Influence of Hospital Management Information System (Health in a Box) on Patients' Satisfaction in the University College Hospital, Ibadan.

Abiola Lateefat LAWAL-BADMUS
LCU/PG/001847

in the Department of Public Health, Faculty of Applied Science, Lead City University, Ibadan, Oyo State, Nigeria for the Award of Master Degree (MPH) in Public Health Informatics and that this has not been previously submitted.

2022

This is to certify that **Abiola Lateefat LAWAL-BADMUS** with matriculation number **LCU/PG/001847** carried out this research work titled "Influence of Hospital Management Information System (Health in a Box) on Patients' Satisfaction in University College Hospital, Ibadan" in the Department of Public Health, Faculty of Applied Science, Lead City University, Ibadan, Oyo State, Nigeria for the Award of Master Degree (MPH) in Public Health Informatics and that this has not been previously submitted.

Dr. E.A. Bamgboye **Date**
Project Supervisor

Dr. T.A. Olowolafe **Date**
Head of Department

Dedication

This research work is dedicated to Almighty God.

Acknowledgement

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I alone stand responsible for the errors if any found in the work.

Abstract

This research work focused on "Influence of Hospital Management Information System (Health in a Box) on Patients' Satisfaction in the University College Hospital, Ibadan.

The purpose of the study to identify the use of hospital management information system on the Patients' satisfaction. The objective aimed to examine use of hospital management information system (health in a box), and patient's level of satisfaction at University College Hospital, Ibadan. The study has added to the body of knowledge on literature review of the use of hospital management information system in the hospital, it has helped in identified the challenges of proper use of hospital management information system. The study adopted cross sectional study design, sample size were 300 patients. The sample size drawn from the population of patients receiving treatment from clinical departments of University College Hospital through the simple random sampling technique. The major instrument was questionnaire, three hundred questionnaires were distributed to the Patients receiving care, and all the questionnaires was filled by the patients and retrieved by the researcher. The statistical procedure that the researcher choose for the analysis of data was descriptive and chi-square method.

The finding shows that there is an existing hospital management information system at University College Hospital and use at different areas of services such as generating patient track number, documentation of clinical information, etc.

However, the Hospital Management Information System has not been regularly utilized by Doctors for documentation of clinical complaints, finding, and notification of clinical appointment electronically, etc. at the various clinics. Patients at the University College Hospital, Ibadan are generally happy with the quality of their care.

The management should create a local regulation to enforce and promote the usage of the system in order to increase the use of hospital management information system and engagement among the doctors.

Keywords:

Hospital Management Information System

Patients' Satisfaction

Notification of Clinical Appointment

Patient Track Number

Clinical Complaints

Word Count: 299

Table of Contents

List of Tables

List of Figures

Chapter One

Introduction

1.1 Background to the Study

1.1.1 Health in a Box

The Federal Ministry of Health in Nigeria launched the Health-in-a-Box program to offer a digital platform for health information to the whole National Health System. The main objective is the real-time acquisition of health data through automation of all Tertiary Health Institutions in Nigeria for improved operational efficiency, human capacity management, national disease reporting, revenue management, drug or other revolving fund administration, and general improvement in the quality of healthcare services throughout the Country. Health in a Box from the Federal Ministry of Health.[1] The Health-in-a-box initiative achieves the desired objectives through 3 main components:

1. The National Health Informatics Centre
2. The National Telemedicine Framework.
3. The Hospital Management Information System

National Health Informatics Centre

A comprehensive Health-in-a-Box Informatics Dashboard that provides real- time data on disease patterns/trends, hospital capacity utilization, hospital performance indicators, drug availability or usage patterns, revenue or financial trends, health insurance patterns, etc. across tertiary health institutions has been activated at the National Health Informatics Centre at the Federal Ministry of Health. This gives the

Federal Ministry of Health a thorough overview and control over tertiary medical centers and the entire healthcare system. The Federal Ministry of Health has access to a wealth of cross-cutting reports through the National Health Informatics dashboard that direct health policy, interventions, and planning for the ongoing improvement of the National Health System. Health in a Box from the Federal Ministry of Health.[1]

National Telemedicine Framework

In Nigeria's Tertiary Healthcare Institutions, Health-in-a-Box offers a standardized telemedicine platform that is connected to the Hospital Management Information System (HMIS) to enable remote access to healthcare services delivered by licensed doctors and medical practitioners over the phone or internet. The telemedicine services are provided in accordance with a uniform national framework that digitally records diagnoses or prescriptions, laboratory or radiology test results, and encounter histories while smoothly integrating ordinary outpatient services with specialty consultations.

A patient's telemedicine profile is created as a result, and it merges with the standard hospital profile at any or particular tertiary healthcare facility. Nationwide. Thus, the telemedicine framework allows for 24-hour services to be provided to the general public directly and also functions as a point of contact for Primary HealthCare Centers. In addition to a mobile application made available to specialists or consultants at tertiary health institutions for escalation or specialist consultations, each tertiary health institution has a dedicated digital center (with voice, video, and data communication options) staffed by resident doctors. Health in a Box from the Federal Ministry of Health.[1]

Hospital Management Information System

The strong and all-encompassing Health-in-a-Box Hospital Management Information System (HMIS) enables end-to-end automation of the fundamental procedures in Nigeria's Tertiary Health Institutions. In order to power the digital transformation being accomplished across Nigeria's tertiary health institutions, the Health-in-a-Box Hospital Management Information System (HMIS) system must be deployed and upgraded information and communication technology infrastructure, including computers, fiber-optics, networking, and inverters. Digital patient registration, records management, encounter triage or clerking, drug dispensing, lab or radiology, testing or result issuance, inventory management, service billing or payment, health insurance administration, and other hospital services are all provided by the Health-in-a-Box Hospital Management Information System. For better hospital management, the Hospital Management Information System (HMIS) also offers thorough Management Information Services (MIS) in the form of reports and analytics.

In a thorough change management procedure that includes in-depth trainings and on-site technical assistance, tertiary health institutions are expertly guided through the digital transformation journey. This process has yielded 100% success at all automated tertiary health institutions. For real-time health data aggregation, each Hospital Management Information System (HMIS) is connected to the National Health Informatics Centre at the Federal Ministry of Health via secure data feeds and high-speed internet.[1]

What does Patients' Satisfaction meant for?

Patient's satisfaction with health care services is becoming an essential factor in health promotion.[2] When patients are happy with the care they receive, they will recover more quickly, visit the hospital more frequently, which will bring in more money for service provision, and medical tourism will decline.[3] The patient's attitude toward the health care provider is influenced by the quality of care provided to the patients, making patient satisfaction with care a crucial instrument in the monitoring of the quality of medical care.[4] The likelihood that a patient will use a healthcare facility in the future and follow medical advice depends on how satisfied they are with their care, which also affects the effectiveness and overall coverage of their treatment. Health care utilization had been found to be influenced by patient's satisfaction with care. Patient's satisfaction is the state of pleasure or happiness that the patients experience while using the health facility. Patients compare their perception of the care received with their expectation to give a judgment of their level of satisfaction.[5] Inter professional collaboration had been documented to positively influence patient satisfaction with healthcare. This made patient satisfaction care to be subjective from the patient's point of view.[6]

Patient happiness is heavily regarded as a crucial component of healthcare quality. Patient happiness is also recognized as a crucial factor in determining the caliber of healthcare services. Recent discoveries have had a significant impact on developing countries, who are increasingly interested in evaluating the quality of healthcare services.[7] In comparison to the earlier manually constructed structure, we can access and retrieve information faster in an electronic information record. The minute details of the patient record are visible, such as the shape of the concede card, the release

frame, the room change frame, and the X- beam frame. Here, in the patient module, the complete information is in the electronic information frame where we can retrieve the complete information of the patient when he or she enters the relevant code of the concession card and the information identified with the patient, including their name, address, sexual orientation, cause, referred by, and specialist name.[8]

The Importance of Patient Satisfaction Evaluation

Why is patient satisfaction a top concern? It is crucial to raise the standard of patient care provided in hospitals. The most important factor in building a long-lasting relationship with your patients is to listen to them. We can gauge patient happiness through their feedback, which provides information on how successful a healthcare provider is. The medical field has been evaluating patients. The expansion of competition and changes in the medical environment have encouraged health care providers to view patients as valuable clients. The patient is now at the center of the entire care process, and offering patient-centered services has become a key focus. In the last several years, health systems have transformed the way they think and provide care.[9]A key indicator of how well health care is delivered is patient satisfaction, which is a crucial metric. In order to maintain market share and stay ahead of the competition, the competitive environment has forced healthcare firms to concentrate on patient satisfaction. You cannot compete successfully if you are unaware of your advantages and disadvantages. Numerous studies have demonstrated a link between higher hospital-level patient satisfaction scores and lower hospital inpatient mortality rates as well as a negative relationship between those scores and a hospital's 30-day readmission rates.[10]

The information acquired through patient satisfaction studies reveals the caliber of treatment provided by staff and physicians and can be used as a tool in performance evaluation and decision-making. Surveys of patient satisfaction can be used as a learning tool. They also act as a way of holding medical professionals and other staff members responsible. As a performance measure, doctors and other staff members may be required to demonstrate that they maintain appropriate levels of patient satisfaction. Data on patient satisfaction can be utilized to prove the caliber of medical services to both domestic and foreign certifying agencies. Patient satisfaction surveys are crucial because they can spot potential issues and fix them before they become serious ones. They could also be employed to evaluate and quantify the advantages of any particular efforts or projects in the provision of services. They can recognize the flawed procedures and actions that patients need to be properly informed about. Most significantly, they can promote patient loyalty by showing that they are concerned about their opinions and actively seeking out ways to enhance the experience. Small facilities in particular confront a number of difficulties when trying to conduct patient satisfaction surveys.[11] Small sample size, designing a statistically valid sampling process, obtaining acceptable response rates, reporting survey data, converting findings into information that can be used for quality improvement efforts, and choosing a survey instrument that will produce valid and reliable results are just a few of the significant difficulties to take into account. While loyalty and word-of-mouth marketing have a big impact on profitability, patient happiness has a huge and direct impact on both. According to research, there is a direct link between patient satisfaction and an organization's financial gains.

1.2 Statement of the Problem

Patients at University College Hospital have reported problems with the Hospital Management Information System (Health in a Box), including high costs for services, long wait times, procedures that are not covered by insurance, poor management-patient communication, a slow response time from the healthcare maintenance organization, and a lack of a referral system to other tertiary medical facilities. All of these problems can encourage patients to travel abroad for medical treatment.

1.3 Justification of the Study

There are many literature review of patients' satisfaction on hospital management information system (Health in a Box) but there is no one at University College Hospital, Ibadan. The researcher hope that it can improve the quality of care, reduce the costs and prolong waiting time, increase patients and providers satisfaction.

1.4 Aim and Objectives of the Study

To investigate the influence of hospital management information system (HMIS) (Health in a Box) on the patient's satisfaction in the University College Hospital, Ibadan.

Objectives

The objectives of this study are to:

i. To assess the uses of hospital management information system (Health in a Box) at University College Hospital, Ibadan.

ii. To investigate the patients' satisfaction on waiting time at the service areas using hospital management information system (Health in a Box) at University College Hospital, Ibadan.

iii. To identify the factors mitigating against patients' satisfaction on hospital management information system (Health in a Box) at the service areas of the hospital.

1.5 Research Questions

1. What is the use of hospital management information system (health in a Box) at University College Hospital, Ibadan?
2. Are the Patients satisfied with the waiting time at the service areas using hospital management information system (Health in a Box) at University College Hospital, Ibadan?
3. What are the challenges of Patients' satisfaction on hospital management Information system (Health in a Box) at the service areas of the hospital?

1.6 Hypothesis

H_o: The use of hospital management information system (health in a box) does not have influence on patient's satisfaction in the University College Hospital, Ibadan.

1.7 Significance of the Study

Hospital Management Information System helps in maintaining a totally secured database of patients and administrative information. This information can be available at your fingertips. Hospital Management Information System helps in improved healthcare delivery by providing medical personnel with better data access, faster data

retrieval, higher quality data and more versatility in data display. It helps in improving efficiency, both on the cost and the clinical care perspective. This is achieved by avoiding duplications, repetitions, delays, missing records and confusions.

Hospital Management Information System helps to force orderliness and standardization of the patient records and procedures in the clinic and increasing accuracy & completeness of medical records of patient. It helps in gathering information to meet management challenges and also helps to educate patients about their diseases of surgical procedures through pictures and animations. It helps as a good managerial tool to provide total, cost-effective access to complete and more accurate patient care data to offer improved performance and enhanced functions.

1.8 Scope of the Study

The study is to evaluate the influence of hospital management information system (Health in a box) on the patients' satisfaction in the University College Hospital, Ibadan, Oyo State, Nigeria.

In response to the requirement for the training of medical personnel and other healthcare professionals for the Nation and the West African sub-region, the University College Hospital was created by an act of parliament in November 1952. The hospital was built as a result of a visitation panel that evaluated the clinical facility in 1951 for the clinical posting of medical students enrolled in the University of London's M.B.B.S program. Following the establishment of a Faculty of Medicine in University College Hospital, Ibadan, now University of Ibadan in 1948, the visitation panel led by Dr. T.F. Hunt of

the University of London rejected the upgraded facilities provided to the government or native authority hospital at Adeoye, Ibadan.

The actual construction of the hospital began in 1953 on its current location, and on

November 20, 1957, it was formally opened for business. The hospital's capacity was 500 beds when it was first opened, but it now has 891 beds and 163 examination couches, with an occupancy rate of 55 to 60% and a low rate of industrial action. Hospital at University College, year 2022.

1.9 Limitation of the Study

This research limited to out-patients clinical service area at University College Hospital, Ibadan. Those to be interviewed are patients receiving care at University College Hospital, Ibadan.

10.0 Operational Definition of Terms

- **Patient:** A patient is a person receiving or registered to receive medical treatment.
- **Hospital Management Information System (HMIS):** is refers to a computer- based system that provides hospital with the tools to organize, evaluate and efficiently manage departments within the hospital. It has five parts namely: hardware, software, procedure, people and data.
- **Hospital Information System:** refers to a system designed to manage healthcare data which includes system that collect, store, manage and transmit a patient's electronic medical record, a hospital's operational management or a system supporting health care policy decision.

- **Patient Evaluation:** This is made through medical history, physical examination, routine laboratory test and other diagnostic procedure.
- **Patient Satisfaction Evaluation:** is concerned with how patients evaluate the quality of the health care experience. It is increasingly being assessed in surveys of health care setting as a maker of quality of care, along with other dimension of quality such as access, relevance to need, effectiveness and efficiency.
- **Patient Satisfaction:** is a measure of the extent to which a patient is content with the health care health care which they received from their health care provider.
- **Tertiary Health Institutions:** is a hospital care obtained from specialist in a large hospital after referral from the providers of primary care and secondary care.
- **Federal Ministry of Health:** is one of the Federal Ministry of Nigeria concerned with the formulation and implementation of policies related to health. It is headed by two Ministers appointed by the President, assisted by the Permanent Secretary who is a career civil servant.
- **Health Sector:** consist of business that provide medical services, manufacture medical equipment or drugs, provide medical insurance or otherwise facilitate the provision of health care to patients.

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Chapter Two

Literature Review

2.1 Conceptual Review

2.1.1 Hospital Management Information Systems

The term "Hospital Management Information Systems" (HMIS) refers to a variety of information systems utilized in the healthcare sector. Hospitals, clinics, and insurance companies all use hospital management information systems extensively. In one such system, a doctor keeps track of patient information (habits, complaints, prescriptions, vital signs, etc.). These systems are used to store patient data by a number of hospital or clinic departments, including Radiology, Pathology, and Pharmacy, for subsequent retrieval and use by many stakeholders. The appointment system itself may be a stand-alone system or a component of a hospital management information system. Without hospital management information systems, modern healthcare is incomprehensible. A database system, also referred to as the backend of the main system, is a component of an information system or electronic system dealing. A database is a collection of data that has been specifically designed to meet an organization's information needs for a given purpose. Depending on the demands of various periods, it can expand or contract to a smaller size. Without the Database Management System (DBMS), which enables numerous tasks and processes like data entry and storage, retrieval and update, data redundancy, data sharing, data consistency, data integrity, concurrency, and data privacy & security, a database would be useless on its own. You can get additional details regarding database systems.[1]

There are numerous ways to organize data in an information system. Tabular data representation is the standard. A database management system with tabular data organization is characterized as relational because most tables may be thought of as mathematical relations. Up until recently, relational databases dominated corporate organizations by a wide margin. Semantic and object-oriented data models were also first established in the 1980s and 1990s. For managing audio-visual data in particular, object-oriented databases gained a lot of popularity. Despite being particularly effective for search queries, semantic database technology has not yet reached its potential, possibly as a result of its intricate ontology-based data model. There is a comparison of relational, object-oriented, and semantic database systems.[1]

➢ **Evolution of Healthcare Systems**

Even though information technology development started much earlier, businesses and corporations only started implementing it in the second half of the 20th century. The healthcare sector has been rather sluggish to utilize technology. Medical systems and records were previously paper-based. Thus, converting paper-based records to database systems was the first step in the use of information technology and systems in hospital and healthcare management. It not only converted paper-based systems to electronic ones but also made it possible to manipulate data. More data could be processed quickly as a result, which was essential for making choices on time. There is a discussion of the initial stages of this change. This technology was consolidated to create healthcare management information systems (HMIS). In many spheres of life, timely decision-making is essential, but in specific healthcare situations it takes a far greater urgency. Instead of taking days to transfer data from one place or application to

another without the use of electronic technologies, hospital management information systems can do so in a fraction of a second. Users can now instantaneously access, use, and manipulate data while doing so. The efficiency of information system operations particularly those of hospital management information systems, is sure to increase as technology continues to advance and be refined.

➢ **Healthcare System Ubiquitous**

Remote healthcare services are intended to be offered via ubiquitous health systems. A ubiquitous healthcare system is a setting where patients can access care regardless of their location or timing. In essence, a ubiquitous healthcare system would keep track on patients' routine activities and notify them or medical personnel of any issues. This article discusses the national healthcare systems in Korea, particularly the idea of u-Hospitals.[2]

2.1.2 Patients' Satisfaction

In the rising global trend of patient-centered care, patients' happiness continues to be a crucial instrument for assessing the quality of care.[3] Globally, the effectiveness of medical practice depends on excellent patient satisfaction response.[4] This is due to the possibility that patient and healthcare professional assessments of a particular health care intervention's relative success could be very different.[5] Health care providers frequently spend a lot of time processing complaints and dealing with non-compliant patients' concerns, which may lower staff productivity and negatively affect the effectiveness of the healthcare system as a whole.[2]

Contrarily, happy patients require less time from doctors and staff and are more cooperative with their medicine and follow-up treatment, making them easier and more enjoyable to care for. Increasingly, modern medicine is realizing the value of patients' viewpoints on healthcare.[2]

To fully grasp the significance of the interactions between health needs, contentment, and quality of life, further empirical investigations are nonetheless required.[3] Studies have emphasized the value of patient feedback as a crucial tool for assessing and enhancing the quality of healthcare services.[6] Recognizing and addressing the patient's reasonable expectations and concerns can help ensure that they are satisfied with the overall quality of the medical care they receive while they are in the hospital. The patient is a consumer with legitimate expectations and concerns each time they visit. According to studies, contentment with a health service is not the same as one's subjective opinion of the quality of the care they received.[7]

For instance, it has been determined that effective communication between patients and healthcare professionals is the single most crucial element of good medical practice. In addition to helping to define expectations and build trust between the clinician and patient, it also helps to quickly and clearly identify problems. The price of healthcare services, the technical competence of healthcare practitioners, and the income level of patients are additional major variables influencing patient satisfaction with care. According to reports, 66% of all health spending in Nigeria is made up of out-of-pocket expenses, making households responsible for the majority of this cost.[3] Out-of-pocket medical expenses frequently result in catastrophic medical costs given the 62.6% poverty rate. According to studies, patient happiness appears to be

negatively correlated with private health spending. Additionally, there is evidence of a positive relationship between patient happiness and the quality of their healthcare; however, this relationship should be taken with caution because patients who lack technical expertise evaluate the technical quality of healthcare.[8] Because of their inherent usefulness as indicators of consumer preference and relative ease of measurement, measures of patient satisfaction with healthcare are frequently utilized by insurers, providers, and academics.[3]

Few studies have been done in Nigeria to determine how satisfied patients are with the treatment they receive at public secondary hospitals. However, while waiting times are a concern for everyone, several patient satisfaction surveys conducted in tertiary institutions across the nation show generally good satisfaction. [3]

2.2 Theoretical Review

2.2.1 What is Health in a Box?

Health-in-a-box is an initiative of the Federal Ministry of Health to provide a digital health information platform across the National Health System. The main objective is the real-time acquisition of health data through automation of all Tertiary Health Institutions for improved operational efficiency, human capacity management, national disease reporting, revenue management, administration of drug/other revolving funds, and general improvement in the quality of healthcare services across the nation.[9]

The three key elements of the Health-in-a-box program allow it to accomplish the targeted goals:

1. The National Health Informatics Centre
2. National Telemedicine Framework
3. The Hospital Management Information System

2.2.1.1 National Health Informatics Centre

The National Health Informatics Centre at the Federal Ministry of Health has been activated with a comprehensive Health-in-a-Box Informatics Dashboard that provides real-time information on disease patterns/trends, hospital capacity utilization hospital performance indicators, drug availability/usage patterns, revenue/financial trends, health insurance patterns, etc. across Tertiary Health Institutions. This provides the Federal Ministry of Health a comprehensive overview and oversight over Tertiary Health Institutions and the overall Health System. The National Health Informatics dashboard also provides the Federal Ministry of Health a plethora of cross-cutting reports to guide health policy, interventions and planning towards continuous improvement of the National Health System.[9]

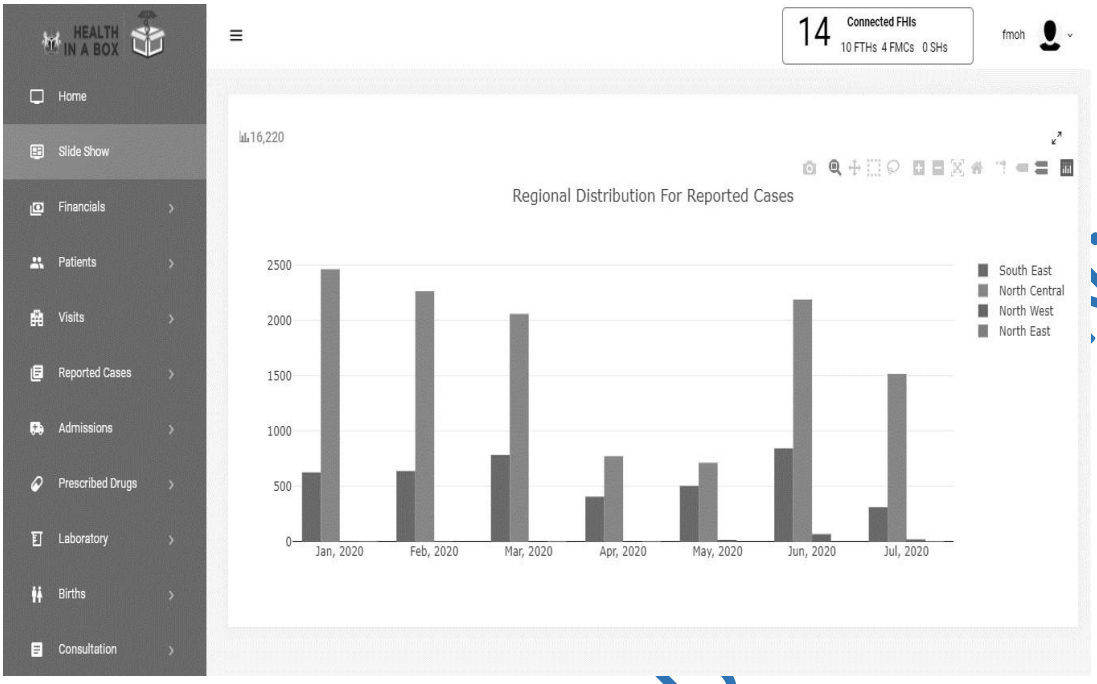

Fig 2.1 https://health-in-a-box.vercel.app/assets/new/dashboard.PNG, FMoH.

2.2.1.2 National Telemedicine Framework

Health-in-a-Box provides a consistent telemedicine platform plugged into the Hospital Management Information System (HMIS) across Nigeria's Tertiary Healthcare Institutions to enable remote access to healthcare services provided by qualified doctors and medical practitioners over telephone or internet. The telemedicine services are rendered under a standardized National framework that seamlessly incorporates general outpatient services with specialized consultations while digitally tracking diagnosis or prescriptions, laboratory or radiology test results and encounter histories. The result is a Patient telemedicine profile that fuses into the traditional hospital profile at any or selected Tertiary Health Institution

nationwide. The telemedicine framework thus enables round-the-clock services to the general public directly and also serves as an escalation point for Primary HealthCare Centers. The telemedicine service is provided through a dedicated digital center at each tertiary health institution (with voice, video, and data communication options) manned by tertiary health institution resident doctors as well as a mobile app deployed to tertiary health institution specialists/consultants for escalation/specialist consultations.

2.2.1.3 Hospital Management Information System

The Health-in-a-Box Hospital Management Information System (HMIS) is a robust and comprehensive platform that provides end-to-end automation of the core processes within Nigeria's Tertiary Health Institutions. The implementation of the Health-in-a-Box Health Management Information System across the tertiary health institutions involve deployment and upgrade of Information and Communication Technology infrastructure including computers, fibre-optics, networking, and inverters to power the digital transformation being accomplished across Nigeria's Tertiary Health Institutions. The Health-in-a-Box Health Management Information System provides for digital patient registration, records management, encounter triaging/clerking, drug dispensing, laboratory or radiology, testing or result issuance, inventory management, service billing or payment, health insurance administration and other hospital services. The Health Management Information System also provides detailed Management Information Services (MIS) in the form of reports and analytics for improved hospital administration.

Tertiary Health Institutions are professionally guided through the digital transformation journey in a robust change management process that involves rigorous trainings and on-premise technical support that has resulted in 100% success at all automated Tertiary Health Institutions. Each Health Management Information System is linked over secure data feeds and high-speed internet to the National Health Informatics Centre at the Federal Ministry of Health for real-time health data aggregation.

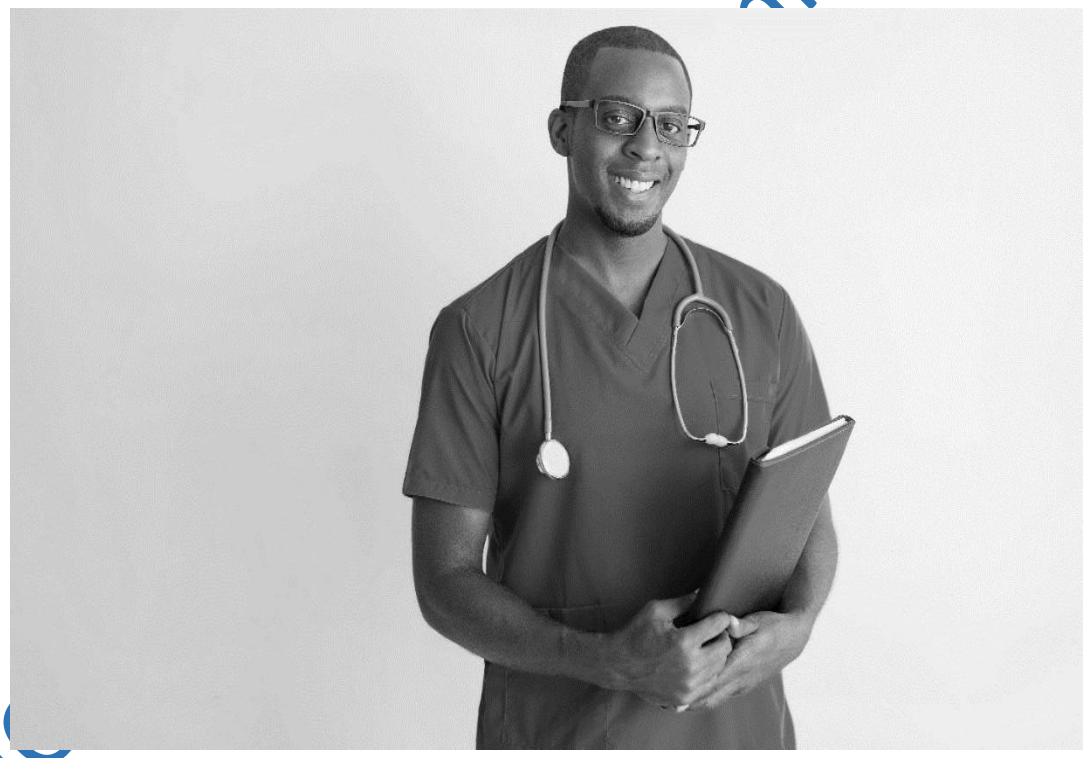

Fig 2.2 https://health-in-a-box.vercel.app/assets/new/Webp.net-compress-image.jpg

2.2.2 National Health System

National Health System can be enhanced through:

1. End to end automation across all Tertiary Health Institutions.
2. Centralized health data aggregation for epidemiological, financial, inventory and general administrative data.
3. National health analytics and reporting for oversight and planning.
4. Automated administration, billing and reconciliation of health insurance services
5. Increased transparency and accountability across tertiary health institutions.
6. Standardization of tertiary health institutions processes for consistent data aggregation and reporting.
7. Improved operational efficiency and patient turnaround time across Tertiary Health Institutions.
8. Improved access to qualitative healthcare at tertiary health institutions and through telemedicine services.

2.2.3 Impact and Success of Health in a Box

Health-in-a-box unifies data across all connected hospitals to drive data-driven decisions and a future built on accurate information. The innovative has achieved significant success in the following areas:

1. Massive improvement in health infrastructure across tertiary health institutions
2. Reducing patients waiting time
3. Improving operational efficiency at tertiary health institution

4. Online real time data acquisition from tertiary health institutions
5. Unifying data and analytics across the national health system
6. Increase drugs availability

2.2.4 Evolution of Hospital Management Information System (Health in Box)

Healthcare management refers to a process where the health risks that pose a hazard to both individuals and groups are fully and effectively handled. It aims to make people and communities more active so they can make the most of limited resources and become healthier[10]. Many acronyms have been used in the creation of such systems since healthcare information systems and health information systems are related ideas. The word "health information systems" is related to many earlier forms of this notion, such as hospital information systems, even if there hasn't been any clear consensus in the literature up until recently. Likewise, phrases like "computerized patient records," "electronic medical records," and "modern electronic health records" are now frequently and essentially used interchangeably. From its earliest forms through health information systems, hospital management information systems have primarily evolved as follows:

1. **From Manual Systems to Electronics Systems:** Over the past few decades, health data and information have mostly been created and maintained on paper; there has been a clear transition to computer-based systems. This skill refers to the ability of modern information technology to analyze and store large amounts of data in order to provide greater knowledge. Healthcare information systems in the future are expected to be almost paperless.[10]

2. **From Local to International Information Systems**: While early healthcare information systems were focused on particular departments (such as radiology or laboratories) or only through a healthcare practice system (such as a hospital or clinic), modern healthcare systems aim to be regional, national, and even worldwide.[10]
3. **From Patients and Consumers to Healthcare Professionals:** Original version, health care information systems were developed to be used by mainly physicians in addition to administrative staff but after that it was passed on to be used by nurses. Since then, the direction has shifted to encompass more patient input.[10]
4. **From Using Data of Patient Care to Research:** additionally, change has been done in using data. Through the last years, patient data has been used specially for patient care management. Currently extend the possibility of using data, firstly used for patient care, as well as for healthcare planning and above all these things for research and education.[10]
5. **From Technical to Strategic Information Management Orientation:** it was noted that while computer supported information systems from the 1960s to the 1990s focused on troubles resulting from the technical issues of the systems, concerns about the organizational problems, social issues and change management issues became more relevant at the turn of the millennium.[10]
6. **From Numeric (Simple) Data to Complicated Type of Data:** This indicates that not only have health information systems' technology components grown in complexity, but also that the data that has been received and processed has done so

as well. Data transitions from numerical to alphanumeric to molecular to imaging.[10]

2.2.5 What is Hospital Management Information System?

A system for managing hospitals and providing patient care is called a hospital management information system. In industrialized nations, the majority of hospitals have created extensive, integrated, and specialized information systems to aid in achieving the best clinical results, ideal financial performance, and most crucially, patient and employee satisfaction. They are considered to be one of the most crucial hubs on which the provision of healthcare within hospitals and other types of medical institutions depends.[10]

The automated web-based program that makes up the hospital administration system is used to track, store, and monitor medications. According to the types of functions that might be provided, health management information systems can be broadly classified into four groups, namely:

1. Patient care services,
2. Professional services
3. Administrative in a hospital
4. Supporting services.

2.2.6 Hospital Management Information System Users

Determining the users of the information system is crucial. All users of a hospital information system are participants in the functionality and operation of the system, which includes:

1. **Internal user:** This category includes all individuals who are directly involved in using the hospital information system, such as the medical staff, administrative personnel, and nursing staff.[10]
2. **External users:** This category includes anyone who uses a hospital information system in an unofficial capacity, such as patients, vendors, insurers, and others.

2.2.7 Components of Hospital Information Systems

A system is a group of pieces or components that are structured towards a single objective. The following are typical elements of hospital information systems:

1. **Elements of information processing that suggest:** (A) Enterprise Functions: Describes the human or machine roles that should be performed in a certain enterprise to help it accomplish its goals and mission. e.g. (Patient admission) (Patient admission) Determine the logical order and sequence of a collection of actions (b) in a business process.
2. **Information processing instruments that imply** (for example, servers, terminals): a. application components that support enterprise function and are managed by application programs; and b. physical data processing components.[10]

2.2.8 Architecture Design

According to the number of application components (functions) that the system could support, the design architecture style of hospital management information systems may be divided into three categories:

1. Hospital management information systems having a single database to house all patient-related data. These software products are ideal for small to larger hospitals. One or more mainframe servers coupled to several terminals or workstations make up the two-tier, centralized database network architecture that is employed in these systems. The patient registration, accounting and finance, billing, laboratory, radiology, human resource payroll, stores, and pharmacy application components that are deployed on the framework can all be accessed through terminals. These workstations lack in-house data processing capabilities.
2. A hospital management information system (software product) with a wide range of heterogeneous application components that is appropriate for big hospitals and numerous hospitals dispersed throughout various locations This form of network architecture uses a distributed database architecture style with three tiers of client-server servers. Several application components have their own databases and persistently store information about specific entity kinds. The network connects the central servers together. Various workstations are connected to this network. The server Introduces functions that can be accessed by the workstations as clients. The workstations are typical personal computer system with its own memory and data processing unit. They can offer access to

application components installed on the application file server as well as to locally installed application components. [10]

The three-tier architecture used in this form of deployment allows for the change of any tier without affecting the other two tiers. Each hospital has local servers that are connected to central servers. The local server has the capacity to operate on its own. It would push data to the centralized servers after the day was over.[10] Hospital Management Information System solution has a three-tier architecture. Additionally, the integrated Hospital Management Information System was designed using the layered architecture style, which divides the program into stacked groups or layers. These are the layers that make up the architecture:

1. **Infrastructure or resource layer:** The infrastructure layer consists of the network infrastructure (switcher, cable, router, fiber optic channel, etc.), as well as the computer hardware (desktop, server, peripheral devices, uninterruptible power supply, etc.); civil infrastructure designed for (control center, server room, etc.); and other components.
2. **The Data Layer** is made up of the necessary databases, such as a GIS database (roads map, references map), a database to keep track of past and present records, other relevant databases, and a system database to manage records, etc.
3. **Integration layer, also known as middleware,** is a strategy for addressing specific issues like heterogeneity, dependability, interoperability, decision support, and security that are present between the application layer and the infrastructure layer or resource layer (extended to operation system).

It consists of a collection of commonly used connected object classes that support information transmission, data staging, and component connectivity.

4. **Application Layer:** facilitate communication with the user. It comprises the software program that gives the user functionalities. It incorporates features into modules that are going to be offered by communication providers.
5. **Communication Layer:** communication carriers are defined.
6. **User Layer:** represents the user of the systems development process, which was carried out employing a variety of technologies and deployment across a wide geographic area. In order to combine such disparate systems, a service-oriented architecture strategy was used. Web services and service-oriented architecture work together to coordinate all the challenges related to developing and utilizing software services while developing software systems.

2.2.9 Hospital Management Information System Communication Standard

Regardless the technology for integration used application components have to communicate if they shall be integrated. A consensus must exist about the syntax and semantics of the data and messages that are to be exchanged. The most important standards for communication inside hospital information systems are HL7, DICOM.[11]

1. **Heath level 7(HL7):** One of the several American National Standards Institute (ANSI) authorized Standard Developing Organization, operating in the healthcare sector worldwide. ("Level seven" point to the highest level of the International Standards Organization's (ISO) communications model for Open Systems Interconnection (OSI) the application level.). It has the ability to provide the

common language for information exchange and electronic patient records in both internally and externally. The vision of Health Level 7 is to build an infrastructure for interoperability in the healthcare domain. Health Level 7 employ the reference information model to derive domain specific information models and process them into HL7 message specifications. HL7 aims to use of such standards within and between health care organizations to growth performance of health care functions such a way that is in desire of all. This means that Health Level 7 aims to facilitate communication in configuration Health Care. Health Level 7 Standards have much flexibility information exchange in both of the hardware and software infrastructure.[12]

2. **Digital Imaging and Communications in Medicine (DICOM):** is a specification kept up to date by the International DICOM Committee that outlines the integration needs of the medical imaging industry. The International DICOM Committee is in charge of maintaining the standard, which identifies the integration needs of the medical imaging industry. The standard includes:

- Message and file formats for several medical imaging modalities (such as computed tomography, digital x-ray, magnetic resonance imaging, ultrasound, and nuclear medicine imaging)
- A network protocol, and a wide range of services that are fully documented.
- An imaging format to transfer images and x-ray dosage information from an inspection to the PACS.
- A task list imaging the patients to be checked from the radiological information system (RIS) to be restored.

- To notify the RIS that the imaging process has been completed.
- To underline that the images have been appropriately saved (and can therefore be erased locally).[12]

2.2.10 The Health Sectors' Hospital Management Information System and Tertiary Healthcare Developments

The conditions that enable global competition in the information society are the development of communication technologies and the importance of the administrative information flows and the inter-institutional communication networks. As a result, information systems are given increased attention in the competitive presentation of public services. One way for public organizations to reduce economic indicators like time and cost is through information technologies. Information systems have been widely used in the health industry since the 1960s. The protection of the public interest and the promotion of social well-being place a high priority on health care. These information systems are thought to offer patients and doctors more convenience through an electronic database, particularly in the presentation of preventive and curative health services. Information systems now play a larger and more crucial role in the delivery of materials, intra-institutional communication, and intra- and inter-institutional information transfers to healthcare professionals. Information systems distinctly display disease statistics as well as the outcomes of institutional performance of healthcare institutions in the industry. The information systems' data on the success rate of institutional service delivery can be used to make a variety of conclusions.[13]

2.2.11 Development and Types of Hospital Management Information Systems

Information systems are made up of the entire skilled labor force, computer networks, system models, and system data needed to carry out diverse tasks such information collection, processing, storage, access, and distribution. Information systems can be thought of as programs that deliver precise, current information when and where it is required[13]. The capabilities of the present software, hardware, and data are directly related to the performance of information management systems. Data collected, stored and analyzed in information management systems are evaluated according to criteria such as certainty, up-to-datedness, reliability, and being unnecessary. As much as possible in the planning of information systems in public administration, the requirements of vertical and horizontal hierarchical levels in the public organizations should be estimated. Information management systems in the public sector are used to monitor the environment and to take into account the interaction of external factors with each other and with public authorities.[13] The Hospital Information Management System is a system that hospitals use to gather and process all relevant data about managing and providing healthcare services. The automation system in the electronic environment allows for the conveyance of this information between the units. It works as an integrator of various information that appears in relation to the medical, financial, and managerial operations of the hospital. The institutional resource planning system known as the hospital management information system has been privatized and improved in quality to meet the demands of the healthcare industry.[13] Hospital management information systems keep a lot of data because hospitals have so many functions. In this type of system, there is a wide variety of information available

from the workforce used by the patient to what the staff can make or do in order to follow the functioning of the hospital and facilitate administrative tasks. The system provides feedbacks on patient care processes for hospitals. It reminds us of the necessary tasks to perform and allows us to develop a diagnosis and treatment protocol that can be applied to a special patient.[13]

- **First-Generation Hospital Management Information Systems:** it was created in the 1960s and came to an end in the 1970s. The first hospital management information system was put to use at California's El Camino Hospital in 1972. Only request inputs and outcome reporting services were offered by this system. Emergency and outpatient care were not offered. Computers have evolved from single-tasking hosts to multi-tasking, user-friendly machines as a result of this process. Additionally, the development of hospital management information systems has been influenced by additional variables like economic advancements and an increase in data manipulation. A few patient care-related themes and essentially the automation of patient medical records are included in the information management systems created during this time.[13]
- **The Second-Generation Hospital Management Information Systems:** mid-1970s and came to an end in the late 1970s. Hospitals are currently concentrating on the usage of financial systems and financial issues. The system's primary goal is to transport data from the end user to the financial systems. Interest in patient care has grown during this time. Integrated patient care information files have been moved to computers by combining data from several clinics.[13]
- **Third Generation Hospital Management Information Systems:** started back in the late 1970s. This phase, which was influenced by the introduction of database

technology at the start of the 1980s, concentrated on concerns with patient care planning, lab challenges, and pharmacy problems.

- **Fourth Generation:** The 1980s' first year saw the start of these behaviors. This period's integration with external systems, such as finance and other departmental systems, is a key characteristic. The fundamental characteristic of this phase is meeting all of the needs of a single firm. The best practice or software procurement strategy for private clinics has been followed by hospitals. As computers became more affordable around 1990, spending in hospital information management system projects rose. As a greater percentage of healthcare providers now own computers, information systems are employed more frequently. The report "Computer-Based Patient Records: Essential Technologies in Health Care" was released by the Institute of Medicine in 1991. This study advocated the usage of electronic patient records and discussed the issues with paper-based records. The report also emphasized the value of doctors to the system and indicated that the patient should be the system's main focus. Patient safety, a decrease in medical errors, and an improvement in the standard of healthcare were the system's top priorities after the 2000s. Wireless technology, radio-frequency identification techniques, and broadband internet have all been utilized as crucial technological instruments in the healthcare sector. Systems for electronic health records are currently some of the most fundamental applications in the healthcare industry. At the heart of the hospital management information system is a patient index. Using this index, all transactions are carried out. The patient's name and surname, date of birth, gender, residence, second name, marital status, mother and father's names, information on allergic reactions, and names and phone numbers for emergencies

are all included in the patient index.[13] Patient enters the system with patient consent, is moved to the appropriate compartment, and after the treatment term, is discharged from the system. In hospital administration, these systems process various patient information. It carries out communication outside of hospitals on topics like finance and procurement. In terms of patient care, it serves as medical divisions and services.[13]

- Systems that are integrated and modular fall under the category of hospital management information systems. The integrated information systems work together to perform all information system tasks. Hospital general information systems, clinical information systems, management information systems, and database management systems are the different types of integrated information systems.

The Hospital General Information System creates hospital-wide online information systems. The medical interpretation and processing of medical data in the context of diagnosis and therapy is made possible by clinical information systems. The processing and archiving of the data required to support management units' decision-making, planning, and auditing processes constitute the management information system. A significant amount of connected data is stored in a common format by the database management system.

On the other hand, modular systems involve various operating and application forms both within and among various parts. By using fragmented institutional practices, this sort of organization lowers the initial investment cost. According to some reference sources, hospital management information systems also include systems for

financial administration, material and facility management, resource consumption and planning, and people management. Through the use of resources and a programming system, effective resource allocation may be accomplished, and the system provides patients with convenience. When determining hospital admittance and operation day, this technique is quite helpful. The system allows for more efficient staff and service utilization, patient transition between services, and staff assistance.[13]

The Objectives of a Financial Management Program are listed as follows:

- To perform routine accounting tasks
- To offer the essential numerical data so that investment decisions can be made with the least amount of expense
- Creating effective and practical financial support mechanism
- To give management data for transaction evaluation and control.

Computers are one of the primary methods used in the material and management system to provide information to management, assisting hospitals in managing resources and facilities more effectively. For instance, this involves project programming, project supervision, facility maintenance, inventory control, food management, and creation of meal lists. In order to take advantage of labor force planning and productivity analysis, hospitals also require a solid people management information system.

2.2.12 The Functions of the Hospital Personnel Management Information System can be summarized as follows:

- Constantly maintaining and recording healthcare staff files

- Obtaining information from files, making necessary correction to information processes, and providing task management.
- To compile the study analysis reports for each hospital cost center and to provide reports to assess personnel issues.
- To produce data on labor cost distribution, quality assurance, and employee Productivity.
- Providing improved support for information on the consequences of illnesses, medications, diagnostics, and therapies
- Being aware of the staff's unique skills and situational circumstances
- Learning more about the effectiveness, efficiency, and cost of patient care.
- Making use of the objectives and advantages of patient management information systems.

2.2.13 The Purposes of Hospital Management Information Systems are:

- The patient's illness and curriculum vitae are both instantaneously logged on the computer and accessible upon request.
- Time is saved in the process of setting up a contemporary archiving system.
- The condition is quickly and accurately diagnosed.
- The computer system keeps track of all hospital management data, and this data is readily available.
- Increased revenue due to accurate billing and official document preparation procedures.
- Computers handle every aspect of material distribution and trading in hospitals.

- Information exchange between various hospitals promotes medical research and offers
- Top-notch communication.
- Health services for prevention and treatment can be controlled.
- Create a sub-system for efficient financial transactions.
- Time is conserved the production of labor-intensive goods and medical equipment is at its peak.

2.2.14 Main Benefits of Hospital Management Information Systems

- By organizing all hospital forms through the system, red tape is reduced. Statistical data can be provided based on a variety of parameters.
- In the hospital, input, output, control, and follow-up of all types of materials help to reduce unnecessary use and leakage.
- All information is maintained in an electronic environment via digital archiving, and pertinent photos are preserved and the reporting system is recorded during operation.
- The performance of the workforce is continuously monitored by videotaping their moves.
- The expedited delivery of healthcare services guarantees the consistency of patient care and their happiness.
- Support is given for case costs, logistical operations, and personnel management. The health care organization's supply chain can be run more efficiently to provide better strategic decisions. [13]

2.2.15 Use of Hospital Management Information Systems

The Ministry of Health and the World Bank's Health Information Systems Project was approved in 1990, marking the beginning of initiatives to create hospital management information systems in tertiary healthcare facilities. The development of management information systems and primary health care information systems are the main objectives of the second health project, which runs from 1995 to 2001. The development of the health information system is one of the primary goals of the first health project, which was launched in 1991.[13] In this manner, the planning phase of the Health Information Systems Project began in 1992. At this point, issues with the hospitals' quality and information validity were assessed. Since 1995, hospitals have started to use information systems more frequently and have a greater interest in hospital management information systems. The Ministry of Health's under secretariat established its data processing division in 1996. In the same year, the data processing division established the Hospital Information Systems Technical Specification Evaluation Commission. In practice, however, there has been no standardization. A study titled "Purchasing Principles of Hospital Information Systems" was created by the Ministry of Health for this reason, and it was given to all hospitals. In an effort to develop application software for the data processing division, the Ministry of Health chose the Ankara Education and Research Hospital as a test facility in 1999. However, this initiative was abandoned at the conclusion of 2003. The decision has been made that hospitals should purchase their information management system requirements from private sector businesses with their own revolving funding sources. The Health Information System Action Plan Working Group developed the "Health Information

System Action Plan" in the same year. The ministry finished its work on providing basic healthcare services in 2004. The Social Security Organization was established in 2005 when SSK, the pension fund, and the contracted hospitals were combined under one roof. This institution also monitored the payment procedures for patients enrolled in the Medula (General Health Insurance) system. [13]

Additionally, the Social Security Institution mandates that Medula be connected via the Internet to every hospital information system. 90% of hospitals have information systems in place by 2005, and 100% did so by 2006.[14]

The Health-Net initiative was launched in 2007 and the Principles on the Purchase of Hospital Information Systems were modified. The Health-Net platform receives the data collected from the hospital information systems over the internet. Health-Net also keeps track of the patients' medical data. The Ministry of Health also planned to leverage the information applications on the Health Special Network, and starting in 2014, it developed health data warehouses (SB.Net). The ministry approved web-based architecture in family medical information systems and hospital information management systems in 2015.

2.2.16 Basic Components of Hospital Management Information Systems

- **Patient Registration-Acceptance:** The relevant polyclinic maintains a record of the patient's personal information when they apply to the hospital. The patient's needs are met.
- **Patient Inpatient-Discharge Procedures:** Drug use and hospital expendable supplies come after the patient admission processes. Following the patient's diagnosis and treatment, discharge procedures are carried out.

- **Patient Follow-up:** It maintains records of actions taken during the patient's evaluation, as well as of prescriptions administered and examinations and treatments administered.
- **Referral of the Patient:** The patient gets transferred to another hospital if the hospital to which they are being referred cannot treat them.
- **Central Hospitalization:** Patients who wish to be admitted to the hospital are given an appointment.
- **Emergency Service:** It creates a patient record for the medical facility's emergency room. It creates the patient's consultation records. It keeps track of the patient's medical care.
- **Human Resources:** These are the systems that allow for the tracking and accrual processing of personnel information. It consists of four modules: accrual for promotions, staff moves, leaves, and records. Permissions for users on the screen and on a per-transaction basis are set up in the system. Users can only utilize the system to carry out the tasks that are assigned to them, as a result.
- **Voluntary Work:** It maintains records of the doctor's examinations and surgeries, the staff members' working days, and the gross wages made.
- **Health Board:** It communicates this data to the e-health system and preserves a record of the permission and medication reports that were granted to the patient.
- **General Accounting:** It keeps track of fixed asset systems and general accounting in accordance with the curriculum.

- **Purchasing or Material:** It specifies and codes the supplies the hospital needs. It offers material storage on shelves and in warehouses. It monitors entrance and leave movements by keeping tabs on the material's supply levels in the hospital.
- **Appointment System through Phone:** Without an operator, the appointment process can be completed 24/7, 365 days a year. Patient flow data is reported, including the daily patient call volume, appointment volume, and daily patient examination volume.
- **Laboratory:** The auto-analyzer equipment used in hospital laboratories is managed by it. It arranges for the patients' preferred tests to be carried out at the proper hospital and auto-analysis gadget. The report is given to the patient after being received from the system and being verified by the laboratory supervisor.
- **Pharmacy:** It maintains medicine and consumable supply inventories and offers the required statistics. It handles the ordering of supplies, billing, and release of hospitalized patients. It adheres to the outpatient clinic's set procedures.

2.2.17 Standards Related to Hospital Management Information Systems.

1. **Unique Descriptive Standards:** These concern the patient, the healthcare facility, as well as the tools and other supplies employed in medical facilities. Patients or healthy individuals, all varieties of healthcare professionals, affiliated organizations, utilized equipment and stock, consumables, medications, blood, and blood products are all included.
2. **Model, Content and Building Standards for Electronic Patient Records:** They are the guidelines that govern the design, scope, and organization of public

hospitals. In order for hospital information systems to keep running smoothly and in unison, it is essential to adhere to a regular set of guidelines. One of the most crucial rings of the chain of common rules is comprised of these standards.

3. **Message or Data Communication Standards:** It entails contact with people who want data as well as the safe and reliable storage of data between the administrative and financial units (diagnostic and treatment data, blood transfusion, e-prescribing, electronic provision and invoicing, laboratory, and imaging data).
4. **Standards related to the Display of Clinical Data:** This encompasses all surgical procedures, all medical waste, pharmacology, medical consumable and medications. It also includes disease diagnostics, healthcare services, dentistry, and the categorization of patients based on their diagnoses.
5. **Privacy or Personality and Safety Standards:** It addresses requirements for patient safety and confidentiality. All patients who apply to the hospital have their personal information collected and preserved in accordance with the privacy principle. When required, this personal information is made available for use.
6. **Standards related to Health Information Management and Quality Indicators:** It covers all forms of medical communication as well as laboratory statistical data quality requirements and indicators. A specific program includes reporting of these data and putting everything ready for use. These guidelines are suitably provided for use by healthcare institutions and organizations.

Hospital Management Information System Patients' Movement at UCH

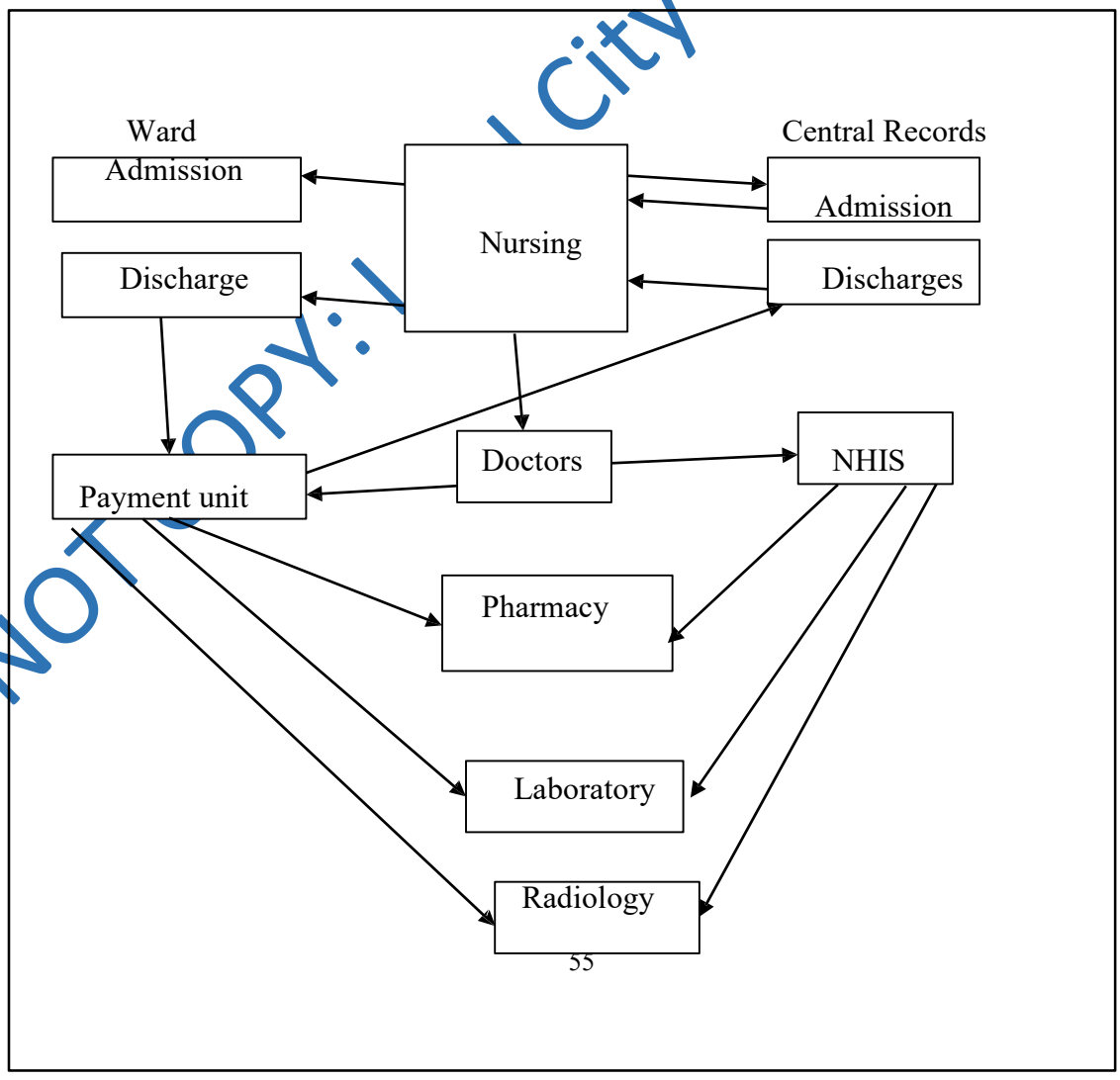

Figure 2.3: Hospital Management Information System (Health in a Box) University College Hospital, Ibadan. **HMIS, UCH, 2022.**

2.2.18 Health Information Management

Health information management is one of the major segments of a health system. Integration of health information management systems improves the effectiveness and efficiency of health services. According to the World Health Organization, it is one of the six building blocks that strengthen a health system. Electronic Health Information Systems are known to improve health information management. It helps to collect, aggregate, store, analyze and evaluate health related data accurately and timely from health facilities to the federal level. Recently, health information management has become important for improving and measuring the quality and coverage of health services globally. However, only a few developing countries have sufficiently strong and effective electronic health information system. With the advent of technology, the computerization of information allowed hospitals to develop electronic health information systems, which led to improvements in productivity and care quality.[15]

The outpatient department in a hospital is a patient's first point of contact and acts as a gateway to various public healthcare services. The main duties of an outpatient department are outpatient intake and consultation. The outpatient department faces particular difficulties, such as having to accept every patient, no matter how many or how ill they are, every day of the week, 24 hours a day. An outpatient department could use improvements in the following areas: quicker registration, shorter wait times, better quality and quicker consultations, resource optimization, and user and customer satisfaction. The establishment of a health information management system with electronic-based data capturing technologies is anticipated to deliver more effective services so that these patients have greater access to excellent care and higher patient satisfaction. [15] The health information management system also supports the outpatient department's pharmacy and laboratory services. Every patient in this outpatient department should register at the registration desk, where they will receive a Personal Health Number (PHN) that is specific to them. Patients are given an identity number upon arrival, and that number is shown on a screen outside the consultation room.

This procedure primarily seeks to cut down on waiting times and suffering while increasing efficiency, which will increase patients' satisfaction with the services provided. Utilizing a health information management system speeds up patient management by ensuring that tests and treatments are administered in the right sequence. Although users and administrators gain from its implementation, patients stand to gain the most because they can receive effective and secure healthcare thanks to this system. Furthermore, the use of computers and printed materials in

consultations is made possible by the implementation of a health information management system.

One of the key issues in medical consultations is the doctor-patient interaction. To deliver high-quality care, the doctor and the patient should have a positive relationship. The main components of creating a successful relationship, among other things, include effective communication, attentiveness, and trust. In healthcare settings, trust and good communication are crucial for better patient care and patient satisfaction. The patient- physician relationship may be impacted by the usage of digital technologies. Consequently, patients' This electronic-based prescription and data recording system in the consultation area will affect people's perceptions of the patient-physician relationship in medical consultations in the December 2021 issue of the Journal of Health Sciences and Innovative Research. Information on how computers in health information management systems impact relationships between doctors and patients is few, though.

2.2.19 Hospital Information System

A hospital information system was created to manage the operations of running healthcare institutions. It is a comprehensive, integrated information system (Hospitals). As with any other integrated system, establishing a health information system takes time, requires specialized professional skills for software production, and most significantly, costs money for development, installation, support, and upgrading.

Advantages of Hospital Information System

The hospital information system assists in keeping a completely secure database of patient and corporate data. This knowledge might be at your fingertips.

1. Hospital information systems contribute to improving healthcare delivery by giving medical staff better access to data, faster data retrieval, higher-quality data, and more flexible data display options.
2. The hospital information system aids in increasing effectiveness from a financial and clinical care standpoint. This is accomplished by reducing confusion, delays, duplication, repetition, and duplication of effort.
3. The hospital information system encourages order and standardization of patient records and clinic operations, improving patient medical records' correctness and thoroughness.
4. Hospital information systems serve as useful administrative tools by offering complete, affordable access to more accurate and thorough patient care data in order to offer increased performance and enhanced functionality.
5. The hospital information system aids in the information gathering process to address management difficulties.
6. Hospital information systems use images and animations to instruct patients about their ailments and surgical procedures.

2.2.20 Structuring Health Information Management to Carry out Functions like Admissions, Discharge and Treatment History Etc.

1. **Patient Registration:** This function of the hospital management information system is responsible for registering new patients for either the inpatient or outpatient departments or providing them with a special identification number.

This number serves as the patient's identification throughout the entire system. Either the inpatient department front desk or the outpatient department reception can register the patient. For every distinct visit the patient makes, an identifying number for the inpatient. This is also a part of registering patient. The Patient identification number is used for tracking of medical records of the patient for that particular outpatient department visit or inpatient admission. All the medical record of the patient are identified by combination of numbers i.e., Patient identification number. The numbers give flexible search in terms of finding patient's History Record.[16] or outpatient department is also made. This is a component of patient registration as well. The patient's medical data for that specific outpatient department visit or inpatient admission are tracked using the patient's patient identification number. Patient identification numbers are used to identify every medical record in a patient's file. Finding the patient's history record is made possible by the numbers' flexible search.[16]

2. **Outpatient Department or Inpatient Department Investigation Cases**: Module of Hospital Management System deals with all kinds of Investigations suggested by Doctors. The function enables the entry of Investigations or Procedures for a particular patient. The entered investigations are rooted through the Billing or Cash office and once the patient pays for the Investigations the entries of the same goes to respective diagnostics center. This flow is not compulsory of inpatients since the billing for inpatients is done at the time of discharge. Investigation requisition is created and printed with function and the same is available at respective diagnostics center for preparation of reports.

3. **Inpatient Admission and Ward Allocation:** This inpatient admissions feature provides the ability to manage patient admittance and assign beds to patients. The patient is recognized by the system as an internal or new inpatient who was referred from the hospital's outpatient or emergency department. This feature provides data about open hospital beds. While allocating the bed, the occupancy status for that specific slot can be discovered. Patient admission's primary purpose is to make it easier to admit patients in accordance with requirements while taking the type of admission and the patient's condition into consideration. The patient may be admitted directly or through a consultant or hospital referral. Depending on whether the admissions process has been successfully completed, the patient's category may include a company, themselves, government schemes, insurance, or a medical case. Once the patient is admitted in the hospital, the room charge starts from the time of admission. The case paper of the patient is printed from the system and is send to the respective Nursing station. Once the admission of the patient is completed the inpatient Identification Number is created by the system for that particular admission of Patient. The inpatient admit card (reference card) is also printed along with the case fill. The system informs with audio visual alert to the respective Nursing Station about admission of the patient under them and to prepare room for patient. In case of medical legal case, system stores the details of the Police Station, Name of the official informed about Medical Legal Case.
4. **Patient Shifting**: This feature of the hospital management system makes it easier to move patients between hospital rooms. With this facility patient's actual position can be updated on line so that the internal functions such as billing,

investigations, and surgery are planned. The position of the patient is very important since all the charges like surgery, procedures, and investigations are related to room category.[16]

5. **Deposits, Advances, Refunds, Discounts and Concessions**: The Hospital Management System's function simplifies all patient financial interactions. Function is crucial in recovering payments from patients periodically throughout the stay. The patient's advances depend on the admittance type, and the system asks the patient's category. To carry out recovery planning, the ratio between interim bills and advances is also maintained. Deposits and advances made at the billing or cash counter are immediately credited to the appropriate accounts. Refund instances are taken into consideration for excessive patient advances.

This transaction is approved by the account's official, after which the refund is processed. The ratio comparison between the interim bill and the company' authority letter amount is examined in the case of Company Category Patients to determine the next course of action. If the patient is to receive a discount, the authorized person approves the sum and processes the discount. The administrator has the flexibility to alter the discount categories. This makes it simple to maintain tabs on the offers and savings. The primary outputs or reports produced by the hospital information system are as follows:

- **Patient List – Admitted or Discharged**: This report provides details on patients who were either hospitalized or discharged during a specific time frame. This makes it easier for management to understand the ratio of admissions to discharges.

- **Bed occupancy Reports:** This report provides data on the number of beds occupied at any given moment per room category.
- **Ward Allocation Reports:** This report provides patient tracking information for rooms that were allotted.
- **Interim Bill and Advance Report:** This report compares the patient's partial payment of an interim bill or advance to the total amount due.
- **Admission and Discharge Register:** The system keeps a register of admissions and discharges. This report provides information on patient admissions and discharges for a given time frame.
- **Consultant wise patients:** This report enables informed patients to identify the referring or overseeing physician at any time.
- **Appointment List:** The system keeps track of the consulting appointments.
  - Completed the listed operation.
  - A report on patient follow-up
  - Canters for diagnosis
  - The patient's investigation and procedure records are accessible through this module.

6. **Automated Clinical Laboratory Systems & Radiology Information System:** The Laboratory System for Pathology, Radiology, Cardiology, Neurology, and Chest Medicine is covered by this hospital information system function. The doctors' prescriptions are sent to the appropriate Diagnostic Centers via the billing system.[16]

- **Pathology:** The laboratory module begins by obtaining online requests from physicians. Laboratory personnel can also generate requests. This facilitates

investigations for referral patients. Tests are grouped under various sections and sample type (specimen). Based on the request the user can input the sample and generate the sample number. Results can be inputted based on the sample type. Results can be inputted either to one test or multiple tests. If the test result requires approval, the supervisor has to approve the result. Test results are available to concerned doctors. Test report can be made confidential. Tests can be performed only after the billing is done. This rule is exempted when the case is declared as Urgent.

- Integration of tests ordered from clinical modules
- Thorough online laboratory reports; Fast entry of results
- Ability for doctors to view results online at any time and from any location
- Up-to-date request status
- Availability of templates for test result input

➢ The radiology module offers X-ray, scanning, ultrasound, and other services. Scheduling of Radiology resources is possible. The system stores all the result details of various tests and makes a Report based on the Test Results. These Tests are carried out both for Inpatient and Outpatient. The system stores all the details (like patient number, Test Report like X-Ray, scanning details) and for each scan the system generates a unique number for the image. Investigations can be done only after the billing is done. This rule is exempted when the case is declared as Urgent.

- CT Scanning: Direct CT Scanned Image Capture, Simple Reporting Facility
- Easy reporting for MRI
- X-Rays: Direct X-Ray picture capture
- Reporting on sonography
- Image capture
- Prescription Discharge Card; Electro Cardio Gram Notes
- Electro Mammo Gram Reporting

➢ **Blood Bank:** The legal and other requirements for operating blood banks were taken into consideration when developing this module. It functions as an online interactive system and goes into information about blood transfusion facilities and the contributing laboratories. Additionally, it creates records for internal business operations and law.

Functions

- Donor's data entry: Donor information, including name, address, phone number, and blood type, is entered into the system by donors.
- The information can be printed as needed. You can print a mailing list for correspondence using the donor data that is currently available.
- Entry of Investigation Data
- According to Blood Bank regulations, the system stores information on various tests.
- Keeps track of test data

- Test findings relevant to HIV and HB are maintained in the system together with other data needed for Blood Bank records.
- Aids in the administration of the blood units at the component level.
- Keeps track of the components' and whole blood's distribution and disposal
- Indicates component properties and expiration dates

Reports

- Donor registration in accordance with the regulations of the food and drug administration
- Report of an Investigation
- Blood Problems Register
- Donors' demographic information[16]

2.2.21 Role of Database in Hospital Information System

The Hospital Information System's database is its beating center. It is a neatly written record that includes the patient's name, medical history, physical examination results, lab test results, treatment, surgical operation reports, and hospital stay. When complete, the record should have the information necessary to support the findings of the investigations, the diagnosis, the therapy, the length of the stay, and the recommended course of action. It then turns into a tool:

- To facilitate communication between doctors, nurses, and other allied health care providers.

- To ensure continuity of patient care.
- To support medical research and education.
- To offer information for the quality review of patient care.
- To protect the doctor, patient, and hospital legally.
- The usefulness of the hospital information system is ruined if an accurate, timely, and complete database is not maintained.

Patients, doctors, nurses, educators, students, hospitals, research teams, and local, national, and worldwide organizations all find value in medical records.

2.2.22 Need of Networking in Hospital Information System

With new applications that enhance patient care and reduce skyrocketing healthcare costs, networking is crucial to hospital information systems. However, the network is becoming a must rather than an option because of the quick changes in next-generation wired and wireless healthcare applications. It is becoming more and more important for providers of hospital information systems to have an infrastructure that can be optimized for these cutting-edge applications. The need for network upgrades to create a more resilient, higher-performing, and secure network infrastructure is driven by applications like electronic medical records, wireless monitoring, and the growing usage of handheld devices. This infrastructure is essential for lowering staff wait times, enabling staff and patient mobility, tracking equipment, and deeper data system integration. Hospital information system providers are still expected to pay for network expansion as more devices are connected via the wired and wireless networks despite the requirement to minimize costs. Hospitals discover that hospital information systems exceed performance and cost expectations while providing a more secure and flexible

network infrastructure that can scale to meet increasing connectivity demands, even though higher performance and lower total cost of ownership may be incompatible goals.[16] Hospital network topologies can differ greatly in complexity and scope depending on the size and role of the institution. Although the basic design of a hospital network is similar to the architecture of other campus networks, it now takes a lot more planning and strategy than it did in the past to adapt to the dynamic changes in improved patient care and cost control. In order to accommodate a variety of medical devices and applications, such as wireless patient monitoring, handheld devices, collaboration, and electronic medical records, hospital information system networks must be more adaptable. An effective network is no longer a luxury; it is a necessity as more wired and wireless services are used and the network must support patient care.[16]

2.3 Review of Empirical Studies

2.3.1 Patient Exit Interview Results on the Factors Affecting Patients' Satisfaction at Different Levels of Bangladeshi Healthcare Facilities

There is a dearth of recent research on Bangladesh's healthcare system's patient satisfaction levels and the elements that affect them. We set out to quantify patient happiness across various types and levels of healthcare institutions and to identify the variables that affect it.[17] patients who were enrolled in particular medical facilities in Rajshahi and Sylhet, two administrative regions of Bangladesh, underwent patient

departure interviews. An electronic structured questionnaire was used to gather data on healthcare experience and satisfaction with care received. A 10 point scale was used to collect data on "overall satisfaction with healthcare," which was then dichotomized using the median-split.[17]We used simple and multivariate binomial logistic regressions to determine the factors that significantly influence patient satisfaction. According to our research, 63.2% of the participants were happy with the healthcare they received. Patients using private facilities reported feeling the most satisfied (73%) while those using primary care facilities reported feeling the least satisfied (52%) Patients' happiness was substantially correlated with elements like convenient opening hours, asking pertinent questions of the physicians, facility cleanliness, and privacy settings. The best predictors of patients' happiness were their level of satisfaction with the cleanliness of the facility (multivariable or 4.30; 95% CI: 3.29-5.62) and the privacy settings (multivariable or 1.68; 95% CI: 1.28-2.21). In conclusion, a sizable proportion of Bangladeshi patients are dissatisfied with the care they have gotten. Focusing on enhancing clinician interpersonal skills, privacy settings, and facility hygiene might boost patients' happiness.[17]

Information systems used in hospitals are no exception to the rule that new innovations can become essential medicines. Hospitals and clinics access much more data through specific patient medical records and can retrieve this data more quickly than ever before. Medical authorities now have more access thanks to the development of personal computers and their integration with medical science, and patients now receive better care and services.[18] The use of hospital information systems has many benefits. Doctors and specialists can more successfully treat

patients by using personal computers, the Internet, and various therapeutic databases. The data obtained via the use of hospital information systems provides quantifiable information that has a significant impact on how medicine is used, medical treatments are carried out, and the healing process is carried out. Additionally, it enables medical facilities to keep better track of patients' historical records, allowing for quicker future treatment. The use of hospital information systems has created opportunities for clinics to improve their current processes and make them more efficient so that they can treat patients more effectively.[19]

2.3.2 Turkish Health Sector Development and Hospital Management Information Systems

Information systems are crucial to the creation, exchange, storage, and transmission of information across a variety of industries. In the healthcare industry, hospital management information systems actively address the demands of doctors, administrators, and patients in institutional operations. Data collection is ensured by hospital management information systems to be accurate, comprehensive, and interconnected. In the 1960s, the first hospital administration information systems were implemented.[20] These systems fall into two categories: integrated systems and modular systems. Hospital general information systems, clinical information systems, management information systems, and database management systems are the different types of integrated information systems.

Another type of hospital management information systems includes staff management, financial management, materials and facility management, resource usage and programming, and material and facility management. Hospital management

information systems provide a variety of functions, including enhancing internal communication channels, cutting expenses, and securely storing data in a digital setting.[20] The World Bank-funded Health Information Systems Project, carried out by the Ministry of Health in 1990, served as the foundation for the development of hospital information management systems in Turkey. After 2000 years, research carried out under the direction and supervision of the Ministry of Health have shown a growing prevalence of hospital information systems use in healthcare facilities.[20]

2.4 Theoretical Framework / Conceptual Framework

2.4.1 Health Management Information System Based on Patient Service Quality

An important tool for improving planning and management in healthcare institutions is a health management information system (HMIS). The monitoring of service delivery in terms of accessibility, coverage, spending, human resources, illness profiles, and health outcomes is possible with any standard health management information system. Researchers have frequently advocated the adoption of a health management information system to help the performance assessment of health systems and to remedy shortcomings and service gaps.[21] The issue is whether using a traditional health management information system to monitor various aspects of the quality of care would result in increased patient satisfaction with healthcare facilities in particular and the standard of care given generally.

This article is based on a literature review that includes certain regional and international periodicals in addition to local ones. A few World Bank and World Health Organization papers on health management information systems and quality

of care were also consulted. Articles from developing and less developed nations were also included to assess the best practices. In order to mention specific information, official records of the Pakistani government were also taken into consideration. Our goal is to determine the value of health management information system and how it may be used to monitor the standard of care in addition to its usual usage. The goal of the health management information system would then be to assess the quality of the services provided at various levels of healthcare in addition to recording data on health incidents

2.4.2 Application of a Health Management Information System Dimensions of Quality of Service in the Health Care Sector

People's personal experiences have been found to increase the quality of services and, in turn, their use of them because they have an influence on how satisfied they are with the treatment they receive.[22] There are many ways to gauge the quality of healthcare, including availability, pricing, acceptability of accommodations, and physical accessibility. Two studies that primarily focused on family planning services demonstrate additional aspects of care quality, such as the right to information, the right to a choice, the provider's technical competence, inter-personal communication, follow-up services, and an appropriate constellation of services in the same setting.

Benefits of Adapting the Health Management Information System

- **Benefits for the Community:** Increased public knowledge will lead to improvements in healthcare standards, which will boost patient happiness. This will

encourage proper use of the health services, which will be tailored to the specific requirements and goals of the community.

➢ **Benefits for Health Providers:** After clinicians received training on patient-friendly services, according to a survey conducted in Burkina Faso, patients felt that treatments were more focused on meeting their requirements. The performance of the provider will be improved by training in interpersonal communication, gender sensitization, and confidence-building techniques. Providers could be assisted in addressing their own attitudes and prejudices through the use of several tested and approved training curricula created to improve the abilities of health practitioners. The information produced by the health management information system may be useful to the providers. By adopting a more sympathetic client-centered approach, changing their attitude, and providing a convivial environment at health service outlets based on the feedback of their clients, it ➢ **Benefits for Policy-Makers/Local Government:** Such a health management information system could serve as a decision-making model in situations where the usage of quality indicators is frequently ineffective.[23] The local government authorities' focus might be directed toward enhancing the living and working environments for health professionals and developing capacity-building plans for them in order to inspire a sense of enthusiasm and spirit in serving the underprivileged population could help them reorient their service. This would eventually support the existing health system reforms in Pakistan, which aim to completely renovate the system to meet the standards of equity, accountability, and good governance.

- **Benefits for Health System Development:** It is crucial for the various sectors to plan and collaborate in order to enhance the population's health status given the complexity of the health care delivery system. A health system tailored to the needs of the local people will eventually be developed using data obtained from such an information system, which will aid in understanding population views and the variables impacting the consumption of health services. As a result, increased service quality and coverage should be the goal.

2.4.3 Information Technology Applications in Healthcare Management

The majority of the information technology (IT) applications that we are used to today have evolved thanks to the internet and Web 2.0. Had we not anticipated the technological breakthroughs that are already a part of our life just 20 years ago? The social order and conventions of the world are being reshaped and redefined by technological innovation, which is riding the wave of disruptive technologies over the past 25 years. Our lives revolve around the medical area, which is also the one we care about the most. This field has experienced significant changes recently.

Since the turn of the century, the medical field has seen significant change. Not only have medical procedures improved, but also the management and flow of medical data. Modern data management and transfer methods have improved the ability to diagnose diseases and have played a crucial role in national health planning and effective record keeping. In particular, the capabilities of database management, which gave rise to the Healthcare Information Systems, have significantly changed the medical profession (HIS). Using Big Data Analytics techniques, medical data collected from various

institutions can now be mined and analyzed in real time. Information technology's significance, advantages, and contribution to the field of medical science:

2.4.3.1 Artificial Intelligence and Robotics in Healthcare

Artificial intelligence (AI) is a branch of computer science with origins in, among other things, management, psychology, philosophy, linguistics, and logic (mathematics). Games, auto components, heavy equipment, and numerous medical instruments all use a lot of AI-dominant tools and applications. The linked list data structure, graphical user interfaces and the computer mouse, rapid development environments, symbolic, functional, dynamic, and object-oriented programming are just a few of the activities used by many programs that are developed with the aid of artificial intelligence to carry out specific tasks.[1] Here are some additional instances. Pharmaceutical discoveries can take many years, often even longer than a decade, and require significant clinical trials in the real world. This process can cost billions of dollars and calls for a sizable quantity of resources. It is desirable to speed up this laborious process to reduce the cost of healthcare in order to save lives and money. A tool using artificial intelligence was utilized to scan existing medications that could be altered to combat the disease during the Ebola outbreak in various West African countries.[1] This demonstrated the seriousness of the situation.

- **Digital Consultation**

These days, medical consultation can take place without the direct involvement of a doctor thanks to an online sickness database. The benefits of these consultations come from the fact that the symptoms provided by patients online are matched with those of about ten thousand known diseases[24] whereas doctors can only match the symptoms

against a small subset of the known diseases with which they are familiar without the assistance of an information technology database. Similar to real nursing, virtual nursing is also offered for parents of sick children, Boston Children Hospital has created another application that offers fundamental health information and guidance.

- **Medic Robots**

Robots have been employed in numerous scientific and social disciplines since their introduction in the 1960s. They are widely used in industries like the fabrication of nuclear weapons, cars, and space exploration. In contrast, the application of this technology in the field of medical science has been fairly sluggish. However, many sophisticated medical procedures are increasingly being assisted by or performed by robots, giving rise to the name "robotic surgery." The use of robots in healthcare administration has a lot of benefits. For instance, the time and money involved in creating medications through clinical trials might be considerable. The world might alter if this procedure could be made more inexpensive and quick. In such trials, robots may be essential. Robots are also very useful for medical training that involves simulation.

In comparison to traditional laparoscopic techniques, using robots during abdominal surgery is novel and has the potential to overcome the current disadvantages and weaknesses. The most promising operations are those that use a robot to provide a laparoscopic approach where open surgery is typically necessary.[1] Similarly, robotic surgery for conditions relating to gynecology can also be quite successful. With a typical laparoscopy, the surgeon would only have a small amount of freedom and a two-dimensional perspective, whereas a robotic system would offer a three-dimensional view with natural motion and allow for a larger amount of freedom.

Another procedure where robots are quite effective is prostatic surgery, which is complicated in terms of the degree of freedom.

Hospitals and clinics all around the world face a serious problem with nosocomial infections. When there are significant and anxious crowds of people, like as during the Hajj, this gets worse. Environments must be cleaned thoroughly and frequently to maintain them clear of harmful viruses and germs. However, some viruses, like as Ebola and the coronavirus that causes Middle ear respiratory syndrome, are extremely contagious and cannot be removed by humans without the use of expensive, possibly ineffective protective gear.

Chlorine is a good cleaning agent for hospitals. This procedure does have a number of disadvantages, including a high risk of infection for the cleaners. In order to clean the space, a comprehensive strategy was put into place in hospitals in the United States.[25] However, some of the employed robots may need a human to move them into the contaminated space because they are not motorized, which increases the risk of human infection. The best way to get rid of fatal infections like the coronavirus that causes middle ear respiratory syndrome and Ebola is unknown.

However, ultraviolet light can successfully eradicate beta Coronaviruses, one of the four strands of Middle ear respiratory syndromes coronavirus. A remotely controllable robot that can move forward, backward, and sideways and can clean itself is required to eradicate such a deadly and spreading infection.[26]

2.4.3.2 Virtual, Augmented and Mixed Reality Simulations

Games and movies have long used the Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) concepts and related technologies, which are all based on

image processing and heavily rely on artificial intelligence. The fields of medicine have long benefited significantly from the tools and technologies of virtual reality, augmented reality, and mixed reality. Robotic surgery has made use of virtual reality to create simulators that train surgeons in a stress-free setting using accurate models and surgical simulation, without jeopardizing patient safety or operating time. You can find a description of augmented reality and virtual reality technologies, along with their benefits and drawbacks. Applications of virtual reality, augmented reality, and mixed reality can also be highly helpful in urology, which provides an explanation of how the technology can be quite valuable in medical and healthcare education .[3]

2.4.3.3 Internet of Medical of Things and Big Data Analytics

An emerging technology is the internet of things. Every day, the amount of data in organizations—including hospitals, clinics, and insurance firms increases. Advanced data processing methods are coupled to create what is now referred to as the "Big Data Analytics" in order to process this vast amount of data.

- **Internet of Medical Things**

A broad paradigm is the "internet of things." The Medical Internet of Things is also known as the Internet of Medical Things when discussing a medical context. You may read about the internet of medical things.[1] The primary goal of the internet of things is to enable ubiquitous access to a wide range of machines and devices through service providers in a variety of fields, including location-based services (LBS), smart homes, smart cities, and e-Health.[27] These equipment, gadgets, and machinery are used by location-based service providers in many different fields. A few others include tools for electronic learning and business, smart homes, cities, and streets, components of

omnipresent health systems, and so on. The total is growing rapidly and might reach fifty billions by 2020.[28]

- **Big Medical Data Analytics**

The amount of data in an organization is rapidly expanding. From their operations, certain organizations have accumulated substantial amounts. In order to assist organizations, plan and make more informed decisions, organizational data needs to be mined and analyzed on a regular basis to identify hidden patterns, unknown connections, market trends, consumers, patients, and treatment records. Big data mining and analysis uncover the enormous reservoir of insight concealed in corporate data, make information clear and useful much more frequently, and improve performance. All of this help to deliver greater value in effective decision-making. When data volume increases, it cannot be managed manually. As a result, big data companies frequently use robotic arms to load and unload data.

In many hospitals, clinics, and insurance firms, medical data is also expanding quickly. The mining and analysis of healthcare data are much more important since they connect to societal well-being. To plan and manage national and international health programs, as well as to find answers to questions about numerous chronic diseases, data-centric research is very desirable. Benefits that big data analytics could have on healthcare.[29]

Authors have outlined five specific tactics for using big data successfully. Which are:

- Implementing big data governance
- Creating a culture of information sharing
- Educating key employees on the usage of big data analytics
- Incorporating cloud computing into the organization's big data analytics, and
- Coming up with fresh business ideas are just a few of the objectives.

Big data analytics are needed to provide and improve patient-centric services, identify diseases before they spread, monitor the caliber of hospital services, enhance treatment options, and offer high-quality medical education, according to a survey of the field in healthcare and government.[1]

2.4.3.4 Data Centric Issues in Healthcare

Data is constantly accompanied with security and privacy concerns. Organizations that hold data are responsible for protecting privacy and security. These problems have a larger importance and pronouncement when relating to medical data. Medical information can be extremely delicate and be related to a patient's life or death. Medical statistics are frequently linked to socio-political issues. It is well knowledge that in 1947, India was split into two nations, giving rise to Pakistan. Larry Collins and Dominique Lapierre contend that the partition of India could have been avoided if "the most closely guarded secret in India" had come to light. Mohammad Ali Jinnah, the head of the Pakistan campaign, was extraordinarily astute and cunning. Jinnah had TB, which was killing him slowly but surely.[30]

2.4.4 Electronic Health Records (HER)

The Ministry of Health and Family Welfare's Circular on Electronic Health Records states that electronic health records can enhance care by making patient health information available when and where it is required. Too frequently, care is delayed because the chart is in one location but is required in another. Clinicians can securely

access the data they need to provide effective and high-quality care thanks to electronic health records:

- When and when a patient's health information is required, it can be made available through electronic health records.
- Too frequently, however, care must be delayed because the chart is located in one location but is required in another.
- Clinicians can securely access the data they need to provide effective and high- quality care thanks to electronic health records.
- Electronic health records can compile all of a patient's medical data to promote more coordinated treatment and better medical decisions.
- Electronic health records can help patients receive better follow-up information.

For instance, following a clinical visit or hospital stay, instructions and information can be easily provided to the patient, and reminders for other follow- up care can be sent to the patient conveniently or even automatically.

2.4.4.1 Benefits and Challenges of using Electronic Health Records

Using electronic health record systems is not without its challenges, but its advantages far outweigh these drawbacks, making their use justified.[31] Their study demonstrated the advantages of process uniformity, ease and agility in information recovery, and improved control over prescriptions, supplies, and procedures. Additionally, the hospitals' criteria were followed with improved consistency. According to research, chronic patients benefit more from programs that offer online access to personal records. Additionally, it was discovered that patients wanted medical records to be integrated more. Patients wanted integrated records that would enable them to

evaluate prescriptions, laboratory findings, and other relevant statistics and a chart history. This involved researching numerous vendor applications and comprehending the various platforms and functions.[32]

2.4.4.2 A meaningful Use of the Electronic Health Records was Direct Involvement of Patients

The electronic health records provide individuals more control over their care and support it in between appointments. According to the study, there should be national payment providers to accommodate all access methods across different insurance.[32] Numerous paper documents and x-ray films can be replaced with electronic health records. For less complicated issues, they could cut back on in-person appointments. The usage of paper, transportation fuel, water, and some harmful chemicals may all be reduced, which would assist to lessen the environmental imprint. They discovered that although there were many advantages to using electronic health data over paper ones—for example, that paper records would deteriorate over time due to water damage, termites, or fire—there was still only a limited uptake of these records. There was a strong requirement for interoperability, technical conformance, and policy compliance among diverse networks in order to achieve the aim of making electronic medical records available across the nation. . It also called for providers to alter their cultural and behavioral practices. The amount of money needed was enormous.

Despite all of these challenges, implementing electronic medical records has several advantages. A motivated and dedicated staff can have a significant impact. It is important to take into account that different stakeholders have varying levels of expectations, as well as the developers' passion, clients' needs and expectations, and

diverse levels of resistance.[33] Patient safety is of the utmost importance, and because electronic health records, acute care clinicians spend a lot of time entering patient care information into electronic health records.[32]

The clinical professionals regularly updated these records. Additionally, they discovered that the utilization of the components of their electronic health records was not well known. The researchers believed that additional research was required to better understand the effects of simplifying the electronic health record's components on how physicians would use them and on the end users' interaction with the system. Electronic health records have been widely used because of their numerous advantages, but interoperability hasn't been reached yet because it requires network technical and policy conformity. They looked into the connection between hospital size and hiring in information technology. They discovered that when compared to larger hospitals, smaller hospitals spend significantly more on information technology. It was unclear what was spent on outsourcing and information technology. They believed that further research should be done on hospital mergers and their impact on them, including a comparison of information technology before and after merging. They also believed that more research was required to determine the optimal size for each department, including the personnel responsible for healthcare information technology in hospitals, as well as the necessity to educate and train the workforce. Her research and implementation of the Integrated Electronic Health Record System for keeping a health card were her key areas of interest. This was discovered to lessen medical errors and offer a connection to medical information and decision support systems. Different meters, including blood pressure, pulse, and

glucose oximeters, can be used to record readings electronically, which can subsequently be sent to a computer and eventually to a health card.

The adoption of electronic health records was greatly aided by an incentive, despite the initial high expenditures for software, hardware, and training. There was a need for additional research on longitudinal growth and interoperability because the acceptance and use of electronic health records appeared to increase over time.

The patients will of course be responsible for paying for this enhanced service because the investments are substantial and the payback period is at least three years. Electronic health records are digital files that contain a patient's whole medical history, thus it's critical that there be adequate security to prevent data misuse. Best practices must be followed in order to lower the number of medical errors, and appropriate and effective technology must be put into place in order to provide patients with high-quality healthcare and make the system more effective. When the effects of implementing electronic health records result in a balance between technological, organizational, and human elements, business value is increased. This demonstrated how vital it is to consider how information technology is embraced.

Constantly utilized to provide therapy as well as support for decision-making in treatment from software at times, there can be no inaccuracies in these records.[34] Electronic health records first appear to need a substantial expenditure, but after some time, the benefits outweigh this and provide for savings. It was discovered that practical concerns were necessary even in nations where the penetration of electronic health records was higher due to the limited success that was attained. Since it was a

national endeavor on the part of the medical institutions, it required both public and governmental support.[35]

According to a survey, private practitioners believe there should be greater human-technology interaction, therefore system developers should consider this while planning and creating their systems. According to research, electronic medical record sharing should be built to match the unique demands, capacities, and constraints of end users as well as the essential features it is meant to enable in order to minimize unfavorable outcomes. It was also discovered that it was time for information to be electronically fed into the system just once, and that it should be accessible at all times when the patient is receiving care. There shouldn't be any extraneous information in the reports.[36] Only the information needed, not the complete report, should be made available when reports are requested by clinicians during treatment. There should be an option to import the data and format it to the end user's specifications. In his examination of the literature, he identified four areas in the health care systems. He first talked about the fundamental requirements needed to make consumer healthcare services appealing to the relevant parties. The second was to find programs that could give patients information and suggestions for how to make the situation better. Devices that allow consumer health care to operate pervasively so that patient benefits are maximized and costs can be reduced were represented by the third. Maintaining personal health records allowed for storage and organization of the records with the aid of other parties. This was the fourth stream. According to this study, consumer health care services that offer safe, user-friendly services and give patients access to health information have a lot of promise. Additionally, the records expand the scope for connectivity.[37]

Despite the benefits of electronic medical records, their adoption rate is still low, and doctors are less willing to use them. The usage of electronic medical records needed to be accelerated. To do this, educational initiatives were needed to highlight the benefits of electronic medical records and further alter physicians' attitudes of them. Patient safety may benefit from the adoption of electronic medical records, but this will depend on how well doctors are able to use the systems once they have access to them.[38]

Resistance to change is something that is typically observed. Resistance existed when switching from paper-based records to electronic health records. According to the study, it's critical to include the employees, provide them with the necessary training, inform them of its importance, and encourage them to practice utilizing it. Before choosing a vendor, much research must be conducted, and a reasonable budget must then be created for the full implementation process. The right money should be established because the investment is substantial. For students to pursue a profession in health information technology, there should be a suitable curriculum and courses. Professionals with a background in health information technology will be in demand and able to find work in this field as the country's healthcare industry develops. The significance of information governance in the improvement of electronic health records was highlighted. It was discovered that Hawaii Pacific Health understood the importance of information as a source for high-quality care. An information governance scheme was discovered to be essential for maximizing.[32]

The institution would be able to deliver care much more effectively and more affordably with the use of electronic health records and other information systems,

which would provide accurate and usable data. Success would be ensured by involving a variety of crucial owners, such as the clinical, legal, compliance, information technology, finance, and other parties engaged. In order to adopt electronic health records, a study on the manpower requirements in hospitals.

2.4.4.3 The Impacts of Information System on Healthcare Management and Diagnostic Services

The information age has significantly impacted many facets of medical and health care, along with advancements in information and communication technologies. The chain of medical services and administrative procedures inside medical services institutions saw a significant transformation as a result of the use of information technology applications. Among these effects are:

- The usage patterns for medical services
- The interaction between patients and medical service providers

The following are the areas where information technology is being used in the field of health care: expanding the scope and geography of where health care services are provided; improving client-provider communication; accelerating the efficiency and speed of disease diagnosis; and protecting customer information.[39] Electronic health information systems (EHIS) and information technology systems have demonstrated that both are useful in increasing the effectiveness of disease detection and treatment around the globe.

Electronic health information systems, which may store health data and examine it when needed from specialists, such as the outcomes of medical studies and treatments,

can be thought of as the digital equivalent of the paper patient chart. Another way to put it is that these systems are made to manage time by only allowing authorized users to access patient records. The technical tools and means play a significant role in the process of integrating the various components and in the coordination of operations. With regards to Healthcare Management and Diagnostic Services affect by Information Systems. It is becoming more and more obvious that information and communication technology (ICT) has a leadership position in data integration, which enables the rapid transfer of information. This is due to the rapid development of information computing, the introduction of the Internet, and the increase in integration with the mobile Internet, cloud computing, data science, and the internet of things.[40] Information that is shared over networks and accessible for legitimate purposes can be characterized as information that is shared over networks and can be easily exchanged between systems in the form of voice, text, or even visual display via optical fibers.[41] E-health systems must be used for operations to be effective and integrated. Since the E-Health Information System can simplify the flow of data and information between programs, it can be compared to three interconnected electronic records (Tier.Net). To enhance patient care and scientific research, Tier.Net is used to store, manage, and distribute electronic patient medical and health records and information.[42]

This review's primary goal is to provide an overview of the literature on the characteristics of electronic health information systems in order to enhance disease prognosis and create therapeutic approaches based on the environment of information systems. Medical care can now be categorized as a modern trend alongside

information technology because it plays a pioneering and distinguished role in advancing hospital operations and administrative processes like locating medical consultations, finding out the results of medical exams, and accepting payments online. The degree of information technology, to some extent, enables several companies to collaborate and share a single database in order to collect the most accurate data possible, increasing the effectiveness of healthcare services. In light of this, the literature on information systems and their integration with the health sector was evaluated in this research.[42]

2.4.4.4 Characteristics of Electronic Health Information Systems

Due to its many advantages, such as improving healthcare service delivery quality, lowering healthcare costs, and lowering the number of unexpected hazards, optimizing the performance of electronic health information systems is crucial for the delivery of health services. The security of the data included in the electronic health records may be threatened by the misuse of the electronic health records system, which could result in inaccuracies relating to the electronic health records. Serious errors could result from such missteps, endangering the patient's safety and jeopardizing the caliber of medical care. The following are important factors to take into account for an EHIS function to run smoothly:

- The effectiveness of electronic health information system functions is mostly governed by patient diagnosis management
- Clinical care management, pharmacy management, laboratory management, radiology information system management, and billing system. [43]

2.4.4.5 Realizing the Impacts of Health Sector Registration in the Big Era

Because so many industries are now interested in big data, modern management decisions are now predominantly driven by data. Big data possesses three traits:

- Size
- Speed
- Miscellaneous

A license to use electronic health records was recently awarded by the United State Department of Health and Human Services (HHS). It is possible to show medical materials that were previously in paper form and to work on integrating them broadly into a variety of electronic equipment and devices. A massive amount of medical data, including clinical or laboratory, personal health management / social affairs network, medical expenses or medical insurance fund data, etc., has been produced as a result of the rapid spread of medical and health information systems and all of their diagnostic tools[45] Accessibility, quality, and cost are the three key factors that determine how effective healthcare systems are.

Costs must be reduced while keeping or improving the level of quality of offered medical services in order to expand the health sector's capacity.[44] Making the most of the critical information that is obscured by the enormous volume of medical data is the quickest and most economical approach to accomplish this. The idea of spreading and exchanging information throughout all institutions is made possible by the creation of fresh, arguably unique approaches enabled by modern information and communication technology.

Large data warehouses, like those containing patient records, test results, medical photographs, etc., do well in hospitals and medical facilities. In order to save medical expenditures, improve the dependability and effectiveness of these systems, and support patients, it is crucial to incorporate information into medical information systems as a first step by receiving the best care which include:

- Hospital Information Systems (HIS)
- Electronic Health Records (EHR)
- Laboratory Information Systems (LIS)
- Radiology Information Systems (RIS)
- Image Archiving and Communication Systems are all common components of Medical Information Systems (IACS)

In a highly decentralized network, these groups with various functions are only loosely connected, necessitating IS integration to achieve integrated planning. Despite data inflation, data is fragmented, dispersed across systems in disparate forms, and stored on remote islands[45]

The business integration between science, technology, and medicine has also led to the emergence of applications for data in new and contemporary formats that are distinguished by a great deal of flexibility and protection. As a result, society is currently characterized as a very dynamic digital society. Complex data from sources like electronic medical records, genetic databases, social media, and wireless mobile medical devices will be able to be integrated thanks to advanced information technologies like cloud computing, data analytics, and the Internet of Things.

To overcome the information isolation barrier and work to gradually integrate information as a service for health care, various medical institutions can collaborate on exchanging and sharing medical information, and hospitals' internal departments can manage this information in the best way possible. This will improve the entire medical system. A crucial component of the healthcare delivery system is picture archiving and communication systems. These systems, which allow medical organizations to simply collect all medical images in the electronic copy and work on storing, presenting, and sharing them, are distinguished by electronic archiving and transferring images with all of their components. Through the exchange of images like x-rays, MRIs, and CT scans, medical facilities and radiologists can break through the informational silos. As a result, the patient's diagnosis and therapy are more effective and of higher quality.[42]

2.4.4.6 Information Technology Uses in the Healthcare Industry and their Effects

Health information system operations face a number of environmental difficulties that could obstruct effective implementation and growth procedures. The difficulty of intervention, the lack of agreement on technical opinions, the lack of human resources, inadequate leadership abilities, a lack of funding, employee resistance, inadequate management, a lack of organizational capacity, and a lack of awareness of the application of techniques are a few of these issues. The evaluation of electronic health information systems will pay particular attention to the interaction between information technology and its intended users in a particular setting, as well as hardware and software. Understanding computer technology is essential for evaluating these

systems, but it's also important to comprehend social processes, the behavioral implications of those processes, and how technology affects those processes. The effectiveness of information technology depends on a variety of factors, including how well it integrates with clinical workflow, how well it is brought into the organization, how well the information obtained from these systems is used, and how well users are encouraged to use it.[42]

- **Difficulty to Intervene and Technical Lack of Consensus**

The inability to intervene and the lack of technical agreement are two of the most challenging problems facing the electronic health information system because they have a significant impact on the process of implementation in general and the technical problems in particular.

- **Scarcity of Human Resources**

An actual barrier to doing duties for an electronic health information system is a lack of human resources. A factor that affects the capacity of human resources is the movement of professional cadres to better-paying non-governmental organizations or institutions, especially when migration takes place outside of the home nation.

- **Poor Leadership Skills**

Poor management and inadequate electronic health system monitoring result from unsupervised administrative processes with numerous inconsistent procedures, which is a significant concern, especially in nations with limited capacities. Its causes include the delay in releasing health information and the absence of input from experts or managers.

- **Lack of Funding**

The creation of an Environmental Health Information System (EHIS) will be expensive and require ongoing funding for the purchase of hardware and software as well as for the upkeep, training, and ongoing development of human resources. The deployment of the Environmental Health Information System is further hampered by unstable electrical power sources and a lack of information technology tools.

- **Insufficient Capacity of Health Systems**

Regulations are always changing, which has a negative impact on the healthcare system as a whole and makes it more difficult to apply the Environmental Health Information System. Concerns concerning the health system's expansion in South Africa, where the country's information technology environment was fragile and its capacity to execute communications was limited, were underlined. By integrating an electronic records management system, in particular, the E-Health Strategy was able to identify obstacles to enhancing the public health system in South Africa. The biggest challenges are inequality, bureaucracy, and the remedial system.

- **Weak Application of Diffusion Techniques**

Environmental Health Information System implementation is hindered by a lack of knowledge of information technology.[46] As an important barrier, there has been a decline in consumers of information technology, for instance, in Iran. Low morale for utilizing the system and weak computer literacy abilities are two factors that frequently have a negative impact on implementation.

- **Personnel Resistance**

Due to doctors' opposition to using the system and preference for the paper approach, a study done in South Africa found that there is a genuine challenge in deploying environmental health information systems. Negative staff attitudes toward the rules and a lack of openness were two major barriers to the successful adoption of the Environmental Health Information System in hospitals in Iran, as well. Despite the fact that Environmental Health Information System in South Africa had all the necessary information, hospital staff exhibited resistance to using the system for prescribing medications and treating patients, which resulted in a lack of response.[44]

2.4.4.7 Consequences

- It is quick to provide information technology to the health sectors. Applying technology and immediately measuring the results is insufficient! Both users and medical experts must devote a lot of effort to understanding new equipment' proper use and reaping their benefits. For example, a study assessing the quality of nursing documents found that after the introduction of information technology, there emerged significant changes in several quality-related indicators after 3 and 9 months of use. Changes or modifications to the devices or programs may have been made for improvement. He might have to wait more than nine months in some circumstances for the verdict.
- Even after the application time has ended, the evaluation may change. A change in work organization or personnel, for instance, could have an impact on how information technology is used. As a result, there is a chance that the environment will have altered since the study's inception, which could make the findings

irrelevant and out of date. As a result, the evaluation's findings are heavily influenced by the time frame of the study.

- Since many evaluation studies are only applicable to specific institutions with their own information system, each information system in our definition is distinct. For instance, it was discovered that after the introduction of the nursing documentation system, the evaluation of document quality and the acceptance of beneficiaries had varied outcomes and were not identical in many study wards due to differences in workflow, user computer proficiency, or support for the organization process for beneficiaries, among other factors.

2.4.4.8 Possible Solutions

We must describe the information technology and the surrounding environment that will be carefully examined prior to the study's launch in order to address the issue of external validity. The motivations and technique used to supply information technology, the ways it is used, and the infrastructure associated to others will all be described, in addition to programs and computers, as well as the number of users and their experiences. Information technology utilization may be impacted by computer hardware (such as data protection networks and devices) and any other factors. Documenting every change in information technology and how this device interacts with consumers is vital to address the issue. To address the issue of external validity, we must first specify the information technology and the environment that will be carefully examined prior to the study's launch. We shall not only discuss the programs and computers, but also the number of users and their experiences, the motivations

and procedures used to supply information technology, its applications, and the infrastructure associated to others. The utilization of information technology may be impacted by computer hardware (such as data protection networks and devices). It is vital to record every change in information technology and the way this device interacts with people in order to remedy the issue. Each group responded to a query pertaining to a particular stage of information technology. The initial stage of this long-term review typically includes a learning curve, along with any later adjustments to the evaluation objective. Given the complexity of the evaluation's subject, it is important to pay close attention to any unanticipated negative effects, such as those that could affect patient care quality and result in longer patient stays, greater dropout rates, or lower participation rates.[42]

2.5 Summary of the Gap in Literature review

Hospital management information system is a software that maintains a record of patients personal information when its apply to the hospital, it maintains record of action taken during the patients evaluation as well as prescription administered and examination administered. Patients who wish to be admitted to the hospital are given appointment, it creates patient record for the medical facility's emergency room, patient's consultation records and keep track of patient's medical care.

It communicates data to the e-health system and preserves a record of the permission and medication reports that were granted to the patients. It reduces the patients waiting time, it increase the drug availability, it unifying data and analytics across national health system, it reduce the medical errors, it avoid duplication, repetition, missing records and confusion.

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Chapter Three

Methodology

3.1 Study Setting

A federal teaching hospital affiliated with the University of Ibadan, University College Hospital is located in Ibadan, Nigeria. An Act of Parliament passed in August 1952 created the University College Hospital (UCH) Ibadan in response to the need for the nation and the West African Sub-Region to train medical workers and other healthcare professionals. Following a Visitation Panel to evaluate the clinical facilities for clinical postings of medical students registered for the University of London's M.B.B.S. degree in 1951, the Hospital was established. Following the creation of a Faculty of Medicine in the University College, Ibadan (now University of Ibadan) in 1948, the visiting panel, led by Dr. T.F. Hunt of the University of London, rejected the upgraded facilities offered by the Government or Native Authority Hospital at Adeoyo, Ibadan.[1]

The University College Hospital (UCH) was ideally placed in Ibadan, the first university in Nigeria's capital and at the time the biggest metropolis in West Africa. The actual construction of the hospital began in 1953 on its current location, and on November 20, 1957, it was solemnly inaugurated. The University College Hospital in Ibadan had 500 beds when it first opened. The hospital currently has 891 bed spaces, 200 exam couches, with an occupancy rate of 42 to 45%. The hospital had two clinical Departments when it opened in 1957, before the Act of Parliament (Medicine and Surgery).[1]

However, the hospital has developed to house over 65 Departments, including the first Department of Nuclear Medicine in Nigeria, which was established on April 27, 2006,

and was commissioned by the former Honorable Minister of Health, Professor Eyitayo Lambo. In the fields of clinical service, clinical research, and training of future health professionals, the Hospital and the University of Ibadan work in good synergy. The Chairman of the Provisional Council of the University College, (now University of Ibadan) was appointed as the first Chairman of the Board of Management of the University College Hospital, Ibadan, emphasizing this functional dependency from the beginning. The UCH offers postgraduate residency training programs in all specialties of internal medicine, surgery, obstetrics & gynecology, pediatrics, otorhinolaryngology, ophthalmology, anesthesia, orthopaedic surgery and traumatology, laboratory medicine, psychiatry, community medicine, family medicine, radiation, radiation oncology, and neurological surgery in addition to undergraduate medical programs (based in the College of Medicine of the University of Ibadan).

The University College Hospital also offers professional or diploma programs in the School of Health Information Management, the Environmental Health Officers Tutors Course, the Primary Health Tutors Course, the Nurse or Midwife or Public Health Nurse, Nurse Tutors Course, and the Post Registration Courses in Nursing, such as Peri-Operative Nursing and Occupational Health Nursing.

The hospital, which provides basic and secondary healthcare services, is primarily a tertiary institution with appendages of community-based outreach activities at Igbo Ora, Abedo, Okuku, Sepeteri, and Jago. The hospital has about 65 service and clinical departments and runs 96 consultative out-patient clinics a week in 50 specialty and sub-specialty disciplines. In addition to the College of Medicine, the Hospital "houses"

a Virology Research laboratory, a World Health Organization (W.H.O) Collaborating Centre in Immunology and an Institute of Advanced Medical Research and Training.[1]

3.2 Research Design

This study adopted cross sectional study design

3.3 Population of the Study

The study population consist of patients receiving treatment at out-patients clinics such as medical outpatients, surgical outpatients, Physiotherapy, family medicine, obstetrics and gynecology, pharmacy, central records, investigation unit – laboratory and radiology, payment unit and billing unit, ear, nose and throat out-patients clinic of University College Hospital, Ibadan.

3.4 Sample Size Determinant

Population of clinic section attendance of patient per day is 1,250. Making reference to idea of [2] Formula.

$$n = \frac{N}{1 + Ne^2}$$

n = Sample size = ?

N = Population of the study = 1,250

e = Margin of the error = 0.05

$$n = \frac{1,250}{1 + 1,250 \times 0.05^2}$$

$$n = \frac{1{,}250}{1 + 1{,}250 \times 0.0025}$$

$$n = \frac{1{,}250}{1 + 3.125}$$

$$n = \frac{1{,}250}{4.125}$$

$$n = 303.3$$

$$n = 300 \text{ approximately}$$

3.5 Sampling Technique

The sample size drawn from the population of patients receiving treatment from clinical departments of University College Hospital, Ibadan, Oyo State, Nigeria through the simple random sampling technique.

3.6 Description of Research Instrument

The major instrument was questionnaire, 300 questionnaires were distributed to patient receiving treatment at out-patients clinic of UCH, Ibadan. . This instrument consist of two parts. Part A: demographic information of the respondents. Part B: Influence of Hospital Management Information System (Health in a Box) on Patients' Satisfaction. The instrument was based on a 3-point scale with score (1) = Yes, (2) = No and (3) I don't know. The respondent gave opinion on the use of hospital management information system, Patients' satisfaction on waiting time at the service

areas using hospital management information system and Patients' challenges on hospital management information system at the service area at the University College hospital, Ibadan.

3.7 Validity and Reliability of Research Instrument

Validity: A pilot survey was conducted on another Patient from each service area to measure the reliability of the instrument in Part B. The reliability of the instrument to measure the Patient's satisfaction on Hospital Management Information System (Health in a Box) at University College Hospital, Ibadan.

Reliability: The questionnaire was designed by the researcher with the supervision of the supervisor who did some useful correction and suggestion which was included in the questionnaire.

3.8 Method of Data Collection

Three hundred questionnaires were distributed to the Patients receiving care at University College hospital, Ibadan, Oyo State, Nigeria and all the questionnaires was filled by the patients and retrieved by the researcher.

3.9 Method of Data Analysis

The statistical procedure that researcher choose for the analysis of data was descriptive and chi square method. Statistics packages for the Social Science (SPSS) software version 25.0, IBM to analyze the data. Descriptive statistical tools such as frequency table and percentile were used to analyzed the socio demographic information of the respondent. Descriptive statistical tools were also used to analyzed the use of hospital management information system at UCH, Patient' satisfaction with their

waiting time at the service areas at UCH and the challenges of hospital management information system on patients' satisfaction at the service areas in the hospital. Chi square was used to test the use of hospital management information system at UCH, and Level of patient's Satisfaction at out-patient clinics of University College Hospital, Ibadan.

3.10 Ethic Approval

The Lead City University Health Research and Ethics Committee granted the study's ethical approval. Institute for Advanced Medical Research and Training (IMRAT) and University College Hospital, (UCH) Ibadan, both granted ethical permission. Each participant provided signed informed permission after receiving information through an information sheet prior to the data collection. The information gathered is maintained in strict confidence and won't be shared with any other parties in order to ensure confidentiality. A signed written informed permission that the research assistant has translated into the respondent's mother tongue.

Endnotes

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Chapter Four

4.1 Results and Discussion of Findings

This chapter presents the result of the study on the "Influence of Hospital Management Information System (Health in a Box) on Patient's Satisfaction in the University College Hospital, Ibadan. The number of analyzed questionnaires that were properly completed was three hundred (300).

4.2 Presentation of Data

4.2.1 Age Group of the Respondents Receiving Treatment at University College Hospital, Ibadan.

Table (4.2.1) below reveals that highest number of patients receiving treatment at UCH was recorded in the following age group: 20 -29 years (47.7%) followed by 40 - 49 years (23.0%), 30 – 39 years (16.7%), 50 -59 years (9.3%) while the lowest was recorded in the age group 60^{+} years (3.3%).

Table 4.2.1: Showing the Age Group of the Respondents Receiving Treatment at University College Hospital, Ibadan.

Age Group	Frequency	Percentage
20 – 29	143	47.7
30 - 39	50	16.7
40 - 49	69	23.0
50 – 59	28	9.3
60^{+}	10	3.3
Total	**300**	**100.0**

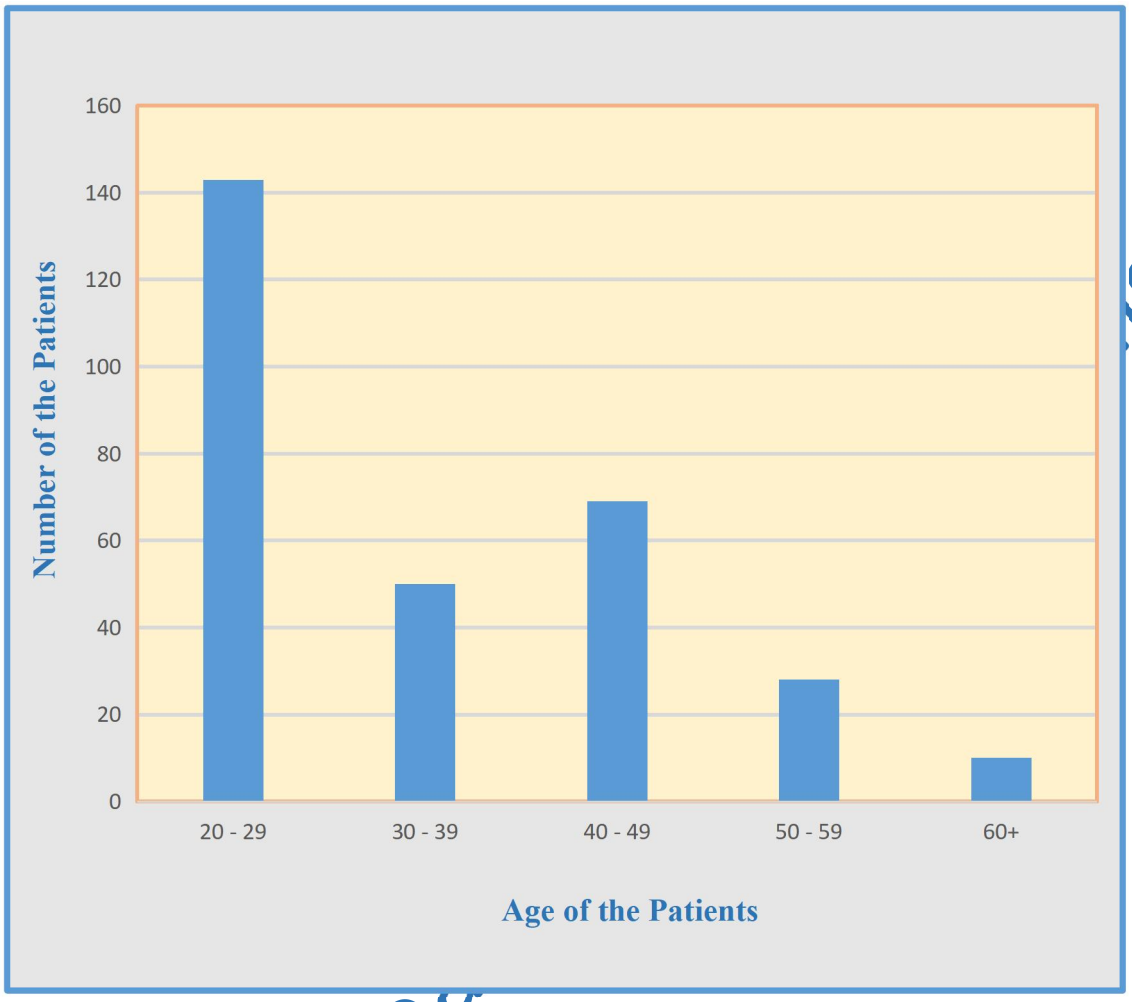

Figure 4.2.1: Age Group of the Respondents Receiving Treatment at University College Hospital, Ibadan.

4.2.2 Sex of the Respondents Receiving Treatment at University College Hospital, Ibadan.

Table (4.2.2) below shows that out of 300 respondents receiving treatment at University College Hospital, Ibadan 191(63.7%) of the respondents were female while 109 (36.3%) were male, this implies that there are more female patients receiving treatment at University College Hospital than male patients.

Table 4.2.2 Showing Sex of the Respondents Receiving Treatment at University College Hospital, Ibadan.

Sex of the Respondents	Frequency	Percentage
Male	109	36.3
Female	191	63.7
Total	**300**	**100.0**

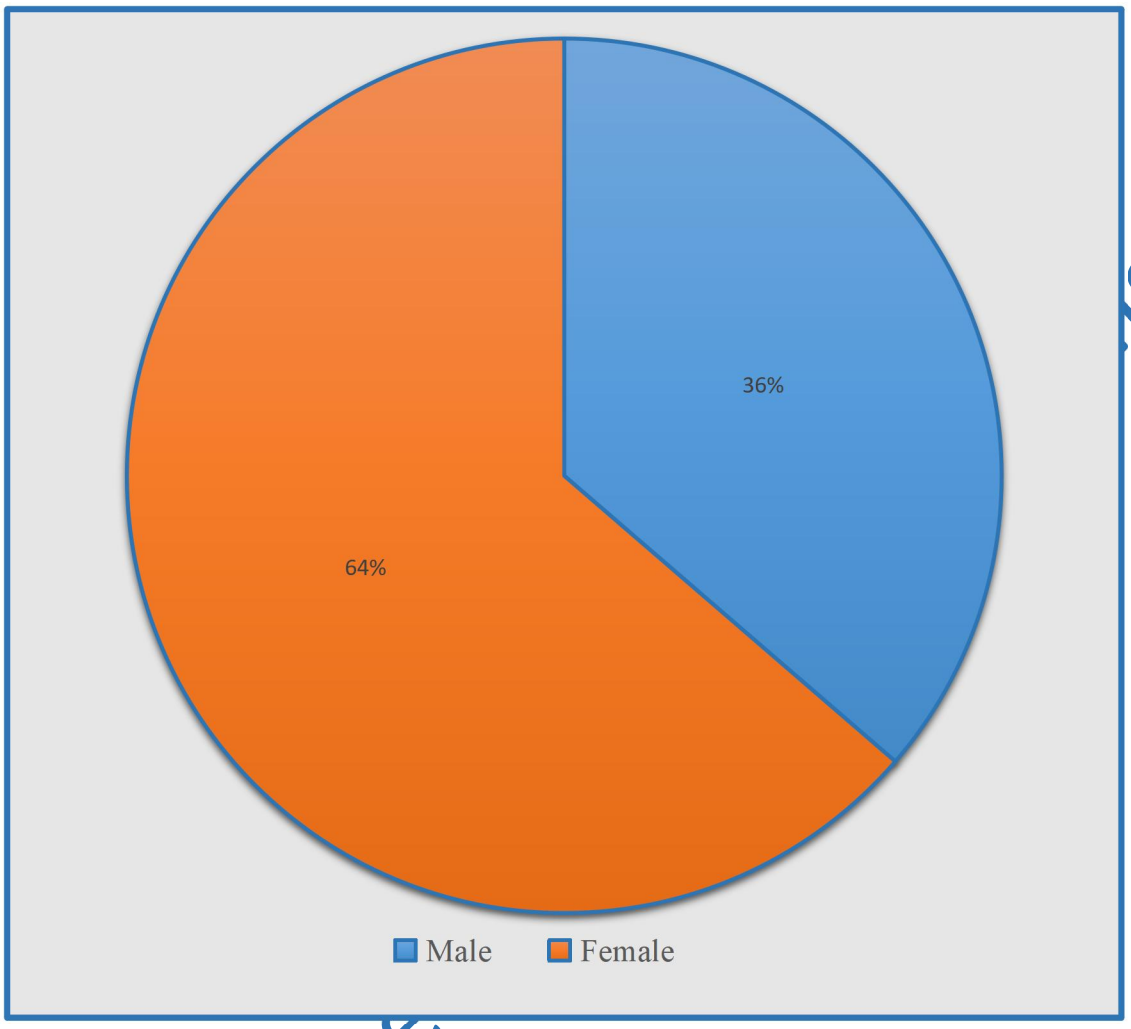

Figure 4.2.2: Sex of the Respondents Receiving Treatment at University College Hospital, Ibadan.

4.2.3 Marital Status of the Respondents Receiving Treatment at University College Hospital, Ibadan.

Table (4.2.3) below shows that out of 300 respondents, 179 (52.0%) of the patients receiving treatment at UCH were married followed by 102 (34.0%) that were single, 13 (4.3%) were widow while 6 (2.0%) were widower. This implies that there are many married people that are receiving treatment at University College Hospital, Ibadan.

Table 4.2.3: Showing Marital Status of the Respondents Receiving Treatment at University College Hospital, Ibadan.

Marital Status of the Respondents	Frequency	Percentage
Married	179	59.7
Single	102	34.0
Widow	13	4.3
Widower	6	2.0
Total	**300**	**100.0**

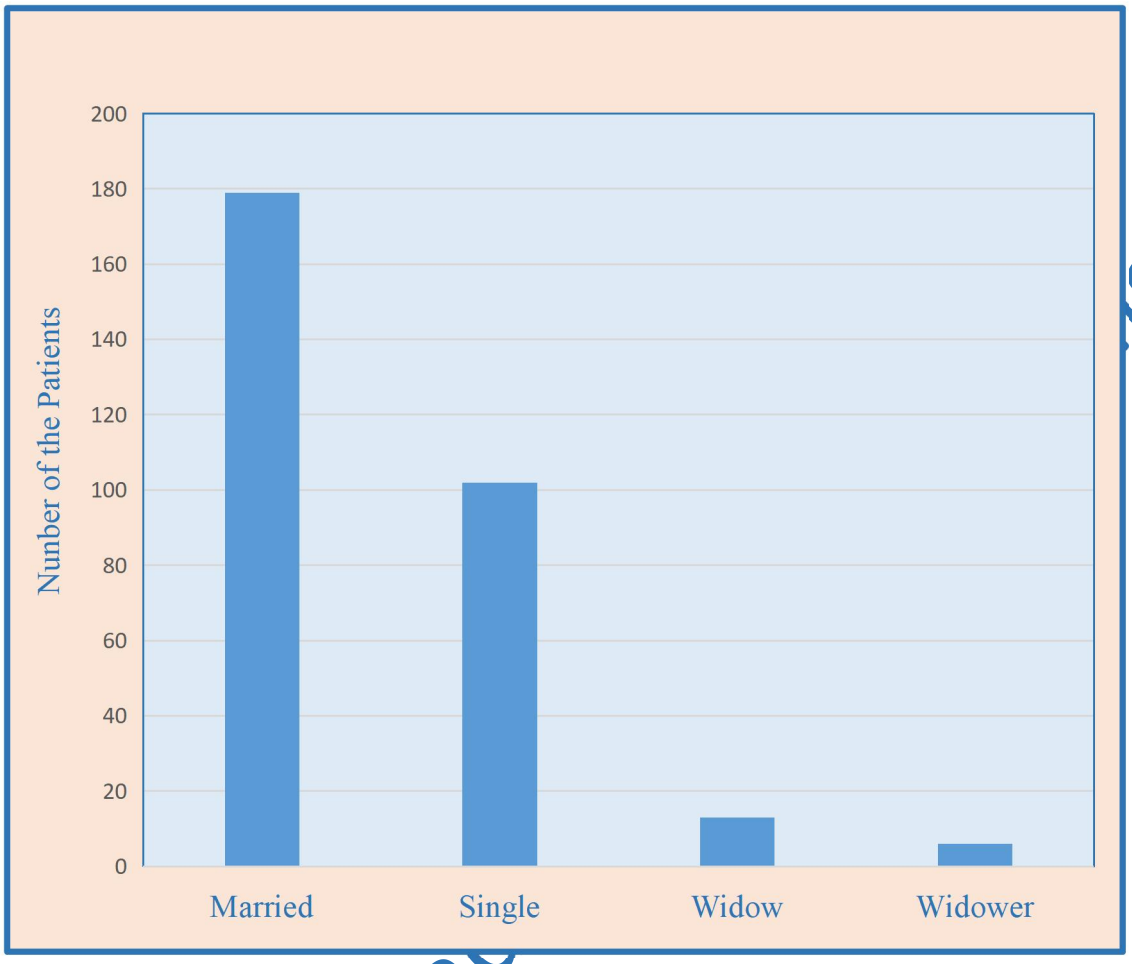

Figure 4.2.3: Marital Status of the Respondents Receiving Treatment at University College Hospital, Ibadan.

4.2.4 Educational Level of the Respondents Receiving Treatment at University College Hospital, Ibadan.

Table (4.2.4) below reveals that 175 (58.3%) of the patients receiving treatment at University College Hospital, Ibadan has tertiary education followed by 54 (18.0%) of the patients that have no education, those with secondary school education were 51 (17.0%) while those with primary education were 20 (6.7%). This implies that there are more educated patients at University College Hospital, Ibadan.

Table 4.2.4: Educational Level of the Respondents Receiving Treatment at University College Hospital, Ibadan.

Educational Level of the Respondents	Frequency	Percentage
Tertiary Education	175	58.3
Secondary Education	51	17.0
Primary Education	20	6.7
No Education	54	18.0
Total	**300**	**100.0**

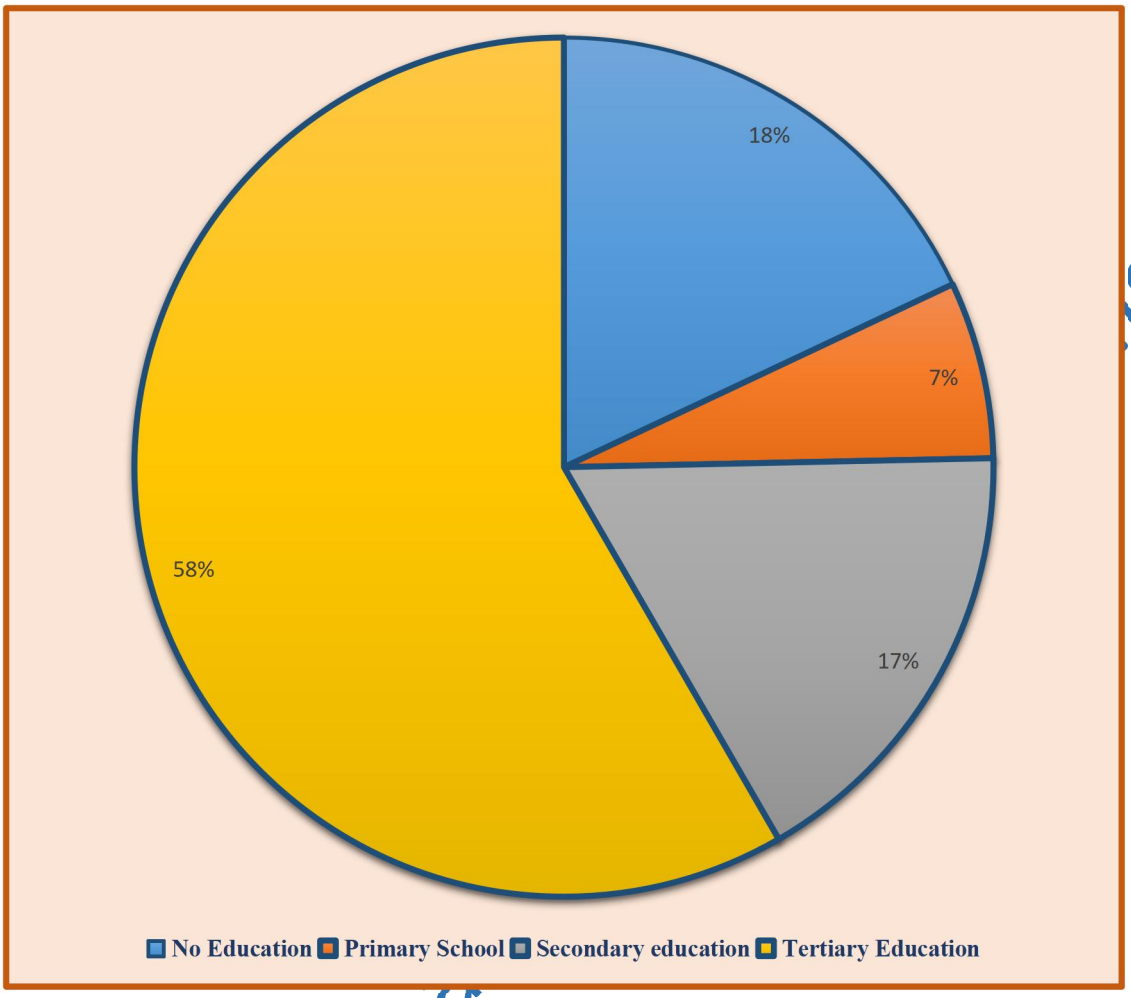

Figure 4.2.4: Educational Level of the Patients Receiving Treatment at University College Hospital, Ibadan.

4.2.5 Employment Status of the Respondents Receiving Treatment at University College Hospital, Ibadan.

Table (4.2.5) below shows the employment status of the respondents receiving treatment at University College Hospital, Ibadan. out of 300 respondents, 132 (44.0%) of the respondents are employed, 85 (28.3%) are self-employed, 68 (22.7%) are students while 15 (5.0%) are unemployed. This indicates that most patients receiving treatment at University College Hospital, Ibadan are Civil Servants.

Table 4.2.5: Employment Status of the Respondents Receiving Treatment at University College Hospital, Ibadan.

Employment Status of the Respondents	Frequency	Percentage
Employed	132	44.0
Self Employed	85	28.3
Unemployed	15	5.0
Students	68	22.7
Total	**300**	**100.0**

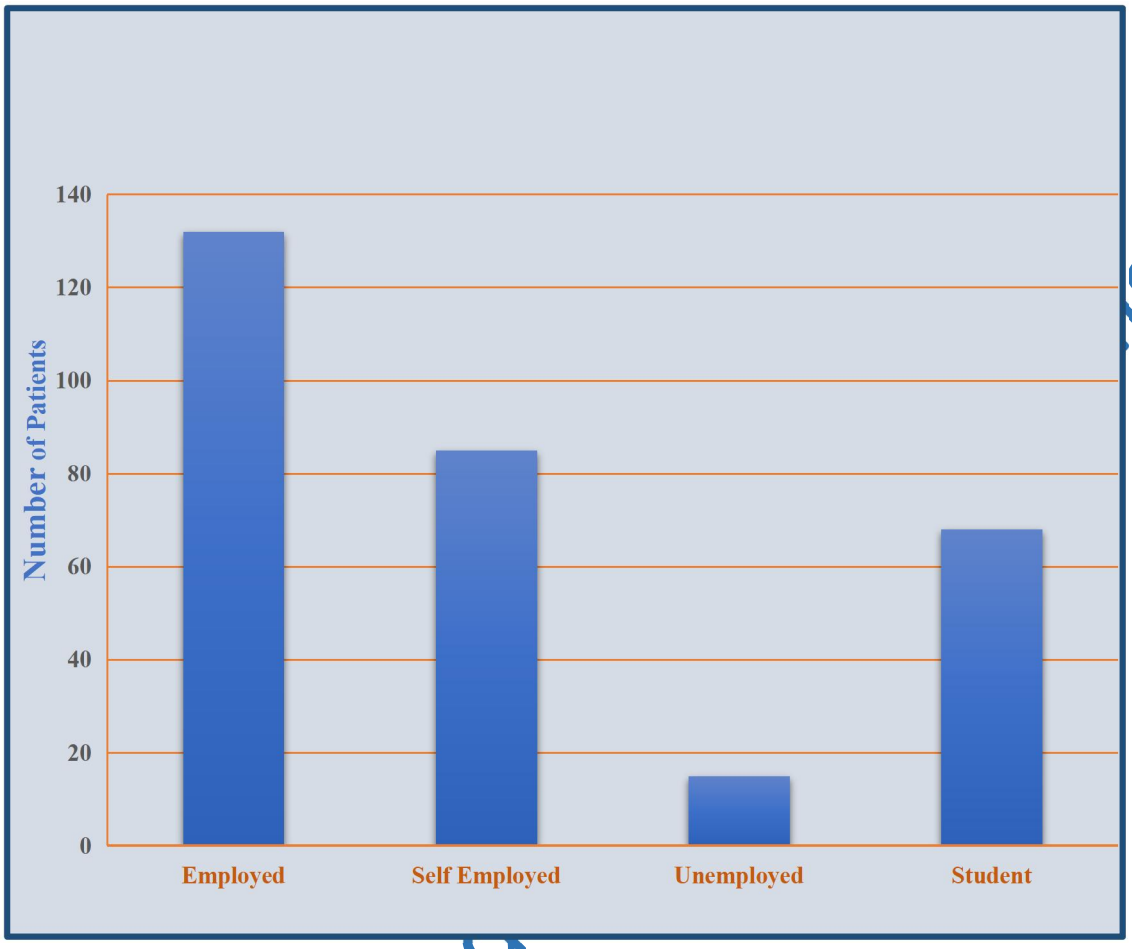

Figure 4.2.5: Employment Status of the Respondents Receiving treatment at University College Hospital, Ibadan.

4.2.6: Use of Hospital Management Information System (Health in a Box) at University College Hospital, Ibadan.

Table (4.2.6): below shows that the majority of the respondents with (70.7%) believed that there is an existing hospital management information system at UCH. And it is used at different areas of services such as generating patient track number, documentation of clinical information, booking of clinical appointment, notification of clinical appointment electronically, entering if vital sign in to computer system by the nurses, issuing of hospital bill, making of payment and generating HMO code. However, the minority of the respondents with (41.3%) believed that the use of HMIs has not been extended to the consulting room.

Table 4.2.6: Use of Hospital Management Information System (Health in a Box) at University College Hospital, Ibadan.

Use of HMIS	Yes	No	I Don't know	Total
Do you know if there is any existing HMIS in the hospital?	212 (70.7)	46 (15.3)	42 (14.0)	**300 (100.0)**
Do they use the computer system to document your information for the first visit in the hospital?	249 (83.0)	41 (13.7)	10 (3.3)	**300 (100.0)**
Do they use computer system to book your clinical appointment?	202 (67.3)	90 (30.0)	8 (2.7)	**300 (100.0)**
Does the computer system notifies you electronically through text messages, e-mails, etc Prior your appointment date?	184 (61.3)	102 (30.7)	14 (4.7)	**300 (100.0)**
Do Nurses enter your vital sign taken in to the computer system when you visit the hospital For consultation?	188 (62.7)	92 (30.7)	20 (6.6)	**300 (100.0)**
Do Doctors use computer system during consultation for clinical documentation?	142 (47.3)	146 (48.7)	12 (4.0)	**300 (100.0)**
Do Radiographers or Radiologist use computer system for image capturing, interpretation and communication of findings?	210 (70.0)	43 (14.3)	47 (15.7)	**300 (100.0)**
Do Laboratory Scientist use computer system to process your investigation and communicate results with Doctors in charge of care electronically?	205 (68.3)	54 (18.0)	41 (15.7)	**300 (100.0)**
Do you make hospital billing through computer system?	251 (83.7)	43 (14.3)	6 (2.0)	**300 (100.0)**
Do you make payment through computer System?	244 (81.3)	44 (14.7)	12 (4.0)	**300 (100.0)**
Do Pharmacy attends to you through computer system?	213 (71.0)	55 (18.3)	32 (10.7)	**300 (100.0)**
Do NHIS officer generate your HMO code by using computer system?	228 (76.0)	42 (14.0)	30 (10.0)	**300 (100.0)**

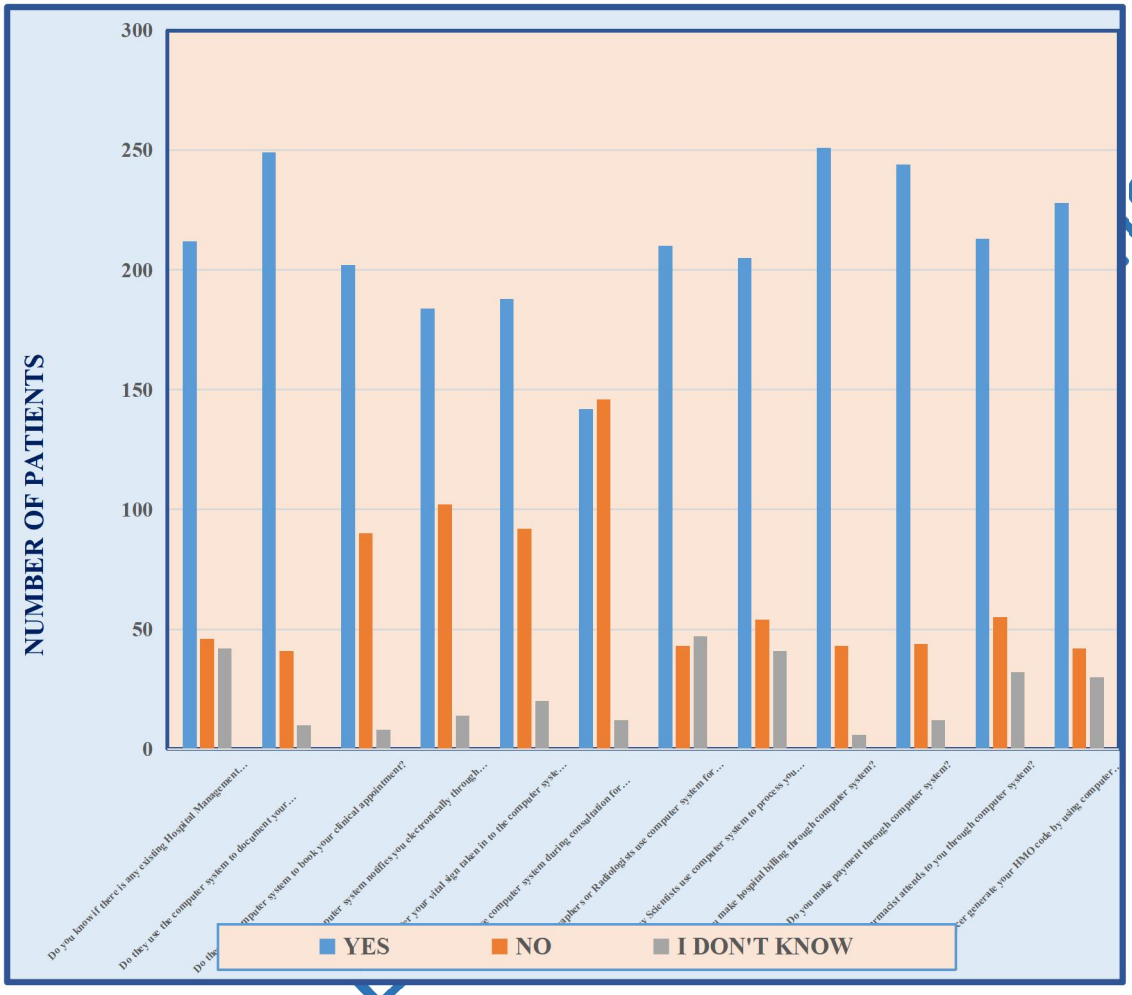

Figure 4.2.6: Use of Hospital Management Information System (Health in a Box) at University College Hospital, Ibadan.

4.2.7: Patient's Satisfaction on Waiting Time at the Services Areas in University College Hospital using Hospital Management Information System (Health in a Box).

Table (4.2.7) below shows the satisfaction of Patients on waiting time at the service areas in the hospital using Hospital Management Information System. This result shows that the most satisfied service area with patient waiting time is consulting room with (67.0%), followed by payment unit area with (59.0%), radiology unit with (58.0%), laboratory unit & pharmacy unit with 57.7% each, registration unit with (57.3%), billing unit with (54.3%) while the least satisfied service area is the nursing unit (53.7%). This implies that patients are satisfied mostly with the time consultant are spending with them.

Table 4.2.7: Patients' Satisfaction on Waiting Time at the Service Areas using Hospital Management Information System at University College Hospital, Ibadan.

Area of Services	Yes	No	I Don't Know	Total
Are you satisfied with your waiting time at Registration unit?	172 (57.3)	120 (40.0)	8 (2.7)	**300 (100.0)**
Are you satisfied with your waiting time at Nursing unit?	161 (53.7)	137 (45.7)	2 (0.7)	**300 (100.0)**
Are you satisfied with your waiting time at Laboratory unit?	173 (57.7)	121 (40.3)	6 (2.0)	**300 (100.0)**
Are you satisfied with your waiting time at NHIS unit?	152 (50.7)	132 (44.0)	16 (5.3)	**300 (100.0)**
Are you satisfied with your waiting time at Consulting room?	201 (67.0)	97 (32.3)	2 (0.7)	**300 (100.0)**
Are you satisfied with your waiting time At Radiology unit?	174 (58.0)	111 (37.0)	15 (5.0)	**300 (100.0)**
Are you satisfied with your waiting time at Billing unit?	163 (54.3)	130 (43.3)	7 (2.3)	**300 (100.0)**
Are you satisfied with your waiting time at Payment unit?	177 (59.0)	123 (41.0)	- -	**300 (100.0)**
Are your satisfied with your waiting time at Pharmacy unit?	173 (57.7)	113 (37.7)	14 (4.6)	**300 (100.0)**

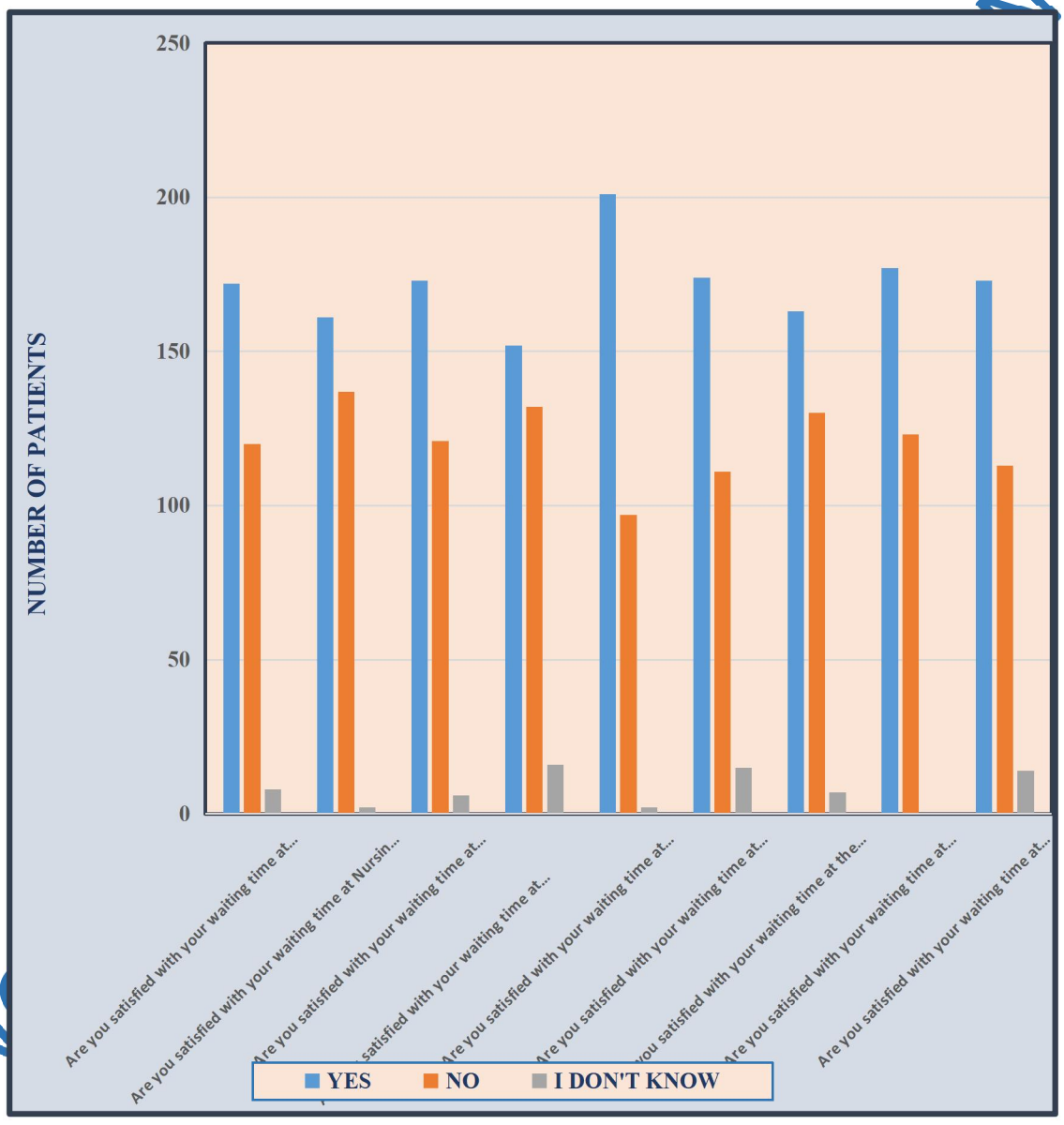
NUMBER OF PATIENTS
250
200
150
100
50
0
Are you satisfied with your waiting time at...
Are you satisfied with your waiting time at Nursin...
Are you satisfied with your waiting time at...
Are you satisfied with your waiting time at...
Are you satisfied with your waiting time at...
Are you satisfied with your waiting time at...
Are you satisfied with your waiting time at the...
Are you satisfied with your waiting time at...
Are you satisfied with your waiting time at...
YES
NO
I DON'T KNOW

Figure 4.2.7: Patient's Satisfaction on Waiting Time at Various Service Areas using Hospital Management Information System at University College Hospital, Ibadan.

Table 4.2.8: Challenges of Patient's Satisfaction on Hospital Management Information System (Health in a Box) at the Service Area in the University College Hospital, Ibadan.

Table (4.2.8) below reveals the challenges patients are facing at service area using Hospital Management Information System at University College Hospital, Ibadan. It shows that the most challenges facing patients' satisfaction in University College Hospital at services areas is network problem and epileptic power supply with (57.0%) followed by slow response of health maintenance organization (HMO) code with (54.0%), poor communication between management and patients with (52.7%), and Hospital Management Information System does not accommodate referrals system from one hospital to another hospital with (45.3%.).

Table 4.2.8: Challenges of Patients' Satisfaction on Hospital Management Information System at Service Area in University College Hospital, Ibadan.

Challenges	Yes	No	I Don't know	Total
Recurrence technical problems that prevent Smooth running of the service (network jams, epileptics power supply)	171 (57.0)	85 (28.3)	44 (14.7)	**300 (100.0)**
Poor communication between management and patients	158 (52.7)	116 (38.7)	26 (8.6)	**300 (100.0)**
HMIS does not accommodate referral letter	136 (45.3)	120 (40.0)	44 (14.7)	**300 (100.0)**
Slow response of HMO code	162 (54.0)	108 (36.0)	30 (10/)	**300 (100.0)**

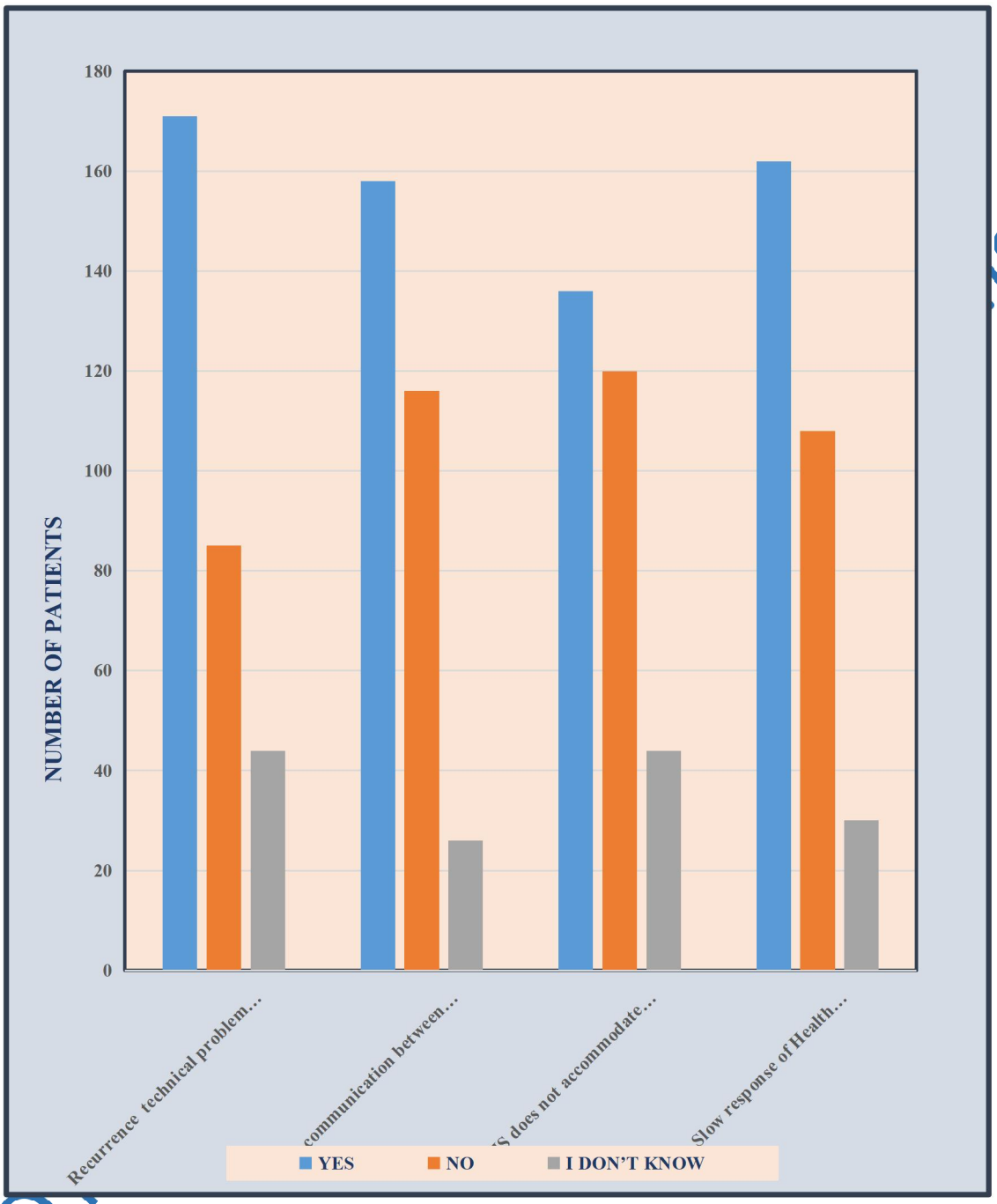

Figure 4.2.8: Challenges of Patient's Satisfaction on Hospital Management Information System (Health in the Box) at University College Hospital Service Areas.

Table 4.2.9: Patients' Level of Satisfaction on Hospital Management Information System (Health in a Box) at University College Hospital, Ibadan.

Table (4.2.9) shows the level of satisfaction of patients on hospital management information system. It shows that (81.3%) of the respondents believed that Hospital Management Information System is most beneficial to their care followed by (72.9%) believed that allowing the patients in decision making relating to patient's care, (65.7%) believed, it allow patients access to health related information, (68.0%) reduce the patients' waiting time, it covers all areas of services, suitable for the patient's care and reduce the health care cost.

Table 4.2.9: Level of Patients' Satisfaction on Hospital Management Information System at University College Hospital, Ibadan.

Level of Patient's Satisfaction	Yes	No	I Don't know	Total
HMIS encourage me participate in decision making relating to my care	218 (72.7)	39 (13.0)	43 (14.3)	**300 (100.0)**
HMIS makes the cost of care I received less expensive	158 (52.7)	101 (33.7)	41 (13.6)	**300 (100.0)**
HMIS covers all areas of service in the hospital	209 (69.6)	65 (21.7)	26 (8.7)	**300 (100.0)**
HMIS allows easy accessibility to my health related information and other services	197 (65.7)	67 (22.3)	6 (12.0)	**300 (100.0)**
I accept that HMIS is beneficial to my care	244 (81.3)	34 (11.3)	22 (7.3)	**300 (100.0)**
HMIS is suitable for the care I received in the hospital	197 (65.7)	58 (19.3)	45 (15.0)	**300 (100.0)**
HMIS help to reduce the time I spend at the service areas	204 (68.0)	66 (22.0)	30 (10.0)	**300 (100.0)**

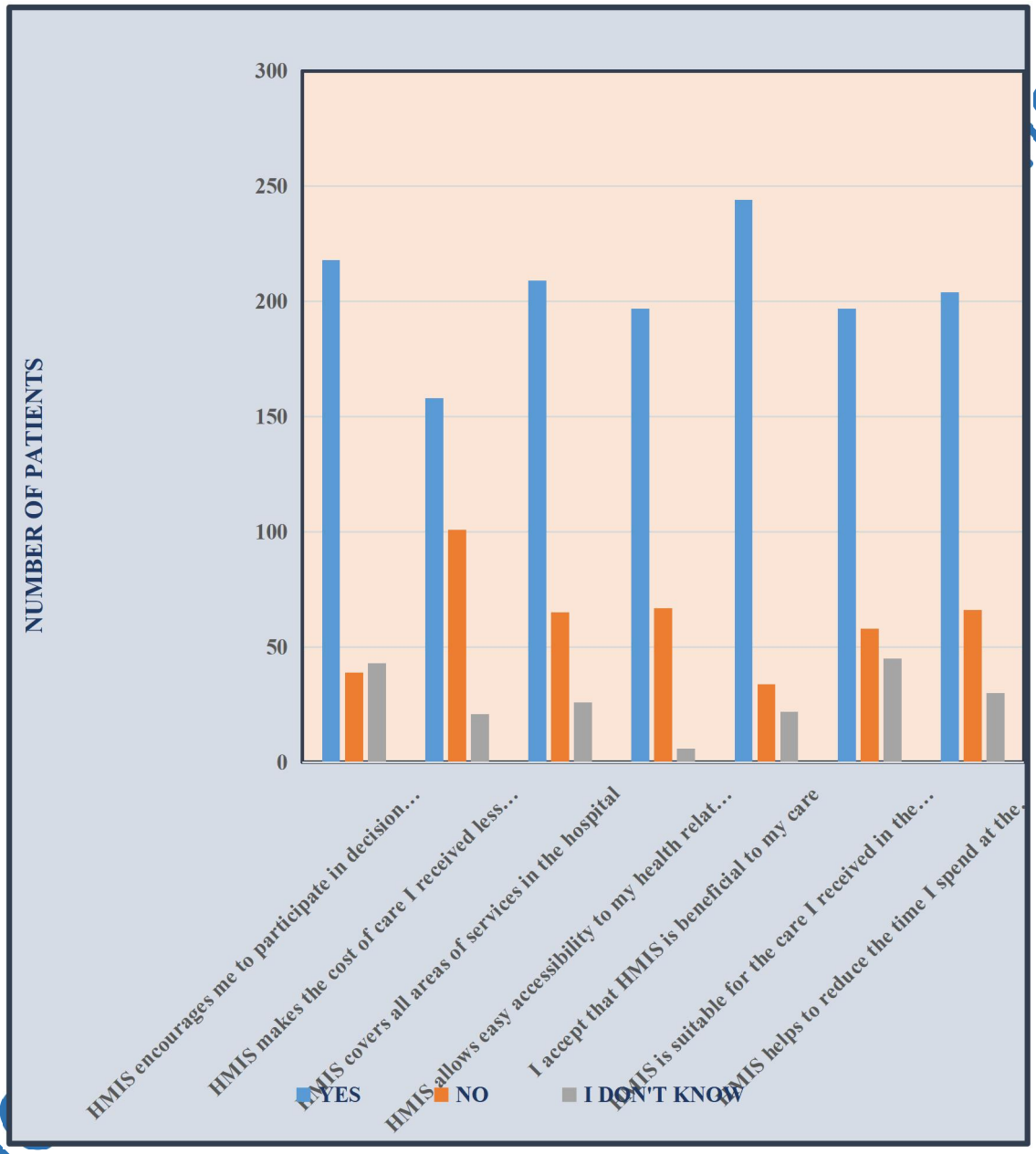

Figure 4.2.9: Patients' Level of Satisfaction on Hospital Management Information System (Health in a Box) at University College Hospital, Ibadan.

4.3 Research Questions

1. What is the use of hospital management information system (Health in a Box) at University College Hospital, Ibadan?
2. Are the Patients satisfied with the waiting time at the service areas using hospital management information system (Health in a Box) at University College Hospital, Ibadan?
3. What are the challenges of Patients' satisfaction on hospital management Information system (Health in a Box) at the service areas of the hospital?

4.4 Test of Hypothesis

H_o: The use of hospital management information system (health in a box) does not have influence on patient's satisfaction in the University College Hospital, Ibadan.

HMIS Use * Patients' Satisfaction Cross tabulation

			Patients' Satisfaction		
			Yes	N	Tot
HMIS Use	Yes	Count	128	56	184
		Expected Count	125.	58.9	184.
	No	Count	76	40	116
		Expected Count	78.9	37.1	116.
Total		Count	204	96	300
		Expected Count	204.	96.0	300.

Chi- Square Tests

		df	Asymptotic Significance (2- sided)	Exact Sig. (2-	Exact Sig. (1-
Pearson Chi-Square	.536	1	.464		
Continuity Correction[b]	.36	1	.545		
Likelihood Ratio	.53	1	.465		
Fisher's Exact Test				.525	.272

Linear-by-Linear	.53	1	.465		
N of Valid Cases	30				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 37.12. b. Computed only for a 2x2 table

4.5 Discussion of Findings

Decision rule: Since P-value (0.464) is greater than 0.05, null hypothesis (H_o) is accepted while alternate hypothesis (H_i) is rejected.

Conclusion: Therefore, The use of Hospital Management Information System (Health in a Box) does not have influence on Patients' Satisfaction at University College Hospital, Ibadan since there is no significant association between use of hospital management information system and patient's satisfaction.

Chapter Five

5.1 Summary of Findings

The finding shows that there was an existing hospital management information system at University College Hospital, Ibadan. And it is used at different areas of services such as generating patient track number, documentation of clinical information, booking of clinical appointment, notification of clinical appointment electronically, entering of vital sign in to computer system by the nurses, issuing of hospital bill, making of payment and generating Health maintenance Organization code. However, the Hospital Management Information Systems has not been regularly utilized by doctors for documentation of clinical complaints, findings, and plans during consultation at the various clinics. It also shows that implementation of hospital management information system (health in a box) will help to reduce medical errors, improve efficiency, both on the cost and the clinical care perspective.

5.2 Conclusion

Hospital Management Information System is a useful tool to all healthcare givers. It helps to force orderliness and standardization of the patient records and procedures in the clinic and increasing accuracy and completeness of medical records of Patient. It helps in gathering information to meet management challenges and to educate patients about their diseases of surgical procedures through pictures and animations. However, it is under-utilised by the doctors as this is attributed to few challenges. Generally, patients in the University College Hospital, Ibadan are satisfied with the healthcare services they received, however, there is no enough evidence to attribute this to the

implementation and use of HMIS. Perhaps, this is due to certain personal characteristics of the individual healthcare workers.

5.3 Recommendations

1. In order to improve the use of HMIS and engagement among the doctors, the management should develop a local regulation to enforce and encourage the use of the system. And the healthcare workers should be appropriately trained on how to use it.
2. To tackle epileptic power supply problem, the management of UCH should make provision for a stable solar power to be used when there is no electrical power.
3. The researcher recommends that State Government, Federal Government and Hospital Management should have agreement that allow a single data base within the country for the referral system to work.
4. The researcher also suggests that there should be good communication between management and patients because it has been established that good communication between patients and healthcare providers is the single most crucial element of good medical practice. In addition to helping to define expectations and build trust between the clinician and patient, it also helps to quickly and clearly identify problems.

5.4 Contribution to Knowledge

The Study has added to the body of knowledge on literature review of the use of hospital management information in the hospital, it has helped to identify the challenges of proper use of hospital management information system. The appropriate

use of recommendation provided by the studies will be beneficial to the facility to improve patients' satisfaction.

5.5 Area of Further Research

Based on the findings of study, the use of hospital management information system does not guarantee patients satisfaction. This implies that other factors must have contributed to high patients' satisfaction. Therefore, the researcher would like to suggest further study to investigate other factors that influence patients' satisfaction, other than the use of hospital management information system