SCHOOL OF PUBLIC HEALTH
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA

DEVELOPMENT OF PATIENT RECORD MANAGEMENT SYSTEM
FOR YENDI HEALTH CENTRE

BY

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THIS HEALTH INFORMATICS PRACTICUM IS SUBMITTED TO
THE UNIVERSITY OF GHANA, LEGON, IN PARTIAL
FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF
MASTER OF SCIENCE IN HEALTH INFORMATICS

JULY, 2018
DECLARATION

I hereby declare that apart from referencing other peoples’ work that I have duly acknowledged, this project is my original work produced from a research I have undertaken under supervision, and that no previous submission of either whole or part of this project has been made elsewhere for a degree. I therefore submit this project to the Department of Biostatistics, School of Public Health, University of Ghana in partial fulfillment of the award for Master of Science in Health Informatics.

Hassanatu Gomdah Abdul-Rahman (10636998)

Signature ………………………………………..

Date ……………………………………………

Dr. Seth Kwaku Afagbedzi (Supervisor)

Signature ………………………………………..

Date ……………………………………………
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<td>CDSS</td>
<td>Clinical Decision Support System</td>
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<tr>
<td>CHPS</td>
<td>Community-based Health Planning and Services</td>
</tr>
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<td>CPOE</td>
<td>Computerized Provider Order Entry</td>
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<td>CSS</td>
<td>Cascading Styles Sheets</td>
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<td>DHIMS</td>
<td>District Health Information Management System</td>
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<td>EHR</td>
<td>Electronic Health Record</td>
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<td>EMR</td>
<td>Electronic Medical Record</td>
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<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
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<td>HTML</td>
<td>Hypertext Mark-up Language</td>
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<tr>
<td>ICT</td>
<td>Information and Communication Technology</td>
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<tr>
<td>MCH</td>
<td>Maternal and Child Health</td>
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<tr>
<td>MySQL</td>
<td>My Structured Query Language</td>
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<td>PHP</td>
<td>Hypertext PreProcessor</td>
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<td>PHR</td>
<td>Personal Health Record</td>
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<td>RCH/FP</td>
<td>Reproductive and Child Health/Family Planning</td>
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<td>SDLC</td>
<td>System Development Life Cycle</td>
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ABSTRACT

INTRODUCTION: Over the years, medical care has become more complex, making complete patient medical history not accessible in certain situations. The quest for comprehensive medical history of patients for the purpose of continuity of care brought about the evolution of storing patient information electronically. Previous health information plays a critical role in the proper diagnosis and treatment of patients. Therefore, there should be an efficient information management system in place that can provide the patients’ health information need of health facilities providing care. Yendi Health Centre among several health facilities is still using paper-based system to manage patients’ records.

METHOD: The development of the patients’ records management system followed the evolutionary prototyping model of System development life cycle. Design of the database employed entity relationship modeling with the use MySQL and Microsoft Office Visio tools. The database development was done using MySQL, coding was done in hypertext markup language (HTML) and hypertext pre-processing (PHP) with Sublime Text 3 as the code editor.

RESULTS: The review of Yendi Health Centre patient information system which is paper-based showed that the system is laborious, insecure and ineffective therefore the staffs were not comfortable using it. A prototype was then built which through the incorporation of user requirements evolved into the patients’ records management system.

CONCLUSION: Based on the results of the review, the staff preferred an electronic system which is more effective and efficient. Hence, this study based on functional and user requirements developed a patient record management system capable of storing and retrieving detailed patient information.
CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Advancement in technology both in developing and developed countries has brought about drastic improvements in health by ensuring easy accessibility of information on health and advancement in health services. In the United States of America (US) Electronic Health Records (EHR) systems have become a central pillar in national health policy (Detmer, 2014).

As part of fulfilling the national eHealth vision most regional and district health facilities in Ghana have embraced the use technological equipment such multimedia device, imaging and printing system, communication and Internet system to manage their activities (Ministry of Health, 2010).

The technological systems are cost effective and do not compromise on quality of service provided. Over the years, there has been a lot of struggle on the proper keeping of patients records so the introduction of systems with regards to patient information will enable health care professionals keep track of patients’ health concerns and treatment over a period of time giving the patient better understanding into the best diagnosis and treatment, enhancing service delivery at the end (GAO, 1991). Cases such as diabetes, cardiovascular diseases (chronic illnesses), and health service for mother and child require a necessary treatment over a time period.

Systems designed containing data on patient information is easily analyzed giving meaning, awareness and understanding of these diseases. More detailed valued data comes from the interactions between health care professionals and patients as compared with the information gotten from observations from the community and/or environment. Also,
investigations and some study activities help in gathering more information about an individual. Data on a patient’s health is mainly gotten from the patient’s health record.

Today’s patient health record is almost similar to that of about 50 years ago. Despite that, over the past decade, there has been a remarkable advancement of technology in the healthcare industry. To be able to keep-up with recent inventions in medicine, the disorderly, unbalanced system needs a central nervous system (Institute of Medicine, 1997).

Worldwide economy and daily experiences is largely dependent on mechanization (automation). Complex systems for a fast range of growth and requests are created by engineers through the combination of automated devices with mathematical and organizational tools. The Patient Record Management System is a programmed system useful for the management of patient data and its administration. Automated medical record system can reduce length of patient’s stay (Rogers and Haring, 1979). General Accounting Office (GAO, 1991) also found out that hospital costs are lessened by $600 on patients due to shorter length of stay in a Department of Veterans Affairs hospital and as well as decreased number of medication errors (Garrett et al., 1986).

The development of electronic systems has greatly transformed institutional operations through the adoption of new methodologies be it big or small systems by the use of a personal computer. The computer helps in fulfilling a lot of functions in the process of producing data thereby making the input process easily manipulated because of the computerization of records of the patient. However, the out-put will lead to the current world of information (Jantz, 2001)

For a health system to function well, the health records and pattern of diseases as narrated by the patients in that health system should be properly documented. The system will not
be efficient if information from patients are not properly documented leading to the misplacement of some data. Jantz (2001) reported that in examining the paper-based documentation system such as that in Yendi Health Centre, creating a well-structured and secured electronic database system to manage patient health data should be of great importance. For health care professionals to be able to make right decisions regarding a patient’s diagnosis, their present and past health information is very important.

The number of patients’ records in Yendi Health Centre has over time increased significantly due to patients opting to seek care at the facility. The current system used to manage patient health record is paper-based. Due to the large numbers of records, this most likely may lead to a number of problems including; unnecessary duplication of the data especially for patients, data inconsistency, since data is held in several places making complete medical history of patients unavailable and difficult to analyze the flow of patients’ health data.

The project when completed will provide a real-time data management environment for the Administration and Staff of Yendi Health Centre, to make their work easier and error free.

1.2 Problem Statement

Care provision is mostly based on the previous health information of the patient. Thus, the previous health information is therefore a vital component in the provision of “that” quality service. As such, there should be an efficient information management system in place that can provide the health information needs of patients that visit a health facility.

Due to over-crowding at the Yendi Municipal Hospital, most of the patients usually opt to seek care at the Health Centre, resulting in a much similar over-crowding at the Health Centre and over burdening the staffs. According to the District Health Information
Management System (DHIMS) the Health Centre records an average out-patient number of about five thousand five hundred (5,500) a year with support of just a few numbers of staffs. Anecdotal evidence shows that an average waiting time at Yendi Health Center is three (3) hours for patients to access health care service at the facility.

According to the records staffs of the facility, sometimes it takes an average of ten (10) minutes to retrieve a patient record from the bunch of folders. Also, the facility lacks a well secured storage place to store patients’ folders. These folders are located within the same open space of the Out –Patient Department (OPD) where patients sit and wait for their turn in the queue. This makes the folders vulnerable to several threats such as unauthorized access, disclosure of patient’s medical information among others.

According to staff at the records unit, sometimes a patient record/folder cannot be found, and they will have to create a new folder for that patient, thereby duplicating the information about that patient within the system. In such case; the patient health history will not be available to help the doctor to easily and appropriately diagnose and treat the patient. Thus, Yendi Health Center needs a well-structured information system that will manage the health records of patients.

1.3 The Study Objectives

1.3.1 The General Objective

The main objective is to develop a Patient Record Management System for Yendi Health Centre.

1.3.2 Specific Objectives

The specific objectives of the project are to:

- Review the existing system.
- Identify the requirements of the Yendi HC Record Management system
• Design Patient Record Management system.

1.4 Scope

The project is designed for Yendi Health Centre to handle a number of out-patient services provided by the health Centre. These include; assigning of Master Patient Index, daily treatment of patients, keeping records about patients. Even though, the facility is made of several units - antenatal unit, the child welfare centre, among other units, the electronic system only serves the medical records unit, the nurses’ station, consultation unit and the dispensary. The system is able to provide easy identification and retrieval of patient record at any point in time.

1.5 Significance of the Study

Yendi Health Centre currently operates a paper-based records system. This computerized system is designed to manage several out-patient activities handled by the paper-based system. These include; assigning of master patient index, keeping records of patients, staff and that of drugs. The system is able to provide easy identification and retrieval of patient record at any point in time. It also provides a one-time access to patient record at different units within the facility. The system provides a readily available patient health history to make continuity of care easier since it is computerized it provides a quick access to the required information. The computerized system saves Yendi Health Centre some office space because the manual system comes with paper folders filed in cabinets and shelves.

The computerized system also ensures a higher level of security as compared to the paper-based system where the folders are stored on shelves located just by the waiting area within the facility. The computerized system only allows authorized staff access to login into the system upon providing their user login credentials. The system when implemented
will reduce the average patient waiting time of three (3) hours to about forty-five (45) minutes thereby reducing the over-crowding at the health facility.

1.6 Organization of the study

Chapter one presents the background of the study, covering the problem statement, the aims and objectives, the scope and the significance of the study. The chapter ends with the organization of the report of the study.

Chapter two presents the study setting, the adoption of health information system and its related key terms. It also explores research of the existing knowledge related to the project under study.

Chapter three covers the methodology employed to carry out the study. It presents the methods of reviewing the paper-based system. It also presents the various stages of the system development life cycle that were followed to develop Yendi HC Record management system.

Chapter four is a presentation of results of review of the paper-based system and the requirement specification of Yendi HC Record management system. The chapter also presents the design of Yendi HC Record management system which includes the data flow diagram and the detailed database schema. Coding and testing is covered in the concluding part of this chapter.

The chapter five of the report presents the conclusion and recommendation on the system and as well as the limitation of the study.
CHAPTER TWO

LITERATURE REVIEW

2.1 The Study Setting

The study was carried out at the Yendi Health Centre formally called Reproductive and Child Health/Family Planning (RCH/FP) and then later changed to Maternal and Child Health Centre (MCH) and now Yendi Health Centre (YHC). It is situated within the heart of Yendi town along the Yendi – Gushegu road in the northern region of Ghana. It was established to provide basic health care services to the people of Yendi and the surrounding villages so as to ease the congestion at the Yendi Municipal Hospital.

The facility has the vision to become the leading provider of excellent service among the health centers under Ghana Health Service with the mission to provide quality health care, help eradicate the neglected tropical diseases and to ease congestion at the Yendi Municipal Hospital.

The facility provides health care services to the people of Yendi and the surrounding communities such as Kunkon, Gamanze, Walyapala, Kuga, Gundogu, Kulkpanga, Meindogu, among others.

Over the years, medical care has become more complex, making complete patient medical history not accessible in certain situations. The quest for comprehensive medical history of patients for the purpose of continuity of care brought about the evolution of storing patient information electronically.

Information is becoming the most important factor in carrying out our daily activities. In today’s information technology day and age, every organization including health facilities are becoming dependent on computer technology for every aspect of their operations. Data
within an organization is being regarded as a basic resource needed to run the organization (Martin, 1990).

For the purposes of planning and management decision making, handling data professionally is necessary. The significance of effective utilization of data for planning, forecasting and many other purposes will turn out to be so great in an organization with automated system, and this will impact greatly on the operations and growth of the organization. Thus, the presence of an automated system in Yendi Health Centre, planning, management and as well decision making will be effectively accomplished.

Health systems in developing countries have always faced several challenges. A lot of opportunities have been made available with the inception of Information and Communication Technology (ICT) in these developing countries to help improve their performances. ICT’s impact in the developing countries has been proven in a lot of trial projects. There has been the need to build the capacity of health care providers, health system managers and health care consumers. Equipment and systems are also been made available, affordable and easy to use. This has contributed to the many initiatives whose sole aim is to improve their efficiency and effectiveness. There are calls to increase the usage of information communication technology over the past three years (Ministry of Health, 2010). These calls arose due to current understandings into the rate at which an application could influence the health of the population. Since the Sustainable Development Targets are time bound it is only prudent to quicken progress towards their achievement (Ministry of Health, 2010).
2.2 Related Key Terms to Patient Record Management System

Patients expect clinicians to make decisions based on their health records. This could be done with the aid of an electronic medical record (EMR). The EMR contains the actual health records of patients that aid the clinicians make the right decisions on the patients’ health. Data from the electronic medical record is programmed to be simple so that they can easily be communicated. It is again the only solution to closing the gaps experienced in the delivery of health care services: billing, quality management, reporting of effects and public health disease surveillance. Additionally, clinical applications which can work on the original information are contained in the EMR. This may include: a clinical decision support system (CDSS), a computerized provider order entry system (CPOE), a controlled medical vocabulary or a results-reporting system. Overall, workflow of clinicians is improved by the use of EMR.

A lifetime electronic patient health record produced from a care delivery system capable of generating data from one or multiple encounters is termed an electronic health record (EHR). The information needed in EHR includes the following: radiology and laboratory reports, demographics and vital signs, medical history, immunization, progress notes and problems. It computerizes the activities of clinicians thereby simplifying it. Also, several other activities (decision based on evidence, quality management, outcome and reporting) which directly or indirectly relates to care through an interface, is generated through interactions between a health care provider and a patient.

Another record type worth mentioning is the personal health record (PHR). It’s an easily understandable lifetime tool that can be globally accessed by patients. It enables individual patients to manage their information, maintain their health status and help them in the cases of those with chronic illness. All these are done through the use of electronic health information and eHealth. With the personal health record, an individual can ensure the
security - through protection from unauthorized access and disclosure - of their personal health information. It also enables the individual patients to share with his legal representatives in a case where the record is defined and subjected to legal restrictions.

2.3 `Healthcare Information Systems

A healthcare information system is a computerized system designed to capture, store, manage or transmit information related to the health of individuals or the activities of health related organizations working within the health sector. Health information systems (HIS) provide evidence for policy and program decisions to support better health outcomes for individuals and for populations overall. Healthcare information systems include: Master Patient Index designed for the registration and assignment of unique identifier; Pharmacy Information System for medication dispensing, inventory, billing, drug information and interaction; Radiology Information System for scheduling, billing, reporting of results; Nursing Information System for storage and collection of nursing documentation, care planning, administrative information; Hospital Information System is a core system that manages hospital census (admission, discharge and transfer) and billing. It is mostly linked to the various departmental systems; Medical Records System designed to manage paper records and require statistical reporting used by medical records personnel; Practice Management System is an outpatient system for managing business related information many of which contain some clinical information; Laboratory Information System designed for ordering of laboratory tests, reporting of test results. It covers blood bank, pathology, microbiology, etc. and Picture Archiving System for storing and presenting radiologic images.

2.3.1 Adoption of Health Information Systems

The World Health Organization in conjunction with the World Bank income group carried out a study which showed that computerized health information systems are being
increasingly embraced by health care providers in economically stabilized countries. Also, developing economies such as Brazil, China and India are also seen implementing electronic medical records (EMRs) in their health delivery settings (World Health Organization, 2012).

Some low economically performing nations that tried implementing electronic medical record systems in large-scale – though unsuccessful - have been able draw both monetary and technical assistance to mount patient information management systems at some selected sites (World Health Organization, 2012). The successful implementation of these systems however needs substantial investments. Resources such as technical, financial and technological which are much needed however cannot be provided by such low economic settings. Also, patient information management systems that are meant for healthcare settings in developed nations may not suitable for health systems in countries of low economic standing.

African and South-East Asian countries largely use the paper-based health information systems. The use of electronic machines to communicate patient health information than just using the computerized systems to manage health data is largely seen in most American, Eastern Mediterranean, and the Western Pacific countries (World Health Organization, 2012). This can be attributed to the use of imaging technologies such as fax machine in which paper-based information is being communicated electronically.

Institutional need for comprehensive data in decision-making by management calls for the need of computerized systems in healthcare settings. Thus, the use of electronic systems for aggregate data is more common than of individual patient data. Opinions may be that computerized personal health data may not be considered valuable as compared to aggregated data for administrative processes such as managerial decision-making,
especially considering the difficulty which the implementation of patient information management systems comes with. However, for better-quality patient care, individual patient data is as much valuable because of continuity of care at different healthcare facilities where patients seek care from. A system such as the electronic record system has the capability of putting together all information regarding patient’s health and made available to other health care providers. This helps in detecting an outbreak early (World Health Organization, 2012).

The Gates Foundation (2009) undertook a complete analysis on the state health information systems in 19 developing countries (three were comprehensively analyzed). Five stages of increasing sophistication of health technology were defined. The first three focus on the development of the district health information system from manual (level 1) through optimized (level 2) and electronic reporting (level 3). Level 4 incorporates operational health ICT systems such as EMR, pharmacy, laboratory, automatic data capture and access to information. Their top level is a fully integrated national health information system, which includes data from all public and private sources (World Health Organization, 2012).

Results from the research indicated that a lot of the countries from the 19 countries chosen concentrated on taking information only at the district level: level one or the manual level had six (6) countries; level 2 had 7 who had begun improved integration, level 3 comprised of 4 countries with electronic reporting systems. Brazil and Belize were the only 2 countries who implemented EMR’s.

The 2007 framework paper of infoDev examined successful ICT usage in developing countries. The paper attributed electronic systems to these successes and the necessity for it to be added in every intervention and setting. It emphasized on certain issues to be
looked at in the local context i.e. open collaboration between health sector and regulatory framework, defining goals clearly, plans to be implemented, possible benefits, coordination of actions facilitated by the public sector (public, private and social efforts), Affordability, availability and accessibility of telecommunication reforms and ICT, regulatory frameworks and data standards, capacity development for health workers and possibilities of ensuring the continuous sustainability of the effort.

The research in Malawi by, Douglas et al (2010) reported what their experiences were with regards to the implementation at the point of care clinical workstations. Out of their research a touch-screen clinical software and hardware system was developed which was used in taking individual patients information, analyzing it and subsequently present the information on national protocols. Again, the system was capable of perfectly guiding health care professionals who are unfortunately low-skilled by diagnosing and treating patients’ whiles following national protocols.

The data combined could be used for making policies and run some analysis. About 55,000 receiving care out of the 650,000 participants in 2010 who received care from the Human Immunodeficiency Virus (HIV).

Lots of data were captured with the help of the systems which could be used in registering patients, caring for HIV patients, laboratory and pharmaceutical work, radiology and managing pediatric patients. The support for the larger communities was registered by the use of free open-source software. Overall success of the programme was tested and was seen to improve the quality of health care and a lot more acceptance by the clinical workers.

In another paper Fahad D. etal (June, 2009) of Makerere University, Kenya, computerized all the records of patients, staffs and drug suppliers at St Francis Hospital Nsambya. Generating report to enable decision making by the hospital management was also
computerized by the new system. The system was able to manage services including Daily
treatment of patients, Admission of patients, keeping records about inpatients and
outpatients, Billing of patients by use of a billing system and other services. The scope of
the system covered departments such as outpatient and inpatient, casualty, radiography
and ultra sound, pathology, pharmacy, and dental departments where data will be used to
generate reports for management decision making and for research purpose.

Through system study, data was collected and analyzed about the current system. To
develop the system, the researchers employed the iterative waterfall model approach of
system development life cycle together with dataflow diagrams, logical and entity
relationship diagrams.

2.3.2 Benefits of Health Information Systems

Patients will be identified uniquely all the time. There will be accuracy, reliability, and
prompt completion of all health records. Morbidity and mortality statistics will be
completed promptly and accurately. Problems relating to filing, loose sheets, etc will be
taken away. Issues with space regarding the storage of paper health records will also be
eliminated. Processing of data will be done to support better decision-making by
healthcare practitioners. Information about an individual patient will be immediately
available at all times for present and future care. Better information for clinicians to make
decisions about treatment and healthcare planning. Patient confidentiality and privacy will
be maintained. Problems associated with coding of diseases and procedures will be
eliminated. All healthcare information generated within the institution will be documented
at the point of care. Standard terminology will be used to ensure information is universally
understood. Increased efficiency of the institution with decreased costs in the long term.
CHAPTER THREE

METHODOLOGY

3.1 System Review

The study area is a health centre under the Community-based Health Planning and Services (CHPS) system of the Ghana Health Service serves as a referral centre for surrounding CHPS zones such as Kunkon CHPS zone, Montondo CHPS zone, Meindogu CHPS, Kulpanga, Kpasonando CHPS, among others.

The scope of service in Yendi Health Centre is basically curative and preventive. Other services include maternal child health services such as antenatal care, weighing and family planning. The units within the facility include; medical records, nurses’ station, consultation, antenatal care, health insurance, maternity, child welfare centre, injection and detention, family planning, dispensary and disease control units.

As part of gathering information on the review of the current paper-based system the researcher visited the facility to observe the daily activities at the various units of the facility and how they manage the patients’ health records. An observation was made to determine the average length of time the patients spend at the facility on a visit.

Questionnaires were also administered to capture the individual staffs’ views and opinions concerning the competencies and weaknesses of the existing paper-based system.

Interviews were also conducted with some key staffs to find out the difficulties they encounter with the paper-based system and also to get their recommendations about the features of the proposed system.

For the analysis of the data that were obtained from the review of the current system and that of the requirement analysis of the proposed system, the researcher used descriptive statistics tools and the results were presented in tables.
3.2 System Development Life Cycle

System development life cycle is an organizational process/procedure for developing and maintaining systems. It helps in establishing a system project plan in the sense that it provides overall list of processes and sub-processes required to develop a system.

It is made up of seven main phases/stages which includes planning/requirement analysis, feasibility study/system analysis, detailed system design, coding, testing, implementation and maintenance.

For the purpose of this project the researcher considered the first five processes due to the limitation of time concerning the period within which the project is allocated.

3.2.1 Planning phase

Through the employment of observation, questionnaire and interviews in the study, data were collected on the status of the current system at Yendi Health Centre. During this stage the researcher carried out a preliminary analysis of the current system to help identify the problem, user requirement and defined the scope of the existing system.

3.2.2 Feasibility Study

During this stage of the system development life cycle, the researcher used interview guide to interview management and other key persons within the facility. The responses from the interview helped the principal investigator to establish the requirements of the proposed system and as to whether the development of the proposed system was feasible.

3.2.3 Detailed System Design

A detailed study of the operations performed in the existing system was done. Interviews were conducted with the key persons at the facility to gather data on the existing system. The researcher observed the system in action, a number of times, to help understand the system as it operates. The researcher used the requirements of the proposed system that
have been established during the feasibility study. The detailed Design of the database employed entity relationship modeling using MySQL Workbench and Microsoft Office Visio.

### 3.2.4 Coding and Testing

In this stage of SDLC the researcher carried out the actual development of the system. The programming codes were generated to reflect the database design in reality. Hypertext preprocessor (PHP) a scripting language was employed by the researcher to handle the back-end of the system; hypertext markup language (HTML 5) and cascading style sheets (CSS) were used to take care of front-end. All codes were written using Sublime Text 3 as the text editor. The database implementation was done using MySQL. The researcher was continuously along-side the coding identified/ tracked any possible defects (bugs) and fixed until the software was free of error.

### 3.3 Prototyping Model of SDLC

In order to build a system that best meets the user requirement specification, the prototype model of system development life cycle was chosen. It refers to the activity of creating sample (prototype) of the software application, for example, incomplete version of the software program being developed. The researcher used the prototype to visualize some component of the software to limit the possibility of misunderstanding the user requirements. Among the three types of the prototyping model, which are the Incremental prototyping, Evolutionary prototyping and the Extreme prototyping, the system specifically was build using the evolutionary prototyping where the prototype evolved into the final system through an iterative incorporation of user feedback.
Figure 3.1: Evolutionary Prototyping Model
CHAPTER FOUR
SYSTEM ANALYSIS AND DESIGN

4.1 Results of the Current System Review

To have an efficient and effective electronic system to replace the existing manual system, the current system was critically analyzed to identify its strengths and weaknesses. This was achieved through observation, administering questionnaires and interviews with key personnel of the facility.

4.1.1 Response Rate

In all 24 questionnaires were issued to the respondent and only 18 were returned answered making a response rate of 75% as indicated in the table below.

4.1.2 Responses to the Review Questions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 25</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>25 - 40</td>
<td>13</td>
<td>72.2</td>
</tr>
<tr>
<td>40 and above</td>
<td>3</td>
<td>16.7</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>11</td>
<td>61.0</td>
</tr>
<tr>
<td>Female</td>
<td>7</td>
<td>39.0</td>
</tr>
<tr>
<td>Basic Computer Skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>16</td>
<td>88.9</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>Educational Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificate</td>
<td>9</td>
<td>50.0</td>
</tr>
<tr>
<td>Diploma</td>
<td>7</td>
<td>38.9</td>
</tr>
<tr>
<td>Bachelor’s Degree</td>
<td>2</td>
<td>11.1</td>
</tr>
</tbody>
</table>

Source: Field survey, 2018
### Table 4.2: Analysis of the Paper-based System

<table>
<thead>
<tr>
<th>System Review</th>
<th>Number of Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Filing system used in the facility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numeric</td>
<td>18</td>
<td>100.0</td>
</tr>
<tr>
<td>Alphabetic</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Alphanumeric</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Provision of ID cards to patient</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>18</td>
<td>100.0</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Patients sometimes don’t come along with their ID cards</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>18</td>
<td>100.0</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Easy retrieval of patient’s folder</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>3</td>
<td>16.7</td>
</tr>
<tr>
<td>No</td>
<td>15</td>
<td>83.3</td>
</tr>
<tr>
<td><strong>Average number of visits in a day</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 40</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Between 40 to 80</td>
<td>18</td>
<td>100.0</td>
</tr>
<tr>
<td>more than 80</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Average time taken to retrieve a folder</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5 minutes</td>
<td>3</td>
<td>16.7</td>
</tr>
<tr>
<td>5 to 10 minutes</td>
<td>14</td>
<td>77.8</td>
</tr>
<tr>
<td>10 to 15 minutes</td>
<td>1</td>
<td>5.5</td>
</tr>
<tr>
<td>more than 15 minutes</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Average time taken to process an old patient</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5 minutes</td>
<td>5</td>
<td>27.8</td>
</tr>
<tr>
<td>5 to 10 minutes</td>
<td>13</td>
<td>72.2</td>
</tr>
<tr>
<td>10 to 15 minutes</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>more than 15 minutes</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Average time taken to register a new patient</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5 minutes</td>
<td>4</td>
<td>22.2</td>
</tr>
<tr>
<td>5 to 10 minutes</td>
<td>14</td>
<td>77.8</td>
</tr>
<tr>
<td>10 to 15 minutes</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>more than 15 minutes</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Satisfaction with the current system</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>No</td>
<td>16</td>
<td>88.9</td>
</tr>
<tr>
<td><strong>Recommendation of an electronic system</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>17</td>
<td>94.4</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td>5.6</td>
</tr>
</tbody>
</table>

4.1.3 Results of Observation /Interview

It was observed that there were long queues of patients waiting, at every unit the patient is supposed to go through to receive care at the facility. It was again observed that the average waiting time at the records unit was about twenty (20) minutes and that at the nurses’ station was about forty-five (45) minutes. A similar observation at the entrance of the consulting rooms showed an average waiting time of one hour, thirty minutes and that at the dispensary was also twenty (20) minutes, totaling the average waiting time from the time of entry to the time of exit to about three (3) hours.

The shelves where patients’ records are kept were situated at the same open place at the OPD where patients sit and wait for their turn in the queue. This makes the patients’ records highly vulnerable to theft, unauthorized access, among other threats. The folders were very dusty, and they were not well arranged because they were overflowing the shelves making the retrieval of patient’s folder a difficult and time-consuming task.

The records staffs did not have an enclose office specific to the unit. They do their regular activities on a table with a bench situated in the same open place of the patient waiting area, making conditions not suitable enough as a working environment. A personal computer was also seen in one small office adjacent the consulting rooms. The purpose of the computer was to verify the validity of national health insurance cards of patients.

The pharmacy assistant noted that sometimes he was not able to understand some of the hand-written prescription written by the doctor and will have to go to the consulting room to seek clarification from the doctor before dispensing the drugs to the patient.

In an interview, management of the facility noted that the facility will be willing to procure additional computers, provide network infrastructure, provide for training of staffs, among other things to ensure the implementation of the electronic system.
All staff who participated in the study recommended that the project should continue. They added that the proposed system should be built in a way that it will be easy to use and more importantly curb the challenges of the existing system.

4.1.4 Strength of the Current System

Among the strengths that were identified with the current system include; comprehensive data collection and standard work flow.

4.1.4.1 Comprehensive Data Collection

All information about patient necessary for an efficient and effective management of patient care is collected at the facility with the manual system.

4.1.4.2 Standard Work Flow

The facility has a standardized flow of data for every visit made by a patient. That is every patient goes through a standardized process right from the entry into the facility till the patient exits.

4.1.5 Weakness of the Current System

The weaknesses that were identified with the current system include;

- Poor Filing System
- Duplication of Data
- Incomplete/Missing Data

4.1.5.1 Poor Filing System

For the purposes of continuity of care, retrieval of patient information (folder) is often very tedious according the records staff as it can sometimes take about ten (10) minutes. This is because some patients’ information was recorded in pieces of papers whilst others were recorded in folders. They were often not arranged properly on the shelves. Some of
the folders were found on the floor just below the shelves. This often led to difficulty in retrieving particular information about a patient as they have to manually search to locate that information.

4.1.5.2 Duplication of Data

Certain information such as patient demographics were found to be recorded in multiple places such as the nurses’ table and as well the consulting room. There were also cases where some information about an individual patient were kept in different files. This often resulted from creating a new folder for a patient when the old folder could not be located.

4.1.5.3 Incomplete/Missing Data

Through an observation made by the researcher, there were cases where a patient is asked of his or last visit to the facility to aid in the retrieval of the patient’s folder. But when it is retrieved, the documentation on the patient’s last visit(s) may not be found in the record.

4.2 Requirements Specification of the Yendi HC Record Management system

4.2.1 General Capabilities of the Yendi HC Record Management system

Once the system was built with the evolutionary prototyping model of the system development life cycle, the system can manage patient information efficiently. The prototype of the system was built, and it evolved into the required system through the incorporation of user requirement specification. This made the software user friendly and more especially address the needs of the user.

The system is a web-based application and it constitutes models or interfaces specific to users at different levels. The system provided proper filing system, prevented multiple entries of the same data and ensured that data entered into the system are complete. As part of ensuring security of patients’ information, the system also used audit trails to keep track of users’ activities.
4.2.2 User Characteristics

The target group of the software is the medical records staffs, general nurses, general practitioners and the pharmacy assistant at Yendi Health Centre who directly manage patient health information. The target group is classified as users with access levels specific to their job description.

Users as medical records staffs had knowledge on how to enter patient registration details (demographic information), assign patient a visit number and retrieve patients’ statistics information from the system. They were provided with interface limited to information they access from the system, shielding them from having access to an inside knowledge of patients’ medical information in the system.

General Nurse Users were provided with interface limiting them access to entering patients’ vital signs and to assign patients to the general practitioner users.

The general practitioner as a user was expected to have access limited to managing patients’ medical information within the system. They would be preview to patients’ information coming from the general nurse users.

The pharmacy assistant user has access patients’ medical prescription coming from the general practitioner users within the software. They are able to dispense drugs to patients and determine access levels of other user of the software.

The administrator user is expected to manage other users within the software. They are able to create and determine access levels of other user of the system.
4.2.3 System Requirements

The minimum system specification (both hardware and software) required for a successful implementation of the system are as follows.

4.2.3.1 Hardware Requirements

The minimum hardware requirements are:

- 1024x768 resolution or higher.
- Dual Core 1.6GHz or faster with RAM: 1 gigabyte (GB) (32-bit) or 2 GB (64-bit)

4.2.3.2 Software Requirements

The minimum software requirements are indicated in the following table:
Table 4.3: Minimum Web Browser Requirements

<table>
<thead>
<tr>
<th>Operating System</th>
<th>Supported Browser List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows Vista SP2</td>
<td>Chrome, Firefox, Internet Explorer 9</td>
</tr>
<tr>
<td>Windows 7 SP1</td>
<td>Chrome, Firefox, Internet Explorer 11</td>
</tr>
<tr>
<td>Windows 8.1</td>
<td>Windows 8.1 Chrome, Firefox, Internet Explorer 11</td>
</tr>
<tr>
<td>Windows 10</td>
<td>Chrome, Firefox, Internet Explorer 11</td>
</tr>
</tbody>
</table>

4.2.4 Functional Requirements of Yendi HC Record Management System

4.2.4.1 Patient Details

The system is able to capture patients’ details at the medical records unit that can be accessed and used by all units of the clinic. The system is able to generate a unique patient’s identifier and as well a visit number automatically.

4.2.4.2 Drug Details

The system includes a component to store drugs that will be prescribed by the doctor and dispensed to patients by the pharmacist control panel concerning drug issuing.
4.2.4.3 Staff Details

This component of the system will store information on the various categories of staff at the health facility.

4.3 System Design

4.3.1 Data Flow Diagram of the Yendi HC Record Management System

When a patient first visits the facility, he/she is registered (his/her demographic information recorded in a folder) at the medical records unit; he then proceeds to the nurses’ table where his vital signs are measured and recorded into the folder; from there he is then directed to the consulting room where his complaints, diagnoses and prescription of medication are all written in the folder. The patient is then directed to the dispensary where he will receive the drugs that has been prescribed to him by the doctor. The patient then exits the facility.

A copy of the folder used to manage patient data was also studied. The details of the folder include: data on patient registration, data on vital signs of patient, patient-doctor consultation, prescription and as well as dispensing of medication.
4.3.2 Detailed Database Structure

The database structure behind the Patient Record Management System is made up of the following relational tables. They include the patient registration table, user table, drug table, visit table, medication table and drug table.
Figure 4.3: Database Structure of the Yendi HC Record Management System

4.4 System Coding

Codes were generated in Hypertext Preprocessor (PHP), hypertext markup language (HTML 5) and cascading style sheets (CSS) to produce a user-friendly interface. The interface is made up of forms including Login form, Main Application Form, Registration Forms for patients and as well as Staff, Process Patient Form, Consultation Form, Add Drug Form, Add Staff Form and so on.
4.4.1 The Login Form

This is the first interface when the system is launched. It allows the user to provide the login credentials (username and password) provided by the system administrator. The username identifies the user and the password authenticates the user. The login button provides access into the system after a user provides the correct username and password.

![Login form](image)

Figure 4.4: Login form
4.4.2 The Main form

This is the main interface of the system after a user successfully logs in. It contains the various menus of the program. Depending on the user type, access is limited to job description of that user.

![Main application window](image)

**Figure 4.5: Main application window**

![Patient registration form](image)

**Figure 4.6: Patient registration form**
Figure 4.7: Patient processing form

4.4.3 Sample Codes

<!DOCTYPE html>

<html class="no-js">

<head>

<meta http-equiv="X-UA-Compatible" content="IE=edge">

<meta charset="UTF-8">

<meta content='width=device-width, initial-scale=1, maximum-scale=1, user-scalable=no' name='viewport'>

<link rel="stylesheet" media="screen" href="/css/layout.css" />

<title>Admin Create</title>

</head>

<body>

<!-- HTML content goes here -->

</body>

</html>
CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The main objective of the study was to develop an electronic system to manage patients’ information at Yendi Health Centre. The current paper-based system at the facility was reviewed and the results indicated that the paper-based system of managing patient information was found to be very slow, requires large amount of space to store patient folders and most importantly, there was lack of security of patients’ health information.

The requirement analysis indicated that, staff with basic IT skills, network infrastructure, server computer with apache web server, and 4 personal computers were required to run the system. The analysis also indicated that the electronic system should have interfaces specific to users at different levels and it should be able to capture detail information of patients, staff, and drugs. It was again suggested that the system should be built in such a way that it will provide proper filing system, prevent multiple entries of the same data and ensure that data entered into the system are complete.

The fore-mentioned disadvantages, among others, of the paper-based system informed the decision to build the electronic system. The system was built based on the results of the review and the requirements that were specified by the users. Although electronic systems come with some security challenges, measures such as login credentials, audit trails, limited access to job description, among others, with the electronic system, will provide a higher security level to patients’ information as compared to the paper-based system.
5.2 Recommendation

The under-listed recommendations could be considered to help in the successful implementation of the system at Yendi Health Centre.

- Security awareness training for all staff
- Provide for all the items such as network infrastructure, computers, required to successfully run the patient record system
- Training of staff on the use of the application

5.3 Limitation of the Study

The main limitation of the study is the limited time within which the project has been executed.

Another limitation of the study was that some respondents were filing reluctant to answer the questionnaires as a result it took more than the estimated seven (7) days to retrieve all the questionnaires that were given out.
REFERENCES


APPENDICES

Appendix A: Questionnaire

My name is Abdul-Rahman Hassanatu Gomdah. I am a Master of Health Informatics student at the School of Public Health, University of Ghana-Legon. I will be developing a patient record management system for your facility. In order to form the basis of the new system, I am using this questionnaire to solicit your views on the current system of managing patient record in your facility. Any information that you will provide as a participant of this project, will be treated as much confidential as possible, and it will solely be used for this academic purpose. Thank you for your time.

Kindly tick [ √ ] appropriately.

Personal Data

1. Age (specify in years) ..............................................................

2. Sex  male [ ]  female [ ]

3. Level of education.
   a) Certificate [ ]  b) Diploma [ ]  c) Bachelor’s Degree [ ]  d) Master’s Degree [ ]  e) Others ..............................

4. Do you have basic ICT skills?
   a) Yes [ ]  b) No [ ]

Review of Current System

1. What system of filing is used in this facility? (a) Numeric [ ] (b) Alphabetic [ ]
   (c) Alphanumeric [ ]  (d) others, specify

2. Does your facility provide ID cards for patient?
   (a) Yes [ ]  (b) No [ ]

3. If yes do patients sometimes forget to come along with their ID cards?
4. If yes, can you easily locate the folder?
   (a) Yes [  ]         (b) No [  ]

5. On average how many patients do you process in a day?
   (a) Less than 40 [  ]   (b) 40 to 80 [  ]   (c) more than 80 [  ]

6. How much time on average does it take to locate an old patient’s folder?
   (a) Less than 5 minutes [  ]   (b) 5 to 10 minutes [  ]   (c) 10 to 15 minutes [  ]
   (d) more than 15 minutes [  ]

7. How many minutes does it take to process an old patient?
   (a) Less than 5 minutes [  ]   (b) 5 to 10 minutes [  ]   (c) 10 to 15 minutes [  ]
   (d) more than 15 minutes [  ]

8. Averagely, how long does it take to register a new patient?
   (a) Less than 5 minutes [  ]   (b) 5 to 10 minutes [  ]   (c) 10 to 15 minutes [  ]
   (d) more than 15 minutes

9. Are you satisfied with the current system?
   (a) Yes [  ]         (b) No [  ]

10. If no would you want to use an electronic system?  (a) Yes [  ]   (b) No [  ]
Appendix B: Interview Guide (For Management)

Technical Feasibility of the Yendi HC Record Management System

1. Do your staffs have basic information technology skills?

__________________________________________________________________

2. Do you have an information technology staff?

__________________________________________________________________

3. Does your facility have personal computers? If yes, how many?

__________________________________________________________________

4. What are the specifications of the personal computers? Please specify
   i) Operating system
   ii) RAM
   iii) CPU
   iv) Hard disk space

5. Do you have a secured office space to house the computers?

__________________________________________________________________

6. Do you have the network infrastructure at the facility?

__________________________________________________________________

7. How do you ensure the security of the current system?

__________________________________________________________________
Financial feasibility

1. Would the facility be willing to purchase electronic equipment needed for the smooth and secure running of the electronic system?
2. Can the facility afford to maintain the system?
3. Is the facility ready to provide for the cost of network infrastructure?
4. Can the facility provide cost for training of staff?
5. Health information security is paramount. Can the facility ensure that all the tenets of information security are provided for regarding the use of the system?

Recommendations (for all Participants)

1. What do you perceive to be the benefits of the electronic system?
2. Could you describe how the electronic system should work?
3. Overall, do you recommend this project go forward or not?
4. Any other comments?