PHYSICIAN'S COMMENT	TEXT	70

The program shows the subject of information required (field name), data type (whether letters or numbers), and data maximum allowed space or length (size). The data type must not exceed the allowed size. This is to standardize data format and strictly maintain space economy. The program therefore, is used to achieve design specification and conformity.

Fig.4.6. INPUT / OUTPUT FORMAT

Input Screen Format: This shows how the data-capturing sheet will appear on the screen. It displays information required on a patient and it is for the user to complete the “form” for each patient. The screen “form” has spaces for the patient’s personal identity and medical condition.

INPUT DESIGN (INPUT SCREEN FORMAT)



Output Screen Format: This also displays on the screen the way information will appear after each processing procedure. It enables the user to do more data manipulation as required on each patient.

Fig.4.7. OUTPUT DESIGN (OUTPUT SCREEN FORMAT)

PATIENT ID NO.	XX
NAME	XXXXXXXX
SEX	XXXXXX
AGE	XXXXXX
OCCUPATION	XXXXXXXXX
ADDRESS	XXXXXXX
NEXT OF KIN	XXXXXXX
DIAGNOSIS	XXXXXXXX
DATE OF VISIT	XXXXXX
CARD NO	XXXXX
DATE OF BIRTH	XXXX
COMPLAINT	XXXXX
PHYSICIAN'S NAME	XXXXX
PHYSICIAN'S COMMENT	XXXX

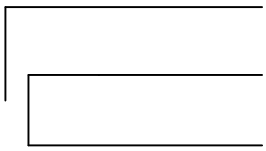
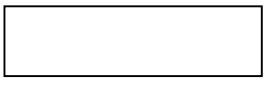
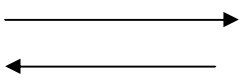
NEXT CLEAR CLOSE

4.2.2. DATA FLOW DIAGRAMS (DFD)

Data flow Diagrams (DFD) are diagrams, which show the directions of flow of data. They describe the inter-relationship between groups of data in a system.

They also represent modern alternative to flowcharts as tools in systems analysis. They are simple to draw and easy to understand because they involve few symbols and rules, and avoid unnecessary technical details. They help to build a logical model of a new system free from unnecessary complexity; and clearly show important data flows. They provide, at a glance, an intelligent picture of the whole system. This is why DFD has been adopted in this design.

Fig. 4.5. Four Legal Symbols for Data Flow Diagram (DFD)

DFD Symbol	Description
	Data source/Destination
	Data Store
	Data Processing/operation
	Direction of Data Flow

4.2.3. ALGORITHM

Algorithm is a complete step-by-step procedure for solving a problem. It takes into account all contingencies that may occur. There are three basic characteristics:

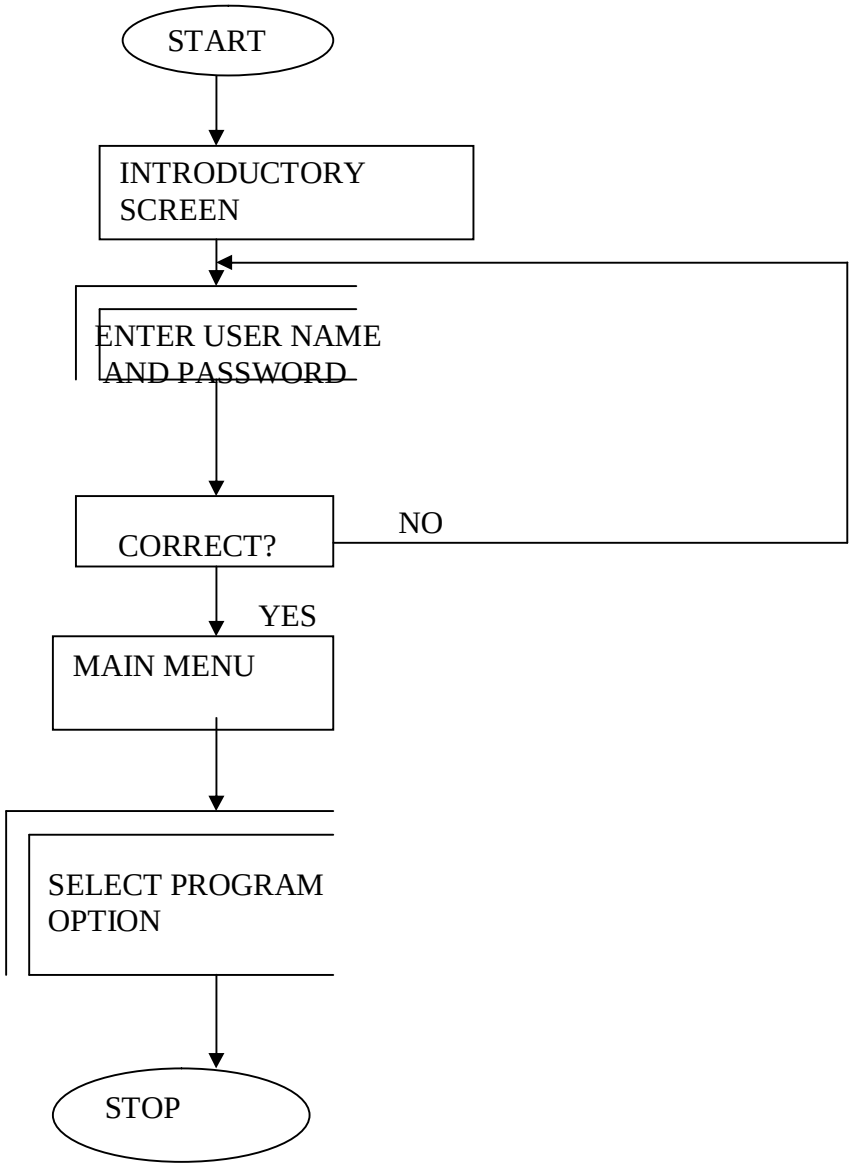
1. The problem must be definite and unambiguous
2. The problem must be finite
3. The problem must be complete

Example of Algorithm

1. Start
2. Enter user name and password
3. If user name and password are valid then
4. Show main menu
5. Else
6. Display message
7. End if
8. Stop

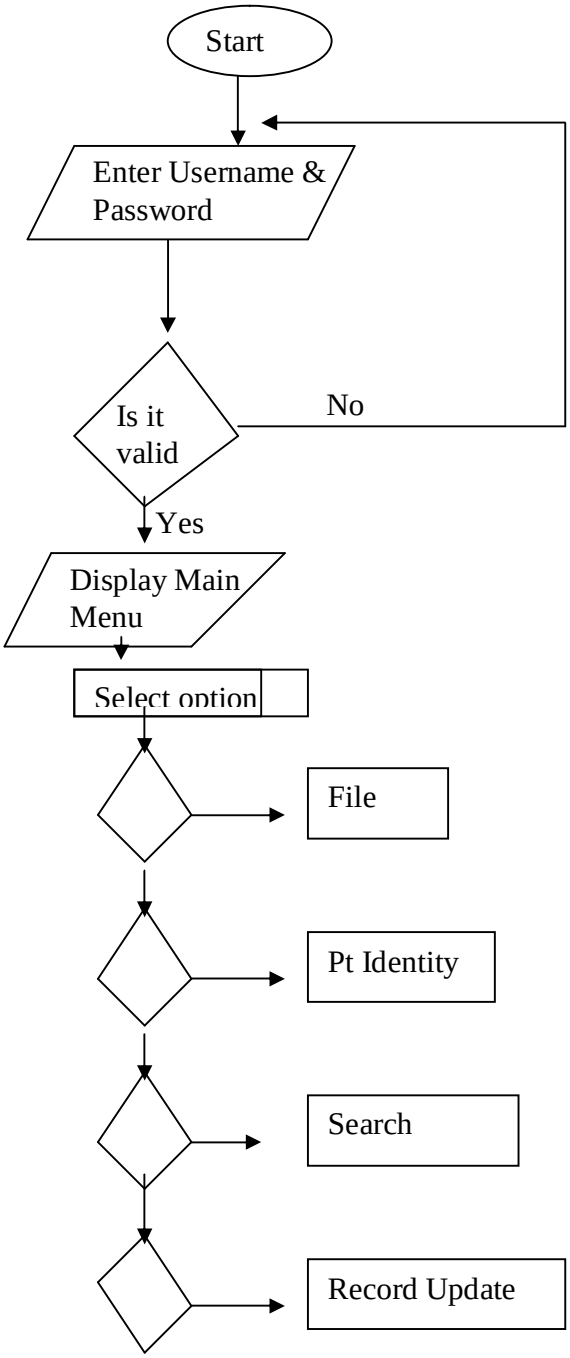
Above example of algorithm demonstrates a suitable communication between the computer and its human operator (human/machine language). The operator starts the machine (computer) and follows the given steps to give his instruction up to the end of the procedure.

Fig. 4.8. PROGRAM START – UP PROCEDURE (ALGORITHM)



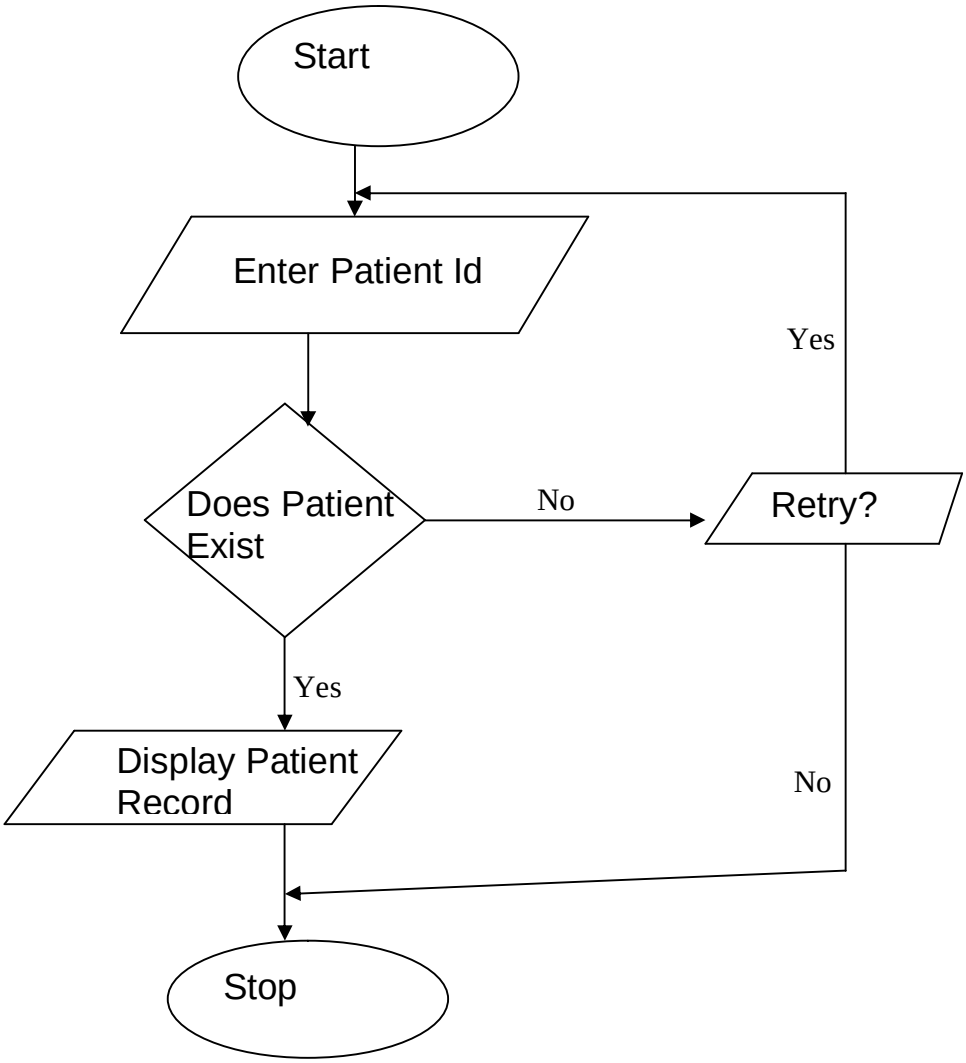
After the introductory screen (formality), the program requires the operator to supply his name and password as stored in the system to clear him as authorized user. Otherwise the system will not proceed beyond the introductory screen formality. This again bars unauthorized access to confidential or “classified” information.

Fig. 4.7. Main Module Flowchart



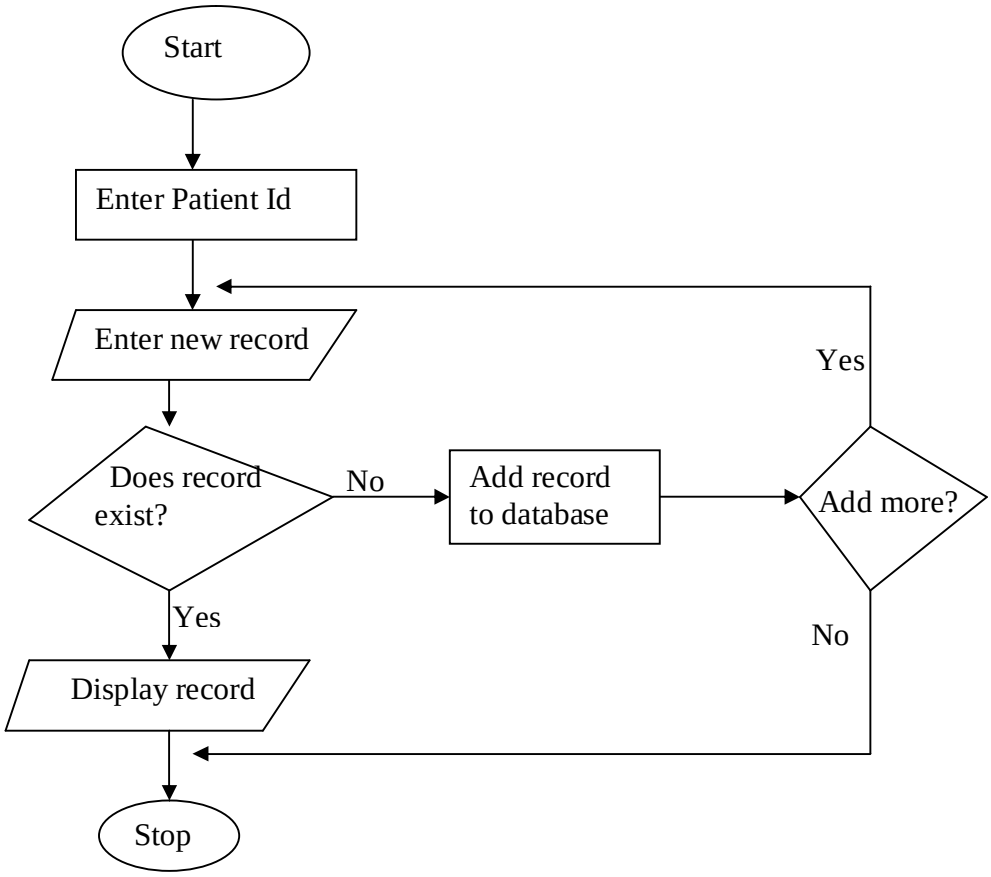
This is the content of the entire design in a compact form like a “map” .If the correct or valid username and password are supplied, the system opens the main menu from which the operator selects which option he wants to work on. The computer obeys as correctly directed.

Fig. 4.9. Search Module Flowchart



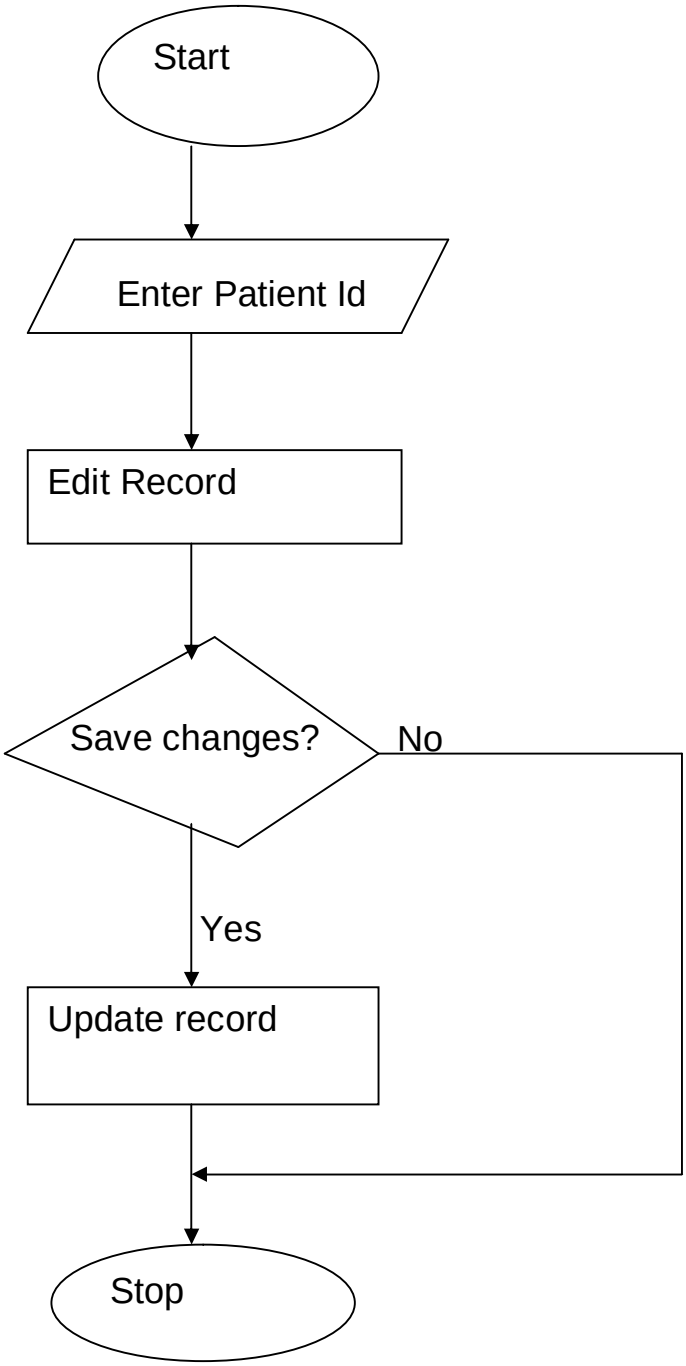
This enables the user (doctor, nurse etc) to search whether a patient has existing older or not by supplying the patient's correct identity to the system. This completely removes the need to go to the records office to retrieve existing folder manually thereby eliminating the waiting time at the records office.

Fig. 4.8. Add Module Flowchart



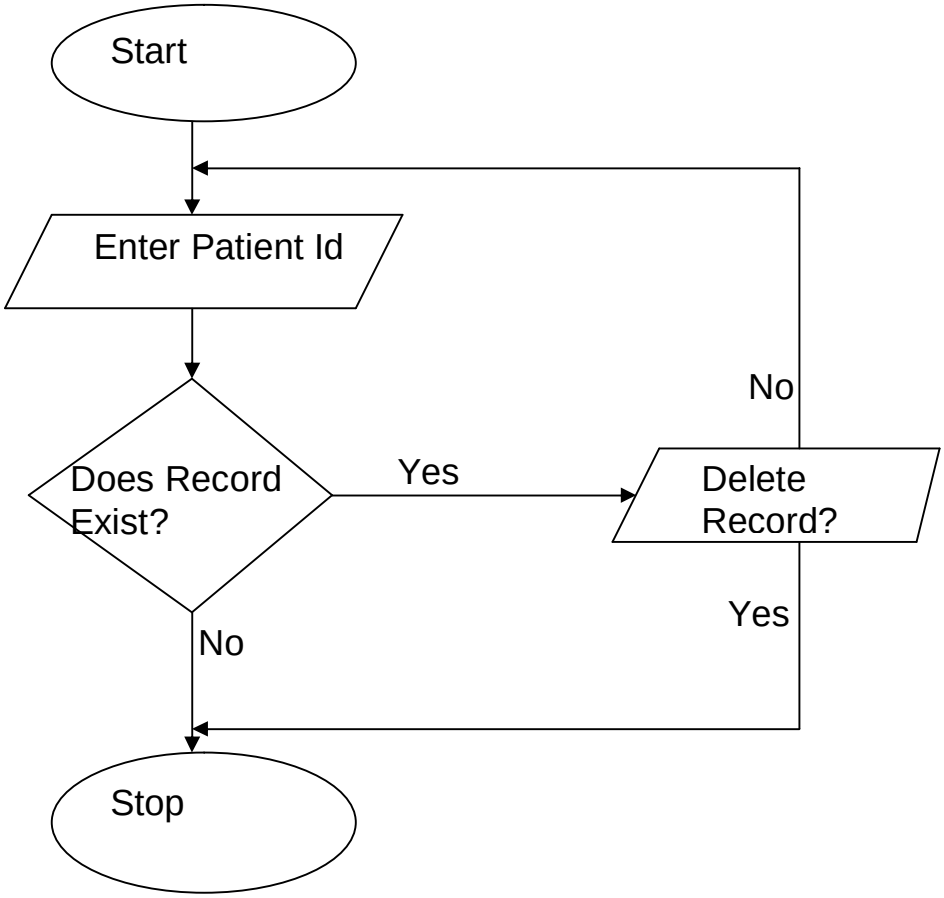
This program permits addition of new data to an existing folder.

Fig. 4.10. Update Module Flowchart



This program permits editing of a record by making necessary changes.

Fig. 4.11. Delete Module Flowchart



This program enables the user to delete parts of the record as required.

4.2.4. CHOICE AND JUSTIFICATION OF PROGRAMMING LANGUAGE PLATFORM (PROGRAM CODING)

Definition:

Program coding may be defined as the representation of the algorithm written for a particular task with the aid of a high level language that helps to translate the single code to machine codes and procedures using the minimum output needed.

Choice And Justification Of Programming Language

Programming is facilitated by use of a suitable programming language. In this design, Visual Basic is the choice language because the language is very flexible and can be used for a variety of applications. The language is developed to support MS-Access database for record storage. Visual Basic 6.0, in particular, has features most suitable for programming.

Such useful features include:

- It is an easy to install application package
- It has versatility of use being Windows based with a graphical user interface facility
- It is user friendly, and makes programming less stressful
- It is network oriented and object based.
- It is an event driven application
- It has modular programming capabilities

4.2.5. PASSWORD

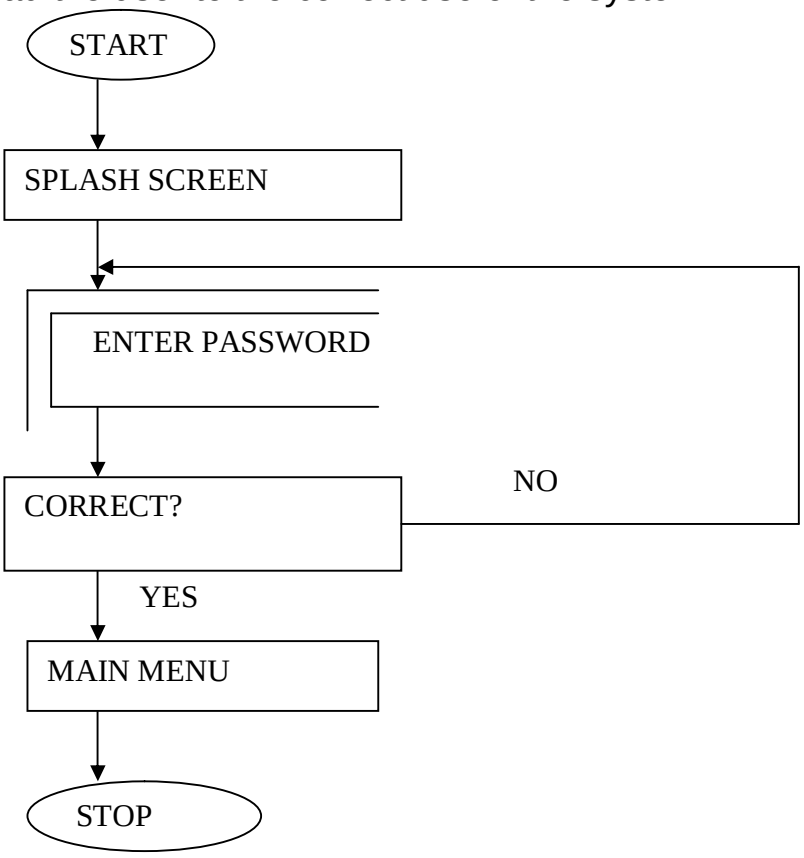
USER NAME: DC

PASSWORD: MEDICAL

ADMINISTRATION LOGIN: NWANKWO

ADMINISTRATION PASSWORD: CD

Fig. 4.12. Main Routine Flowchart: This is more or less a road map to the operation of the new design. It takes a step-by-step approach to lead the user to the correct use of the system.



4.10. Codes are found in Appendix A and Sample outputs in Appendix B

How The New Method (Electronic Method) works.

The new method is based on the use of computer network. All the service stations in the Health Services Department are connected by computer in a network.

The Service Stations include:

- Medical records unit
- Consultation Rooms (Doctors Office)
- Pharmacy unit
- Laboratory unit
- Nursing unit
- Administration unit including Director's office.

For New Patients: They first go to the Medical Records unit to have their data captured in the computer and circulated to other units through the computer network.

For old patients: These already have their data captured and stored in the computer network. They are only required to go to the specific unit of their desired service and receive service by a simple retrieval of their existing record. Two important requirements of the new system are that the health staff should be efficiently computer literate,

and electricity supply should be assured since the entire system depends on electricity for its operation. Of course, equipment maintenance is important too.

4.3. Validation of the New System and Discussion of the Result

The new system was validated by test-running it and debugging (making necessary procedural corrections). By so doing, all the materials required to put it to satisfactory use were established. The method involved the use of sample data to feed into the system and run it in order to monitor its performance.

The test run established that the program can be run on a Pentium 1-1v computer with a minimum speed of 133MHz and RAM capacity of 32MB. It is a windows-based application to be run on Windows like Windows 95, Windows 98, Windows 2000, Windows XP etc. Storage backup facilities may also be required e.g. reserve hard disk, floppy disks, CD plates etc. A good quality printer with high speed and legibility of print is necessary.

The test run showed that a patient only needs to go to the Records Office to open a new folder electronically during a first visit. This activity per se would take a maximum of 15 minutes to complete for an established (old) folder, the patient by-passes this step and goes straight to the doctor for consultation. The doctor only needs to key in the required patient's identity mark and his folder is made open on the computer screen for further proceedings. For this, the waiting

time at the Records Office for folder retrieval is zero as against the average waiting time of 37.8 minutes in the manual system whether to issue a new folder or retrieve an old one. Again, the need for a patient's folder to pass through many hands (trained or untrained staff) is removed. A doctor could even use a password to lock up a patient's record for strict confidentiality. This is very important because a record may contain very sensitive personal issues mentioned to the doctor in strict confidence. Such issues include social maladies in the family, infidelity to spouse, crime and many others.

The validation exercise showed that a hand book (documentation) on the new system is necessary to guide its correct use and prevent careless damage. Such a handbook would contain necessary information (as shown below) on:

- Change Over Procedure
- System Maintenance
- Setting up the Application Software
- Running the Application
- Exiting the Program

4.4. SYSTEM IMPLEMENTATION AND DOCUMENTATION (USER MANUAL)

SYSTEM IMPLEMENTATION

System or program implementation involves orderly schedule of activities, and the list of materials required to put the new system to use. The implementation stage is very important because it enables a practical test of the new design and establishes its workability or not to the desire of the programmer and system management.

The relevant factors in system implementation are;

- System hardware and software requirements
- System test-run and debugging
- System change-over or conversion procedures
- System maintenance.

4.5. SYSTEM HARDWARE AND SOFTWARE REQUIREMENTS

The application program as developed can be implemented on a Pentium 1-iv computer with speed of at least 133MHZ, capacity of at least 32MB RAM. It is a Windows based application to be run on Windows like Windows 9X, Win 98, Win 2000, Win XP etc. Storage backup facilities may also be required e.g. reserve hard disk, floppy

disks, CD- plates etc. A good quality printer with high speed and legibility of print is necessary.

4.6. SYSTEM TEST-RUN AND DEBUGGING

System test-run implies testing whether the newly designed system will operate properly and satisfactorily or not. It involves the various ways used to establish the performance of the system. In this test, sample data were fed into the system as input data and run. During the test-run, bugs were discovered and the system adequately debugged. The system was subjected to repeated trials to ensure satisfactory performance.

4.7. CHANGE-OVER PROCEDURE

The change-over or conversion procedure refers to the steps and process involved in changing from one system to another. In this design, parallel conversion was adopted because it enabled both the old and new systems to be operated concurrently for some time to ensure smooth change-over and continuity of normal work before the old system is withdrawn and replaced by the new system. During the change over process, the two systems were compared extensively to justify the change to a new order.

4.8. SYSTEM MAINTENANCE

Regular maintenance of any system is necessary to prevent unnecessary breakdown and disruption of service.

The important facts in the maintenance of the new system are:

- The system should be used as recommended in the program documentation
- Users of the system should be given new orientation and training
- Use instructions should be strictly adhered to
- Periodic servicing of the computer hardware and peripherals to pre-empt breakdown
- Use of external data storage facility as a back up to avoid total loss of information in the event of sudden system collapse
- The system administrator should always maintain the database

4.9. PROGRAM DOCUMENTATION

Set up the Application Software

To set up the program, follow these steps:

- Insert the floppy disk in the drive
- Open the disk

- Copy the database file in the folder, my document
- Run the set up from its icon
- Follow the instructions of the wizard to finish the installation

4.10. RUNNING THE APPLICATION

The application executable file name is (Medical Records)

Switch on the computer and its peripherals, wait for its diagnostic run i.e. booting.

- Click start. Then program
- Click my computer, open the $3^1/2$ floppy diskette, open the folder of (MEDICAL RECORDS)
- Select (MEDICAL) double click to start
- After the welcome screen display, and opening the folder, enter the valid User Name (DC) and Password (MEDICAL)
- Then you have to enter the Administration user Name (NWANKWO) and Administration Password (CD).

NOTE: The user name and password are case sensitive.

A shortcut can be created on the desktop by the normal procedure to make the application easily reachable.

4.11. EXITING THE PROGRAM

To quit the program:

- Click file from the main menu
- On the file drop down menu, click quit.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION.

5.1. Summary And Conclusion

The project set out to design a computer based Medical Records System to replace an old system of manual operation. The drawbacks in the manual system were exposed through systems analysis, which also revealed the comparative advantage of the automated new system.

The problems identified in the manual system were office long waiting time (average 37.8 minutes) at the Records office as against zero – 15 minutes in the electronic system, high service cost (N1668,000=00) annually compared to N576,000=00 (a gain of 65%) for the electronic system and largely dissatisfied patients (79%) resulting from the poor service associated with the manual system. Issues of missing folder, missing record, unauthorized access and uncertainty of confidentiality common in the manual method are eliminated in the new system. The new system was found to be more efficient, satisfactory, and cost effective.

In conclusion, computer based medical records system has overwhelming advantages over manual system. Besides, the user is equipped to benefit maximally from the present global system of

mass communication. The university is most suited for the adoption of the new system because of its position as the highest known centre of learning and research. Finally, the use of electronic medical records system benefits all concerned and hurts none.

5.2. Recommendation

The following recommendations are made based on the findings of the work;

- Use of Electronic Medical Records System in place of manual method
- A separate study to find out the cost of computerization of the entire Health Department for maximum benefit from the new system
- A separate study to find out the cost of conversion to the new system including staff training and retraining and installation.

BIBLIOGRAPHY

Akpan E.O. and Chizea E.F. (2002) Project Management Theory and Practice. FUTO Press, Owerri.

Alper B.S. (2001). Answering Family Physicians Clinical Question Using Electronic Medical Databases. J fam Pract. 01-Nov-2001, 50 (11) 960-5. Atlanta, USA.

Akukwe A.C. and Uzoma J.P. (1999). Computer Applications: A Practical Approach to Electronic Data processing. Jisona Enterprises. Owerri.

Aremu H.B. (1998). Introduction to Health Records Management. Fasmen Publishers, Ilorin.

Becker L. (2001). Helping Physicians Make Evidence Based Decisions. Am Fam Physician; 63 (11): 2130, 2133, 2 (36). http://www.famphysician.com/document.cfm?DID=23

BCA (2004) Handbook of Business Computer Applications. 3rd Edition, Gower, England.

CODHESNU (2002) Communique of Conference of Directors of Health Services of Nigerian Universities. Lagos.

Complink (1996-2005) Legal Notices of Computer Management Centre Inc. 2nd Edition, McGraw Hill, London.

Dunlop C.L. (1992). A Practical Guide to Maintenance Engineering. Butterworth International Edition, Oxford.

Genaro (Feb. 25, 1999). General Accounting Office Report on Medical Records Privacy: Van Nostrand Reinhold Publishers, New York.

Guyatt GLL, Sackett DL, Cook DJ (1994). Users Guides to the Medical Literature. The evidence based medical working group. JAMA, 271:59-63. Upper Derby, USA.

Jerant A.F. (2000). Applied Medical Informatics and Computing Skills of Students. Residents and Faculty Fam Med 01 April 2000, 32 (4) 367-72. http://www.medicalinformatics.fr/xx-cong/20-cl2-e.htm.

John Peter U. (1999). Introduction to Computer: The way you will appreciate it. Jisona Enterprises Ltd. Owerri.

Linda (2003). A Brief Summary of the Medical Privacy Rule. Report for congress RS 20934, updated February 14, 2003. vol 16, England.

Lucey, T. (1998). Quantitative Techniques. Winchester, Hampshire. 16 Bere Close, D.P. publications.

Minnesota (1999-2005). Minnesota Salary Survey of the Department of Employment and Economic Development: Seek Solutions Version 3.0 pg 1-2. New Jersey Prentice Hall Inc.

Medical Records Privacy (2003). Questions and Answers on the HIPAA Final Rule. Updated January 3, 2003. 2nd Edition, Gower, England.

National Research Council (1997). Health Information on Electronic Form. http://www.waa.ca/?pid=152.

Nworuh, G.H. (2002). Operations Research: Lecture Manual. Unpublished.

Odiari A.U. (1997). Data Processing and Information System. Principles and Management, Glanic Venture Nigeria.

Osuagwu O.E. (2002). Design and Development of Artificial Intelligence Based Medical Expert System. A case study of orthodox and alternative medicine (AIMEDOC). Global Christian University, Tampa Florida, USA. PP 50-70.

Osuagwu O.E. (2005) Software Engineering: A Pragmatic and Technical Perspective. OIPH , Owerri. Pp 4,31,70.

Osuagwu O.E. (2007) Computer Modelling, Research Analysis and Decision Support Systems. Second Edition Vol. 1. OIPH, Owerri . pp 3 and 14.

Paul B.D. (1992). Relational Database Design. Information System Series. Black well Scientific Publications, Oyo.

Project Management Journal (Aug, 1986) Project Management Institute. London.

Rehm S. (2001). Electronic Medical Records. The FPM Vendor Survey. Fam Pract. Manager Olsan 2001. 83 (1) 45-54. http://www.electronicmedicalrecords.co.uk/articles.php

Rolstadas, A. (1999) "Management by Projects". Production Planning and Control, vol.10, No. 1, pp 1 – 2.

Statistics and Records: Health Records Department. FMC. Owerri Unpublished.

Steven C.L.L. (1990). Computer Information System. Butterworth Heinemann Oxford.

WHO Newsletter (2002). Quarterly Bulletin of the World Health Organization (WHO) pp 8,14 and 20. Vol. 17 No 2. Lagos, Nigeria.

APPENDIX A
PROGRAM SOURCE CODE

```
Dim Strsql As String
Private Sub CmdEXIT_Click()
Unload Me
End Sub

Private Sub CmdFind_Click()
On Error GoTo Error_detect
Strsql = "SELECT * FROM UMC WHERE [PATIENTID] ='" & Text1.Text & "'"
Data1.RecordSource = Strsql
Data1.Refresh
TextBinding
Exit Sub
Error_detect:
  MsgBox Err.Description, vbInformation, "University Medical Center"
End Sub

Private Sub CmdRefresh_Click()
Label15.Caption = Empty: Label16.Caption = Empty
Label17.Caption = Empty: Label18.Caption = Empty
Label19.Caption = Empty: Label20.Caption = Empty
Label21.Caption = Empty: Label22.Caption = Empty
Label23.Caption = Empty: Label24.Caption = Empty
Label25.Caption = Empty: Label26.Caption = Empty
Label27.Caption = Empty: Text1.SetFocus
End Sub

Private Sub Form_Load()
Me.Show
Data1.Visible = False
Data1.DatabaseName = App.Path & "\MEDICAL.MDB"
Data1.RecordSource = Strsql
End Sub
Private Sub TextBinding()
With Data1.Recordset
  Label15.Caption = !PATIENTNAME
  Label16.Caption = !SEX
  Label17.Caption = !AGE
  Label18.Caption = !OCCUPATION
  Label19.Caption = !ADDRESS
  Label20.Caption = !NEXTOFKIN
  Label21.Caption = !DIAGNOSIS
  Label22.Caption = !DATEOFVISITING
  Label23.Caption = !CARDNO
  Label24.Caption = !DATEOFBIRTH
```

```
  Label25.Caption = !COMPLAINT
  Label26.Caption = !CONSULTANT
  Label27.Caption = !DOCTORCOMMENT
End With
End Sub

Dim Strsql As String

Private Sub CmdCLEAR_Click()
Text14.Text = Empty: Text1.Text = Empty
Text2.Text = Empty: Text3.Text = Empty
Text4.Text = Empty: Text5.Text = Empty
Text6.Text = Empty: Text7.Text = Empty
Text8.Text = Empty: Text9.Text = Empty
Text10.Text = Empty: Text11.Text = Empty
Text12.Text = Empty: Text13.Text = Empty
Text1.SetFocus
End Sub

Private Sub CmdEXIT_Click()
Unload Me
End Sub

Private Sub CmdFind_Click()
On Error GoTo Error_detect
Strsql = "SELECT * FROM UMC WHERE [PATIENTID] ='" & Text1.Text & "'"
Data1.RecordSource = Strsql
Data1.Refresh
TextBinding
Exit Sub
Error_detect:
  MsgBox Err.Description, vbInformation, "University Medical Center"
```

```
    !DIAGNOSIS = Text7.Text
    !DATEOFVISITING = Text8.Text
    !CARDNO = Text9.Text
    !DATEOFBIRTH = Text10.Text
    !COMPLAINT = Text11.Text
    !CONSULTANT = Text12.Text
    !DOCTORCOMMENT = Text13.Text
    .Update
End With
  CLEAN
  Exit Sub
Errorhandler:
   MsgBox Err.Description, vbInformation, "University Medical Centre"

End Sub

Private Sub Form_Load()
Me.Show
Data1.Visible = False
Data1.DatabaseName = App.Path & "\MEDICAL.MDB"
Data1.RecordSource = Strsql
End Sub
Private Sub TextBinding()
With Data1.Recordset
  Text2.Text = !PATIENTNAME
  Text14.Text = !SEX
  Text3.Text = !AGE
  Text4.Text = !OCCUPATION
  Text5.Text = !ADDRESS
  Text6.Text = !NEXTOFKIN
  Text7.Text = !DIAGNOSIS
  Text8.Text = !DATEOFVISITING
  Text9.Text = !CARDNO
  Text10.Text = !DATEOFBIRTH
  Text11.Text = !COMPLAINT
  Text12.Text = !CONSULTANT
  Text13.Text = !DOCTORCOMMENT

End With
End Sub

Private Sub CmdCancel_Click()
End
End Sub

Private Sub CmdLogin_Click()
```

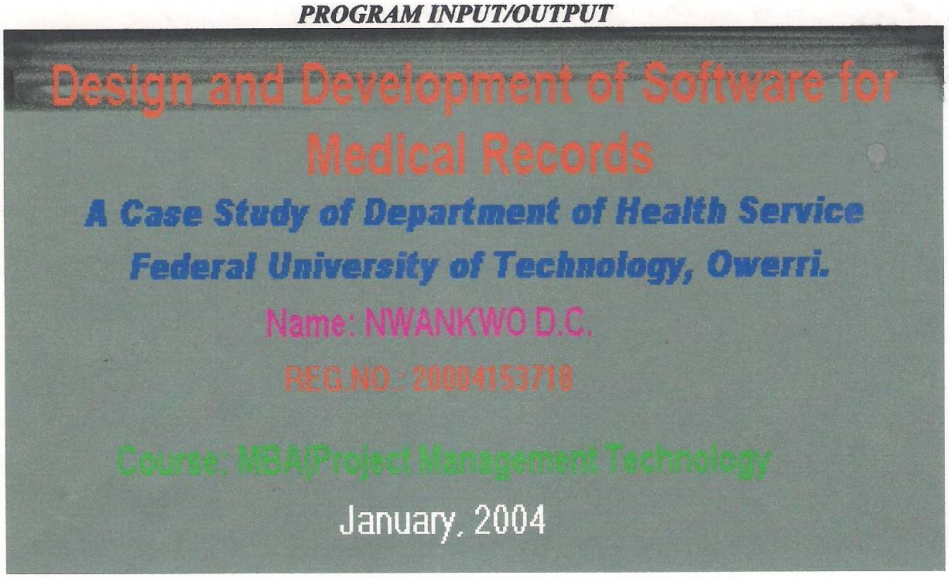
```
On Error GoTo ERROR_HANDLE
      With Data1.Recordset
   If .Fields("AUTHORIZED").Value <> Text1.Text _
   Or .Fields("LOGIN").Value <> Text2.Text Then
   GoTo ERROR_HANDLE
        Else
     Unload Me
     MDIFrmMENU.Show
  End If
  End With
  Exit Sub
ERROR_HANDLE:
   MsgBox Err.Description, vbInformation, "University Medical Center"
   Text1 = Empty: Text2 = Empty
   Text1.SetFocus
End Sub

Private Sub Form_Load()
Me.Show
Text1.SetFocus
Data1.Visible = False
Data1.DatabaseName = App.Path & "\MEDICAL.MDB"
Data1.RecordSource = "LOGIN"
End Sub

Private Sub CmdCLEAR_Click()
Combo1 = "----SEX----": Text1.Text = Empty
Text2.Text = Empty: Text3.Text = Empty
Text4.Text = Empty: Text5.Text = Empty
Text6.Text = Empty: Text7.Text = Empty
Text8.Text = Empty: Text9.Text = Empty
Text10.Text = Empty: Text11.Text = Empty
Text12.Text = Empty: Text13.Text = Empty
Text1.SetFocus
End Sub
Private Sub CLEAN()
Combo1 = "----SEX----": Text1.Text = Empty
Text2.Text = Empty: Text3.Text = Empty
Text4.Text = Empty: Text5.Text = Empty
Text6.Text = Empty: Text7.Text = Empty
Text8.Text = Empty: Text9.Text = Empty
Text10.Text = Empty: Text11.Text = Empty
Text12.Text = Empty: Text13.Text = Empty
Text1.SetFocus
End Sub
Private Sub CmdEXIT_Click()
```

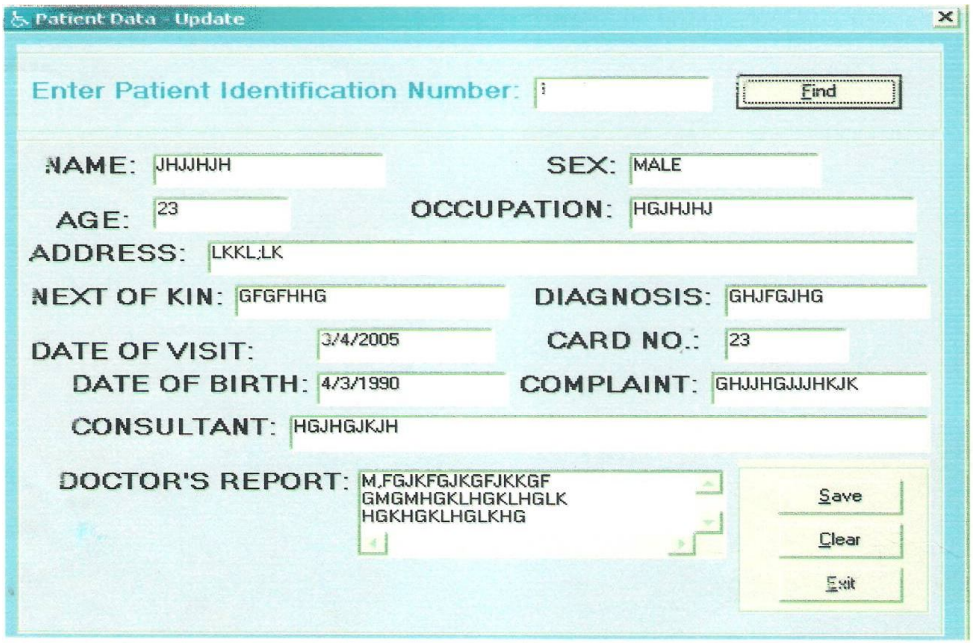
```
Unload Me
End Sub

Private Sub CmdSAVE_Click()
On Error GoTo Errorhandler
With Data1.Recordset
   .AddNew
   !PATIENTID = Text1.Text
   !PATIENTNAME = Text2.Text
   !SEX = Combo1
   !AGE = Text3.Text
   !OCCUPATION = Text4.Text
   !ADDRESS = Text5.Text
   !NEXTOFKIN = Text6.Text
   !DIAGNOSIS = Text7.Text
   !DATEOFVISITING = Text8.Text
   !CARDNO = Text9.Text
   !DATEOFBIRTH = Text10.Text
   !COMPLAINT = Text11.Text
   !CONSULTANT = Text12.Text
   !DOCTORCOMMENT = Text13.Text
   .Update
End With
  CLEAN
  Exit Sub
Errorhandler:
   MsgBox Err.Description, vbInformation, "University Medical Centre"

End Sub

Private Sub Form_Load()
Me.Show
Data1.Visible = False
Data1.DatabaseName = App.Path & "\MEDICAL.MDB"
Data1.RecordSource = "UMC"

With Combo1
.AddItem "MALE"
.AddItem "FEMALE"
End With
End Sub

Dim Strsql As String

Private Sub CmdDelete_Click()
On Error GoTo Error_Free
```

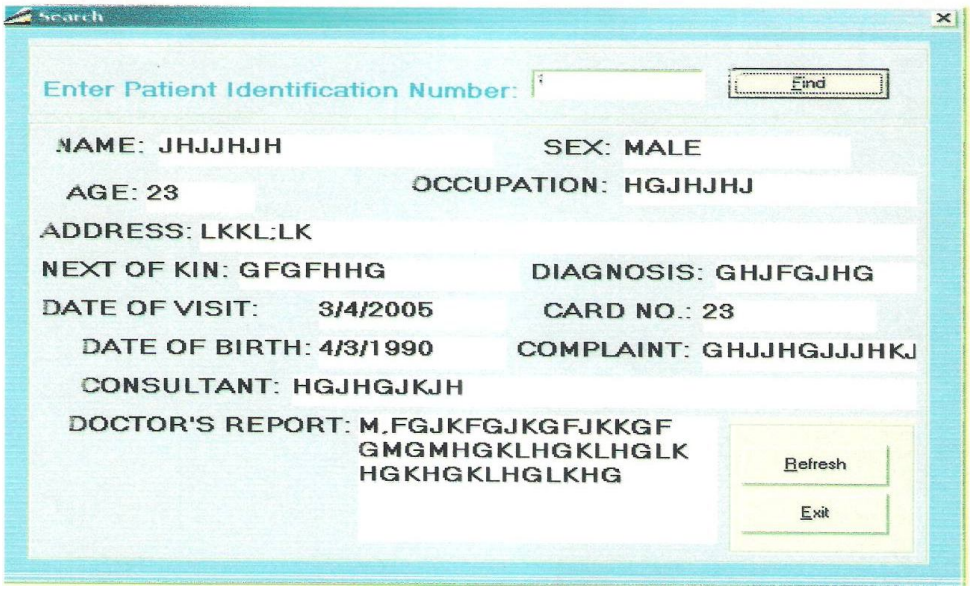
```
With Data1.Recordset
   .Delete
   If .EOF Then
   GoTo Error_Free
   End If
Exit Sub
Error_Free:
  MsgBox Err.Description, vbInformation, "University Medical Center"

End Sub

Private Sub CmdEXIT_Click()
Unload Me
End Sub

Private Sub CmdFind_Click()
On Error GoTo Error_detect
Strsql = "SELECT * FROM UMC WHERE [PATIENTID] ='" & Text1.Text & "'"
Data1.RecordSource = Strsql
Data1.Refresh
TextBinding
Exit Sub
Error_detect:
 MsgBox Err.Description, vbInformation, "University Medical Center"
End Sub
Private Sub TextBinding()
With Data1.Recordset
 Text2.Text = !PATIENTNAME
 Text14.Text = !SEX
 Text3.Text = !AGE
 Text4.Text = !OCCUPATION
 Text5.Text = !ADDRESS
 Text6.Text = !NEXTOFKIN
 Text7.Text = !DIAGNOSIS
 Text8.Text = !DATEOFVISITING
 Text9.Text = !CARDNO
 Text10.Text = !DATEOFBIRTH
 Text11.Text = !COMPLAINT
 Text12.Text = !CONSULTANT
 Text13.Text = !DOCTORCOMMENT

End With
End Sub

Private Sub CmdRefresh_Click()
Text14.Text = Empty: Text1.Text = Empty
```

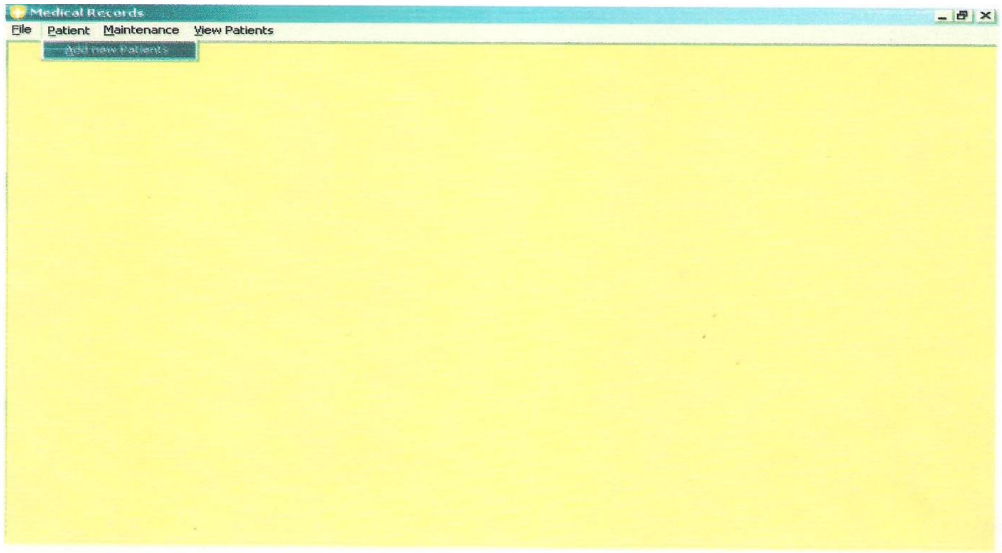
```
Text2.Text = Empty: Text3.Text = Empty
Text4.Text = Empty: Text5.Text = Empty
Text6.Text = Empty: Text7.Text = Empty
Text8.Text = Empty: Text9.Text = Empty
Text10.Text = Empty: Text11.Text = Empty
Text12.Text = Empty: Text13.Text = Empty
Text1.SetFocus
End Sub
Private Sub Form_Load()
Me.Show
Text1.SetFocus
Data1.Visible = False
Data1.DatabaseName = App.Path & "\MEDICAL.MDB"
Data1.RecordSource = Strsql
End Sub
Private Sub CmdActivate_Click()
On Error GoTo ERROR_HANDLE
      With Data1.Recordset
   If .Fields("USERNAME").Value <> Text1.Text _
   Or .Fields("LOGON").Value <> Text2.Text Then
   GoTo ERROR_HANDLE
      Else
     Unload Me
MDIFrmMENU.delpat.Enabled = True
MDIFrmMENU.updat.Enabled = True
MDIFrmMENU.addp.Enabled = True
MDIFrmMENU.sear.Enabled = True
MDIFrmMENU.BAKUP.Enabled = True
 End If
 End With
 Exit Sub
ERROR_HANDLE:
   MsgBox Err.Description, vbInformation, "University Medical Center"
   Text1 = Empty: Text2 = Empty
   Text1.SetFocus
End Sub
Private Sub CmdDeactivate_Click()
Unload Me
End Sub
Private Sub Form_Load()
Me.Show
Data1.Visible = False
Data1.DatabaseName = App.Path & "\MEDICAL.MDB"
Data1.RecordSource = "LOGON"
```

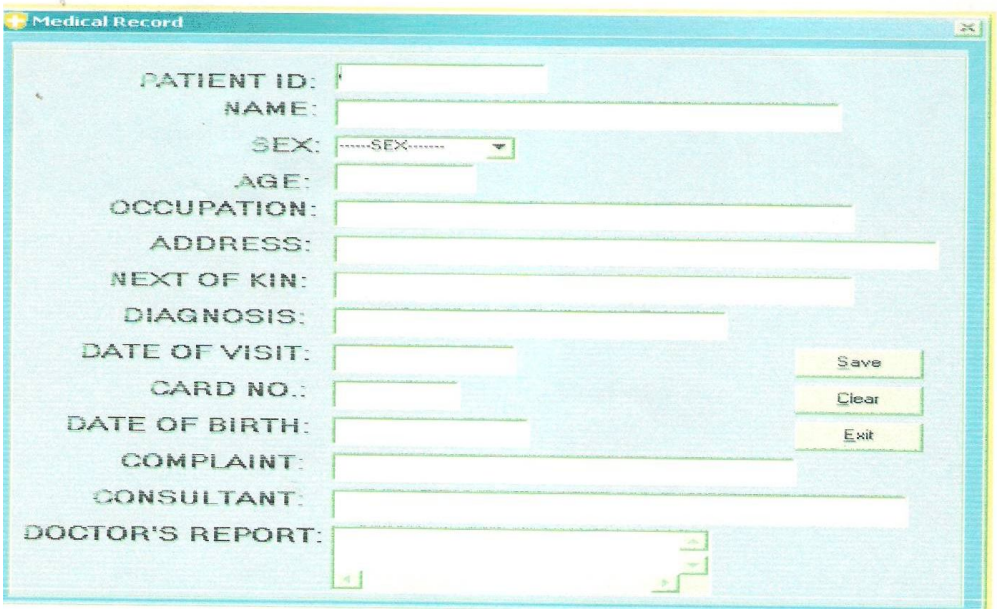
APPENDIX B
PROGRAM INPUT/OUTPUT




Patient Data - Update
Enter Patient Identification Number:
Find
NAME: JHJJHJH
SEX: MALE
AGE: 23
OCCUPATION: HGJHJHJ
ADDRESS: LKKL;LK
NEXT OF KIN: GFGFHHG
DIAGNOSIS: GHJFGJHG
DATE OF VISIT: 3/4/2005
CARD NO.: 23
DATE OF BIRTH: 4/3/1990
COMPLAINT: GHJJHGJJJHKJK
CONSULTANT: HGJHGJKJH
DOCTOR'S REPORT: M,FGJKFGJKGFJKKGF
GMGMHGKLHGKLHGLK
HGKHGKLHGLKHG
Save
Clear
Exit


Search
Enter Patient Identification Number:
Find
NAME: JHJJHJH
SEX: MALE
AGE: 23
OCCUPATION: HGJHJHJ
ADDRESS: LKKL;LK
NEXT OF KIN: GFGFHHG
DIAGNOSIS: GHJFGJHG
DATE OF VISIT: 3/4/2005
CARD NO.: 23
DATE OF BIRTH: 4/3/1990
COMPLAINT: GHJJHGJJJHKJ
CONSULTANT: HGJHGJKJH
DOCTOR'S REPORT: M,FGJKFGJKGFJKKGF
GMGMHGKLHGKLHGLK
HGKHGKLHGLKHG
Refresh
Exit


Medical Records
File
Patient
Maintenance
View Patients
Add new Patients


Medical Record
PATIENT ID:
NAME:
SEX:
-----SEX-----
AGE:
OCCUPATION:
ADDRESS:
NEXT OF KIN:
DIAGNOSIS:
DATE OF VISIT:
CARD NO.:
DATE OF BIRTH:
COMPLAINT:
CONSULTANT:
DOCTOR'S REPORT:
Save
Clear
Exit

Appendix C

Table 4.1. Waiting Time And Patient Satisfaction (Week One)

	Monday				Wednesday				Friday			
	Time In	Time Out	Wait	Pt	Time In	Time Out	Wait	Pt	Tm In	Tm Out	Wait	Pt
1	8^{00am}	8^{40am}	40	N	8^{10am}	8^{20am}	10	Y	8^{40am}	9^{15am}	35	N
2	8^{00am}	8^{42am}	42	N	8^{10am}	8^{20am}	9	Y	8^{45am}	9^{20am}	35	N
3	8^{00am}	8^{45am}	45	N	8^{11am}	8^{40am}	29	N	8^{50am}	10^{am}	70	N
4	8^{10am}	8^{55am}	45	N	8^{15am}	8^{50an}	35	N	8^{55am}	9^{10am}	15	Y
5	8^{12am}	9^{01am}	49	N	8^{15am}	8^{57am}	42	N	9^{am}	9^{28am}	28	N
6	8^{12am}	9^{05am}	53	N	8^{15am}	8^{30am}	15	Y	9^{10am}	10^{am}	50	N
7	8^{30am}	8^{42am}	12	Y	8^{21am}	9^{04am}	43	N	9^{12am}	9^{21am}	9	Y
8	8^{50am}	9^{30am}	40	N	8^{30am}	9^{10am}	40	N	9^{20am}	9^{50am}	30	N
9	8^{51am}	9^{42am}	51	N	8^{35am}	9^{20am}	45	N	9^{25am}	10^{30am}	65	N
10	8^{53am}	9^{40am}	47	N	8^{40am}	9^{10am}	30	N	9^{30am}	10^{20am}	50	N
11	8^{55am}	9^{40am}	45	N	8^{45am}	9^{40am}	55	N	9^{40am}	10^{20am}	40	N
12	8^{58am}	9^{45am}	47	N	8^{50am}	9^{20am}	30	N	9^{45am}	10^{40am}	55	N
13	9^{00am}	9^{45am}	45	N	8^{55am}	9^{30am}	35	N	9^{50am}	10^{50am}	60	N
14	9^{05am}	10^{00am}	55	N	9^{00am}	9^{30am}	30	N	9^{55am}	10^{10am}	15	Y
15	9^{07am}	9^{40am}	33	N	9^{05am}	9^{30am}	25	N	9^{58am}	10^{28am}	30	N
16	9^{10am}	9^{50am}	40	N	9^{12am}	9^{52am}	40	N	10^{00am}	10^{30am}	30	N
17	9^{15am}	9^{50am}	35	N	9^{12am}	9^{55am}	43	N	10^{10am}	10^{50am}	40	N
18	9^{17am}	9^{52am}	36	N	9^{15am}	9^{40am}	25	N	10^{15am}	10^{50am}	35	N
19	9^{25am}	10^{00a}	35	N	9^{20am}	10^{00a}	40	N	10^{20a}	11^{00a}	40	N

		m				m			m	m		
20	9^{30am}	10^{15am}	45	N	9^{25am}	9^{55am}	30	N	10^{25am}	11^{05am}	40	N
21	9^{35am}	10^{30am}	55	N	9^{30am}	10^{10am}	40	N	10^{30am}	11^{40am}	40	N
22	9^{38am}	10^{30am}	52	N	9^{31am}	10^{40am}	59	N	10^{35am}	11^{55am}	20	N
23	9^{40am}	10^{30am}	50	N	9^{35am}	10^{40am}	65	N	10^{40am}	12pm	70	N
24	9^{45am}	10^{00am}	45	N	9^{40am}	9^{50am}	10	Y	10^{50am}	11^{20am}	30	N
25	9^{45am}	10^{00am}	15	Y	9^{45am}	10^{20am}	35	N	10^{55am}	11^{40am}	45	N
26	9^{50am}	10^{15am}	25	N	9^{45am}	11^{00am}	75	N	10^{05am}	11^{40am}	35	N
27	10^{00am}	10^{10am}	10	Y	9^{50am}	10^{30am}	40	N	11^{20am}	11^{50am}	30	N
28	10^{05am}	10^{40am}	35	N	9^{52am}	10^{40am}	48	N	11^{25am}	12pm	35	N
29	10^{10am}	11^{10am}	60	N	9^{58am}	11^{00am}	62	N	11^{30am}	12^{20pm}	50	N
30	10^{15am}	10^{45am}	25	N	10^{00am}	10^{30am}	30	N	11^{35am}	12^{50pm}	15	Y
31	10^{20am}	11^{50am}	30	N	10^{10am}	10^{45am}	35	N	11^{40am}	12^{20pm}	40	N
32	10^{40am}	11^{10am}	30	N	10^{15am}	10^{50am}	35	N	11^{50am}	12^{50pm}	60	N
33	10^{45am}	11^{40am}	55	N	10^{20am}	10^{50am}	30	N	11^{55am}	1^{00pm}	65	N
34	10^{55am}	11^{30am}	35	N	10^{50am}	11^{20am}	30	N	12^{pm}	12^{30pm}	30	N
35	10^{58am}	11^{50am}	52	N	11^{00am}	11^{40am}	40	N	12^{10pm}	12^{50pm}	40	N
36	11^{00am}	11^{30am}	30	N	11^{10am}	11^{50am}	40	N	12^{20pm}	1^{00pm}	40	N

37	11^{10am}	11^{40am}	30	N	11^{20am}	12^{pm}	40	N	12^{25pm}	1^{55pm}	30	N
38	11^{15am}	11^{50am}	35	N	11^{30am}	12^{40pm}	70	N	12^{30pm}	1^{30pm}	60	N
39	11^{20am}	11^{55am}	35	N	11^{45am}	12^{30pm}	45	N	12^{40pm}	1^{00pm}	20	N
40	11^{40am}	11^{45am}	5	Y	11^{50am}	12^{40pm}	50	N	12^{50pm}	1^{30pm}	40	N
41	11^{45am}	12^{10pm}	25	N	11^{55am}	12^{20pm}	25	N	12^{55pm}	1^{30pm}	35	N
42	11^{50am}	12^{30pm}	40	N	12^{00pm}	12^{30pm}	30	N	12^{58pm}	1^{20pm}	22	N
43	11^{55am}	12^{30pm}	35	N	12^{10pm}	1^{00pm}	50	N	1^{00pm}	1^{40pm}	40	N
44	11^{55am}	12^{40pm}	45	N	12^{15pm}	12^{50pm}	35	N	1^{05pm}	1^{55pm}	50	N
45	11^{48am}	12^{45pm}	47	N	12^{20pm}	1^{00pm}	40	N	1^{10pm}	1^{40pm}	30	N
46	11^{50am}	12^{50pm}	60	N	12^{30pm}	1^{00pm}	30	N				
47	11^{55am}	12^{40pm}	45	N	12^{40pm}	1^{25pm}	45	N				
48	11^{57am}	12^{40pm}	43	N	12^{50pm}	1^{30pm}	40	N				
49	11^{59am}	12^{45pm}	46	N	12^{55pm}	1^{45pm}	50	N				
50	12^{00pm}	12^{20pm}	20	N	1^{00pm}	1^{20pm}	20	N				
51	12^{05pm}	12^{19pm}	14	Y	1^{10pm}	1^{50pm}	40	N				
52	12^{10pm}	12^{40pm}	30	N	1^{15pm}	1^{20pm}	5	Y				
53	12^{15pm}	12^{40pm}	25	N								
54	12^{20p}	12^{50p}	30	N								

	m	m										
55	12^{40p}m	1^{00pm}	20	N								
56	12^{30p}m	1^{30pm}	60	N								
57	12^{32p}m	1^{20pm}	48	N								
58	12^{35p}m	1^{30pm}	25	N								
59	12^{35p}m	1^{00pm}	25	N								
60	12^{35p}m	12^{50p}m	15	Y								
61	12^{40p}m	1^{20pm}	40	N								
62	12^{50p}m	1^{20pm}	30	N								
63	1^{00pm}	1^{40pm}	40	N								
64	1^{30pm}	1^{50pm}	20		52				45			
Ave			37.3		Ave		39.2		Ave		39.3	

Source: Research Survey, 2007.

Appendix D

Table 4.2. Waiting Time And Patient Satisfaction (Week Two)

	Monday				Wednesday				Friday			
	Time In	Time Out	Wait Time	Pt	Time In	Time Out	Wait Time	Pt	Tm In	Tm Out	Wait Time	Pt
1	8^{00am}	8^{50am}	50	N	8^{07am}	8^{20am}	13	Y	8^{22am}	9^{59am}	37	N
2	8^{03am}	8^{45am}	42	N	8^{10am}	8^{19am}	8	Y	8^{27am}	9^{20am}	53	N
3	8^{10am}	8^{45am}	35	N	8^{11am}	8^{47am}	46	N	8^{50am}	9^{am}	10	Y
4	8^{10am}	8^{25am}	15	Y	8^{15am}	8^{32an}	17	N	8^{55am}	10^{06am}	71	N
5	8^{17am}	9^{01am}	46	N	8^{15am}	8^{57am}	42	N	9^{am}	9^{18am}	18	N
6	8^{21am}	9^{13am}	53	N	8^{15am}	8^{30am}	15	Y	9^{12am}	9^{23am}	11	Y
7	8^{30am}	8^{43am}	13	Y	8^{25am}	9^{am}	35	N	9^{12am}	10^{06am}	54	Y
8	8^{30am}	8^{46am}	16	N	8^{28am}	8^{48am}	20	N	9^{15am}	9^{43am}	28	N
9	8^{32am}	9^{17am}	45	N	8^{30am}	9^{02am}	32	N	9^{20am}	10^{20am}	60	N
10	8^{40am}	9^{05am}	25	N	8^{30am}	9^{00am}	30	N	9^{22am}	9^{45am}	23	N
11	8^{40am}	9^{18am}	38	N	8^{30am}	9^{30am}	60	N	9^{40am}	10^{20am}	40	N
12	8^{40am}	8^{50am}	10	Y	8^{35am}	9^{20am}	45	N	9^{43am}	10^{27am}	54	N
13	9^{02am}	9^{45am}	43	N	8^{35am}	9^{22am}	47	N	9^{55am}	10^{08am}	13	Y
14	9^{02am}	9^{53am}	51	N	8^{50am}	9^{26am}	31	N	9^{55am}	10^{34am}	39	N
15	9^{30am}	10^{00am}	30	N	8^{55am}	9^{11am}	16	N	10^{01am}	10^{51am}	50	N
16	9^{45am}	10^{41am}	56	N	9^{01am}	9^{41am}	40	N	10^{05am}	10^{54am}	49	N
17	9^{45am}	10^{22am}	37	N	9^{01am}	9^{48am}	47	N	10^{09am}	10^{28am}	19	N
18	9^{47am}	10^{09am}	22	N	9^{05am}	9^{36am}	31	N	10^{10am}	10^{52am}	42	N
19	9^{50am}	10^{50am}	60	N	9^{05am}	9^{34am}	29	N	10^{10am}	10^{58am}	48	N
20	9^{55am}	10^{35am}	40	N	9^{08am}	10^{01am}	53	N	10^{12am}	10^{58am}	46	N
21	9^{55am}	10^{00am}	5	Y	9^{08am}	9^{29am}	21	N	10^{15am}	10^{50am}	35	N
22	10^{05am}	10^{22am}	17	N	9^{10am}	9^{53am}	43	N	10^{20am}	11^{10am}	50	N
23	10^{10am}	11^{05am}	55	N	9^{10am}	9^{59am}	49	N	10^{20am}	11^{07am}	47	N
24	10^{10am}	10^{48am}	38	N	9^{10am}	10^{01am}	51	N	10^{25am}	10^{55am}	30	N
25	10^{10am}	10^{28am}	18	N	10^{30am}	11^{15am}	45	N	10^{28am}	11^{17am}	49	N

26	10^{12am}	10^{37am}	25	N	10^{30am}	11^{00am}	30	N	10^{30am}	10^{57am}	27	N
27	10^{15am}	10^{48am}	33	N	10^{46am}	11^{27am}	41	N	10^{35am}	11^{12am}	37	N
28	10^{15am}	10^{52am}	37	N	11^{00am}	11^{36am}	36	N	10^{36am}	10^{58am}	22	N
29	10^{20am}	10^{48am}	26	N	11^{00am}	11^{43am}	43	N	10^{45am}	11^{57am}	72	N
30	10^{22am}	11^{08am}	40	N	11^{12am}	11^{36am}	24	N	10^{58am}	11^{33am}	35	N
31	10^{30am}	10^{59am}	29	N	11^{15am}	11^{47am}	32	N	11^{10am}	12^{04pm}	54	N
32	10^{30am}	11^{09am}	39	N	11^{30am}	12^{07pm}	37	N	11^{13am}	11^{43am}	30	N
33	10^{40am}	11^{20am}	40	N	11^{37am}	11^{55am}	18	N	11^{16am}	11^{57am}	41	N
34	10^{45am}	11^{15am}	30	N	11^{45am}	12^{30pm}	45	N	11^{25am}	12^{16pm}	51	N
35	10^{48am}	11^{23am}	35	N	11^{55am}	12^{52pm}	57	N	11^{45am}	12^{06pm}	21	N
36	10^{55am}	11^{32am}	37	N	11^{55am}	12^{20pm}	25	N	12^{00pm}	12^{40pm}	40	N
37	10^{55am}	11^{27am}	34	N	12^{00pm}	12^{43pm}	43	N	12^{00pm}	12^{48pm}	48	N
38	11^{00am}	11^{41am}	41	N	12^{02pm}	12^{52pm}	50	N	12^{05pm}	12^{41pm}	36	N
39	11^{05am}	11^{55am}	50	N	12^{05pm}	12^{42pm}	37	N	12^{15pm}	1^{07pm}	52	N
40	11^{07am}	11^{28am}	11	Y	12^{10pm}	12^{42pm}	32	N	12^{17pm}	1^{01pm}	44	N
41	11^{10am}	11^{40am}	30	N	12^{12pm}	12^{57pm}	45	N	12^{22pm}	12^{52pm}	30	N
42	11^{10am}	11^{53am}	43	N	12^{30pm}	12^{38pm}	8	Y	12^{40pm}	1^{30pm}	50	N
43	11^{16am}	11^{43am}	27	N	12^{36pm}	1^{24pm}	48	N	12^{45pm}	1^{13pm}	28	N
44	11^{18am}	11^{53am}	35	N	12^{40pm}	1^{10pm}	30	N	12^{48pm}	1^{53pm}	5	Y
45	11^{25am}	11^{54am}	29	N	12^{45am}	1^{28pm}	43	N	1^{02pm}	1^{41pm}	39	N
46	11^{30am}	12^{05pm}	35	N	12^{55pm}	1^{21pm}	26	N	1^{10pm}	1^{35pm}	25	N
47	11^{38am}	12^{23pm}	45	N	1^{05pm}	1^{36pm}	31	N	1^{15pm}	1^{55pm}	40	N
48	11^{45pm}	12^{09pm}	24	N	12^{30pm}	1^{10pm}	40	N	1^{30pm}	1^{53pm}	23	N
49	11^{56am}	12^{35pm}	39	N	1^{30pm}	1^{58pm}	28	N	1^{30pm}	2^{07pm}	37	N
50	12^{10pm}	12^{45pm}	35	N	1^{45pm}	2^{15pm}	30	N	1^{32pm}	2^{03pm}	41	N
51	12^{12pm}	12^{56pm}	42	N					1^{35pm}	1^{54pm}	19	N
52	12^{12pm}	12^{27pm}	15	Y					1^{38pm}	2^{30pm}	52	N
53	12^{15pm}	1^{04pm}	49	N					1^{42pm}	2^{18pm}	30	N
54	12^{30pm}	1^{00pm}	30	N					1^{45pm}	2^{24pm}	42	N
55	12^{38pm}	1^{34pm}	56	N					1^{45pm}	2^{13pm}	28	N

56	12^{38pm}	1^{16pm}	34	N					1^{46pm}	2^{14pm}	40	N
57	12^{38pm}	12^{57pm}	19	N					2^{00pm}	2^{20pm}	20	N
58	12^{39pm}	1^{20pm}	59	N								
59	12^{41pm}	1^{23pm}	44	N								
60	12^{44pm}	1^{33pm}	49	N								
61	12^{44pm}	1^{04pm}	20	N								
62	12^{47pm}	1^{26pm}	39	N								
63	12^{49pm}	1^{46pm}	57	N								
64	12^{52pm}	1^{04pm}	12	Y								
65	12^{55pm}	1^{40pm}	45	N								
66	12^{55pm}	1^{22pm}	27	N								
67	12^{50pm}	1^{58pm}	60	N								
68	12^{59pm}	1^{37pm}	38	N								
69	1^{00pm}	1^{32pm}	32	N								
70	1^{08pm}	1^{22pm}	30	N								
71	1^{12pm}	1^{33pm}	45	N								
72	1^{20pm}	2^{01pm}	41	N								
73	1^{25pm}	1^{50pm}	25		50				57			
Ave			36.2		Ave		37.1		Ave		37.4	

Source: Research Survey, 2007.

Appendix E

Table 4.3. Application of the new Method(Week one)

	Monday				Wednesday				Friday			
	Time In	Time Out	Wait Time	Pt Typ	Time In	Time Out	Wait Time	Pt Typ	Tm In	Tm Out	Wait Time	Pt Typ
1	8^{30am}	8^{32am}	2	Op	8^{46am}	8^{48am}	2	Op	8^{31am}	8^{33am}	2	op
2	8^{35am}	8^{40am}	5	Np	8^{50am}	8^{51am}	1	Op	8^{45am}	8^{46am}	1	Op
3	8^{45am}	8^{46am}	1	Op	9^{00am}	9^{02am}	2	Op	8^{50am}	8^{56am}	6	NP
4	9^{05am}	9^{06am}	1	Op	9^{10am}	9^{11an}	1	Op	9^{00am}	9^{01am}	1	Op
5	9^{08am}	9^{10am}	2	Op	9^{30am}	9^{31am}	1	Op	9^{31am}	9^{32am}	1	Op
6	9^{15am}	9^{19am}	4	Np	9^{35am}	9^{36am}	1	Op	9^{40am}	9^{45am}	5	Np
7	9^{36am}	9^{38am}	2	Op	9^{50am}	9^{56am}	6	Op	10^{10am}	10^{11am}	1	Op
8	9^{30am}	9^{34am}	4	Np	10^{10am}	10^{11am}	1	Op	10^{15am}	10^{16am}	1	Op
9	9^{50am}	9^{51am}	1	Op	10^{15am}	10^{16am}	1	Op	10^{31am}	10^{32am}	1	Op
10	9^{58am}	9^{59am}	1	Op	10^{15am}	10^{17am}	2	Op	11^{00am}	11^{02am}	2	Op
11	10^{10am}	10^{12am}	2	Op	10^{21am}	10^{22am}	1	Op	11^{45am}	11^{52am}	7	Np
12	10^{45am}	10^{46am}	1	Op	10^{30am}	10^{31am}	1	Op	12^{02pm}	12^{03pm}	1	Op
13	10^{45am}	10^{47am}	2	Op	10^{40am}	10^{42am}	1	Op	12^{15pm}	12^{17pm}	2	Op
14	11^{20am}	11^{27am}	7	Np	11^{30am}	11^{35am}	5	Np	12^{30pm}	12^{31pm}	1	Op
15	11^{24am}	11^{25am}	1	Op	11^{40am}	11^{41am}	1	Op	12^{40pm}	12^{41pm}	1	Op
16	11^{30am}	11^{32am}	2	Op	11^{46am}	11^{48am}	2	Op				
17	11^{50am}	11^{55am}	5	Op	11^{50am}	11^{51am}	1	Op				
18	12^{05pm}	12^{06pm}	1	Op	12^{10pm}	12^{11pm}	1	Op				
19	12^{30pm}	12^{31pm}	1	Op	9^{05am}	9^{34am}						
20	12^{46pm}	12^{48pm}	2	op	9^{08am}	10^{01am}						
Ave			2.4		9^{08am}	9^{29am}	1.8				2.2	

Source: Research Survey.

Appendix F

Table 4.3. Application of the new Method(Week Two)

	Monday				Wednesday				Friday			
	Time In	Time Out	Wait Time	Pt Typ	Time In	Time Out	Wait Time	Pt Typ	Tm In	Tm Out	Wait Time	Pt Typ
1	8^{35am}	8^{40am}	5	Np	8^{46am}	8^{47am}	1	Op	8^{30am}	8^{36am}	6	Np
2	8^{45am}	8^{46am}	1	Op	8^{50am}	8^{51am}	1	Op	8^{45am}	8^{47am}	2	Op
3	8^{47am}	8^{48am}	1	Op	9^{00am}	9^{02am}	2	Op	8^{45am}	8^{52am}	7	NP
4	9^{10am}	9^{12am}	2	Op	9^{15am}	9^{16an}	1	Op	9^{05am}	9^{06am}	1	Op
5	9^{45am}	9^{46am}	1	Op	9^{30am}	9^{31am}	1	Op	9^{11am}	9^{12am}	1	Op
6	9^{58am}	10^{00am}	2	Op	9^{40am}	9^{42am}	2	Op	9^{11am}	9^{13am}	2	Op
7	10^{10am}	10^{11am}	1	Op	9^{01am}	9^{02am}	1	Op	9^{31am}	9^{32am}	1	Op
8	10^{18am}	10^{20am}	2	Op	10^{05am}	10^{06am}	1	Op	9^{45am}	9^{46am}	1	Op
9	10^{30am}	10^{31am}	1	Op	10^{18am}	10^{19am}	1	Op	9^{45am}	9^{47am}	2	Op
10	10^{50am}	10^{51am}	5	Op	10^{25am}	10^{26am}	1	Op	10^{00am}	10^{02am}	2	Op
11	11^{05am}	11^{06am}	1	Op	10^{45am}	10^{50am}	5	Np	10^{15am}	10^{16am}	1	Op
12	11^{19am}	11^{20am}	1	Op	11^{00am}	11^{01am}	1	Op	10^{31am}	10^{32am}	2	Op
13	11^{25am}	11^{26am}	1	Op	11^{15am}	11^{16am}	1	Op	10^{41am}	10^{42am}	1	Op
14	12^{30pm}	12^{31pm}	1	Op	11^{30am}	11^{32am}	2	Op	11^{00am}	11^{01am}	1	Op
15	12^{40pm}	12^{42pm}	2	Op	11^{49am}	11^{50am}	1	Op	11^{10am}	11^{11am}	1	Op
16	12^{45pm}	12^{46pm}	1	Op	12^{05pm}	12^{06pm}	1	Op	11^{30am}	11^{31am}	1	Op
17	12^{50pm}	12^{51pm}	1	Op	12^{30pm}	12^{31pm}	1	Op	11^{50am}	11^{51am}	1	Op
18	12^{56pm}	12^{57pm}	1	Op					12^{05pm}	12^{07pm}	2	Op
19	12^{56pm}	12^{58pm}	2	Op					12^{15pm}	12^{16pm}	1	Op
20	1^{oopm}	1^{01pm}	1	op								
Ave			1.7				1.4				1.9	

Source: Research Survey.