ADDIS ABABA UNIVERSITY
SCHOOL OF INFORMATION SCIENCE
AND
SCHOOL OF PUBLIC HEALTH

M.Sc in Health Informatics Programme

Design and Development of Web Based Information System for Asthmatic Treatment and follow up for Enchini Hospital

By Belay Denbalu Leta

A project submitted to the school of graduate studies of Addis Ababa University in partial fulfillment of the requirement for the Degree of Masters of Science in Health Informatics

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Addis Ababa Ethiopia

June, 2018

Dedication

I would like to dedicate this research project to my beloved family, to my Dad Ato Denbalu Leta , My Mom Woizero Bayetu Wake & my brother Ato Taddessa Denbalu.

Acknowledgment

I would like to extend my deepest gratitude to my advisors Solomon Teferra (PhD) and Ato Mengistu Yilma (MpH), for their unreserved follow up and superb comments during the undertaking of this research project. Their Guidance and intellectual advices were my inspirations, without their help it would have been impossible to finish the whole project and I really want to thank you.

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Finally, Above all I would like to thank God for leading me all the way, as my light, my lead and my provider without him, I would never make it. Thank you, Jesus again and again!.

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List of acronyms

APS	Application Service providers
BCL	Base Class library
CSS	Cascading Style Sheets
CM	Chronic Dieses
CDM	Chronic Dieses Management
CLR	Common Language runtime
IDE	Integrated Development Environment
EMR	Electronic medical record
E-Health	Electronic Health
ERD	Entity Relationship Diagram
HIT	Health Information Technology
HIS	Health Information System
HMIS	Health Management Information System
IHMEM	Integrated Healthcare Medical Emergency model
IS	Information System
ICS	Integrated Care Service
ICT	Information Communication Technology
JS	JavaScript
LAN	Local Area Network
MMS	Multimedia Messaging Service
MRS	Medical record system
ODBC	Open Data Base Connectivity
PHP	Personal Home Page
RDBMS	Rational Database Management System
SMS	Short Message Service

SDLC	System Development Life Cycle
SSL	Secure Sockets Layer
TB	Tuberculosis
US	United State
UE	Usability evaluation
UI	User Interface
MYSQL	Structured Query Language
W H O	World Health Organization
WWW	World Wide Web

Abstract

Back ground: People who have asthma from early childhood can experience an asthma-related disability for much of their life. Web-based applications provide the power of desktop and server applications with the flexibility and accessibility of the web. Using web browsers, users can securely access applications from anywhere within the reach of the organization intranet or extranet.

Objective**:** The main objective of this project is to Design and develop a web based Information system to improve asthma treatment and follow up of asthma patients in Enchini Hospital.

Methodology: In this project design science methodology were used. Design Science Research project is inherently a problem-solving process. To develop web based information system a necessary software application like Java script, PHP, data base and ASP.Net were used. Finally the project will be presented in Addis Ababa University School of public health & Information Science.

Result: Health care information system is a computer application to represent patient information in a friendly user interface and allowing users to review and interact with patient health information, such as diagnosis, medicine orders, managing patient appointment, follow up and other services. The menus of the developed system were developed by Oromic language, because the community who got service from the Hospitals was Oromo, so they can communicate with their health providers by their own languages. As the results of user evaluation proves, 92.72% of the evaluators agree that the system meets their need for users interface and the system prototype has a good & clear informational and functional explanation regarding the major functionalities of the system and it is accepted as a better technology that link health providers with patients.

Conclusion: Web based information Systems have the potential to improve Asthma care, follow up and quality of life in patients and reduce Hospitalizations for asthma disease. Based on the result of the evaluation we may conclude that the system is accepted by its potential users (medical professionals and patients) and its full implementation can improve asthmatic treatment and follow up in the hospital.

Generally the designed & developed of web based information system fulfills the gap between patients & health providers in the process of asthma treatment & follow up. We recommend the full implementation of the system and make it accessible for the users.

CHAPTER ONE

1. INTRODUCTION

1.1 Back ground

The World Health Organization (WHO) estimates that there are 300 million people world-wide suffering from asthma with approximately 250,000 asthma-related annual deaths. The last few decades have witnessed the rise in the global incidence of asthma particularly in industrialized nations [1].

A chronic disease, as defined by the U.S. National Center for Health Statistics, is a disease lasting three months or longer. About 40 million Americans are limited in their usual activities due to one or more chronic health conditions [2].

About half of all adults have a chronic condition, and approximately 8 percent of children ages 5 to 17 were reported by their parents to have limited activities due to at least one chronic disease or disability [3]. ICT application like web based system can help patients to manage their asthma conditions on a day-to-day basis, but it is still too much for the minority [4].

Asthma is a chronic disease that affects the airways in the lungs. During an asthma attack, airways become inflamed, making it hard to breathe. Asthma attacks can be mild, moderate, or serious and even life threatening. When your asthma symptoms become worse than usual, it's called an asthma attack. Severe asthma attacks may require emergency care, and they can be fatal. Asthma is treated with two kinds of medicines: quick-relief medicines to stop asthma symptoms and long-term control medicines to prevent symptoms. Symptoms of an asthma attack include: Coughing, Shortness of breath or trouble breathing Wheezing, Tightness or pain in the chest [5].

The muscles around the bronchial tubes tighten, causing the airways to narrow; Mucus is produced within the bronchial tubes further restricting air flow [6]. People with asthma are often referred to as twitchy, meaning they seem to overreact to stimuli such as aero-allergens and cold, dry air over time, the airways, or bronchial tubes, become inflamed and sensitive. The following are risk factors which have been identified as triggering or contributing to the asthma disease. These factors are important for identifying people most at risk of developing asthma and for whom prevention strategies may be effective. They are: Parental smoking (post natal), maternal smoking, family history of asthma, Pre-term birth, low birth weight, occupational exposure to pollutants and etc [7].

In health care organizations, the term refers to various web-based and non-web-based technology solutions such as electronic medical records (EMRs), health portals, automated billing systems, radiology information systems, and a myriad of clinical decision support systems and follow up

system to name but a few. These systems all have the potential to enable and support superior health care operations and efficient and effective health care processes [8].
Web based information system for health encompasses tools that facilitate communication, processing and transmission of information by electronic means for the purpose of improving health care. It is a powerful tool and plays an important role in improving health related access and quality of services for the community. Recent advances have resulted in emergence of innovative ideas in health care services with better quality of care for the patients [9].

A useful web based information system would provide comprehensive support to clinicians addressing an individual patient's current health status or health concerns, as well as their entire span of health care needs both today and over time. Many health conditions can be characterized as a 'chronic' condition. Although most Chronic conditions lead to a gradual deterioration in health some chronic conditions are associated with outcomes that are immediately life threatening, such as stroke or heart and asthma attack. Chronic conditions share the following characteristics: They have multiple and complex causes and risk factors, follow a pattern of recurrence or deterioration, they occur across the lifespan with increased prevalence in the aged and they can result in functional impairment or residual disability [10].

The need for improving quality of care in chronic disease management is gaining the attention of healthcare policymakers and stakeholders due to the growing burden of chronic diseases including escalating healthcare spending and the high contribution of chronic conditions to overall morbidity and mortality [11].

Healthcare is highly collaborative in nature. Healthcare professionals are involved in, what Clark calls, joint activities most of the time. This explains why the communication space is so vast, and why the quality of communication is so important for the quality of care. Most applications of Information and Communication Technology (ICT) within health care aim at the enhancement of collaborative work, the electronic medical record and web based information system is a clear example [12].

1.2 STATEMENT OF THE PROBLEM

Asthma is a major cause of chronic morbidity and mortality worldwide and represents a substantial economic and social burden throughout the world [13]. The World Health Organization (WHO) estimates that there are 300 million people world-wide suffering from asthma with approximately 250,000 asthma-related annual deaths [1].

The populations that are affected by asthmatic diseases and rising costs have brought about some unique health care challenge to our global society. In response to the unmet health care needs, researchers are actively seeking for innovative solutions that target for prevention of diseases and personalized diagnosis and treatment.

Patients who have asthma should be scheduled for planned follow-up visits at periodic intervals in order to assess their asthma control and modify treatment if needed. Asthma is highly variable. It can change over time, vary by season or situation, and differ from person to person. Because response to asthma therapy also can vary, periodic monitoring of asthma control through clinical visits is essential to step up therapy (increase the dose, number of medications, and frequency) as necessary; or, step down (decrease) therapy when possible to the minimum medication necessary to maintain control.

Health information can be produced from health facilities in order to be used for sound decision making and problem solving in the health care which specifically used for the purpose of clinical management at the point of care, for management, planning and procurement purpose at district level, and for the governance of the health system at regional and national levels and to communicate health providers with patients [14].

During follow up there were so many problems that dissatisfy the patients. Example they come from long distance to the health facilities to treat their asthma while if the doctor does not available or has another schedule, the patients lose their time, cost of transports, cost of foods, miss asthma care and other things that dissatisfy the patients [15].

Within the contexts of designing and developing a web based information system for asthmatic treatment and asthma patients follow up, we will improve the uncoordinated and fragmented manner in which health services are nowadays provided, thus allowing, by means of tools and electronic integrated services, a better health care more rapid and precise diagnosis, even if they are in their own home by using web based information systems.

In Oromia region west Shoa zone Ada Berga woreda Enchinni Hospital people who are affected by asthmatics are around 295 per year. Among this 78 are younger than 15 while 217 are older than 15. As the HMIS data of the asthma patients in the Hospital shows the trends of asthma diseases is increasing yearly. People who live around that hospital are affected by asthmatic diseases because there are around three Cement factories which inflamed the air around that hospital.

Asthma is a serious health and economic concern in a world similarly in Ethiopia. By developing web based information system that support asthmatic treatment and follow up in Enchini Hospital it is possible to minimize the problem of asthmas patients & follow up, even if in a distance at their own home they communicate with their health care providers.

1.3 OBJECTIVE

1.3.1 General Objective

- The general objective of this project is to design and develop a web based Information system to improve asthma treatment and follow up at Enchini Hospital, Oromia regional state.

1.3.2 Specific objectives

To achieve the general objective, the following specific objectives were stated.

1. To investigate the system process and change empirically
2. To Design the web based information system for asthma patients follow up.
3. To develop a web based information system to support asthma patients in the process of asthma treatments.
4. To evaluate the systems.

1.4 SIGNIFICANCE OF THE PROJECT

This project will help health practitioners as well as patients by providing multidimensional function in the process of delivering health services. Primarily, it helps to facilitate health services for considerable number of individuals who are demanding the services at the desirable quality by saving their time.

Even if everyone were to have access to basic Information Communication technology, such as mobile phones and personal computers, Telemedicine and web based information system in health care is not self evident. The acceptance of e-Health or use of ICT is varying among both client and medical professionals.

Generally by developing web based information systems to support asthmatic treatment and follow up we will provide the following benefits in healthcare:

- Developing better treatments, including cure, and better models of care and follow up.
- Reducing asthma's overall burden of disease and create awareness of self management of asthma.
- Improves patient care and quality by providing available, accessible, and consistent and on time patient information by using web based information system.
- Provides an opportunity to share/ exchange standardized patient information between different hospitals through web based information system.
- Support decision making functions of the organization by using the available information.
- Improves data quality and reliability.
- Greater ease in navigating the health system for consumers' coordination and integration of services, and workforce development.
- It can assist in monitoring of patients in their homes, saving time and cost of travel, ensure better communication, improved security and assist to bridge the gap between patients and their healthcare providers.

  Generally it improves the relationship between patients and health providers in the process of asthma treatments and used to follow ups.

1.5 SCOPE OF THE PROJECT

The scope of this project is designing and developing web based information system to support asthmatic treatment and follow up in Oromia region west Shoa Zone Ada berga Woreda Enchini Hospital, within two semesters. The reason for selecting Enchini Hospital is I know that populations around that area are affected by asthmatic diseases. Conceptually the project focused on the designing of a web based and development of the prototype of web based information system. A web-based information system is also necessary in order to improve the accessibility of the data whenever and wherever needed by health professionals and patients without any geographic boundary.

1. 6 Limitation of the study

The projects were developed up to prototype stages therefore it's not fully implemented web based information systems because to develop up to implementation, it takes so much budget and time. That means the proposed project was limited up to the development of prototype. Because of time limitation and financial constraints it was difficult to encompass whole different life cycles of web based information system/software development.

CHAPTER TWO

2. REVIEW OF LITERATURE

2.1 General Literature review

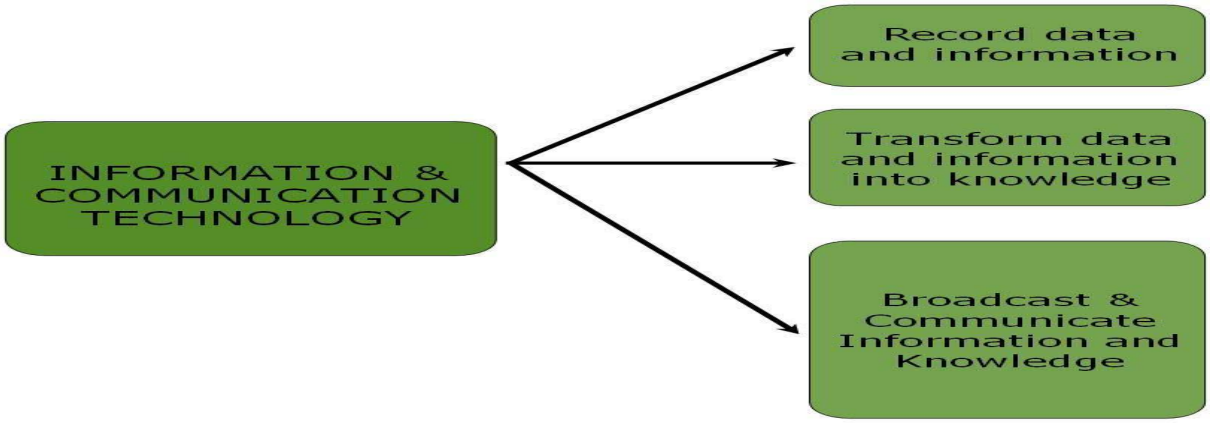
WWW is the source of information over the internet. It is growing at a phenomenal rate. Delivering information over the web is cost effective and fast, and gives internet users easy access to databases from any locations. For this reason, technology will bring many opportunities for creating advanced information system management applications. Web-based technology platforms allow for seamless, integrated delivery of desired services to users with requisite access right and privileges. Web-based and Web-enabled tools provide greater capacity to achieve efficiency in collecting and analyzing data and disseminating results [16].

According to Iskowitz et al, a web-based information system encompasses these kinds of system, Web presence sites that are marketing tools designed to reach consumers outside the firm, Electronic commerce systems that supports consumer interaction, such as online shopping, Extranets that support business to business communication and a system that support health care delivery and improve patient satisfaction [17].

An effective National Health ICT Strategy presents a set of interventions that the health sector plans to use to facilitate the efficient and effective delivery of services [18].
Information systems (IS) have much to offer in managing healthcare costs and in improving the quality of care. In addition to the embedded role of information technology (IT) in clinical and diagnostics equipment, information systems are uniquely positioned to capture, store, process, and communicate timely information to decision makers. This will also enable better coordination of healthcare services at both the individual and community levels [19].

Information and Communication Technology (ICT) is a wide term that refers to all computer-based advanced technologies for managing and communicating information. It is broader than Information Technology (IT) which is defined as the study, design, development, implementation, support or management of computer-based information systems, particularly software applications and computer hardware [20].
Web-based applications provide the power of desktop and server applications with the flexibility and accessibility of the web. Using web browsers, users can securely access applications from anywhere within the reach of companies intranet or extranet. As the use of IT to process medical data increases, much of the critical information necessary to meet these challenges is being stored in digital format. Web-enabled information technologies can provide the means for greater access and more effective integration of healthcare information from disparate computer applications and other information resources [21].Within the ICT domain, what is typically stressed by the user's communities is the great potential of ICT tools regardless of their ultimate goals. Usually, ICT is employed for three major actions: (1) To record data and information, (2)

To transform the data and information into knowledge which can be shared and, eventually (3), communicate the data, information and knowledge.



Figure

1: The main functions of ICTs in health care Adopted from IT Association of America, 2008

The World Health Organization (WHO) defines e-health as the leveraging of the information and communication technology to connect providers and patients and governments to educate and inform healthcare professionals, managers and consumers to stimulate innovation in care delivery and health system management and to improve our healthcare system [22].

Health IT plays a key role in digitizing and transmitting health information electronically that can improve patient outcomes. Health IT processes can also include:1) Use of electronic health records (for patients, physicians, insurers, hospitals and clinics), 2) Health information exchange across industries and geographies like web based information systems, 3) Use of electronic health information to detect trends in population and public health and 4) Transmission of medication refills and a patient's prescription history and etc [23].

2.1.1 Information and communication technology in chronic diseases

Information and communication technologies (ICTs) are widely employed in many applications for improving quality of services [24]. The Chronic Care model was proposed by the World Health Organization almost one decade ago to face the epidemics of chronic conditions. It is widely accepted as a conceptual framework with Integrated Care Services (ICS) being one of the core components, but its implementation represents a profound reshaping of health care. ICT is acknowledged as key enabler of ICS through the development and small-scale validation of personalized services and integrated care programs, engaging chronic patients and relatives as active members of the care team, enhancing collaboration among careers and promoting seamless continuity of care across different care settings [4].

The successful implementation for CDM requires an integrated approach which can be facilitated through use of ICT in health services. Monitoring chronic conditions will improve patient

awareness and responsibility of their health and chronic conditions. ICT will improve health services quality and efficiency. It will become easier for distant services to be made available and help meet demand, enhancing health service capacity and its accessibility [13]. Internet plays a significant role in connecting all the participants in the health community. It is used to control remote medical equipments, communication between parties such as patients and doctors, search for needed information, transferring text, graphics, audio and video files as well as supporting collaboration in real-time [25].

2.1.2 Web-based Interventions for Self-management in Chronic Disease

As noted above, increasing use of the internet by consumers of health information and ongoing technological development has led to the design and institution of many internet based interventions. These interventions are designed to improve self management in patients with chronic diseases such as heart disease, diabetes, and arthritis. A number of studies have been conducted to evaluate internet based interventions [45].

A recent systematic review of mobile-health technology that covered health behavior change and disease management interventions found mixed results regarding the effectiveness of interventions. While the results showed no or small effect in diet and physical activity interventions on weight control, there was some evidence of benefit for short term management of diabetes and asthma and for reminders for vaccine appointment attendance and cardiopulmonary resuscitation training. As a result, mobile technology based interventions are not yet optimal and need to incorporate additional components found in effective self-management interventions [46].

2.1.3 Approaches to Chronic Disease Self-management

A broad range of self-management models has been developed and implemented nationally and internationally (Department of Health Victoria, 2008). The Stanford chronic disease self-management program, also known as the Lorig course as noted above, was developed in the 1990s at Stanford University. The program was initially developed for arthritis self-management and extended across different chronic diseases. The program has a structured content and includes a six week group based course for 10-15 patients (Department of Health Victoria, 2008). Since the program is based on group intervention, it is considered effective in reducing isolation and therefore facilitating self-efficacy. It was also proposed that self-efficacy of participants would improve thorough peer learning and sharing. The program offers strong goal setting and problem solving skills [46].

Asthma care quality improvement tool

The care management part of the quality improvement tool helps practices identify where they can improve the quality of care they provide to patients with active asthma and reduce their risk of exacerbations.

The asthma care quality improvement tool enables practices to extract and analyze relevant clinical data from their clinical information system. The quality improvement tool works across

all clinical information systems and presents data in an easy to use format allowing practices to gain insight and knowledge into their management of patients with asthma.
The asthma care quality improvement tool helps practices by Establishing a more accurate prevalence rate for asthma within their practice population, facilitating clinical audit against national standards for all asthmatic patients prescribed asthma medication, using patients' medication history to summarize treatment strategies, highlighting patients whose current treatment step may require review and reporting on key factors that are associated with an increased risk of exacerbation Providing the facility to compare data with other practices both locally and nationally and the option to share aggregated data [47].

2.1.4 Web Based Health Information Systems

The World Wide Web "WWW" or "Web" is a techno-social system to interact humans based on technological networks. The WWW enhances human cognition, communication, and co-operation. The growth of web can be shortened into generation of four kinds; Web one up to four generations, as a web generation of cognition, communication, co-operation and integration respectively. The reason for the Web's success is largely due to its simplicity for use and information retrieval. Its nature of simplicity and usability makes web to be preferably used in any sector for management and transaction of information [26].

Web sites that provide patient access to electronic medical records (EMR) and electronic patient–provider communication can support more transparent and active sharing of personal health information. Sharing of the different information through the web may encourage patient activation and more effective partnerships with providers. Viewing medical test results, after-visit summaries, requesting medication refills and participating in secure clinical messaging with providers were the most commonly used portions of the Web site by patients and providers. The availability and accessibility of the web made secure transfer of confidential patient information fast and reliable. Patients can take their information wherever they go for medical care. Most importantly beyond clinicians' use of the Web as a tool to support evidence-based practice, patients may use Web-based information to enhance their interactions with physicians and to become more knowledgeable partners in managing their own health. The web can also enable patients to make informed health care choice [27].
Web-based technologies to promote asthma control and improve outcomes are currently studied and welcome. On the other hand, there is increasing evidence that an improper and addictive use of the internet-based resource (such as social networks) could have a negative impact on asthma, either in term of control and self-perception.

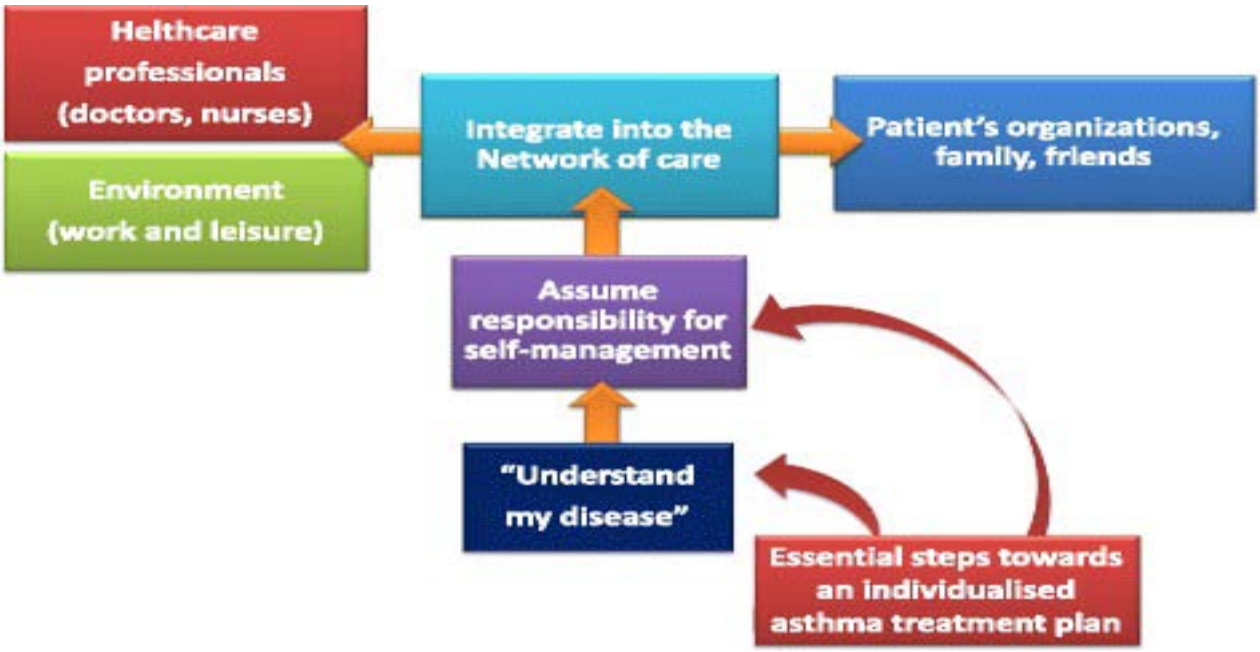


Figure 2: Essential steps towards an individualized asthma treatment plan, adopted from Asthma research practice, 2015

2.1.5 Use of Health Information

In the context of health sector reform and decentralization, health systems are managed as closely as possible to the level of service delivery. This lead to the shift of function between the central and peripheral levels which generates new information needs and calls for the restructuring of information systems to collect and use information for decision making at local, district, provincial and national levels and to follow up patients current status.

Health information systems serve multiple users and a wide array of purposes that can be summarized as the generation of information to enable decision-makers at all levels of the health system to identify problems and needs, make evidence-based decisions on health policy and allocate scarce resources optimally.

The health information system provides the underpinnings for decision-making and has four key functions: data generation, compilation, analysis and synthesis, and communication and use. The health information system collects data from the health sector and other relevant sectors, analyses the data and ensures their overall quality, relevance and timeliness, and converts data into information for health-related decision-making. A good health information system brings together all relevant partners to ensure that users of health information have access to reliable, authoritative, useable, understandable, comparative data [43].

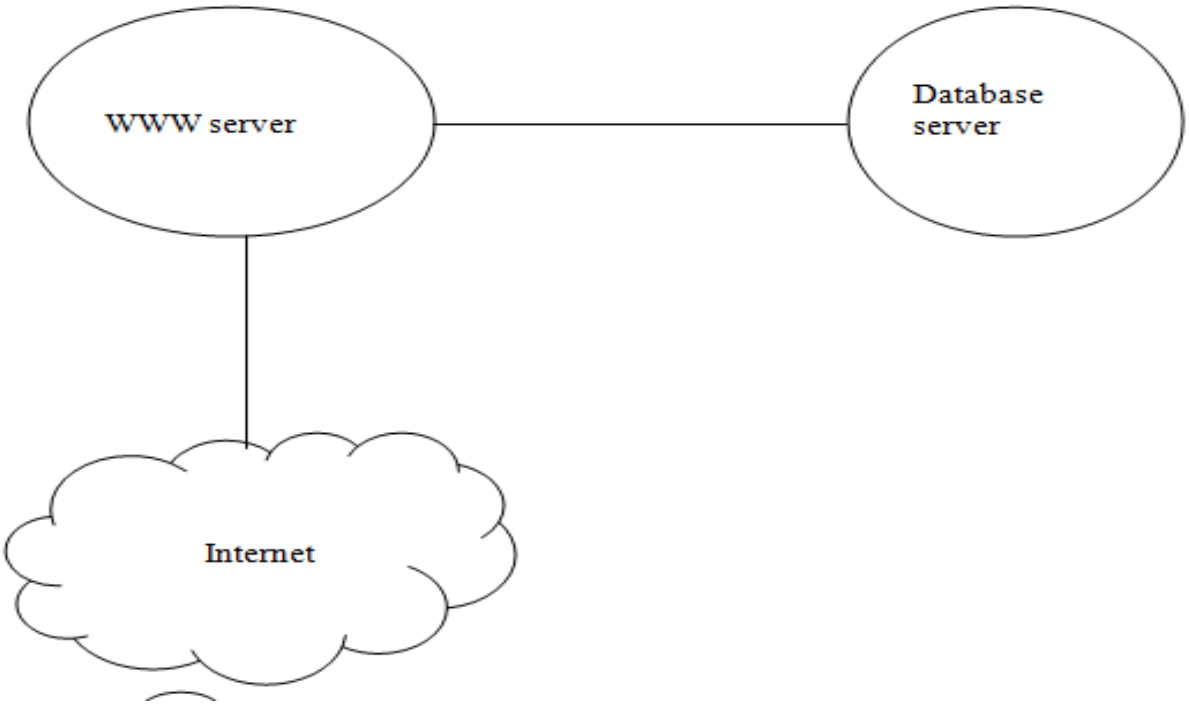


Figure 3: an outline of the WWW-based consultation system, adopted from Web-based system for medical tale consultation.

To improve health care services, it is very important that there is consistency in clinical data. Traditionally, large amounts of data have been captured in unstructured formats, but the industry is applying structured data with standardized coding and terminology. Information system architecture can make sure that the data structures and taxonomies implemented throughout the organization are in coherence internally and well-suited externally with business partners, regulators, and payers.

2.1.6 Web-based communities for home care patients

In addition to web-based applications that follow an institution-centric approach and link home care patients to health care providers, the Internet also supports a consumer-centric model and enables the creation of networks between home care patients diagnosed with the same condition, families or other informal caregivers, communities, and the general public. Such networks are often referred to as virtual communities. A virtual community is a social entity involving several individuals who relate to one another by the use of a specific communication technology that bridges geographic distance (Demiris, 2005). Virtual communities demonstrate core attributes where in members has a shared goal, interest, need, or activity that is the primary reason for being part of the community. A virtual community with a health care purpose or focus is a group of people, as well as the social structure that they collectively create, based on the use of telecommunication with the purposes of educating, providing support, discussing issues, sharing resources, consulting with experts, and sustaining relationships beyond or without face-to-face events. Numerous such applications function as self-help groups of individuals diagnosed with

the same clinical condition or undergoing similar treatment. As Finn (1999) demonstrated, virtual self-help groups can provide many of the processes used in face-to-face self-help and mutual aid groups. The emphasis in such virtual communities is on mutual problem solving, information sharing, and expression of feelings, mutual support, and empathy especially for follow up.

2.1.7 Chronic Disease Management

The integration of ICT with chronic care management processes or frameworks can promote a technology enabled, systematic approach to chronic disease prevention and control, and support critical care coordination, provider patient interaction, and self-management functions across systems, populations, and conditions [23].

World Health Organization (*WHO*) has stated chronic diseases to be the leading cause of illness burden, disability and death globally and a major focus for health policies and health care systems internationally. Long-term disease or chronic disease means any kind of illness or condition, which requires continual medical treatment, restrains the ability to function and that sustains longer than one year's like asthma, back pain, cancer, depression, diabetes, heart disease, insomnia, and stroke [28].

Key functional elements of web based information systems are Frequent and reliable communication between patient and provider, real-time decision making at the point of care, customized patient guidance and education to support self-care, clinical information exchange to facilitate care coordination, adherence to evidence-based practices to support ongoing quality improvement and performance accountability by reporting program and organizational outcome [13].

2.1.8 ICT in health care

The applications of information and communications technologies in medicine are commonly referred to as telemedicine and medical informatics. Although these terms are often used together and confused with each other, they are separate and have their own definitions.

The Institute of Medicine (1996) defines telemedicine as the use of electronic information and communications technology to provide health care when distance separates the participants. It includes all forms of electronic communication between patients and health providers and among providers, starting from telephone to interactive video and web-based communication.

The TM approach is a particular importance for elderly or patients who suffer from multiple chronic conditions which can benefit at distance from an integrated personalized care approach (i.e., integration between primary, secondary, home and self-care) [13]. Tele-health has been used to support self-management of long-term conditions such asthma. Patients' respiratory signs and symptoms were recorded at home and transmitted to a remote control center and chest physiotherapy was prescribed and modulated accordingly. This modality was associated with reduced hospitalizations and emergency room admissions [29].

Home Tele monitoring encompasses the use of audio, video, and other telecommunication technologies to monitor patient status at distance. It is an automated process for the transmission of data on a patient's health status from home to the respective health care setting. Only patients or their family members, when necessary, are responsible for keying in and transmitting their data without the help of a health care provider such as a nurse or a physician [4].
Through mostly pilots and research studies, information and communications technologies have shown the potential to aid in the effective, cost-efficient treatment of chronic diseases. Such technologies are best able to aid in self-management applications (such as symptom control, medication adherence), and in some cases even alert notifications of environmental triggers, a critical piece of symptom control [13]. Web based application can be applied to for, raising the capacity of the person to increase the years of healthy life and activity. Prevention can be applied throughout the whole life of a person, but it is particularly important for old people, since it allows them to have more years of healthy life and better manage already existing disease, Compensation and Support concern elderly people with physical or cognitive impairment that need help with the daily activities, Independent and active ageing refers to the possibility for old people to keep on living on their own, participating to the social activities and, when wanted, working [30].

As a chronic disease whose treatment contains a significant adherence component, and as one that has the greatest impact on children, asthma especially lends itself to the use of ICT as part of its core management strategy. Web based application can help fill many of these gaps to make information about asthma treatment and symptom management more widely available, thereby reducing inequities. In particular, mobile and web platforms can play significant roles in delivering reminders to patients to improve adherence, which results in better outcomes and decreased emergency room utilization due to asthma.
Due to the fact that asthma does not follow a traditional chronic disease progression (as the disease often resolves itself when a child becomes older), the focus for those with minimal-moderate disease is to control symptoms and minimize unnecessary healthcare utilization, rather than to delay disease progression. Asthma is a common, chronic disorder of the airways characterized by wheezing, breathlessness, chest tightness, and coughing at night or early in the morning, known as asthma exacerbations or attacks. Airflow is obstructed by factors which narrow airways in the lungs in reaction to certain exposures or triggers, making it hard to breathe [26].

2.1.9 Follow up

Follow up is the act of making contact with a patient or caregiver at a later, specified date to check on the patient's progress since his or her last appointment. Appropriate follow up can help you to identify misunderstandings and answer questions, or make further assessments and adjust treatments. In addition, follow up helps to promote a good working relationship between health providers and your patients. Follow-up is a vital part of ongoing patient safety. It allows for subsequent investigations to be checked and acted upon, encourages specialist review of patients and ensures that patients with chronic conditions receive the appropriate secondary care input.

Follow-up of patients who have experienced an acute exacerbation of their asthma sufficiently severe to warrant treatment at a hospital reduces re-admission rates and improves patient symptoms. Reliable information from follow-up evaluations can lead to improved policy, better services, and better Outcomes for users. Traditionally, the role of emergency physicians in caring for patients with acute asthma has been to provide emergency treatment and then to suggest follow-up visits with the primary care provider for ongoing preventive care [48].

After initiating or stepping up medication, it is very important to follow up with patients and assess their response. When deciding on follow-up intervals, it's helpful to bear in mind that inhaled corticosteroids can take about 4 weeks of regular use to have the most benefit. Individuals vary widely in their response to and tolerance of specific therapies and drugs, and it is difficult to predict which medications will be both effective and tolerable for an individual patient. Therefore follow up for asthma patients are to achieve good symptom control, maintain normal activity levels, minimize future risk of exacerbations, and reduce adverse effects from medications.

Asthma is a chronic inflammatory lung disease, and all chronic diseases need regular follow-up visits. Practitioners need to assess whether or not control of asthma has been maintained and if a step-down in therapy is appropriate. Further, practitioners need to monitor and review the daily self-management and action plans, the medications, and the patient's inhaler and peak flow monitoring techniques. The exact frequency of visits is a matter of clinical judgment. If asthma is uncontrolled or a change in medication or clinical status has occurred, the patient should be followed in two to six weeks for an evaluation [49].

2.1.10 User Interface Designing / Prototype

A prototype is a working model that does not normally have all the required features or provide all the functionality of the final system. The main purpose of developing a prototype database system is to allow users to use the prototype to identify the features of the system that work well, or are inadequate, and if possible to suggest improvements or even new features to the database system. In this way, we can greatly clarify the users' requirements for both the users and developers of the system and evaluate the feasibility of a particular system design. Prototypes should have the major advantage of being relatively inexpensive and quick to build [31].

2.2 RELATED WORKS

The World Wide Web (Web) was originally conceived in 1989 as an environment to allow for the sharing of information (e.g., research reports, databases, user manuals) amongst geographically dispersed individuals. The information itself was stored on different servers and was retrieved by means of a single user interface (Web browser) [32].

In addition to web-based applications that follow an institution-centric approach and link home care patients to health care providers, the Internet also supports a consumer centric model and enables the creation of networks between home care patients diagnosed with the same condition, families or other informal caregivers, communities, and the general public. Such networks are often referred to as virtual communities. A virtual community is a social entity involving several individuals who relate to one another by the use of a specific communication technology that bridge geographic distance (Demiris, 2005). More than 75% of all health care costs are due to chronic conditions. Four of the five most expensive health conditions (based on total health care spending in a given year in the United States) are chronic conditions heart disease, cancer, mental disorders, and pulmonary conditions and asthma [33].

Improvement of medical practice has resulted in successful treatment and cure of more diseases. However chronic diseases, which have gradual progression and long-term fluctuation and difficulty in treatment, like asthma are still major healthcare problems similarly in Ethiopia [34].
Some studies define SDLC primarily as a complete step-by step process of developing an application system that supports business needs or the requirements of an organization and health care (McManus, 2003; Rob, 2004).

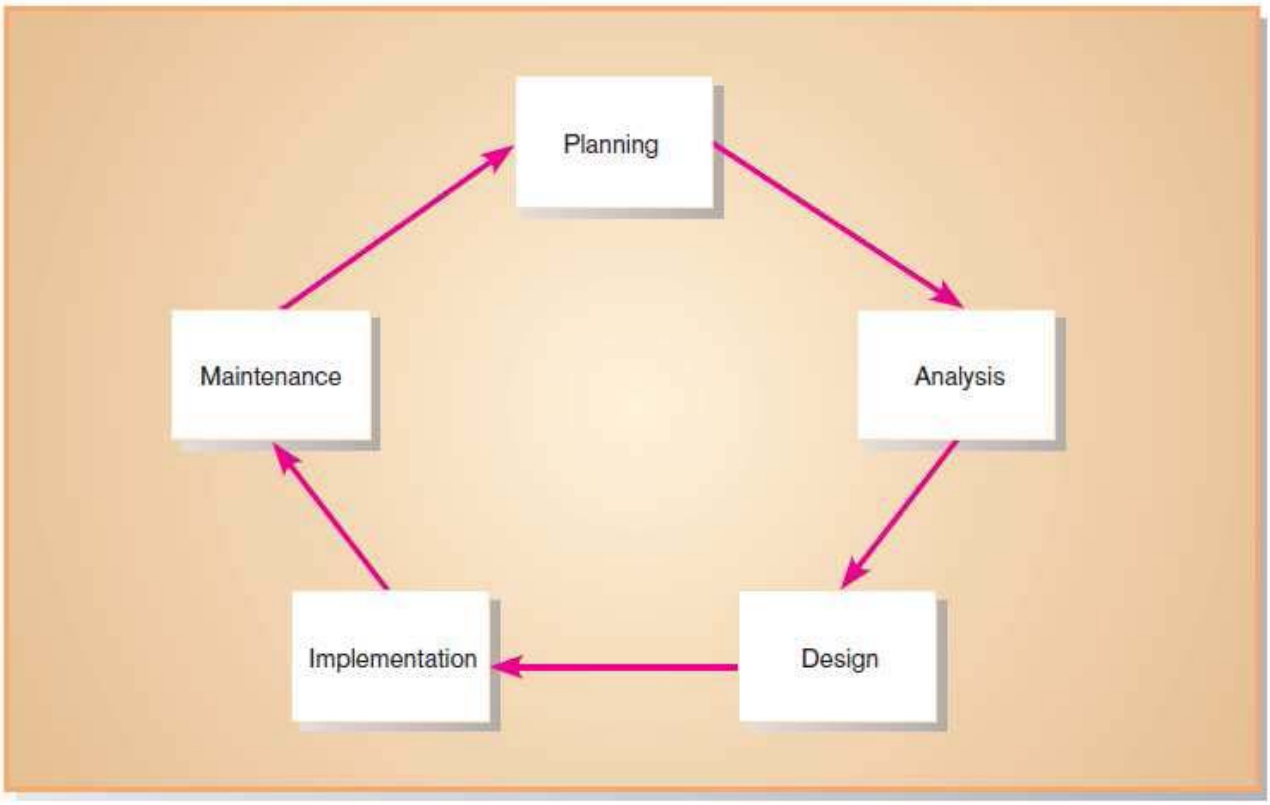


Figure 4: System Development Life Cycle **(Hoffer, George & Valacich 2011)**

Basically, first in the Planning stage, the proposed system needs to be identified, prioritized and arranged according to the user requirements. Next, in the Analysis stage, those requirements will be comprehensively analyzed and structured to produce solutions. Then, at the Design stage, the requirements will be transformed into the solutions into logical and physical system specifications which contain detailed descriptions of independent functions and features associated with the technology to be employed. After that, in the Implementation stage, the system will be fully implemented and tested to ensure the requirements are met. And lastly, the Maintenance stage will soon to improve and enhance the system [35].

This SDLC methodology is taken as a basis to create a new development methodology for building web-based information systems. This new development methodology needs to cater to the multi-disciplinary nature of web-based development including aspects such as analysis and design, user interface development, human-computer interaction, project management, graphic design and presentation (Kumar and Sang wan, 2011).
Web-based information systems have been well developed that offer huge potential to the market in business-to-consumer transactions, and gains of efficiency in business-to-business e-commerce and health care. Information systems using web technology, delivered by the Internet, are now prevalent throughout the world. To design and develop such systems, we need to

consider the aspect of development time and costs for the entire development process which covers stages from requirements analysis up to implementation. This is important to the clients of web-based development consultancy organizations where they need to rapidly deliver their web-based information systems online to health care service [35].

A study delivered in China in 2005 launch a web-based, case-based electronic reporting and recording system for tuberculosis (TB) information management system of the country [36]. This study delivers the system with capability of holding TB patients detailed treatment data and treatment outcomes, including demographic information, clinical data and drug susceptibility testing results that are stored using Oracle database.

Other study which computerizes all the records about patient, staff, drug suppliers and report production of St. Francis Hospital Namibia in Uganda. This study follows iterative waterfall approach to automate health information system of the hospital. It also uses data flow diagram and logical entity relationship diagram to show the data flow and relationship between entities of the system [37].

In developed countries, in Europe and United States the use of EMR has been driven by the belief that these systems can help to improve the quality of health care. These systems were also adapted in developing countries. In Kenya there are some benefits gained from the electronic recording system which is called Medical Record System (MRS) implemented in 2001. As evaluation results of this system showed that, Provider time per patient was reduced by 58% and patients spent 50% less time waiting in the clinic. Clinical personnel spent 50% less time interacting with patient, two third less times interacting with each other, and more time in personal activities. This motivates the health providers to give their attention to information utilization from the services [38].

The health workers participating in the health provision also believe this advantage of the technology. For example when we see in Ethiopia as study by Mitiyos showed that most of the respondents in his study agreed that they need computers in order to use local data on their day-to-day activities. But some writers oppose this idea they said that as “computers are not a universal solutions and clearly they offer no readymade solutions, a computer is a machine for handling symbols. And they advise just to focus on the other challenges concerning to the human resources as well as other resources, but other studies both from the developed and developing countries indicate that implementing electronic recording system brings some improvement in the health service delivery.

Kabaso and Korpela have suggested that “Africa has seen a balanced rise in the Information and Communication Technology (ICT) systems installed in health care institutions. However, this uncoordinated mass migration to electronic health information systems in Africa has made a diverse and difficult computing environment where most of the installed systems have technologies that are limited, copyrighted and narrow. Still, the infrastructure in Africa to assist the electronic exchange of information has a number of limitations. The structure of connectivity on which applications run is still segmented. Most parts of Africa lack the availability of a

reliable connectivity infrastructure. In some cases, there is no connectivity at all. The realities of interoperability and re-usability problems have started to become more prominent in Africa as more systems are developed and deployed. [55]

For several years, a great effort has been devoted studying the implementation of various software development methodologies. Especially since the introduction of Water fall model early 1970s to late 1980s, software development methodology has attracted much attention from software engineering researchers. Despite its potential use, using waterfall solely may not work efficiently, especially in the software development with high complexity and frequent change in requirements.

However, there is no method has been a silver bullet which can address all the problems in the software development. Instead, each of which may have strong and weakness and can complement each other. [56]

The study conduct in USA was used to Design a Web Based Nursing Home Information System. Most of the nursing homes in the United States do not have clinical information systems at their facility due to which elderly people who reside in the facilities are not reaping the benefits that these systems are thought to have. Some Nursing homes that do have clinical information systems deployed are not primarily designed to support nursing care coordination [58].

The purpose of this study is to explore the emerging need for Nursing Home Information Systems (NHIS) in long term care facilities and the promise they hold for increased efficiency, better accuracy, reduced cost, and improved outcomes. With Internet becoming an important topic in health care industry due to its capability for increased accessibility to information, a web based information system proves more beneficial to organizations [58, 59].

The study conducted in Columbia, designing the a Diabetes Disease Management System .The researcher show the role of modeling clinical work flow in the design philosophy of our application, and summarize the application’s feature and usage. Next, the researcher describes observations made during and after design and implementation, and how they relate to the informatics literature. Finally, the researcher elaborates on the application, and its use as an organizational frame work for the roles of information technology in diabetes care [59].

In this project we design and develop web based information system to improve asthma treatment and follow up in Oromia regional state west shoa zone Ada berga woreda Enchini Hospital.

CHAPTER THREE

3. METHODOLOGY

The British Computer Society defined an Information Systems methodology as a recommended collection of philosophies, phases, procedures, rules, techniques, tools, documentation, management, and training for developers of information systems [39].

Generally methodology in web based development is a formalized approach to implementing the System development life cycle. Different types of project methodologies are available. In this project ***design*** **science** methods were used to develop web based information system to improve asthma care and asthma patients follow up in Enchini Hospital. Design Science Research is inherently a problem-solving process. The fundamental principle is that knowledge and understanding of a design problem and its solution are acquired in the building and application of an artifact.

Accordingly, to develop our web based information system, PHP, html, JavaScript, and Mysql database were used to construct the system.

Following the process of design science in our web based system developments the following six steps/activities of the approach have been accomplished. As it has been mentioned in chapter one our work is limited only to the development of the prototype of the system.

1. Problem identification: Define the specific research problem and justify the value of a solution. Since the problem definition will be used to develop an effective art factual solution, it may be useful to atomize the problem conceptually so that the solution can capture the problem's complexity.
2. Objectives of a solution: at this stage the objectives of a solution from the problem definition. The objectives will be inferred rationally from the problem specification
3. Design and development: Create the art factual solution.
4. Demonstration: Demonstrate the efficacy of the artifact to solve the problem. This could involve its use in experimentation, simulation, a case study, proof, or other appropriate activity. Resources required for the demonstration include effective knowledge of how to use the artifact to solve the problem.
5. Evaluation: Observe and measure how well the artifact supports a solution to the problem. This activity involves comparing the objectives of a solution to actual observed results from use of the artifact in the demonstration.
6. Communication: Communicate the problem and its importance, the artifact, its utility and novelty, the rigor of its design, and its effectiveness to researchers and other relevant audiences, such as practicing professionals, when appropriate.

The project were developed at Echini Hospital by designing and developing web based information system to support asthmatics treatment and follow up through following the above one to six activities.

3.1 Web Technologies or the Application Development Platform

This application could be developed using different web-based application tools or Web Technologies or their combination. Based on our familiarity and accessibility of the technologies, we have applied the following ones for the development of our prototype:

I. The JAVA Platform

Java is a programming language expressly designed for use in the distributed environment of the Internet. It was designed to have the "look and feel" of the C++ language, but it is simpler to use than C++ and enforces an object-oriented programming model. Java can be used to create complete applications that may run on a single computer or be distributed among servers and clients in a network. It can also be used to build a small application module or applet for use as part of a Web page. There were five primary goals in the creation of the Java language;

(a) It should use the object-oriented programming methodology

(b) It should allow the same program to be executed on multiple operating systems.

(c) It should contain built-in support for using computer networks.

(d) It should be designed to execute code from remote sources securely.

(e) It should be easy to use by selecting what were considered the good parts of other object-oriented languages.

The Java platform is a fundamentally new way of computing, based on the power of networks and the idea that the same software should run on many different kinds of computers, and other devices.

II. Microsoft .NET

The **Microsoft .NET Framework** is a software component that can be added to or is included with Microsoft Windows operating system. It provides a large body of pre coded solutions to common program requirements, and manages the execution of programs written specifically for the framework. The .NET Framework is a key Microsoft offering, and is intended to be used by most new applications created for the Windows platform.

The pre-coded solutions that form the framework's Base Class Library (BCL) cover a large range of programming needs in areas including: user interface, data access, database connectivity web application development, numeric algorithms, and network communications. Programs written for the .NET Framework execute in a software environment that manages the program's runtime requirements. This runtime environment, which is also a part of the .NET Framework, is known as the Common Language Runtime (CLR). It is included with Windows Server 2003 and Windows Vista, Window 7, Window 8 and can be installed on older versions of Windows.

In a nutshell, .NET is:

- ✓ NET is Microsoft's new Internet and Web strategy
- ✓ NET is NOT a new operating system
- ✓ NET is a new Internet and Web based infrastructure
- ✓ NET delivers software as Web Services
- ✓ NET is a framework for universal services
- ✓ NET is a server centric computing model

- ✓ NET will run in any browser on any platform
- ✓ NET is based on the newest Web standards.

III. Microsoft's SQL Server:

Microsoft SQL Server is a relational database management system (RDBMS) produced by Microsoft. Its primary query language is Transact-SQL, an implementation of the standard Structured Query Language (SQL) used by both Microsoft and Sybase. Microsoft SQL Server also supports Open Database Connectivity (ODBC).

SQL Server includes support for database mirroring and clustering. A SQL server cluster is a collection of identically configured servers, which help distribute the workload among multiple servers. SQL Server supports data replication, spanning three different scenarios:

1. **Snapshot replication:** Snapshots of a database are pushed out to all replication subscribers of a server.
2. **Transaction replication:** Changes to the database are continually published out to clients.

3. **Merge replication:** Synchronizing the database with other servers participating in the replication Changes to all databases happen independently and during replication, the changes are synchronized among all databases [51].

Tools and Techniques

Identification and utilization of an appropriate tool and technique is critical to the success of developing web based information system for improve asthma treatment and follow up. The following tools were used in this project:

Microsoft Visio 2010 was used to draw sequence diagrams. Sequence diagram is selected because of it is easily available and ease of use especially for design part.

Net Beans is an open-source integrated development environment (IDE) for developing with Java, PHP, C++, and other programming languages. Net Beans is also referred to as a platform of modular components used for developing Java desktop applications.

WampServer : refers to a software stack for the Microsoft Windows operating system, and consisting of the Apache web server, Open SSL for SSL support, MySQL database and PHP programming language. WAMP is widely used and relied upon for local development or as a ready-to-deploy server.

PHP/personal home page is a server-side scripting language designed for web development but also used as a general-purpose programming language.

3.2 Study Area

The study was conducted at Enchini Hospital. Enchini Hospital is located at Oromia region west Shoa zone Ada Berga woreda which is 64Kms far from Addis Ababa. The Hospital is bordered on the south by Welmera woreda, on south west by Ejere woreda, on the west by Meta Roobi woreda and on the north & east by the Muger river which separates it from the semen Shoa zone. It began service in 2007 E.C within 75 health professionals and 53 supportive staff members. The hospital serves for about 372,690 peoples.

3.3 Study Period

The study was conducted from February 2017 to May 2018.

3.4 Study design

The purpose of the project is developing web based information system that can support asthma treatment and asthmas care follow up. **Design science** was used to investigate in the project to develop web based information system to improve asthma care and follow up asthma patients in Enchini Hospital.

3.5 Dissemination plan of the study finding

The result of the project was presented to Addis Ababa University community as part of Msc project and a copy of the project will be disseminated to Addis Ababa University School of public health and School of Information Sciences, department of Health informatics.

3.6 Ethical Consideration

The project proposal was sent for approval to the project and Ethics Committee at School of public health, Addis Ababa University before I proceed to the study Permission will obtained from hospital administration to conduct the study in Enchini Hospital.

This project was reviewed and approved by the Addis Ababa University, Department of Public health Research Ethics Review Committee.

Based on the Ethical clearance The Ababa University school of public health also sends a letter to the Enchini hospital. Then the hospital assigns my letter to person who it concern.

3.7 Operational Definition

Information: is processed data and useful for decision making.

System: A collection of components that work together to achieve a common objective.

Information System is an organized system for the collection, organization, storage and communication of information. More specifically, it is the study of complementary networks that people and organizations use to collect, filters, and process, create and distribute data.

Web based information system is an information system that uses Internet web technologies to deliver information and services, to users or other information systems/applications. It is a software system whose main purpose is to publish and maintain data by using hypertext-based principles.

Health management information system is a routine health information system or information systems in the health system producing service generated routine data, which includes data that can be used for services.

Follow up is the act of making contact with a patient or caregiver at a later, specified date to check on the patient's progress since his or her last appointment. Appropriate follow up can help you to identify misunderstandings and answer questions, or make further assessments and adjust treatments.

Patient: client; people who get service from health facilities.

Entity relationship diagram: An entity-relationship diagram (ERD) is a data modeling technique that graphically illustrates an information system's entity and the relationships between those entities.

CHAPTER FOUR

4. RESULT AND DISCUSSION

4.1 Analysis and Design of the System

4.2 Analysis

4.2.1 Introduction

Collection and analysis of the requirement is one of the basic and essential steps in the software development life cycle. Investigations of the existing system in use by various means provide the basic and necessary inputs for the system to be designed. The collected inputs should be organized in a meaning full manner to provide the proper functionalities of the system in a way that shows the flow of information, data generated and the users of the system.

Health care information system is a computer application to represent patient information in a friendly user interface and allowing users to review and interact with patient health information, such as diagnosis, medicine orders, managing patient appointment and other services. Moreover, application of health information system works as data repository for patient health information such as patient registration, systems administrator and follow up for asthma treatment. On the other hand, using the information system allows the patient information to be accessible and the patient can access his/her own information online, register online and in some systems can book their appointment online.

As the data of our questionnaires shows most of the people doesn't have awareness of Asthma to prevent from their self. And they cannot communicate with health providers to follow ups their asthma status because of they come from long distance. They prove that the designed and developed system is a good technology that link health providers with patients.

Security aspects

Security is a very important aspect in many applications of Internet today such as e-commerce and e-Health care. The proposed system employs many techniques for protecting patient privacy. These techniques include data encryption, user authentication and database integrity protection. User authentication is performed by entering username/password information as Administration.

Much has been made recently regarding the safety of web-applications and the possibility of criminal hackers. Technology such as encryption and firewalls are an increasing occurrence to support web applications. Password-protected pages that use encryption as their main weapon against hackers tend to address issues of transmitting or accessing sensitive information (such as credit card details. Encryption is a process whereby a mathematical algorithm is used to describe how a piece of data is to be encrypted.

A firewall cuts down the amount of access points open to a potential attacker and patrols these rigorously. This type of security is very applicable to all types of web system in order to preserve

confidentiality and privacy, availability (their ability to provide a service), and authority and accountability [52].

Software

The web browser is currently the preferred software to access online information. Any type of information within a web application can be viewed through a web browser and it the job of the developers to ensure this is true for their system. A single piece of software for accessing information enables many forms of cross-referencing and linking. It provides excellent opportunities for users to be able to manage their information sources at the information level rather than the computer systems level [53].

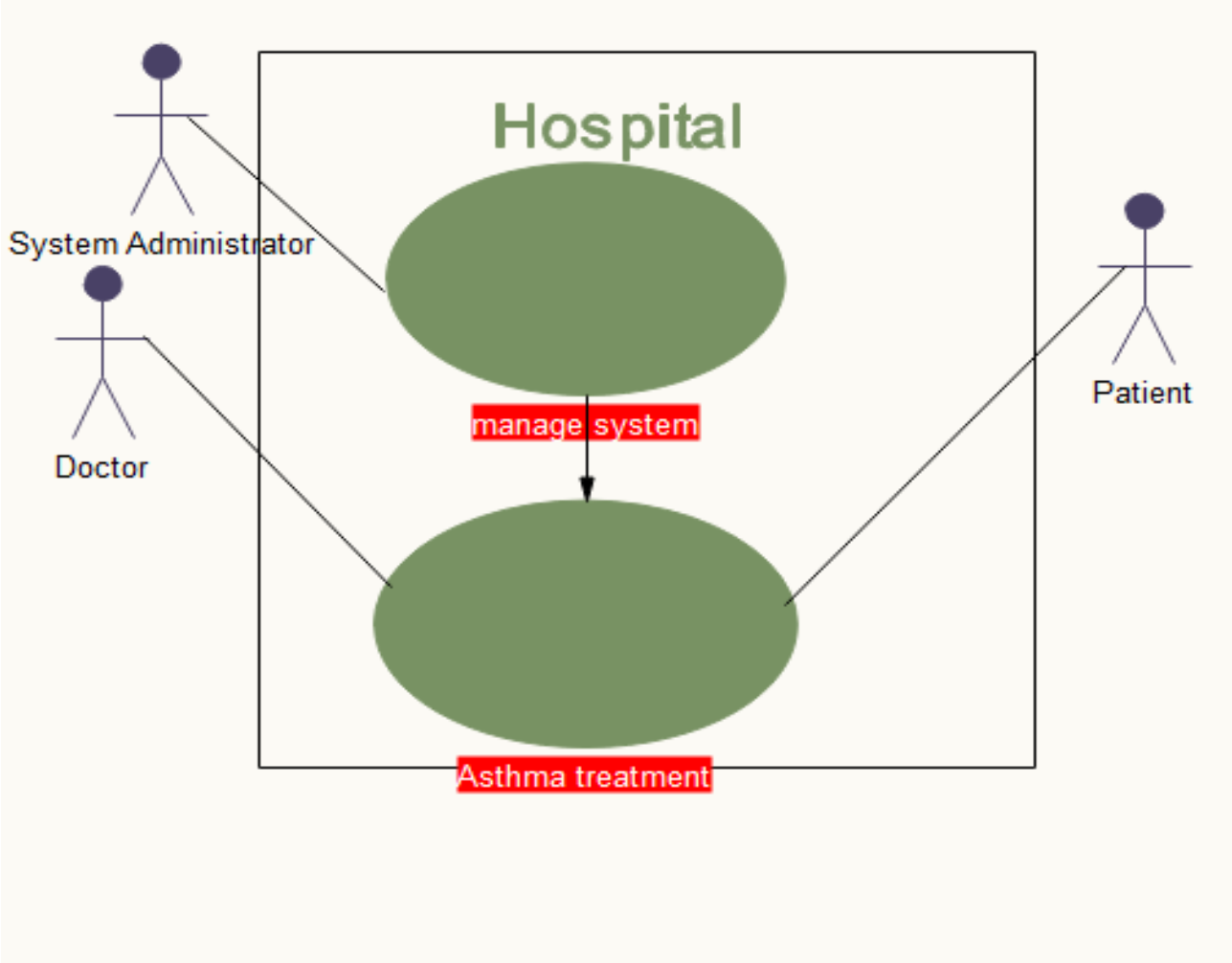
Hardware

Hardware is best described as any physical component of a computer system that contains a circuit board, ICs, or other electronics. A perfect example of hardware is the screen on which you are viewing this page. Whether it be a computer monitor, tablet or smart phone; it's hard ware. Without any hardware, your computer would not exist, and software could not be used.

System use case modeling

Use cases are an easy simple and good way of representing and explaining the system users/actors and the major use cases/scenarios. Another value of use cases is that, they emphasize the user goals and perspective; this diagram can clearly show who is using the system, what their typical scenarios of use are, and what their goals are.

An actor describes any entity that interacts with the system. In this system, the interaction of actors with the system, this runs in the Web based system or through the web interface which is deployed in the Hospital. In the proposed system, the following actors were identified.



The use case modeling

Actor Name	Description
System Administrator	Administrator refers to the person who administers the system and Maintain the system of User Account.
Doctor's	Doctor's refers to professionals who diagnosis and treated asthma patients follow up and treatment through the system.
Patients	Patents refers to registered in a system and communicate about his asthma status within his doctors.
HMIS Officer	HMIS Officer refers to generate summary of reports the HMIS person enter to the system as health professional by his own user name and password.

Table 1: Identified Actors

4.2.2 Hardware and software requirement

This portion provides the hardware and the software requirements needed for effective and efficient running of the system. In order to develop the system, both software and hardware requirements were considered. As this system is using the following were used to full functionality of the system; best performance is needed thus the below listed are recommended for the implementation.

Server side Hardware requirements for developing web based information system Asthma treatment and follow up

Component	**Recommended**
CPU	2 quad core Intel®/ Core i[X] or Xeon processors at 2.33 GHz-3.5GHz series processor
Hard disk	160 GB SATA
DVD-ROM	48 DVD+/- RW
Memory	2 GB or more RAM
Screen/video adapter	A monitor with a resolution of 1024X768
Backup streamer	Digital tape streamer with the same capacity as the total disk space
NIC	Network card supported by the network installed 100 Mbps for best performance
Scanner	Windows compatible Scanner
Printer	Windows compatible printer

Table 2: Server Side Hardware requirement

Client side Hardware requirements for developing web based information system Asthma treatment and follow up

Component	Recommended
CPU	Intel Pentium® Dual core CPU ES400 at 2.33/2.49 GHz processor

Hard disk	160 GB SATA
RAM	2 GB or more RAM
Screen/video adapter	A monitor with a resolution of 1024X768
NIC	Network card supported by the network installed 100 Mbps for best performance
Printer	Windows compatible printer
Scanner	Windows compatible Scanner

Table 3: Client Side Hardware requirement

Server Side Software requirement for Develop web based information system for asthma treatment and follow up

Component	**Recommended**
Operating system	Windows XP/Vista/7/8/10
Microsoft.net framework	.NET 3.5 SP1 ,SQL ,C++
Anti-virus program	Licensed[updated] product
Browsers	Mozilla fire fox, chrome
Application software	Java script, Msqls data base, HPH and ASP.Net Updated version.

Table 4: Server side software requirement

Client side requirement for Develop web based information system for asthma treatment and follow up.

Component	Recommended
Operating system	Windows XP/Vista/7/8/10
Anti-virus program	Licensed[updated]
WampServer	WampServer 2.5
Fire fox	Updated

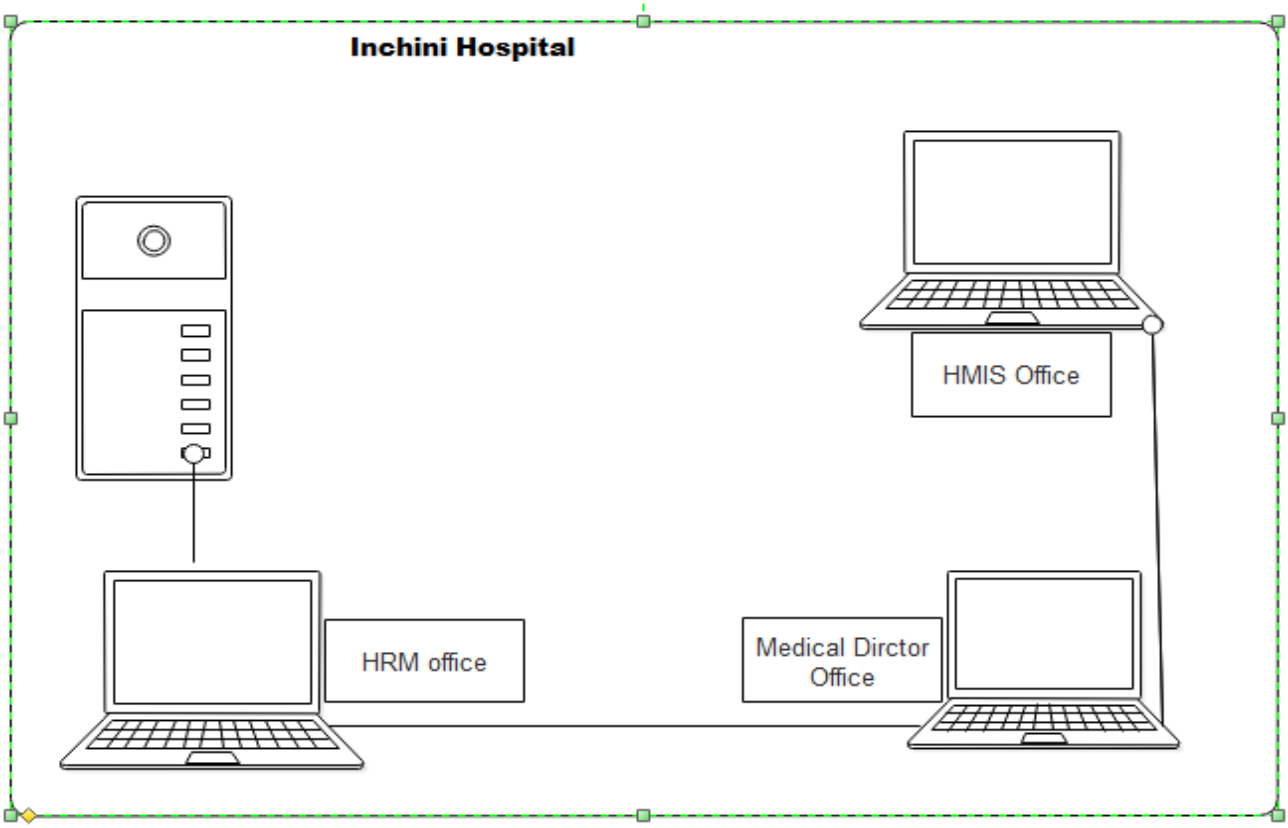
Table 5: Client side software requirement

4.2.3 Existing system

In the Enchini Hospital there is internet access for some of department and LAN connection for Health management information system (HMIS) only. While know it's not functional currently. There is no sophisticated system for health provider and patients like web based information system clinical decision support systems which satisfy patients and health professions and

strength the communication between patients and health providers. Similarly the users can not access information what they want because of a lack of arrangements and structured technology accesses/any internet connection.

Generally in the hospital there is no ICT infrastructure to improve health care systems, that means the hospitals cannot communicate other hospital, the patient cannot communicate with health providers even if they cannot have enough computers and printers.



4.2.4 Proposed system (To be)

The introduction of the new proposed system is designing and developing web based information system for improving asthma care treatment and follow up in Oromia regional state Enchini Hospitals, it helps to facilitate the services online to take immediately action in asthma treatment and follow up process. This system will be used to connect strongly Health providers and patients to follow up patients. The menus of the developed system were developed by Oromic languages, because the societies around that hospital were Oromic languages speakers so they can communicate easily with their health providers through this system.

The proposed systems were designing & developing web based information system for asthma treatment and follow up during asthma treatment processes in Enchini Hospital. The designed and developed system is an easy and sophisticated system that can improve asthma care

treatment and asthma patients follow up even if at their own home and that links patients with health providers strongly.

Generally the developed system fulfills the gap between health providers and patients by improving the communication between each of them during the asthmatic treatment process.

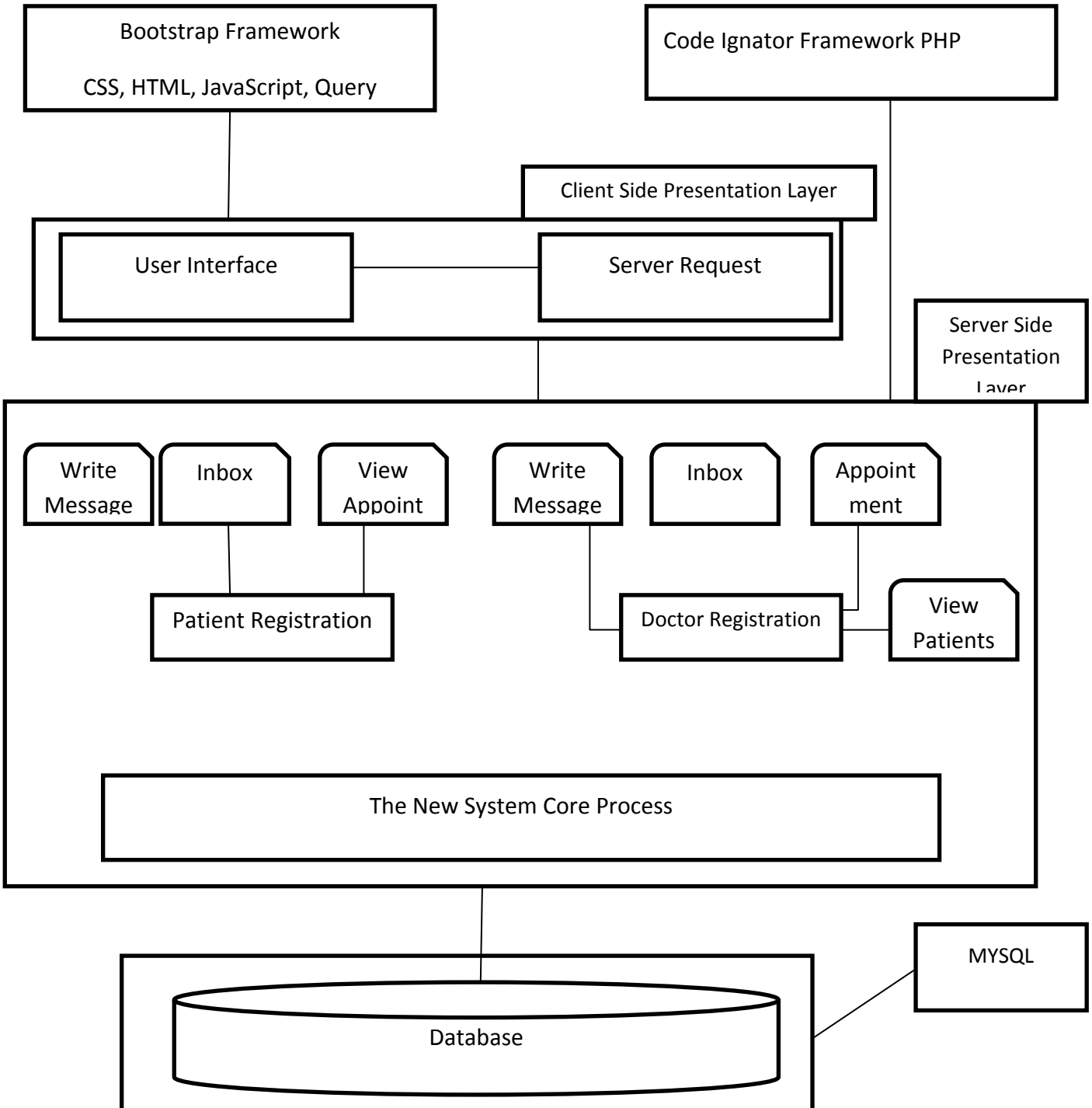


Figure 5: Figure Proposed web based information system for asthma treatment and follow up from February 2017 to May 2018

Entity-Relationship (ER) model

One of the most popularly used semantic data models. A semantic data model refers to a data model that supports a richer set of modeling constructs for representing the semantics of entities, their relationships, and constraints. E-R model is used conveniently as a tool for logical data modeling and design documentation [41].

It is a high-level data model of the specific application area. It describes how different entities (objects, items) are related to each other. It also describes what attributes (features) each entity has. It includes the definitions of all the concepts (entities, attributes & relationship between entities) of the application area. The ER diagram was used to demonstrate the data model of the web based information system to improve asthma treatment and follow up in Enchini Hospital.

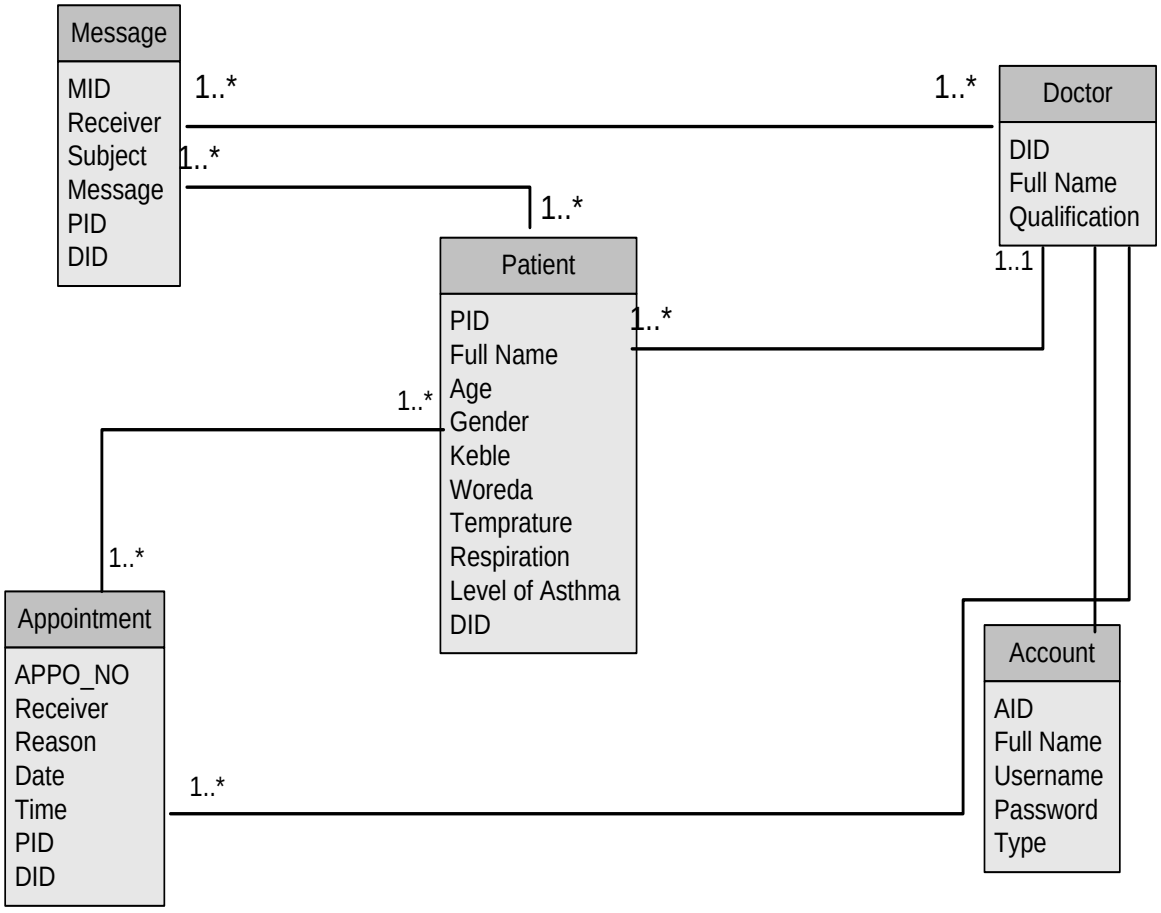


Figure 6: Entity relationship diagram for developing web based information system for improving asthma treatment and follow up from February 2017 to May 2018

The entity relationship is used to show the relationship between patients and doctors within their attributes.

The entity relationship identified based the attributes of the patient's history and health professional history. Both attributes are identified and drown above is the relation of their attributes.

4.2.5 Subsystems Description

Interface Subsystem

1. **Registration interface:** enables the users to register vital events.
2. **Report Interface:** enables the system to show the report generated by the system.
3. **Login interface:** enables the system to be accessed by system users. The system users in order to interact with the system must first interact with the login interface.
4. **User Account interface:** enables the administrators of the system to interact with the system in order to administrate it.

Login into the System

This use case is runs in the server side. It enables the health providers' login into the system based on the given privilege. The use case is first initiated via a boundary object, login Button and the login based on the given information to access from the system.

Register User/ Create Account

Register new user use case is used to register new system users. It runs in the server side of the system. When new user needs to be registered, the system administrator initiates this use case and fills the registration form. If the user information is valid, registration will complete successfully. After user account is created the Doctors or patients can login as their own account privileges.

User Interfaces of the Web based Information System for improving asthma treatment and follow up

The first user interface the actors of the system will obtain the home page prior to getting access to the different pages and functionalities.

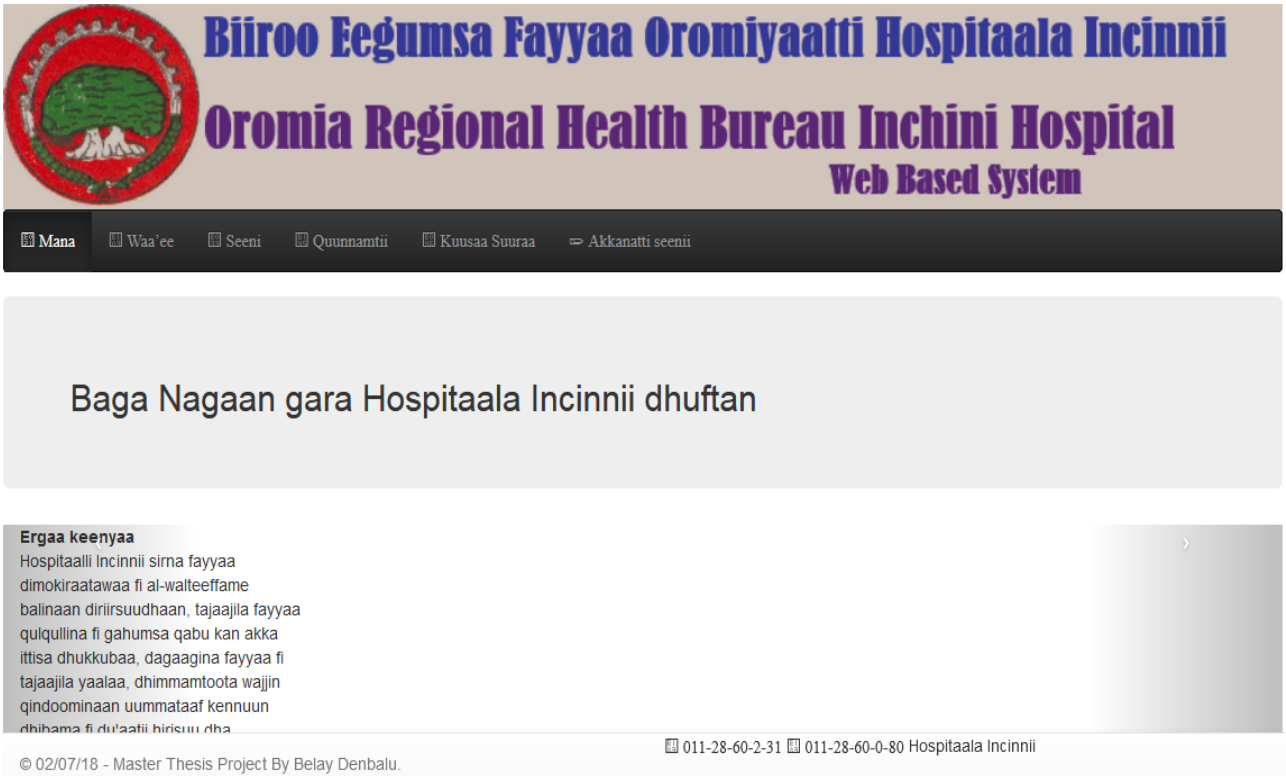


Figure 7: Home page Web based Information System for improving asthma treatment and follow up from February 2017 to May 2018

The home page provides the different information about the services and over view of asthma. The hyperlinks that are found at the top, each one of them lead to different locations and provide

different functions. Most importantly in order to get the required services from the system the user must login into the system thus the user have to click on the **Login as** button. All the minus of this prototypes are written by Oromic languages. A home page is generally the main page a visitor navigating to a website from a web search engine will see, and it may also serve as a landing page to attract visitors. The home page is used to facilitate navigation to other pages on the site by providing links to other pages.

Figure 8: Login Web based Information System for improving asthma treatment and follow up from February 2017 to May 2018.

This user interface is a gate way to the different functionalities of the system. Each user before logs into the system must have the appropriate password and user name and privilege assigned by the administrator of the system. It has name, password, and login and deletes, this all user interface menus are written by Oromic language.

In generally Logging in is usually used to enter a specific page, which trespassers cannot see. Once the user is logged in, the login token may be used to track what actions the user has taken while connected to the web site.

Figure 9: About as Web based Information System for improving asthma treatment and follow up from February 2017 to May 2018

This interface is used to display about Asthma diseases and about this web based system for the users and other who used to this web based system. And also this interface shows the general over views of asthmatic diseases.

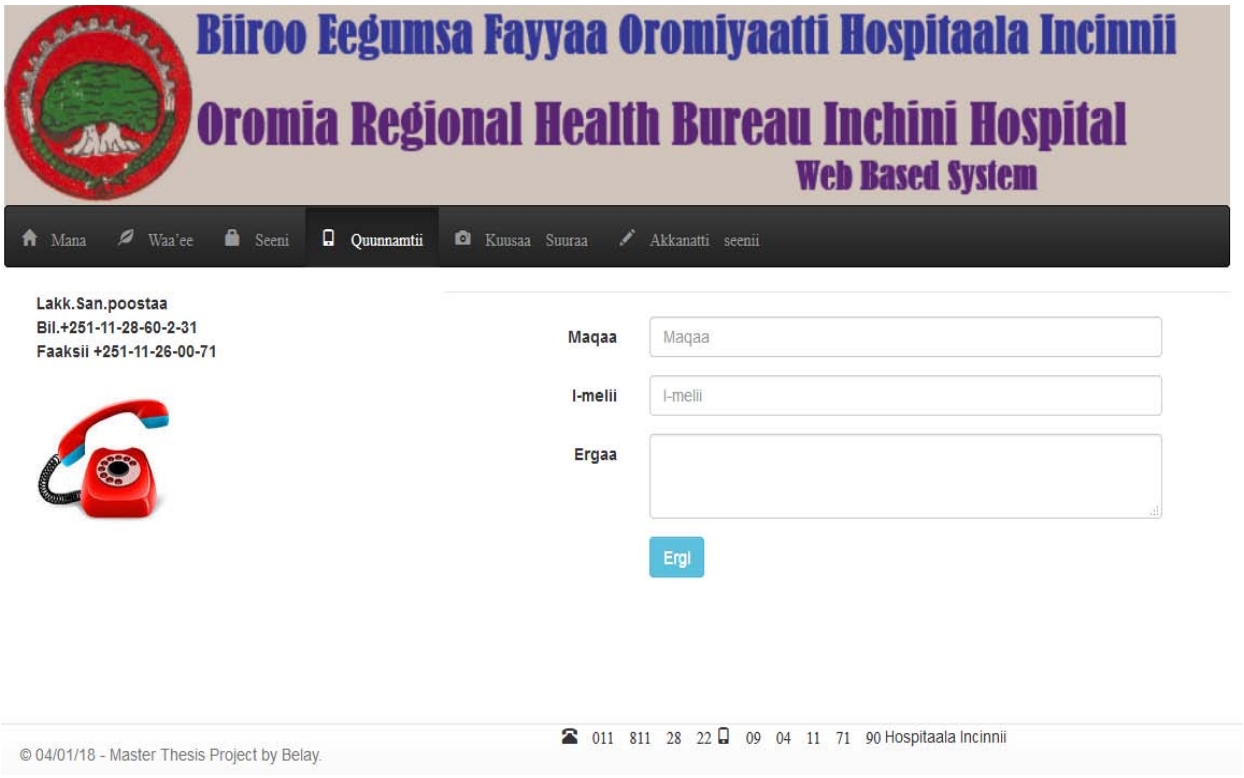


Figure 10: Contact as page for Web based Information System for improving asthma treatment and follow up from February 2017 to May 2018

The contact page is used to show the address of this web based information system site and to contact this web based system service, that have name , Email, and messages.

Figure 11: Gallery page for Web based Information System for improving asthma treatment and follow up from February 2017 to May 2018

This interface shows pictures of asthma patients and other pictures that can shows about asthma diseases. In generally this interface shows pictorially a person who are affected by asthma. Therefore the all linked pictures describes about asthma diseases'.

Figure 12: Login as page for Web based Information System for improving asthma treatment and follow up from February 2017 to May 2018

This interface is a session and user authentication service that permits a user to use one set of login credentials (e.g., name and password) to access web based system/application. The service authenticates the end user for all the applications the user has been given rights to and eliminates further prompts when the user switches applications during the same session. This interface has name, users name, password, password confirmation, and user's types. In this interface there are two types of user name that are selected from combo box; those are login as a Doctors and as patients.

Figure 13: Doctor Registration form page for Web based Information System for improving asthma treatment and follow up from February 2017 to May 2018

This user interface is used to register Health professionals within their names and professionals to the web based system. Once if you are registered the system can hold up you delete that health professionals if they may be leave or turn out to other Hospital.

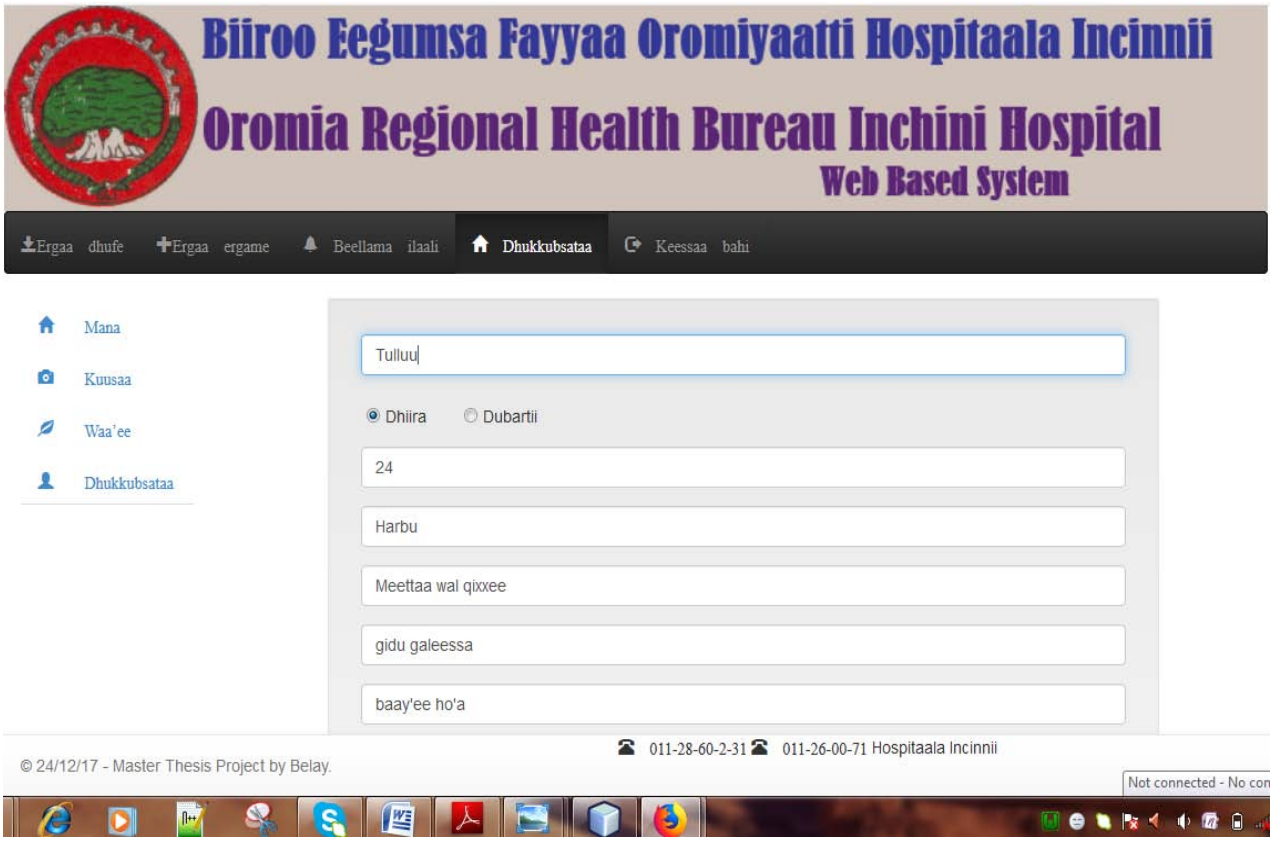


Figure 14 Patient Registration form page for Web based Information System for improving asthma treatment and follow up from February 2017 to May 2018.

This user inter face shows about patients registrations that have name, Sex, age, zone , woreda ,levels of diseases and patients temperature.

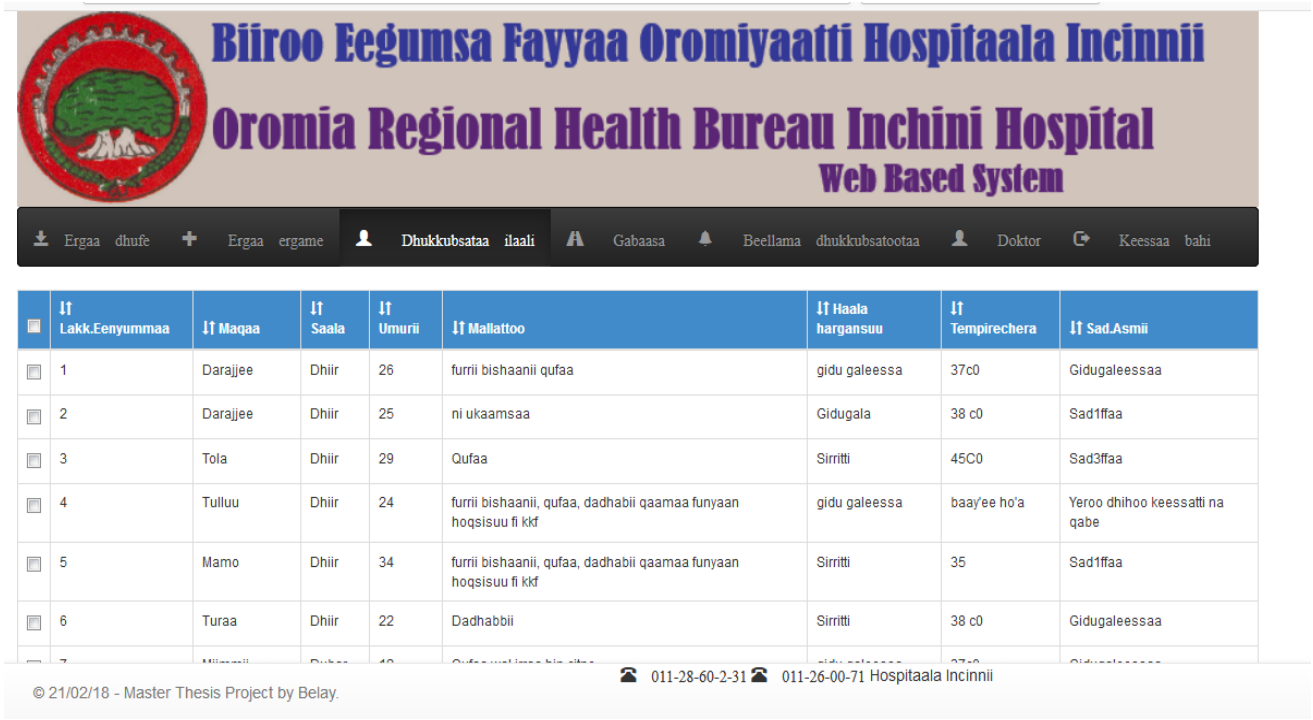


Figure 25: View Patients page for Web based Information System for improving asthma treatment and follow up from February 2017 to May 2018.

This user interface shows the health professionals can views patients that include name, age, symptoms breathing, temperatures and asthmas levels. It describes a patient's history in the forms of tables.

Figure 36: Report forms page for Web based Information System for improving asthma treatment and follow up from February 2017 to May 2018

This user inter face shows the reports that are generated from the system that include, patients name, age, symptoms, breathing levels, temperature, asthmas level and date of patients get care service. This interface shows the summary history of patients by the forms of tables.

Figure 47: View appointment forms page for Web based Information System for improving asthma treatment and follow up from February 2017 to May 2018

This user interface enables to view the appointment of patients, cause of appointment, and time of appointments. This interface gives clear information for asthma patients follow up.

4.2.6 Out Comes of the Project

The outcomes of these projects are Patient satisfaction, Working knowledge of the asthma action plan, minimizes adverse effects, utilization of healthcare enough awareness of asthma self treatment by communicating among between patient & health professional through web based information system necessary follow up and treatments at right time and strongly relation between patients and health providers.

Generally this project will guide the development of web based information system to improve asthma treatment & asthma patient follow up in Oromia region West shoa zone Enchini Hospital. Because of the fact that I 'am lived in that woreda's area I know asthmatic is a serious diseases in that areas and many people can be affected by this diseases, to improve this problem, I can plan to prove this problem by designing & developing web based information systems that can improve asthma care and patients follow up by strongly linking health providers with asthma patients.

4.2.7 User Interface Evaluation

The goal of the system user interface was to determine the usability of a designed and developed web-based information system to improve asthma treatment and follow ups in Echini Hospital.

Heuristic evaluation is one of the most commonly used discount evaluation methods due to its low cost. It is an inspection method that can prospectively uncover problems with a user interface, indicate the severity of the problems, and make suggestions for fixing the problems. [41].

Usability is the extent to which users can use a computer system to achieve specified goals effectively and efficiently while promoting feelings of satisfaction in a given context of use. Usability evaluation (UE) consists of methodologies for measuring the usability aspects of a system's user interface (UI) and identifying specific problems.

The evaluation of the interface is undoubtedly one of the most important aspects of software design and development. Without evaluation, designers would have little indication as to the successful and, more importantly, the non-successful interface designs. The evaluation of the interface for the web based information system used a method of questionnaires to evaluate the interface for the prototype developed web based information system to improve asthmatic treatment and follow up.

Functionality and interface evaluation Questionnaire

The below mentioned table was developed to collect the required response from the stakeholders of the system to help in assessing and evaluating the user interface for the newly developed system prototype.

No	**Functionality and interface evaluation Questionnaire**					
	Rate your agreement with the following statements (Place a X in the appropriate column)	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	It was clear to access the different options menus			1	2	7
2	The system was clear and easy to link asthma patient information with health providers			1	1	8
3	It was clear to see the generated report			1	2	7
4	Highlighting on the screen helpful			2	2	6

5	The status of exchange messages was informative and accurate for both parties.				1	9
6	It was clear what different parts of the system menu do			1	2	7
7	The menu was by Oromic language so it is better for the around that community to use friendly				1	9
8	The all systems interface was easy to use				4	6
9	the prototype was good for patients and health providers			2	1	7
10	It was batter for asthma patients follow up				1	9
11	This prototype was better for manage their own asthma & minimize their time and costs.				2	8
	Total			8	19	83
	Average result			7.27	17.27	75.45
	Total Average Value			**92.72**		

Table 6: User interface evaluation

Average result= number of result * totals numbers of person participates / numbers of questionnaire.

The total average result= Average result of agree + Average result of strongly agree.

The result of the user interface evaluation is shown above. The value of the responses are taken based on their responses the functionality of the system Questionnaire response Strongly Agree =83, Agree=19, Neutral=8. According to the result of user interface evaluation most of the respondents that is 7.27says neutral, 17.27 says agree, 75.45 says strongly agree. Generally this usability and user interface evaluation respondents show that 92.72 of the system prototype has agree that's good and clear informational, functional explanation regarding the major functionalities of the system.

4.3 Discussion of the Result

Asthma can be described as a chronic respiratory condition which can be identified by breathing difficulty, wheezing, and cough and chest tightness. Narrowing and swelling of the airways and increased mucus production are the major episodes looked for to establish an asthma condition. Physical examinations, pulmonary function tests, blood tests and chest X-rays are also used to determine asthma. The medications used to manage asthma long term are symptom preventers and symptom controllers. Symptom reliever medications are used for the immediate control of its symptoms. Inhalation or ingestion of allergens and pollutants, exposure to cold weather, exercises, infections and occupational factors such as dust and chemicals can be considered asthma's risk factors, and healthcare professionals need to provide client education in order to prevent and minimize asthma attacks. Chronic asthma conditions affect client physical, psychological and social wellbeing [54].

Health care information system is a computer application to represent patient information in a friendly user interface and allowing users to review and interact with patient health information, such as diagnosis, medicine orders, managing patient appointment and other services. Moreover, application health information system works as data repository for patient health information such as patient registration, systems administrator and financial management and used to follow up patients.

A Web based integrated health care management system is a computer application with an interactive web database to manage and analysis the entire health care information such as Patient Information, which contains, personal information, consultations history medications history, treatments and diagnosis history, appointments, confirm the patient’s appointment online by themselves, documents and payments, Health Care Information which contains, insurance companies, health care client’s health care documents, managing the products, managing the products suppliers, different types of reports and Health Care Staff, which contains doctor schedule, staff documents tracking the system user. Digital health is rapidly expanding for asthma management and includes mobile applications and electronic monitoring devices for asthma inhalers [42].

Follow-up of patients who have experienced an acute exacerbation of their asthma sufficiently severe to warrant treatment at a hospital reduces re-admission rates and improves patient symptom controls [44].

In this project the web based information system for asthma treatment and follow up were designed and developed.

Generally the new designed and developed web based information system to improve asthma treatment and follow up was better for both Health providers and patients during the process of asthma treatment and follow up in Enchini Hospital. Since asthma is chronic diseases which need immediate action when somebody is exposed by these diseases it’s easy to take immediate action on line using web based information system by communicating with health providers using this technology application. The designed system menus was developed by Oromic language, because the society around Ada Berga woreda Enchini Hospital was Oromo People so

they understand the application easily, therefore the developed system is a good technology to link patients with health providers by their own local languages.

The User evaluation of this designed and developed prototypes proves that the system meets users interface agree that 92.72% of the system prototype has a good and clear informational and functional explanation regarding the major functionalities of the system and better technology that link health providers and patients. The new designed prototype system prove the problem of asthma patients during the follow up process, and easy to take immediate action by communicating with their health providers whenever at everywhere.

Additionally as the result of the questioners prepared to evaluate the functionality of this system shows Designed and developed web based information shows the system is a better technology that link asthma patients to health providers and to follow up asthma patients. And also the health providers communicate day to days their own asthma levels and their activities. Currently the Hospital have 11 desk top computers , 8 laptops, 6 printers, 1 scanners ,1 photo copy, and others information communication technology infrastructures.

Therefore as the result of the questionnaires shows the designed and developed systems is a good technology that link patients with health providers and also easy to understand the menus of the system because the menus of the system are developed by Oromic local languages.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

There is growing interest in the potential of the Web-based and other digital media as a platform to deliver more tailored self-management support, while maintaining cost-effectiveness, with greater scope for integration into the everyday lives of those with asthma.

Web based information Systems have the potential to improve Asthma care, follow up and quality of life in patients and reduce Hospitalizations.

The user interface designed and developed prototype shows part of the system which the user interact to the system. It includes different components like screen displays that provide navigation through the system, Home, about as, Log in, contact as, gallery and report forms that the system produces and follow up patients. The designed and developed prototype menus are developed by Oromic language, because the society around the Hospital was Oromo People so they understand the application easily, and it's good to communicate by their own local language with their health providers.

The User evaluation of this prototypes proves that the system meets users interface agree that 92.72 % of the system prototype has a good and clear informational and functional explanation regarding the major functionalities of the system and its better technology that link health providers with patients. The new designed and developed prototype system prove the problem of distance of asthma patients during the follow up process, cost of transports, time and easy to take immediate action by communicating with their health providers. The system is good for patients to exchange their asthma information with their health provides by their own local languages and it can assist in monitoring of patients in their homes, saving time and cost of travel, ensure better communication, improved security and assist to bridge the gap between patients and their healthcare providers. Similarly it's better to generate the summary of report from the system.
Generally the designed and developed prototype of web based information system to improve asthma treatment and follow up for Enchini Hospital were proved user acceptance that it's a good technology that link patients with health providers by their own local language.

5.2 RECOMMENDATION

This study made to Design and Develop web based information system to improve asthma treatment and follow up in Enchini Hospital. as it was concluded, asthma diseases is one of chronic diseases and which need immediate action and follow up, to take this immediate action and follow up we need to use a technology web based information system that can improve asthma treatment and easy to follow up asthma patient, the existing system problem to follow up asthma patients were also identified. An attempt was made by this study to design and develop web based information system for asthma treatment and follow up that link patients with health providers.

The following points should be done by the Federal ministry of health, Oromia Regional Health bureau, and Enchini Hospital and future researches in order to improve the current asthma treatment and follow up uses practices.

To Federal Ministry of Health and Oromia Health Regional bureau

- The Federal Ministry of Health and the Oromia Health Regional bureau should work on the capacity building of health professionals to use the developed system and update their technology skills and to work friendly with the system.

To The Hospital

- The Hospital should be able to provide the necessary infrastructural that support during the implementation of the system like electric power, internet access and other necessary equipments tools.
- The hospital should provide hardware and software in order to install the system.

To Researchers

- Researchers or students should continue the project to complete all the rest part of system implementation, by using this project as an input for next phase of software development process.

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The Strategy to Implementation the system

Any software development project, a methodology should be followed to ensure project consistency and completeness. As any other information technology system design and development project, starting from the planning to the implementation The Web development life cycle includes the following phases: planning, analysis, design and development, testing, and implementation and maintenance.

The cylices the developed web based information system prototype implementations is the carrying out, execution, or practice of a plan, a method, or any design, idea, model, specification, standard or policy for doing something. As such, implementation is the action that must follow any preliminary thinking in order for something to actually happen.

During the Development phase the real code is written here. Integration and testing: Brings all the pieces together into a special testing environment, then checks for errors, bugs and interoperability. Acceptance, installation, deployment: The final stage of initial development, where the software is put into production and runs actual business. Maintenance: During the maintenance stage of the SDLC, the system is assessed to ensure it does not become obsolete. This is also where changes are made to initial software. It involves continuous evaluation of the system in terms of its performance. Evaluation Some companies do not view this as an official stage of the SDLC, while others consider it to be an extension of the maintenance stage, and may be referred to in some circles as post-implementation review. In addition to evaluating the software that was released, it is important to assess the effectiveness of the development process. If there are any aspects of the entire process, or certain stages, that management is not satisfied with, this is the time to improve. Evaluation and assessment is a difficult issue. However, the company must reflect on the process and address weaknesses.

In generally to implement the system we follow system development life cycle (SDLC).

There were software and hard ware requirement with its specification.

Server side Hardware requirements for developing web based information system Asthma treatment and follow up

Component	**Recommended**
CPU	2 quad core Intel®/ Core i[X] or Xeon processors at 2.33 GHz-3.5GHz series processor
Hard disk	160 GB SATA
DVD-ROM	48 DVD+/- RW
Memory	2 GB or more RAM
Screen/video adapter	A monitor with a resolution of 1024X768
Backup streamer	Digital tape streamer with the same capacity as the total disk space
NIC	Network card supported by the network installed 100 Mbps for best performance
Scanner	Windows compatible Scanner
Printer	Windows compatible printer

Server Side Hardware requirement

Client side Hardware requirements for developing web based information system Asthma treatment and follow up

Component	Recommended
CPU	Intel Pentium® Dual core CPU ES400 at 2.33/2.49 GHz processor
Hard disk	160 GB SATA
RAM	2 GB or more RAM
Screen/video adapter	A monitor with a resolution of 1024X768
NIC	Network card supported by the network installed 100 Mbps for best performance
Printer	Windows compatible printer
Scanner	Windows compatible Scanner

Client Side Hardware requirement

Server Side Software requirement for Develop web based information system for asthma treatment and follow up

Component	**Recommended**
Operating system	Windows XP/Vista/7/8/10
Microsoft.net framework	.NET 3.5 SP1 ,SQL ,C++
Anti-virus program	Licensed[updated] product
Browsers	Mozilla fire fox, chrome
Application software	Java script, Msqls data base, HPH and ASP.Net Updated version.

Server side software requirement

Client side requirement for Develop web based information system for asthma treatment and follow up.

Component	Recommended
Operating system	Windows XP/Vista/7/8/10
Anti-virus program	Licensed[updated]
WampServer	WampServer 2.5
Fire fox	Updated

Client side software requirement

Key Implementation Practices

- At the outset, create an extendible directory and file structure to manage the web's files and/or software components (CGI or Java programs).
- Use HTML tools where helpful.
- Check the web's implementation in various browsers.
- Use templates or web generating schemes for supporting a consistent look and feel.

Key Implementation Resources

- The HTML Station: summary and demonstration of HTML syntax.
- HTML index section on HTML from webreference.com. Includes links to editors, etc.

Annex: I

English version information sheet and consent form.

English version of information sheet and consent form for the questionnaire developed for to develop web based system to support asthma treatment & improve asthma quality care in Enchini Hospital.

1. Questioner identification number----------
2. Interviewer code ---------- name----------
3. Date of interview----------
4. Name of the hospital----------

1-Information sheet

Greetings:

My name is _____ I am working with Belay Denbelu who is currently a post graduate student in Addis Ababa University, Department of Health Informatics.

The objective of the study is for to develop Web based System to support asthma treatment & improves asthmas care quality and patient safety in Enchini Hospital.

Even thought study is conducted for the partial fulfillment of master program in health informatics, it is believed to contribute much for the understanding of the role of ICT in asthma treatment and develop web based system for the asthma treatment.

You will be asked to fill a questionnaire that will help in investigating the issues. Your co-operation is very helpful. Your name will not be written on the questionnaire and all the information you will provide will be kept strictly confidential. You will be facing no harm by participating and you are also not obliged to answer any question you don't wish to answer. To fill the questionnaire 20-30 minutes will be required. If you wish to comment feel free to use the contact address.

Consent Form

Considering the information you get from the general information sheet, we would be thankful if you spend some time with us solving questions related to the issues. Are you comfortable to participate in this study?

• If yes, continue to next page

• If no, skip to other participant

Based on the above information I agree to participate in the study voluntarily.
Signature ----------
Date ----------
Contact
Name: Belay Denbelu Leta
Tel: 251-920-01-75-53/09-06-61-44-88
E-mail: BelayDenbalu@gmail.com

Annex-II English version questionnaire

1. A question to develop Web based System to support asthma patients & improves asthma care quality and patient safety in Enchini Hospital.

Circle the response in the response column that best matches with the answer of the respondent.

Part I:-Socio-demographic characteristic

- Questionnaire ID ----------

S.No	Question	Response	Remark
I	Socio demographic status		
1.	Name of the hospital	----------	
2.	Respondent number	----------	
3.	Residence	1. Urban 2. rural 3. Other	
4.	Occupation	1. Farmer 2. Trader 3. Employer 4. Others	
5.	Age of the respondent	1. 15-19 2. 20-24 3. 25-29 4. 30-34 5. ≥35	
6.	Educational status.	1. Illiterate 2. Primary school 3. Secondary school 4. Technical/vocational	

		5. Higher	
7.	What is your current Marital status?	1. Married 2. Single 3. Divorced 4. Others	
8.	Average monthly household income in Ethiopia birr.	1. >20000 2. >10000 3. >5000 4. ≥2500 5. <2500	
9.	Which religion do you fallow?	1. Orthodox 2. Muslim 3. Catholic 4. Protestant 5. Other	
10.	How many children do you have?	----------	
11.	Ethnicity	1. Oromia 2. Amhara 3. Tigray 4. SNNPR 5. Others	
12.	Position of the respondent in the facility	1. Manager 2. Health professional 3. ICT technician 4. Other If other specify----------	

Annex III. Functionality and interface evaluation Questionnaire

The below mentioned table was developed to collect the required response from the stakeholders of the system to help in assessing and evaluating the user interface for the newly designed and developed web based information system prototype.

No	**Functionality and interface evaluation Questionnaire**					
	Rate your agreement with the following statements (Place a X in the appropriate column)	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	It was clear to access the different options menus					
2	The system was clear and easy to link asthma patient information with health providers					
3	It was clear to see the generated report					
4	Highlighting on the screen helpful					
5	The status of exchange messages was informative and accurate for both parties.					
6	It was clear what different parts of the system menu do					
7	The menu was by Oromic language so it is better for the around that community to use friendly					
8	The all systems interface was easy to use					
9	the prototype was good for patients and health providers					
10	It was batter for asthma patients					

	follow up					
11	This prototype was better for manage their own asthma					
	Total					
	Average result					
	Total Average result					

Annex IV: Interview guide Line

1. Have you ever heard of asthma?
2. What is the role web based system in asthma treatment?
3. How can we control asthma diseases by using web based system?
4. Are there enough ICT infrastructures in this Hospital?
5. Do you think there is a sufficient human power of ICT skilled in the staff?
6. Who is more beneficiary of web based systems in this hospital?
7. Do you think that ICT can improve the awareness of asthma treatment?
8. What types ICT you used in this Hospital? Telemedicine, Computer, assess, Wi-fii LAN, MAN, WAN, EMR connection or others?
9. Is there a planned approach to automate the current system?
10. . Do you have computer? How many?
11. For what purpose do you use it?

Thank you

Guca: - I Oromic version of the questionnaires
Guca waliigaltee fi Oddeffannoo ittiin Sassabnu

Godina Shawaa lixaatti Hospitaala Incinnii keessatti gaafannoo Tekonolojjii Quunnamtii fi Odeeffaannon fayyadamuun gahee dhukkuba asmii irratti qabu maal kan jedhu sassaabuuf gaafannoo qopha'e.

1. Guca Odeeffannoo
   1. Lakkoofsa addaa gaafannoo----------
   2. Kooddii nama raga sassaabuu---------- maqaa----------
   3. Guyyaa gafannoon itti taasifame----------
   4. Maqaa Hospitaalaa----------

Hawwii Gaarii:

Maqaan koo----------jedhama. Ani Odeeffannoo funaanaa yoon ta'u Odeeffanoon Sassabu kana Dargaggoo Balaay Danbaluu barataa Yuuniversiitii Finfinnee Muummee Sayinsii Odeeffannoo fi Saayinsii fayyaa Digirii 2ffaa keessatti qorannoo gaggeeffamuun qorannoo ykn pirojeektii isaanii xumuruuf akkan isaan deegaruufi. Kaayyoon Qorannoo isaanii gahee Teekonolojjii Quunnamtii fi Odeeffannoon dhukkuba asmii keessatti qabu fi hubannoo to'annoo Asmii jedhu irratti hojjechuu dha.

Gucni gaafannoo kun immoo qorannoo kana milkeessuuf kan fayyadu waan ta'eef akkan nuuf guutaniif jaalalaan isin gaafachaa maqaan keessan guca gaafannoo kana irratti kan hin barroofne ta'uu isin hubachiisaa deebii deebiftan guutumman guutuutti hicitii qoranichaa eegaa qorannoo kana qofaaf kan oolu ta'a.

Kanaafuu adeemsa qoranichaa keesatti akka barbaachisummaa isaatti bilisummaadhaan soda tokko malee guuta. Gaaffiin isin guutuu hin barbaanne yoo jiraate guutuudhaaf hin dirqamtani.Gaafannoo kana guutuuf daqiiqaa 20-30 kan fudhata yoo ta'u yaadaa fi gaaffii kamiyyuu gaafannoo kana ilaalchisee yoo qabattan teesssoo armaan gadii kanaan na argachuu ni dandeessu.

Guca Odeeffannoo waligalaa kennu kana ilaalchisee gumaacha keessaniif isin galateeffachaa gafannoo kana itti fufuu barbaaddu yoo te'e Eyye gara fuula itti aanutti darbi lakki yoo ta'e immoo gara hirmaataa biratti darbi.

Odeefannoo armaan olii kana irratti hunda'uudhaan gaafannoo qorannoo kana irratti hirmachuudhaaf fedha kootiin walii galeera.
Mallattoo----------
Guyyaa----------
Teessoo:

Maqaa: Balaay Danbaluu
Bil. 09-06-61-44-88
Email: belaydenbale@gmail.com

Guca lama
Kutaa tokko
Kutaa I Gaafannoo waa'ee Hawaasummaa ilaallatu

Lakkoofsa addaa gaafannoo----------

T/L	Gaaffii	Deebii
I	**Haala jireenya hawaasummaa**	
1.	Maqaa Hospitaalaa	
2.	Lakkofsa deebii kennaa	
3.	Bakka jireenyaa	1. Magaalaa 2. Baadiyyaa 3. Kan biro
4.	Haala hojii	1. Qonnaan bulaa 2. Daldaalaa 3. Hojjetaa 4. Kan biro
5	Umurii Deebii kennaa	1. 15-19 2. 20-24 3. 25-29 4. 30-34 5. >35
6.	Haala barnootaa	1. Qalama 2. Sad.1ffaa 3. Sad.2faa 4. Koollejjii 5. Yunivesitii/barnoota ol aanaa
7.	Haala fuudhaa fi heerumaa	1. Kan fuudhe/kaadhimate 2. Kan hin fuune 3. Fuudhee kan hike 4. Kan biro
8.	Galii maatii kan baatii qar. Itiyoophiyatti	1. >20000 2. >10000 3. >5000 4. ≥2500 5. <2500

9.	Haala amantii hordofan	1. Ortodoksii 2. Musliima 3. Kirstaana 4. Waqeffataa 5. Kan biro
10.	Maatii meeqa qabdu?	----------
11.	Saba	1. Oromoo 2. Amara 3. Tigiree 4. Ummata kibbaa 5. Kan biro
12.	Gahee deebii kennaa	1. Gaggeessaa 2. Ogeessa fayyaa 3. Ogeessa TQO 4. Kan biroo Kan biroo yoo ta'e----------

Guca II: Gaafannoo Afaanii

1. Hubannoo dhukkuba Asmii gahaa qabdaa?
2. Gaheen TQO'n to'annoo dhukkuba asmii irrattii qabu maali?
3. Haala kamiin dhukkuba asmii TQO fayyaadamnee to'achuu dandeenya?
4. Paakejiin TQO gahaan Hospitaala kana keessa jiraa?
5. Humni namaa Hospitaala kana keessa jiru dandeettii itti fayyadama TQO gahaa qabaa?
6. Hospitaala kana keesaatti TQO irraa fayyadamaa kan ta'e eenyuu?
7. Akka TQO'n hubannoo to'annoo dhukkuba asmii cimsu ni beekataa?
8. Gosoota TQO keessaa Hospitaala kana keesatti kam fayyadamtu? Dawwa teledhani ,Kompitera, Intrneetii shiboon alaa ,wal quunnamtii cimda kompitera muraasaa mo kan borooti?
9. Karoorri sisteemii tekinolojjii kana ammayyeessu qbduu?
10. Komputera qabduu ? meeqa qabdu?
11. Komputeroota kana maaliif itti fayadamtu?

Galatoomaa !!!!