JIMMA UNIVERSITY

JIMMA INSTITUTE OF TECHNOLOGY

FACULTY OF COMPUTING AND INFORMATICS

INFORMATION SCIENCE DEPARTMENT

MSc. IN INFORMATION SCIENCE (INFORMATION AND KNOWLEDGE MANAGEMENT)

INVESTIGATING THE CHALLENGES OF HEALTH INFORMATIONSYSTEMS STANDARD AND INTEROPERABILITY ON HEALTH SERVICE ACTIVITIES

BY:

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JIMMA, ETHIOPIA

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A RESEARCH SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR DEGREE OF MASTERS OF SCIENCE (MSc) IN INFORMATION SCIENCE (IKM)

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As members of the board of examining of the MSc. research defense examination of the "Investigating the Challenges of Health Information Systems Standard and Interoperability on Health Service Activities", we members of the board listed below, read and evaluated the thesis and examination.

Chair Person _____Signature _____Date_____

Principal Advisor _____Signature _____Date_____

Internal Examiner _____Signature _____ Date_____

External Examiner _____Signature _____Date_____

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List of Acronyms and Abbreviations

ANSI: American National Standards Institute

CDC**:** Center for Disease Control

CDISC: Clinical Data Interchange Standards Consortium

E-Health: Electronic Health

EHR**:** Electronic Health Record

EMR: Electronic Medical Record

FMOH: Federal Ministry of Health

FPC: Finite population correction

HIE: Health Information Exchange

HIS**:** Hospital Information System

HL-7**:** Health Level 7

HMN: Health Management Network

IS: Information Systems

ISO: International standards organizations

IT**:** Information Technology

KHISIF: Kenya Health Information Systems Interoperability Framework

LIS: Laboratory information system

OpemEMR: Open Electronic Medical Record

OpenMRS: Open Medical Record System.

SDO: Standards Development Organization

WHO**:** World Health Organizations

XML**:** Extensible Markup Language

Abstract

This study presents the challenges of health information systems standard and interoperability in healthservice. Itis crucialto consider important aspects of technological development in health centers activities. The aim of the study is to investigate the challenges of health information systemsand developaframework that enhances the effectiveness of information systems standard and interoperability to provide healthservice. The study was followeddescriptiveresearch design. Interview and questionnaire were employed in order to get real information on the current practice of health centers activities. The sample of 748employees engaged in health information systems standard and interoperability on health centers was selected and stratified random sampling fromfive-health center for questionnaire survey. The study found that the current health information systems serviceactivitiesshould be modeled to include the vital health information systems. Lack of interoperability and coordination cause for health information system, and the staffhadn't training on Health information systemsapplications which are the main challenges in the hospitals. According to the finding,the proposed and designed framework is encouraging for future change on these health information systems applications in health sector, which is essentialto improve the current health information systems implementationpractice.In regression analysis, the component of health information systems affected existing of health information systems service delivries in the health center.Finding indicates 72.7%, of variation in challenges of health information systems is explained by major components listed while 27.3% of variance is explained by other factors.Majorhealth information systems components had a greater influence on employee current challenge of health information systems. It concluded, health sector are continuing to rely on technology to perform their activities. On the other hand, health organization are number one concerns across the globe.It recommended that the health information system implementation for health center activities is a fairly new concept and as many health sectors are capital intensive to work.

Keyword: Health Information System, Interoperability, Standard and Interoperability

CHAPTER ONE

1.0. INTRODUCTION

1.1. Background of Study

Health service is a key component for individual's quality of life. An individual required standard andimproved healthcare services in their environment. Health-care center is one of the community basedorganization, which need great enhancements of health information system for quality service deliver. It is the backbone forhealth-caredelivery system and it supports the way in which health employees interact with each other seeking for their activities (Cheik*et al.*, 2020).A health information system (HIS) is a system for collecting, storing, managing, and transmitting a patient's electronic medical record. It is a basic for healthcare systemlead for quality of health service delivery. Today, there is high considerations forhealthcaretotransformand address quality of health services delivery. The ability of an organization to meet its quality health objective depends largely on the knowledge, skills, motivation and technology deployment with responsible people for organizing and delivering health services. It is the system that integrates data collection, processing, reporting, and information use to improve health service efficacy and efficiency at all levels of the healthcare system through better management (WHO, 2008).

Therefore, tomeet health-careservicerequirements currently technology is a basic strategy. Both health-care practitioners and the information systems (IS) research community have been paying special attention to HIS in developing nations in recent years (NYELLA, 2015).Like many other developing countries, Ethiopia faced wide range of health-related challenges, and the health systems that handle those challenges are limited in resources and competence. Using different technology, such as HIS, can help our community to overcome obstacles in health service delivery (Roztocki et al., 2019).Health centers service delivery with technology-driven like HISsystem that makes the process of sharing protected health information and providers health-care service activities, allowing for the efficient handling of patient data. The use of aids in enhancing patient care quality, lowering operational costs, eliminating data entry errors, and streamlining the entire internal management process(Ngafeeson, 2014).

Currently,to transmit health information among multiple systems, the health sector requires interoperability. This makesall health sectors to be fully interoperable using ICT.Therefore, interoperability enables organizations to connect and exchange information with one another, such as health-care information, through a local area network (LAN) or a wide area network (WAN), without restriction in terms of implementation or access (Oyeyemi and Scott, 2018).This support health-care technology system like HIS and devices to communicate, interpret, and store data using similar standards. According to Sachdeva and Bhalla (2010), interoperability in the healthcare industry is a major challenge. By implementing these universal standards, critical data can be transmitted without relying on a single information system. Standardization allows us to communicate effectively and achieve interoperability.his establishes a common vocabulary and set of expectations, allowing systems and devices to communicate with one another.The Health Level 7 (HL7) standard is a healthcare standard that provides for the communication and integration of healthcare systems as well as worldwide data sharing. The most important requirement is to collect useful data and make it widely available to others. As a result, a standard is required that can provide the best services in terms of efficiency and dependability.

In Ethiopia, since the development of the national eHealth strategy and the National HIS roadmap, HIS has gotten a lot of attention. The national eHealth initiative intends to use information and communication technology to lead healthcare sectors (ICT). HIS particularly focused the Health Sector Development Program (HSDP IV)(Robel et al., 2013).The major problem of health services of Ethiopian hospitals are lack of information exchange between eHealth systems and a lack of information utilization for planning and decision-making at all levels (hospitals, districts, regional, and federal levels).Due to fragmented information creation and storage, personal health information is not fully utilized to promote effective and efficient care(ISA, 2016).

Therefore, the purpose of this study is to investigating challenges of HISstandard and interoperability in hospitals. In this work, the study was proposed a frameworkfortheset the direction to prepare an effective health-care service delivery framework.This study also addresses the issues interoperabilityandstandard HIS challenges in hospitals.

1.2. Statement of Problem

Today, the spread of ICT has contributed to the advancement of society.HIS serves as an enabler for citizens, government agencies, and the growing significance of information in many aspects of life today (Roztocki et al, 2019). The power of a health information system (HIS) to connect communities, share information, and support health services in all aspects of human existence is immense.HIS an enabler for private, government and for all others company leads toward attaining their objectives in efficient way(Matta, 2015).

Health-care center is an organization, whichneedthe quality of health services delivery. Deploying HIS for healthcare services activities is insufficient unless health sector employees' capacity is evaluated (Lau, 2017). According to Ngafeeson (2014), health-care information systems opportunities and challenges promise to increase legibility, investigate challenging medical issues, reduce costs, and improve overall healthcare quality, but there are many challenges resulting from technology, end-users, and the environment that continue to undermine these efforts.According to their work explored the challenges that lie in health information systems and lessons learned were also highlighted (Asemahagn, 2018). The strategic plans to indicated health sector development program(HSDP) are primarily concerned with improving the quality of health service delivery through HIS (FMoH, 2010). To provide quality health services to the community, the Ministry of Health created an eHealth system for hospitals. According to a report by the federal ministry of health (FMoH), the ministry of health and its technical partners installed e-Health systems for a number of hospitals in Addis Ababa, including St. Paul and Black Lion specialized hospitals, with lack of standardization and coordination the main limitations identified(Addisu, 2021).Also Mulusew(2018) study revealed that lower functionality status influencing the information technology adoption among electronic health management information system.In addition works done South West Shoa Zone Hospital on implementation status of HMIS implementation is being hampered by inadequate information utilization, a lack of identifying information required at specific levels, and a lack of resources. (Addisu, 2021).

Human resources have thus been one of the main obstacles to implementing effective e-health services and bringing about the desired cultural revolution in the use of health information(Binyam et al., 2020).A more extensive capacity building exercise is required for this challenge to impement HIS to enhance quality service delivery .A competent HIS workforce, a functional IT infrastructure, a well-established interoperable system, a variety of installed and

functional applications at all recommended levels, and the existence of legally binding and directive (policy and strategy) documents are expected(FMOH, 2020).

Selamawit (2015) conducted a study on improving HIS information security and privacy in the event Open MR faces several challenges, including existing infrastructure, organizational readiness, a lack of structural security and privacy elements needed to support evolving IT infrastructure, emerging legislative regulations, and ever-increasing threats. This work also identified challenges in HIS such as a lack of information exchange between different eHealth systems and a lack of information utilization for planning and decision-making at all levels (hospitals, districts, regional, and federal levels).

There is a limitation of interoperability between (LIS) and (EHR) systems, according to a study done by Wondwosen*et al*., (2018), which explores the general nature of two hospitals in Addis Ababa data exchange interoperability framework for laboratory information system (LIS) and electronic health record (EHR). In order to provide the best answer and a comprehensive framework in this area, the study also proposed that a standard framework and policies be created for future health HIS, data interchange and options in electronic health record systems in eHealth domains.

Generally, many studies have been tried to solve the problem and, this study wasusedthis as an input, and concludesthe implementation and use of health information system services in an eco-friendly manner is an important issue that needs further study.Those study identified different factors that challenges HIS implematation while study in addition to interoperability other highly affected ehealth standard included. Study by Wondwosen*et al*., (2018) only included LIS and EHR in two hospitals while this research incuded all applications in five hospitals. Also this study research identified which factor matter most in HIS implematation in order to quality health services.In developing countries like in Ethiopia, where health center is fraught with serious challenges at multiple levels, there is an increasing pressure to ensure that enhance information system implementation should be put in place in the context of health center needs. Hence,problemsidentified from all above researchers HIS data exchange standard and interoperability problems exist inhospitals, which need further study for data exchange standard and interoperability in framework healthcare centers activities.

Therefore, with this study, challenges currently available concerning in terms of HIS standard and data exchange interoperability, integration and coordination wasaddressed with proposed framework. This study is going to answers the following questions.

1. What kind of HIS standards are followed in developing health system firms for health centers?
2. What are the challenges facing health centers in implementing HIS?
3. What is appropriate framework to address interoperability among Ethiopian hospitals?

1.3. Objectives of Study

1.3.1. General objective

The general objective of the study istoinvestigatethechallenges of health information systems standard and interoperabilityonhealth centers activities.

1.3.2. Specific Objectives

In line withthegeneral objective, thefollowing specific objectiveswere addressed.

- To identify the current challenges existing in useof HISin Ethipianhospitals
- To investigate the interoperability toexchange health informationamonghealth centersin Ethipian governments,
- To identify the current standards of HIS application in in Ethipian governmentshospitals for connecting HIS systems together,
- To propose a framework for effective HIS application to enhance health-care serviceEthipian governmentshospitals.

1.4. Significance of the study

The findings of this study isbenefit the Ministry of health, hospitals, healthstakeholder'susersand health sector at all levels. Itprovide great support for specialized hospitals and other respective hospitals in order to achieve their required objective quality service delivery and to meet their customers' needs. In addition,thefinding assist in the preparation of an interoperability plan for the long-term sustainability of e-health systems in hospitals by bringing all fragmented e-Health systems into one picture without any boundaries. This is also contain information about e-health applications in Ethiopia, specifically in the context of hospitals, as well as address some of the challenges of data interoperability by designing an information exchange interoperability framework between health institutions to enable more effective and efficient healthcare delivery. The findings used toprovide decision-making with more information regarding existing e-Health systems at the hospital level in terms of data exchange interoperability, as well as a framework for FMOH decision-makers, partners and stakeholders.

1.5.Scopeand Limitation of the Study

The study was accomplished in five selected hospitals as well as Federal Ministry of health (FMoH) Ethiopia. Those hospitals were Black Lion specialized,St.Paul specialized,St.Peter specialized and Jimma University Specialized hospitals. One is from private which was Korea hospital. In order to select these hospitals , different points were considered as criteria of selection.Those criterias firstly, four them specialized government hospitals. Second longer experience on complex health service. Third well establishments ICT facilities and infrastructure to support e-healthservices. Forth high population of countries refered to those hospitals. While korea hospital is higly preferred private hospitals by multiple users.From these selected hospitals target participant for study werehealth professionalsandIT staff while participants from Minister Office were regulatory domain experts. The focus for thisparticularstudy was HIS standard and interoperability impacts for quality service delivery.

Furthermore, lack of reference papers and literature concerned with HIS implementation framework for effective health center service delivery, and lacks some complimentary information such as how interoperability works between Health center delivery services.

1.6. OperationalDefinition

Health information system: System designed to manage health-care data for a hospital operational management,

Information system: An integrated set of components for prcessing and storing for providing information and digital product.

Interoperability: Ability of a computer system to run application programs from different implementers, and to interact with other computers across local area network regardless of their physical architecture and operating systems.

Health information system standard:-The process of agreeing to standards, the universal language facilitating the exchange of health information among two different data systems.

1.7. Organization of the Study

This thesis is organized in to five chapters and discussed as the following: The first Chapter deals about the introduction, the background of the study and problem statements, objective, significance of the study, scope and limitation, and operational definition terms. The second Chapteris about aliterature review and the related works. The third Chapter discusses the methodology employed to conduct this thesis and mainly address used methodology, which is qualitative and quantitative method with descriptive research approach. The fourth Chapter is aboutdescribes the analysis of findings in terms of results and discussions and the last chapter about conclusion and recommendation.

CHAPTER TWO
LITERATURE REVIEW AND RELATED WORK

2.1. Overview of Health Information System (HIS)

Health information system (HIS) is the meeting point of healthcare and information systems in order to provide better healthcare. This supports data collection, compilation, analysis and synthesis, as well as communication and application for decision-making. A healthcare information system (HIS) is a collection of networking technologies, clinical databases, electronic medical health records, and other biological, administrative, and financial systems that generate, transmit, and store healthcare information (Ngafeeson, 2014).

This system is a technical phenomenon for the health-care business, allowing for the efficient handling of patient data. This solution helps to improve patient care quality, reduce operational expenses, eliminate data entry errors, and streamline the entire internal management process. As a result, HIS offers increased benefits for planning and implementation interventions in addition to actual healthcare services. Since HIS deployment cannot cover all of the requirements for healthcare service delivery, it should be regarded a challenge. The implementation problems, such as system compatibility, standard guidelines, and follow-up on accomplishments, require careful study. Opportunities and problems abound in today's HIS information systems. Standard and interoperability issues are the most significant technical hurdles in HIS implementation. (Scott & Oyeyemii, 2018).

The challenges regarding interoperability and standardization are not only affects in healthcare service delivery but all technological application have consider these core factors in order to effective information exchange(Check et al, 2020). Unless those problems get solution implication using technological applicant cannot attain expected objectives. In order to share data from one institutions to other must be based around common language (data components and terminology), structures, and organization (Scott & Oyeyemii, 2018).

So standard is prerequisite in order to attain the goal of interoperability between healthcare systems.Theimplementationofcommon standards allows for the transfer of relevant datafromparticular information system, which support to communicate effectively in order to attain the goal of interoperability(Edwin and Kimaro, 2015).Standards are categorized into three

main categories: (1) Classification, and terminology standards; (2) Data interchange standards; and (3) Health record content standards.These all expected for information exchange between technological applications (Ngafeeson, 2014).

Since 2006, Ethiopian healthcare system has used electronic health management information systems; nonetheless, the functionality and challenges need to be assessed (Mulusew, 2018). According to Wondwosen et al., (2018), the (FMoH) has been trying to transition from paper-based to electronic HMIS since 2009, in conjunction with Tulane University, the Center for Disease Control (CDC), and UNAID. A lack of information transmission across multiple e-Health systems and a lack of information use for planning and decision-making at all levels have been recognized as difficulties in Ethiopian HIS (Selamawit, 2015).Communities in developing nations have a variety of health-related challenges, and health information systems that address those challenges are impeded by a lack of resources and capability(Ngafeeson, 2014).The main purpose of HIS not applying advanced technology but to improve quality service delivery for health related information (NYELLA, 2015).

2.2. Challenges of Health Information system

There are varieties of challenges in HIS starting from deploying to implementation. These challenges arise from the interaction of technical, human, and organizational elements that influence the acceptance and usage of these healthcare systems in general (Mulusew, 2018). Others regarding lack of regulations and policies to support health information systems, a lack of financial resources, privacy concerns, and the nature of the healthcare sector are among the problems (NYELLA, 2015).These obstacles include concerns with the technology, the healthcare context, system users, and the regulatory environments.Challenges regarding technical issue such as standard principles, interoperability, security, privacy issues which included in challenges (Scott & Oyeyemii, 2018).

From these listed challenges interoperability and standardization difficulties influence not only healthcare service delivery, but all technological applications must consider these basic criteria in order to effectively transmit information(Cheick et al, 2020). Unless those problems get solution implication using technological applicant cannot attain expected objectives. In order to share data from one institution to other must be based around common language (data components and terminology), structures, and organization (Scott & Oyeyemii, 2018). In order to

remove challenges in interoperability between healthcare systems following common standard is mandatory. According toNgafeeson(2014) standards are categorized into three main categories such as first(Classification, vocabulary, and terminology standards), second data interchange standards; and third Health record content standards.The standard guidelines help to transfer information between HIS implementations.

2.3. Interoperability in Health Information System

Interoperability is defined as the ability of two or more information systems or components to share and utilize information based on standards (Iftikhar et al, 2012). Interoperability allows different health information systems to work together within and across organizations to improve people's health and the effective delivery of health care(NYELLA, 2015).According to USAID description in Kenya HIS there are three different levels of health information technology interoperability as described below

I. Foundational interoperability:-Which allows data from one information technology system to be received by another. It does not require the ability for the receiving information technology system to interpret the data.

II. Structural interoperability:-is a step in the data sharing process that defines the structure or format of the data.The syntax of data interchangesoneof structural interoperability. It guarantees that data is exchanged across data sources.

III. Interoperability at the highest level is provided through semantic interoperability. This refers to the ability of two or more systems or elements to communicate information and utilize that information. Semantic interoperability makes use of both data architecture and data codification, including vocabulary, so that receiving information technology systems can understand the data.

2.3.1 .Interoperability Standards

The Office of the National Coordinator for Health Information Technology (ONC) is use the Interoperability Standards Advisory process to coordinate the identification, assessment, and determination of the "best available interoperability standards and implementation specifications for industry use to meet specific clinical health IT interoperability needs (ISA, 2016).Standard establish a common vocabulary and set of expectations that allow systems or devices to communicate with one another, according to Oyeyemi and Scott (2018). This allows physicians,

labs, hospitals, pharmacies, and patients to share data regardless of application or market source, making it easier to digest information about a person and improving overall healthcare coordination and delivery (Oyeyemi and Scott, 2018).

2.3.2 Types of Standard

HIMSS states standards are divided into several categories.Informatics specialists categorize the different types of health data standards available for use into the following Standards are categorized into three main categories: (1) Classification, vocabulary, and terminology standards; (2) Data interchange standards; and (3) Health record content standards .These all expected for information exchange between technological applications (Ngafeeson, 2014).

Health terminology and standards are representation assigned to a term so that it may more readily be processed and most terminologies incorporate a coding system for computer processingclassification arranges or organizes like or related terms for easy retrieval (NCVHS, 2017).Data interchange standardsstudy the issues related to the adoption of uniform data standards for patient medical record information and the electronic exchange of such information and report to the Secretary of Health and Human Services (HHS) recommendations and legislative proposals for such standards and electronic exchange(NCVHS, 2017). Health record content standards are patient registration information, a problem list, medication records, progress notes, and the results of ancillary reports are often included in a physician's office record(NCVHS, 2017).

2.3.3 . Underlying Principles

The principles of interoperability are essential behavioral factors that guide interoperability actions. This section outlines broad interoperability principles that are aligned with digital development concepts, as well as guiding real implementation use cases that are pertinent to the process of developing interoperable HIS ecosystems. They define the environment in which HIS are developed and implemented.

The underlying principles of the KHISIF are grouped into three categories:

Core interoperability principles;

1. Principles related to generic user needs and expectations; and
2. Foundational principles for cooperation among public administrations.

2.4. WHO Health system Framework

In the field of strengthening and researching health systems, frameworks can make concepts clearer and help with understanding underlying dynamics. In order to foster a shared understanding of what a health system is and what constitutes strengthening health systems, WHO created a framework known as the health systems building blocks.This framework as having six building blocks: (I) service delivery; (ii) health information technology;workforce; (iii) information; (iv) medical products, vaccines and technologies; (v) financing; and (vi) leadershipand governance, as well as process elements (access,coverage, quality and safety) and outcomes (improvedhealth and health equity, responsiveness, social and financial risk protection and improved efficiency)**(WHO, 2008)**.

These frameworks are designed to offer a set of instructions for determining if health care information systems are adequate.

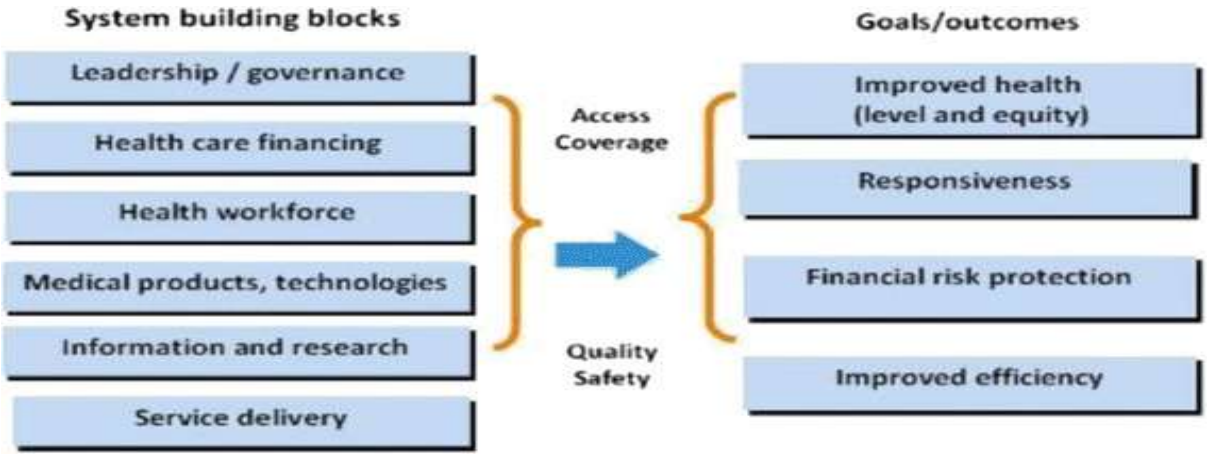

Fig 2.1: A health systems Framework ((WHO, 2008)

2.5. Ethiopian Health Information System(HIS)

HIS in developing countries, especially Ethiopia, has gained more attention in recent years as governments, non-governmental organizations, donors, and other development partners have expanded their efforts to improve healthcare quality service delivery in country as described HSDP IV (FMoH, 2010).To do this, HMN will solicit participation in the creation of a two-level worldwide set of standards for health information.By involving HMN partners and donors in wide-ranging harmonization efforts in the first place, and by assisting the quick and targeted alignment of health data stakeholders and infrastructure in focal countries in the second (WHO, 2008). The Ministry of Health has been working on enhancing evidence-based decision-making and determination of progress and impacts based on quality of data primarily through the implementation of the Information Revolution Roadmap.The electronic medical record (EMR) is a comprehensive national electronic health record (EHR) and reporting and analysis system designed to improve patient care, increase efficiency, and make the reporting and analysis system more accurate, timely, and effective at all levels, from community health workers to health facilities, Woredas, Zones, regions, and the Federal Ministry of Health

HIS ultimate purpose is to create high-quality data for decisions that are based on evidence to enhance the coverage, quality, and equity of health care.eHealth can also be defined as a method of ensuring that the appropriate health information is delivered to the appropriate person at the appropriate time and place in a secure, electronic format to improve the accessibility and quality of health care delivery, research, education, and knowledge for the health system (Binyam et al., 2020). Ithelp to monitor job efficiency and provide information about whether the health sector is acting appropriately. Doing things correctly enables actors to quickly identify management weaknesses in the health system, fill them, and improve system performance (FMOH, 2020).Ethiopia begin on a national eHealth coordination and alignment strategy in order to establish a flexible and efficient eHealth capability .Health information workforce: Since the implementation of the reformed HMIS, MoH has made significant efforts to create a well-functioning HIS through the deployment of the health information and other health workforce, as well as the enhancement of their capability.In conjunction with the Ministries of Education and the Civil Service Commission, the MoH has also created career paths and a curriculum for HITs and health informatics specialists (FMOH, 2020).

HIS requires sufficient human resources, money, technology, space, and HIS structure as inputs to run the system, where capacity building, application development and deployment, standard-setting for policy and legislation, conducting surveys, surveillance, and research, and ongoing monitoring and evaluation are expected to be carried out. This will entail the creation of national frameworks and infrastructure components that can be used at the national, regional, and local levels to develop solutions that can integrate and share data across geographic and health-care sector borders.

The electronic medical record (EMR) is a comprehensive national electronic health record (EHR) and reporting and analysis system designed to improve patient care, increase efficiency, and make the reporting and analysis system more accurate, timely, and effective at all levels, from community health workers to health facilities, Woredas, Zones, regions, and the Federal Ministry of Health (Addisu, 2021).So in order to meet required HIS application for quality health services, needs adequate human resources, finance, technology, premises and HIS structure as inputs to run the system where capacity building; applications development and deployment; development of policy and legislation documents and standards; conducting Survey, surveillance & research; and continuous monitoring and evaluation are the expected activities to be performed.

2.6. Standard of Ethiopian Health Information System

Global health partnerships offer extraordinary opportunities to advance public health in developing countries. Establishing a comprehensive set of globally agreed and linked technical standards for health information in developing country like Ethiopia. All countries therefore need a nationally defined minimum set of health indicators used regularly in national programme planning, monitoring and evaluation (WHO, 2008).As identified in the document by 2011, the Framework and Standards for Country Health Information Systems (the "HMN Framework") is expected to be the universally accepted standard for guiding the collection, reporting, and use of health data by all developing nations and worldwide agencies. This can only be accomplished by reaching an agreement on the goals and coordinating the investments now required by the country's health information systems.

Firstly, at country level, it will focus investment and technical assistance on standardizing health information system development, and serve as a benchmark for baseline system assessments. As

part of this, a roadmap is described for strengthening health information systems, and putting in place ongoing monitoring and evaluation. Second, the HMN Framework will permit access to – and better use of improved health information at the country and global levels (WHO, 2008).

There are levels of standard set on HIS services by WHO(2008) for developing countries like Ethiopia.To build and maintain an HMIS that provides agreed-upon indicators that meet agreed-upon quality criteria of timeliness and reliability, are based on standardized instruments, and are given through a well-defined and consistent channel. As sets of standard for counries established with six components, a health information system can be further subdivided into its inputs, processes and outputs. AccordinglyWHO(2008) stated, the six components of a health information system for all countries are:

Health information system resources : These include the legislative, regulatory, and planning frameworks needed to assure a fully effective health information system, as well as the resources required to make such a system work. Personnel, funding, logistics support**,** information and communications technology (ICT), and coordinating mechanisms within and amongst the six components are examples of such resources.

Indicators:a fundamental set of metrics and objectives for each of the three health information domains listed in the plan and strategy for a health information system.Determinants of health, inputs, outputs, and outcomes of the health system, as well as health status, must all be included in indicators. Establish standardized cascaded indicators for monitoring and evaluation at all levels and establish disease case definitions for all levels (FMOH, 2020)

Data sources:-can be divided into two main categories; (1) population-based approaches (censuses, civil registration and population surveys) and (2) institution-based data (individual records, service records and resource records). A basic set of standards for each source and strategic elements in achieving these standards are described to establish close communication and consistent practices amongst all who supply and use HMIS and other health-related information (FMOH, 2020).

Data management :-It includes all facets of handling data, including collection, storage, flow, quality control, processing, compilation, and analysis.Where it matters, such as in the case of disease surveillance, specific standards for periodicity and timeliness are set. Using standardized

data collecting technologies, client/patient encounter records are created, including those from homes and communities, that adhere to service delivery standards and include the data needed for continuity and high-quality care (FMOH, 2020)**.**

Information products:-data must be turned into information that can serve as the foundation for knowledge and evidence that will guide health action.

Dissemination and usage: By making health information easily accessible to decision-makers (while taking into account organizational and behavioral restrictions) and by offering rewards for information use, the value of health information can be increased..Standardized reporting instruments Eetablish mechanism and reporting formats to collect HMIS data from the client/patient recording formats in the most efficient way possible(FMOH, 2020)**.**

Fig 2.2: – Minimum standards for data-collection methods ((WHO, 2008)

2.7. Related work

According to study by Scott &Oyeyemii(2018) in interoperability in health and social care organizational issues are the biggest challenge while standards and legal other next challenges when compared to other impacts such as technology, semantic and security.According toCheick et al.(2020). The development of properly integrated and scalable information systems in the health sector in developing nations has proven challenging and is expected to remain difficult in light of the ongoing fragmented funding of health initiatives, according to. Those authors stated additional points and proposed the concept of flexible standards as a vital component of a long-term infrastructure development strategy and issues that must be addressed, including the need for standards that can adapt to a changing health-care environment.

According to Ndlove*et al*., (2021) study on frameworks for connecting mhealth to electronic health published assessments of eHealth interoperability frameworks for connecting mhealth solutions to erecords and determined how useful they are for informing interoperability initiatives in Botswana's eHealth strategy. So this structured literature review analysis indicated the country recognizes interoperability, mhealth, and e-records as separate concerns, but does not link mhealth and e-recordsforsolutions challenges.

As study paper of Wondwosen *et al*., (2018) on data exchange interoperability framework for eHealth applications in Ethiopia indicates with the view to proposing and developing a data exchange interoperability framework with applied an exploratory research approach and a constructive method were applied to address the data exchange interoperability issues and to propose a data exchange framework between the LIS and EMR.So according to this study shows a lab-technologist in St.Paul Specialized Millennium Medical College hospital said there are both EMR and LIS which are almost doing the same function in our laboratory which created duplication of effort and heavy work load. As study result from Zewditu Memorial Hospital indicatedlack of interoperability and integration between LIS and EMR is the main challenge which cause fragmentations and data redundancy as well as different report generation. Both application users indicated that data exchange is considered as one of the major problems in the hospitals and experts at the ministry agreed that there are data exchange challenges and gave recommendations on LIS and EMR in relation to planners and decision makers.

The study paper by Belesti(2016) show the present condition of HIS in Ethiopia based on a review of information from existing sources from electronic journals, thesis papers, databases, internet, conference proceedings, Government publications, reports, statistics and books. Results confirmed that indicators and information products are considered adequate but data management is very poor. Health information system resources, dissemination and use, as well as data sources coverage, are also inadequate. Hence this literature review revealed that the overall HIS in Ethiopia is poorly developed.The EMR application lacked laboratory standards, slow in data retrieval, had many laboratory orders, low error detecting capability such as prescription overdose, and different naming conventions.

According to Belay et al (2020)investigate knowledge management technology implementation for supporting decision making in Ethiopian health sectors revealed as the overall level of KM technology implementation in Jimma University Specialized hospital is still low. So, this study done about challenges of knowledge management technology implementation was gatheredusingpurposive sampling and qualitative research methods, through conducting semi-structured interviews.

Study done in Zanzibar by NYELLA(2015) Challenges in Health Information Systems integrationwhile some countries have managed to integrate the vertical reportingsystems into the national HIS, ensuring reliance and continuous use of the integratedHIS by the programs' managers is still a big challenge. The fragmentation of the HISafter integration, ensuing from the non-reliance and compliance to the integratedsystem, has not received much attention empirically or analytically.HIS integration in developing countries is considered as an approach towards rationalization and unification of disparate systems, with an objective to provide easyand equal access of relevant information to all stakeholders. This study described at the challenges posed by the historicity the conservative influence ofhistorically accumulated and institutionalized practices, technologies and perceptions and heterogeneity lacking integration and increasing fragmentation across thecollection of information systems of information systems in the development andintegration of the health information systems. In order to gather this study semi structured interviews were used, where interviewees were asked open ended questions to elicit their viewpoints related to the use of the integrated HIS. A number of documents and software tools were analyzed.

As works done by Oleribe et al(2019) on identification key challenges facing healthcare systems in Africa stated with decreasing order inadequate human resources , insufficient budgetary allocation to health, and poor leadership and management,training and capacity building for health workers, increased budgetary allocation to health and campaigning for political support and commitment. This study done with 15 countries while 11 countries participated from Africans.

Table 2.1: Summary of related works

Authors name & year	Topic	Finding	Research Gap
Mniyichel(2021)	Investigate knowledge Management Technology Implementation For Supporting Decision Making In Ethiopian Health Sectors	This study revealed that the overall level of KM technology implementation in Jimma University Specialized hospital is still low	Investigation factors minimize KM technology implementation in Jimma University Specialized hospital
Addisu(2021)	Implementation Status of Health Management Information System in Hospitals of South West Shoa Zone, Oromia, Central Ethiopia	Study revealed with three dimensions availability of resources, compliance to guideline, and utilization of information were below the standard agreed	Additional study will be needed acceptance of system by higher officials and simplicity HMIS for implementation
Oleribe et al(2019)	Identifying Key Challenges Facing Healthcare Systems In Africa And Potential Solutions	Inadequate human resources, insufficient fiscal allocation to health, and poor leadership and management were the first three challenges identified in this study	Professional standard and types to maximize quality healthcare system require study
Mulusew(2018)	The functionality status and challenges of electronic health management information system: The case of public health centres in Amhara Region, Ethiopia	This study found a relatively high percentage of eHMIS adoption, but poorer functioning for a variety of reasons.	-The critical factor for lower functionality rate needs other investigation -At hospital level need additional study
Oyeyemi and Scott(2018)	Interoperability in health and social care: organizational	The biggest barrier to interoperability was organizational concerns.	The way organizational interoperability challenges removed

Authors name & year	Topic	Finding	Research Gap
	issues are the biggest challenge		need additional work
Mikael(2018)	Governance lessons from an interorganizational health information system implementation in Ethiopia	-There are impacts of unstructured interorganizational linkages on IOS adoption, -influenced by the social and political activities	-Intraorganizational level HIS implementation limitation need additional investigation
Selemawit(2015)	Enhancing Information Security and Privacy of Health Information System:A case of OpenMRS	Confidentiality on the server side is protected by a carefully positioned access control system, encryption protects confidentiality during data transfer and storage, anonymization of patient medical records, and the use of log files are among the prototype's primary security and privacy features.	-Additional security and privacy using biometric technologies, such as finger prints - patient online access to such records.
NYELLA(2015)	Challenges in Health Information Systems Integration: Zanzibar Experience	-Use of the integrated HIS is limited. -There is no use of the integrated HIS at all. -Tensions in the Health Information System (HIS) Integration	The way users receive and interact with the newly integrated HIS additional investigation.
Ngafeeson(2014)	Healthcare Information Systems :Opportunities and Challenges	The outcome (success/failure) HIS is the gap between design conceptions of HIS and present reality -Technical rationality -Managerial rationality -Medical rationality	-Systems implementation should be viewed as more than the realization of a planned technical project within an organization, - A contextual approach of implementation should be recognized and addressed in HIS implementation research

Authors name & year	Topic	Finding	Research Gap
			- Organizational redesign should be viewed as a process that cannot be completely planned and controlled in HIS implementation study.

Generally based on the literatures presented, HIS adoption is major concerns inhealth-caredevelopment.According to the related work, the main challenges are classified to technical and regulatory matters.There are many challenges identified by those researchers while technical common limitations are absence of standard and interoperability between healthcare applications. Consequently, it is reasonable to conductHISstandard and interoperability for effective health sector (hospitals) service delivery to fix these major problems. Therefore, thisresearch addresses the adoption of HIS standard and interoperability on health centers activities, which is not addressedearlier.

2.8. Conceptatual framework

Federal ministry of Health (FMoH), identified some of common challenges that is similar with this study and design national level eHealth strategy road map based on Health Matrix network framework designed by world health organization, discussed in Figure 2.2below.

The Federal Ministry of Health is expected data from hospitals through eHealth applications. Nowadays the public hospitals have an opportunity to have HIS within the next five year (HSDP -IV) and need national to facility level data exchange. The capacity of two or more systems or components to communicate information and utilise that information has been referred to as interoperability.A appropriate interoperability framework is necessary to provide an established approach to interoperability and describe common aspects, given the significance of connecting eHealth solutions to eRecord systems in the developing world(Kagiso, Maurice, & Scott, 2021). Then based the above findings on the national level information sharing is so vital in the health sector for many reasons. Hospitals' health information exchange, HIS administration and regulation of eHealth, and the interoperability levels to be attained are all highlighted in the HIS interoperability framework.The proposed data exchange interoperability framework between HIS create an option to solve those challenges at each level. These framework work only hospitals level and mainly consider the national level eHealth framework. That basically answers the challenges related on data exchange in the hospitals which implemented HIS.

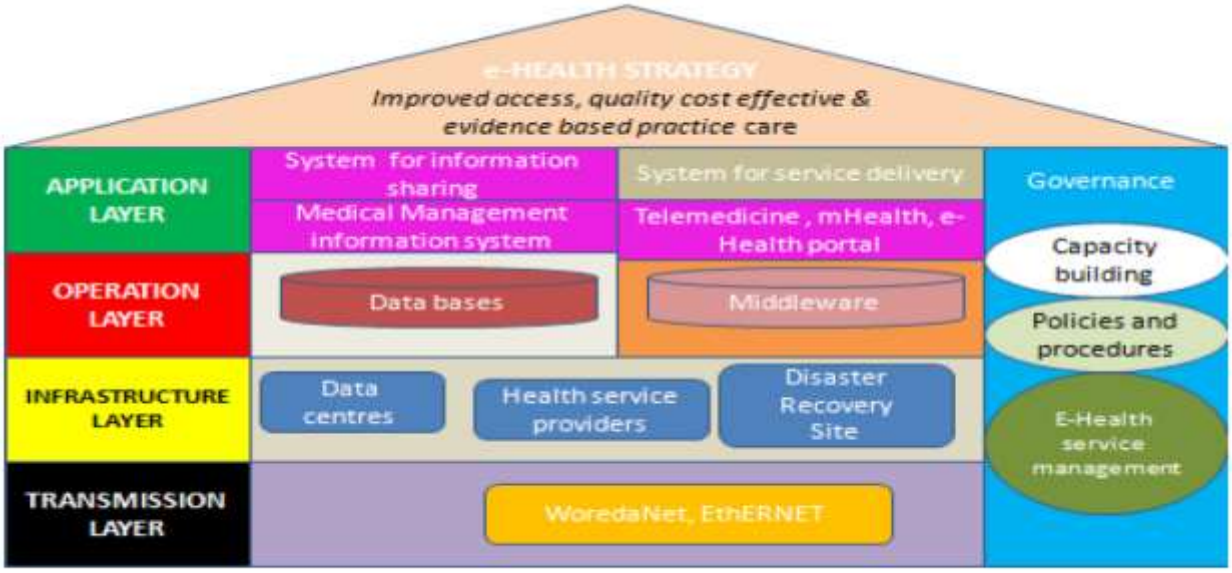

Figure 2.3. Conceptual framework of the interoperability between HIS(Wondwosen, *et al*, 2013)

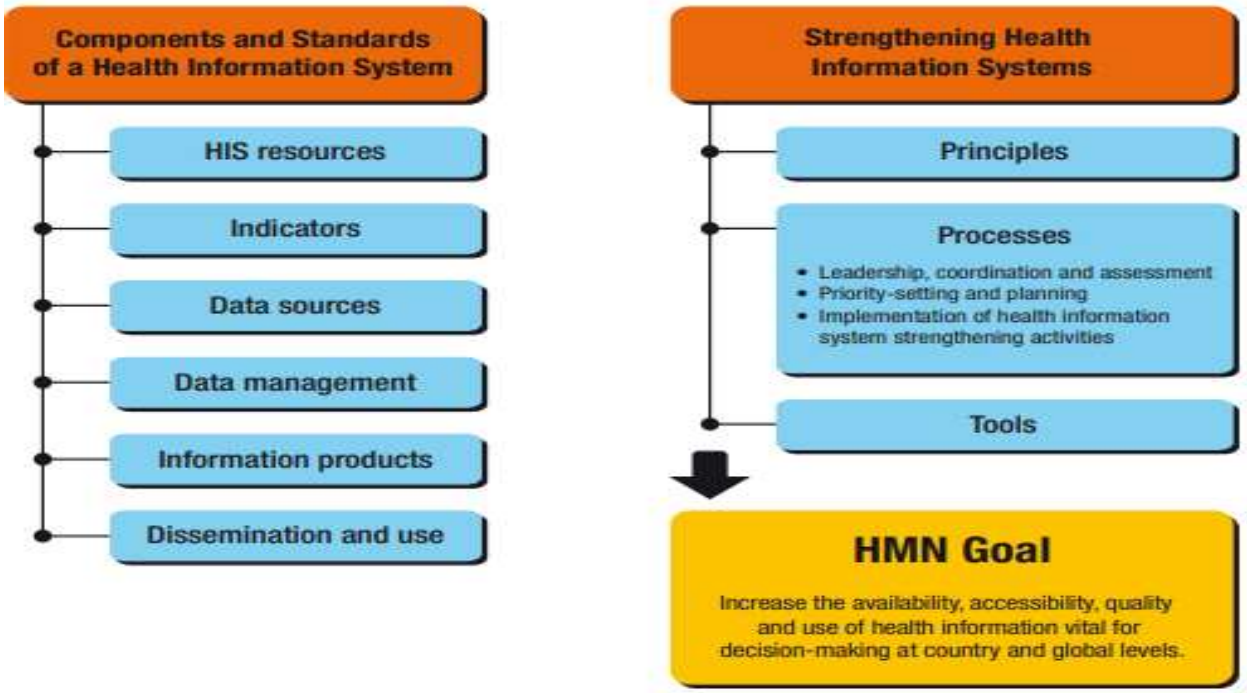

Figure 2.4: Framework and Standards for Country Health Information Systems

As shown above the figure 2.4, it is intended that by 2011, this Framework and Standards for Country Health Information Systems (the "Health Matrix network Framework") will be the universally accepted standard for guiding the collection, reporting and use of health information by all developing countries and global agencies. This will only be achieved by fostering agreement on the goals and coordinated investments now needed by country health information systems. Components and standards of a health information system of a health information system, as shown in the left-hand column of Fig. 2.4. These are health information system resources, indicators, data sources, data management, information products, and dissemination and use. Desirable standards to be attained when strengthening or establishing each health information system component are reviewed. Data-management methods are proposed and subsequent practical use of the information generated.Strengthening Health Information Systems principles, processes and toolsguiding principles for health information system development are outlined, and practical steps for implementation proposed. As part of the "processes" of strengthening health information systems (shown in the right-hand column of Fig. 2.4), three

implementation phases are identified, which are all accompanied by continuous evaluation and improvement.

In general based on the above federal minstery of health and world health organization with investigation challenges of health information system interobability and standards health service activities have to implemented successull HIS for solution eHealth services activities.

2.9. Theoretical framework of the study

The structure that can hold or support a research study's theory is known as the theoretical framework.The theory that explains why the research problem under study arises is introduced and described in the theoretical framework. The theoretical framework should show a comprehension of ideas and concepts that are pertinent to your research paper's subject and that connect it to other, more general areas of study in the course you are taking(Adom, 2018).Concepts and their definitions, as well as any existing theories that are applied to your specific subject, make up a theoretical framework..

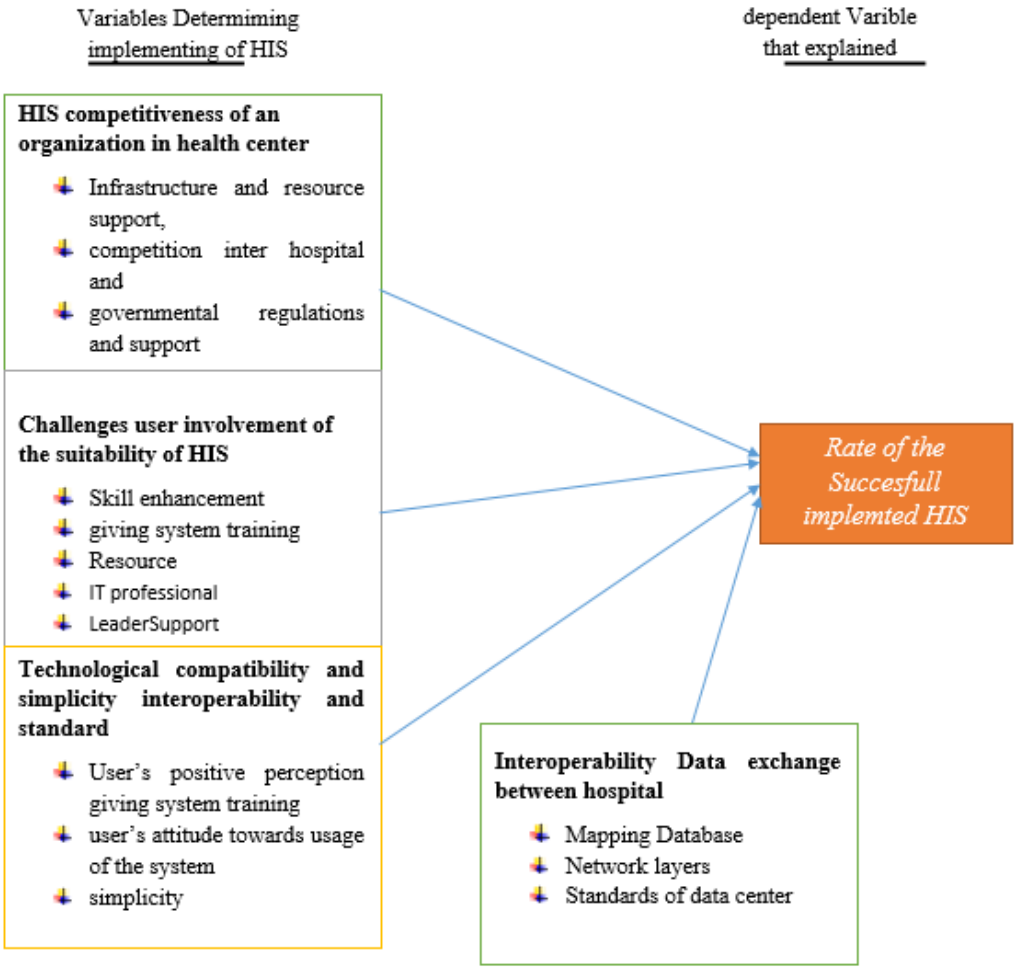

Figure 2.5. Theoritacal framework (wondesen, 2013 & WHO, 2011)

Modified by researcher (2022)

CHAPTER THREE
METHODOLOGY

3.1. Research Design

This study follow descriptive research method. Descriptive research methoddescribes the characteristics of populationenquiries of different kinds. The major purpose of descriptive research is description of the state of affair as it exists at present.

The data collection method was both qualitative and quantitative in nature. The qualitative method was used to obtain qualitative data from structured interview and the quantitative method was used to collect quantitative data using self-administered questionnaire.It is an instrument for both approaches because they are inexpensive, flexible, and allow researchers to collect data from a selected sample of people (Jones, Baxter and Khanduja, 2013).

3.2. Description of the StudyArea

The study wasconducted at five hospitals located in Addis Ababa and Jimma. Those hospitals are Black lion, St.Paul, ST.Peter, Korea and Jimma University specializedhospital. These hospitals preferred for this study and selected depending on accessibility and experience they haveon HIS, technology application, infrastructure deployed, electronic services they have, budget and time constraints. Those hospitalslocatedNorth West, East Addis Ababa andatJimma university main campus compound. In addition, this study wasincluded Ministry of health, which is highly responsible regarding giving direction in implementation eHealth for quality service delivery.

3.3. Population of the Study

The target population of the study are health professionals and IT Staff of these hospitals as well as Ministry health employees. Health professionals from these hospitals selected in order to get knowledge how they are applying standard guideline country following. The study respondentswereselected on the basis of their knowledge of the phenomenon being studied.Then total population of study was 2,389 health professionals, 74 IT staff and 26 regulatory domain experts.

3.4. Study Variables

The independent and dependent variables are the variables in a research of a cause andeffect connection. The cause is the independent variable. Its value is unaffected by the other factors in the research. While change occur at in independent variables dependent variable effected.

3.4.1. Dependent Variable

Dependent variable is depends on other factors that was measured. These variables are expected to change as result of an experimental manipulation of the independent variable. So in this study, HIS service delivery dependent on many factors that specified in independent variable. The research aimed to examine affecting factors in the investigating of challenge of HIS; hence the HIS is explained or dependent variable.

3.4.2. Independent Variable

The variable that is untouched by the other factors we are attempting to quantify. It is the state of an experiment that has been systematically changed by the researcher.However, specific to this study different strategy implemented in order to enhance health service delivery considered as independent variables. Thus, the study used simplicity interoperability and standard, perceived characteristics of users, competitiveness of an organization in health center challenges, technological factor/challenge, challenges of management support and user involvement of the suitability of his as independent variables.

3.5. Sampling Techniques and Sample Size

For this study, both probability and non-probability techniques have been proposed. From the probability study,stratified sampling methodwasused.Stratified random sampling wasusedin order to investigate the number respondentsof this study. The application stratified random sampling due to existence of different groups such as health professionals, IT professionals, administrative body of these hospitals and regulatory body from Ministry of Health. From the non-probability techniques purposive sampling techniques was used. Purposive sampling technique wasusedtoget required administrative body of these hospitals and Ministry of health regulatory body, which allows the researcher to identify important informants who are thought to be able to supply the needed information.

$$n = \frac{z^2 * p * q * N}{E^2 * (N-1) + z^2 * p * q}$$ (Kothari, 2004)

WHERE:-

N= total population

n = required sample size

z = confidence level at 95% (standard value of 1.96)

E = margin of error at 5% (standard value of 0.05)

p =population proportion at which the sample size is maximum (at p=0.5 and q=0.5, p*q=0.25)

To check the finite population correction (FPC) the researchers divides the determined sample size to the population. If the result is greater than 5% (i.e. n/N>5%N), FPC used to adjust the final sample size unless the required sample size can be accepted as it is (Kothari, 2004).

FPC formula : nf = n/(1+c)Where C = n/N and nf = final sampling size

Sample sizing for Korea Hospital

N=206(total number)

$$n = \frac{1.96^2 * 0.5 * 0.5 * 206}{0.05^2 * (206-1) + 1.96^2 * 0.5 * 0.5} \approx 134$$

C = n/N=134/206=0.65>0.05

nf = n/(1+c)=134/(1+0.65)=81

So sample size for this study was**81.**

Sample sizing for Black Lion hospital

N=716(total numbers)

$$n = \frac{1.96^2 * 0.5 * 0.5 * 716}{0.05^2 * (716-1) + 1.96^2 * 0.25} = 250$$

c=250/716=0.35

nf=250/1.35=**185**

Sample sizing for Phexiroos hospital

N=463(total numbers)

$$n = \frac{1.96^2 * 0.5 * 0.5 * 463}{0.05^2 * (463-1) + 1.96^2 * 0.25} = 210$$

c=210/463=0.45

nf=210/1.45=**144**

Sample sizing for St. Paul Specialized

N=612(total numbers)

$$n = \frac{1.96^2 * 0.5 * 0.5 * 612}{0.05^2 * (612-1) + 1.96^2 * 0.25} = 236$$

c=236/612=0.38

nf=236/1.38=**171**

Table 3:1:Sample size from each hospitals and MOE

No	**Name of Hospital**	**Sample sizing**
1	Korea Hospital	81
2	MOE	26
2	Black Lion Specialized	185
3	Jimma University Medical Center	167
4	ST.Peter Specialized	144
5	St. Paul Specialized	171
Total		**748**

3.6. Sources of Data

The study was used both primary and secondary data. Primary data also known as raw data was collected from the original source. Secondary data is the data obtained from secondary sources such as reports, books, textbooks, journals, documents, magazines, the web and other written material on internet related to social work professionals and satisfaction in government and non-government organizations reports of earlier interventions and or prior research done earlier in and outside the country,was collected as sources of data.Primary and secondary data's was used to support and study. The primary data was collected from pre organized self-administered questionnaires and the secondary data was obtained from periodic publications of papers and periodic progress reports.

3.7. Methods of Data Collection

For this studywas used questionnaire, interview and observation in order to get adequate information and data.

3.7.1. Interview

The interview was conducted semi-structured interviews with open-ended questionnaires for Ministry of health officials and Hospitals administrative body. Seventeen individuals from MOE and three administrative body from each 5 hospitals were interviewed to understand the issues on challenges of HIS standard and interoperability for quality health deliveries .

3.7.2. Questionnaire

Questionnaires were prepared for IT staffs and health professionals to get required information.The questionnaires are prepared as such a Likert scale questionnaires was designed to obtain data from health professionals and ICT staff for demonstration and evaluation of the proposed framework with respect to its comprehensiveness, clarity, completeness, compatibility, correctness and applicability.The questionnaire design was based on the objectives of the study. Both close and open ended questionnaire was prepared to gather required knowledge on specified objectives.

3.8. Data Analysis

The study used inferential and descriptive statistical methods. The entire questionnairewere recorded and coded then entered into SPSS software packages for analysis. The results were presented in the form of tables. Regression analysis is suitable for studyto determine which factors matter mostHIS implementation. This is due to permits researcher to make statements regarding the accuracy with which one or more independent variablesthatpredict more the value of a quality health service delivery. Analysis of variance (ANOVA) allows a researcher to examinedifferences in allpopulation means simultaneously and it calculates a value that indicates the degree of variations in the means using variances of groups. In addition, organizing, summarizing, charting, and graphing data in order to describe a group of people who was measured or observed. It isinclude percentage and frequency data.

3.9. Ethical consideration

So in order to investigate this study researcher have get permission from government official. Privacy and confidentiality were maintained at all times and all findings were reveal in a confidential manner no personal or identifiable information was recorded or printed in the study. No names were recorded during the interviewing process. The data was not being transferred to any third party.The researcher will pay attention on different ethical consideration like dressing style, communication ways, and respect for the target population during data collection.Ethics are a set of moral principles that are widely accepted, which guide the researcher in observing the rules.

CHAPTER FOUR
RESULT AND DISCUSSION

4.1. Result

This study was designed to investigate the challenges ofhealth information systems standard and interoperability on health centeractivities. The results derived from the collected data were presented and analyzed in this chapter. In general, the chapter demonstrated the response rate, a background of respondents and results of the study about theHealth Information Systemsas per the stated objectives.

4.1.1. Response Rate

The field survey result indicated that from the 748 questionnaires distributed to investigating the challenges ofhealth information systems standard and interoperability on health centers activities 512 filled and returned from the respondents.Therespons rate is presented in table 4.1 below:

Table 4.1: Distribution of the response rate

No	Name of Hospital	Number of questionnaires		Percentage
		Distributed	Returned	
1	Korea	81	47	58%
2	MOE	26	17	65%
2	Black Lion Specialized	185	119	64%
3	Jimma University Medical Center	167	104	62%
4	ST.Peter Specialized	144	107	74%
5	St. Paul Specialized	171	118	69%
Total		**748**	**512**	**100%**

As indicated on the above 4.1 table some respondent did't returned distributed questionnaire by different reseans. Some of respondents from travelled out of countries, some of them always giving schedule when repeatedly contacted,some them redponse as they are too busy in order fill questionnaire. Generally they took questionnaires to respond with schedule but lastly after multiple contact some respendent from each hospitals refuse to response. Overall as researcher conclude getting data from hospital quite challenge**.**

4.1.2. Demographic Information of Respondents

The respondents of the survey questionnaire have different personal information. The demographic profile of respondents participated in the study are shown in the tables and figures below.

Table 4.2: distribution of gender respondent

Sex	Frequency	Percentage
Male	373	72.9%
Female	139	27.1%
Total	**512**	**100.0%%**

As indicated on the above table 4.2, among the total 512 respondents, (72.9%) were male and the remaining (27.1%) were female. This data shows that the participation of female was less than males in over all activities of organization. This implies the above table the majority of the respondents are male in the study area. Researcher judjment concludes that there are higher male employees health professional exists in these hospitals.

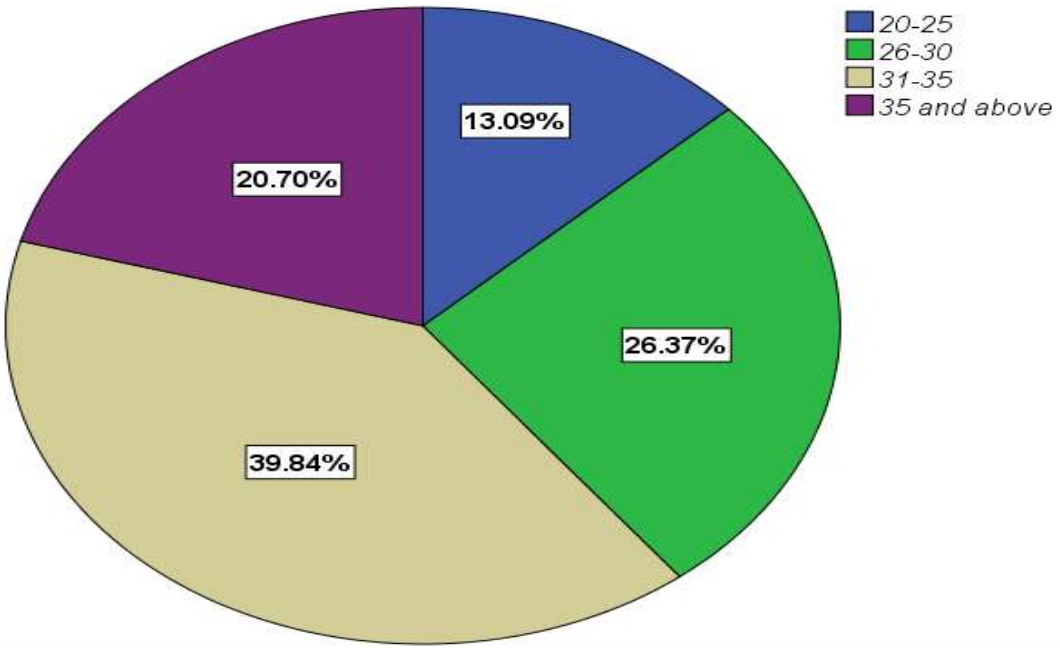

Figure:4:1:Age of respondents

As shown above figure 4.1, concerning the age distribution of respondents, from this figure the majority (39.84%) of the respondents are found in the age group of 31 to 35 followed by 26.37% age group of 26 to 30 and 20.7% in the age group of 20-25 and 13.09 % age group >35 respectively. This implies that respondents of the survey study are fairly included from all age groups although the majorities are in the middle of the frequency distribution.Majorities of the respondents are found between the age groups ranges of 31-35 years. Majority of respondent within that staff in middle age.

Table 4.3: distribution of marital status of respondent

Marital status	Frequency	Percentage
Married	223	43.6%
Single	243	47.5%
widow	7	1.4%
Divorce	39	7.6%
Total	**512**	**100.0%**

As indicated on the above table 4.3, among the total 512 respondents, (47.5%) were single, 43.6%married, divorce 7.6% and the remaining (1.4%) were widow. This data shows that the participation of widow and divorce were less while single and married participation were

maximum. Researcher conclude on the above table the majority of the respondents are single in the study participants.

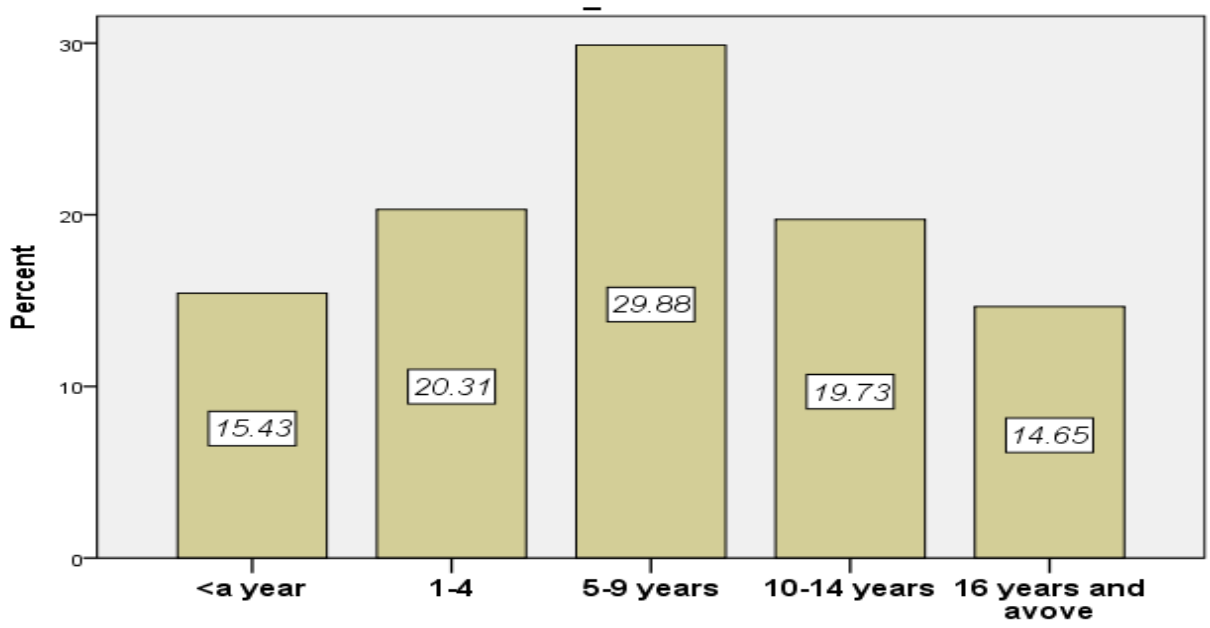

Figure 4.2: Distribution of year of experiences respondent

As shown above figure 4.2 that, out of 512 respondents, 29.88% of respondents were the working 5-9 years in college and followed 20.31% were existence in college 1 to 4 years and 19.73% service duration 10 to 14 years, 15.43% service duration were less than a year and finally 14.65 above 16 years services participated. According to the result of this study, the majority of the respondents found the year between 5 to 9 years experiences. Researcher conclude that majority of well experianced.

4.1.3. CurrentChallengesof Health Information System

Table 4.4:distribution of HIS application&other services respondent

HIS application	Frequency	Percentage (%)
Yes	418	81.6%
No	94	18.4%
Total	**512**	**100.0%**

As it stated above table 4.4, 81.6% of the respondents were said “Yes”, on HIS application such as eHMIS,EHR, LIS, IPFSMISt, IFMIS, HRIS, ePHEM and other application for eHealth

servicesinhospitals. About 18.4% of them were said “No”. According to the result of this study, the majority of the respondents said that, the challengesHIS application such as eHMIS,EHR, LIS, IPFSMISt, IFMIS, HRIS, ePHEM and other application for eHealth servicesin hospitals. From this there are some professionals still didn’t know existence of HIS application in there while actual the system exists. In order to well HIS implematation, awareness creation for all health professional will expected hospitals leadership.

Table 4.5:Distribution of HIS training respondent

Get training	Frequency	Percentage (%)
yes	177	34.6%
No	335	65.4%
Total	**512**	**100.0%**

As shown in above table 4.5 that, about the 65.4% of the respondents were said “No”, on using got training on these HIS applications in staff. About 34.6% of them were said “yes”. According to the result of this study, the majority of the respondents didn’t get training.Since the result shows most health professional didn’t get on HIS application, hospitals administrative bodies have to give attention toward HIS well implematation for quality services.Researcher conclude limitation of training is one of challenges of HIS implematation in hospitals.

Table 4.6: Distribution of the challenges regarding leadership support respondent

challenges regarding leadership support	Frequency	Percentage (%)
Strongly Disagree	11	2.8%
Disagree	36	7.1%
Neutral	114	21.3%
Agree	335	65.4%
Strongly Agree	16	3.4%
Total	**512**	**100.0**

As shown in abovetable 4.6, 65.4% of the respondents were saidagree, on challenges regarding leadership support and HIS application probleminhospitals. About 2.8% of them were said strongly disagree. According to the result of this study, the majority of the respondents said that, the current existing challengesinhospitalwaschallenges regardingleadership support and HIS

application problemwere at agree.This results of respondent indicates that there were challenges on HIS implematation due to lack of leadership supports. Researcher conclude still the management and leadership support limitation exists toward HIS implematation ineach hospitals.

Table 4.7: Respondent distribution of ICTinfrastructure challenge

ICT infrastructure challenges	Frequency	Percentage (%)
Strongly Disagree	9	1.8%
Disagree	38	7.4%
Neutral	104	20.3%
Agree	345	67.4%
Strongly Agree	16	3.1%
Total	**512**	**100.0%**

As shown in the above frequency distribution table 4.8 the overall views of respondents' regarding the current existing challenges, 345(67.4%) is a significant number to judge or comprehend that the employees of the health sector staff have agree on ICT infrastructure challenges to implement HIS. Whereas about 104(20.3%), from the returned questionnaires, respondents have replied their neutral feelings towards the eHealth.From this result it may be argued that although the majorities (67.4.5%) of the employees have had ICT infrastructure challenges to implement HIStowards the on applications were agree.From these results, it is obvious or it can be safely concluded that majority of the employeeshaveICT infrastructure challenges to implement HISon applications.So management of each hospitals have to create the way in which hospitals infrastructure will be fulfilled.

Table 4.8.Distribution of level HIS application acceptance respondent

level HIS application acceptance	Frequency	Percentage (%)
Poor	34	6.6%
Fair	366	71.5%
Good	17	3.3%
Very Good	48	9.4%
excellent	47	9.2%
Total	**512**	**100.0%**

As described in abovetable 4.8, overall views of respondents' regarding the level HIS application acceptance by health professionals'staff, (71.5%) is a significant number to judge orthat the employees of the challenges of health information systemstaff have fairHIS application acceptance by health professionals. Whereas about 48(9.4%), from the returned questionnaires, respondents have replied their very good feelings towards the HIS application acceptance by health professionals.From this result, it may be argued that although the majorities (71.5%) of the employees have had HIS application acceptance by health professionals were fair.From these results, therefore, it is obvious or it can be safely concluded that majority of the employeeshave low levelHIS application acceptance by health professionals on application in the health center.Depending on this respondent result each hospitals have togaveattension toward acceptabity of HIS for efficient quality services. In addition each hospitals have to identify why health professional acceptance is low. Which factors limits the interests of health professionals toward HIS applications.

Table 4.9: Respondent distribution of the technical support challenges

Technical support challenges	Frequency	Percentage
Strongly Disagree	19	3.7%
Disagree	72	14.1%
Neutral	42	8.2%
Agree	326	63.7%
Strongly Agree	53	10.4%
Total	**512**	**100.0%**

As frequency distribution table 4.9above the overall views of respondents' regarding the technical support challenges for HIS applications, 326(63.7%) is a significant number to judge or comprehend that the employees of the health center (hospital) staff have agree technical support challenges for HIS applications. Whereas about 72(14.1%), from the returned questionnaires, respondents have replied their disagree feelings towards the technical support challenges for HIS applications.From this result it may be argued that although the majorities (63.7%) of the employees have had betterawareness towards the technical support challenges for HIS applications were agree.From these results, therefore, it is obvious or it can be safely concluded that majority of the employeeshavetechnical support challenges for HIS applications.As result showed there are technical support challenges in HIS application. This guide toward ICT

professionals limitation. So hospitals management body have works how technical persons fills the limitation.

4.1.4. Interoperability Between eHealth In Health Centers

The capacity of a computer system to run application programs from various implementers and to communicate with other computers on a local area network, regardless of the physical architecture and operating systems of those computers, is known as interoperability.A computer system must be interoperable in order to interface with other computers on a local area network and run application programs from other systems, regardless of their physical architecture and operating systems. Interoperability allows different health information systems to work together within and across organizations to improve people's health and the effective delivery of health care(Scott & Oyeyemii, 2018).It is a critical area for enhancing health service delivery, boosting health, and facilitating information interchange among health-care institutions, as well as assisting in decision-making processes and increasing operational performance.This needs critical attensiondeveloper,hospitals management and national health regulatory guidance**.**

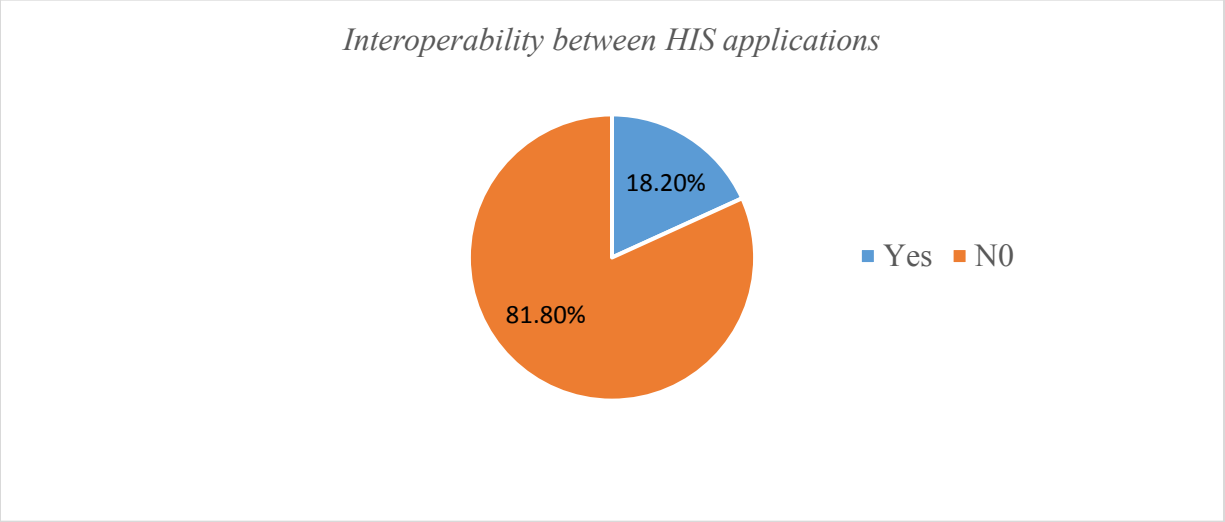

Figure 4.3: distribution of interoperability between HIS applications respondent

According to above figure 4.3, out of 512respondent, 81.8% of the respondents responded that "NO" of there was using HIS applications were interoperability between HIS applications in

thehospitalstaff and 18.20% of them responded that “YES” as they didn’t interoperability between HIS applications in the hospital much more. From this we concluded that the employee in hospital and MOE staff were NO interoperability between HIS applications in thehospital.Researcherconclude from responses there is no interoperability in HIS application in each hospitals. This need high consideration with FMOH,Hospitals and all health stake holder to enhance health service delivery with removing this challenge.

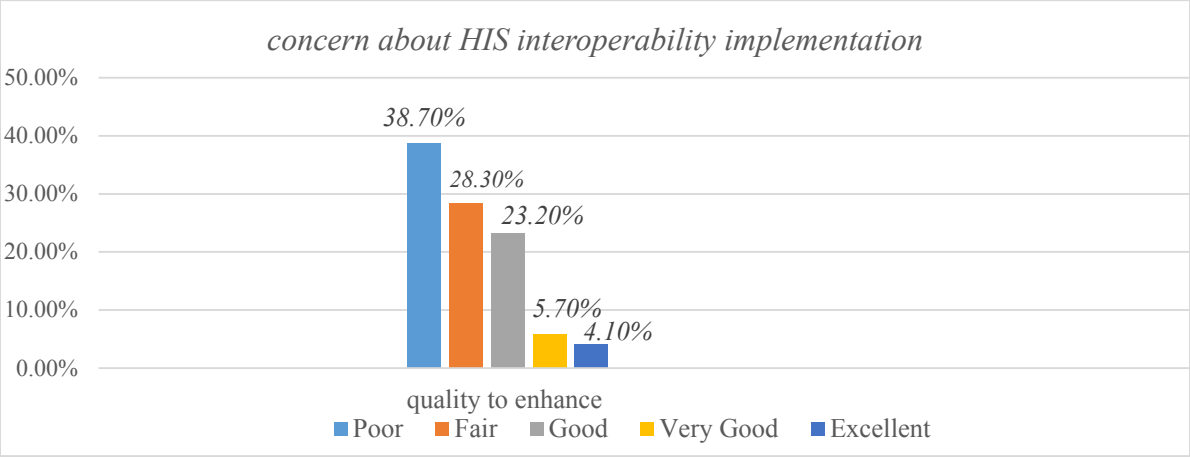

Figure 4.4: distribution of the HIS interoperability implementation respondent

As shown in the above figure 4.4 that, out of 512 respondents, 38.70% of respondents were poor organization concern about HIS interoperability implementationapplication was not helpful for request face problem in hospital and MOE staff. About 28.30% of them were fair. About 23.20% of them said that, was good, and 5.70%of them said was very good. According to the result of this study, the majority of the respondents said that, organization concern about HIS interoperability implementationpoor for request problem face in the work environment.Researcher understood from responses there is no interoperability in HIS application in each hospitals. This need high consideration with FMOH,Hospitals and all health stake holder to enhance health service delivery with removing this challenge.

4.1.5. Suitability of Existing HIS Implementation in Hospitals

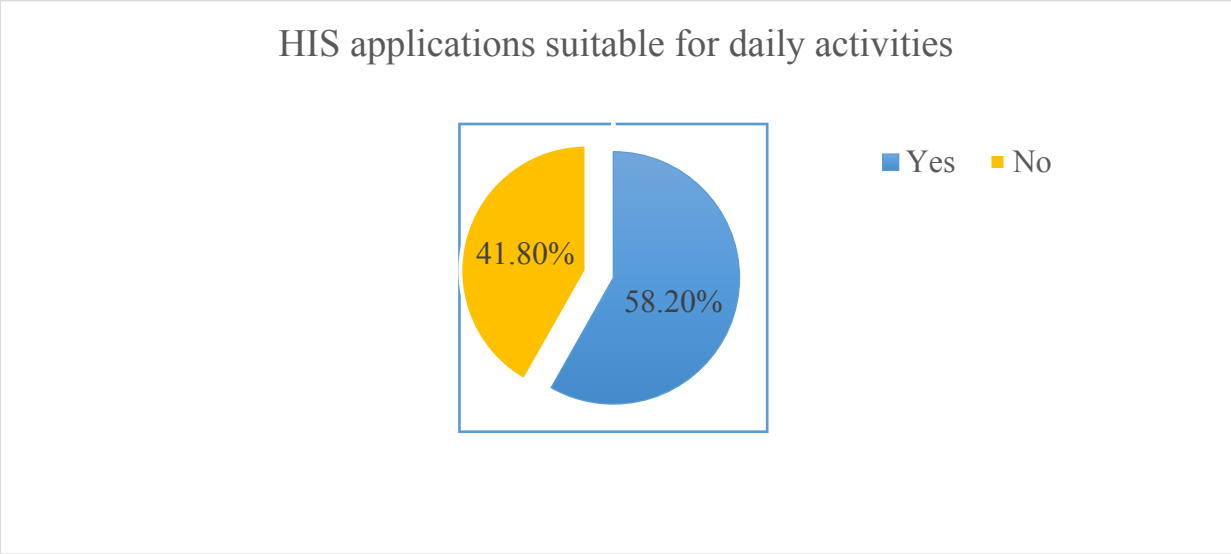

Figure 4.5: distribution of the HIS applications suitable for daily activities respondent

According to above figure 4.5 shown that, out of 512 respondent, 58.20% of the respondents responded that "yes" of there was using HIS applicationswerecurrent HIS applications suitable for daily activities of health professionals and 42.5% of them responded that "no" as they didn't much more used current HIS applications suitable for daily activities of health professionals. From this concluded that the employee in hospital and MOE were current HIS applications suitable for daily activities of health professionals. Since health professionals believe and understood the enhancements of HIS for health services its good to fix other challenges in order to improve health services.

These administrative tasks are so time consuming that less time can be devoted to direct patient care, their primary function. Certain assertions have been made with regard to computerising the total environment of patient records, capturing statistical indicators, stock control high inhancements.According to Asemahagn(2018)computerising the clinic at the point of service will naturally lead to less time devoted to administrative tasks, thus increasing the time available for direct patient care. Health Information Systems help in saving time as well. By making all the patients' information computerized and personal activities automated, HIS saves a significant amount of time in making patient care coordinated and hospital management seamless.

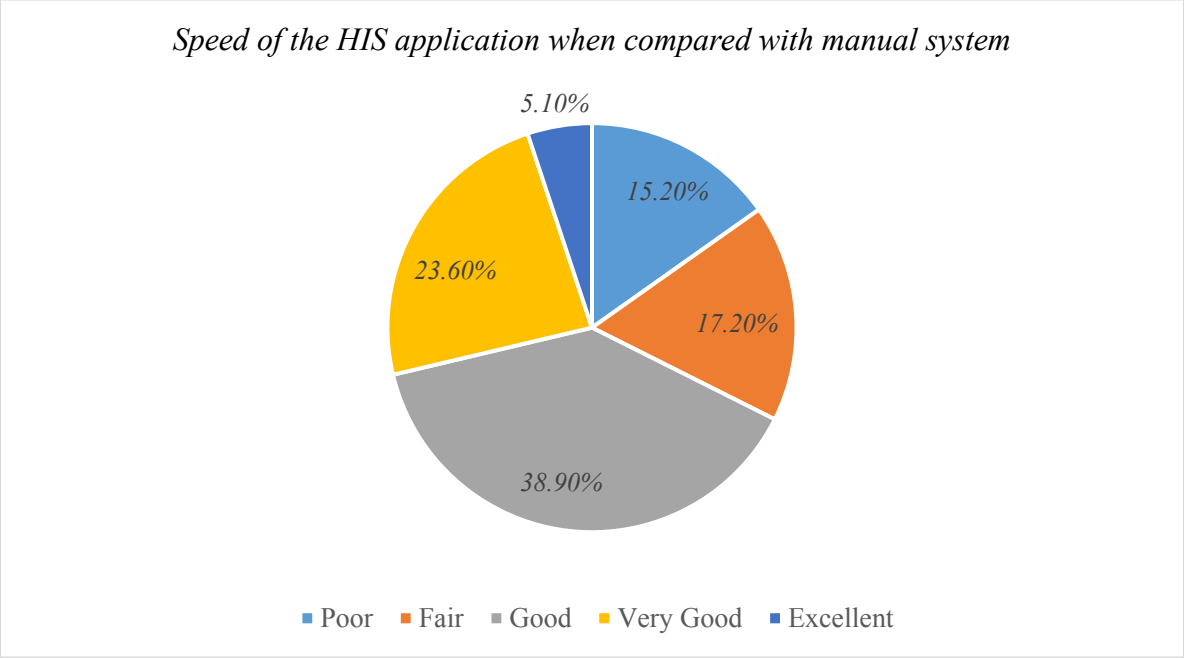

Figure 4.6: distribution of the speed HIS application respondent

As shown above figure 4.6 that, out of 512 respondents, 38.90% of respondents said that***speed*** to use HIS applications in speed HIS application when compared with manual system hospital good. About 23.60% of them were very good. About 17.20% of them said that, was fair, and 15.20%of them said was poor. According to the result of this study, the

majority of the respondents said that, factors to use HIS applications in hospital andMOE staff were good.

Table 4.11:distribution of the quality of health services respondent

quality of health services	Frequency	Percentage (%)
poor	52	10.2%
Fair	66	12.9%
Good	146	28.5%
Very Good	209	40.8%
Excellent	39	7.6%
Total	**512**	**100.0%**

As shown above table 4.11 that, out of 512 respondents, 40.8% of respondents said thatqualityof health services using HIS applicationvery good. About 28.50% of them were good. About 12.9% of them said that, was fair, and 10.2%of them said was poor. According to the result of this study, the majority of the respondents said that, quality of health services using HIS applicationreally nice (very good).

Table 4.12:distribution of the HIS application helpful professional respondent

HIS application helpful professional	Frequency	Percentage (%)
poor	69	13.5%
fair	65	12.7%
good	130	25.4%
Very good	209	40.8%
Excellent	39	7.6%
Total	**512**	**100.0%**

As shown in the above table 4.12 that, out of 512 respondents, 40.8% of respondents were very HIS application helpful for efficiency of health professionals workfor request face problem in hospital and MOE staff. About 25.40% of them were good. About 13.5% of them said that, was poor, and 12.7%of them said was fair. According to the result of this study, the majority of the respondents said that, HIS application helpful for efficiency of health professional'sworkvery good for request problem face in the work environment. So HIS is required by health professionals .

4.1.6. Standards for HIS Application in Hospitals

Standard establish a common vocabulary and set of expectations that allow systems or devices to communicate with one another, according to (Oyeyemi and Scott ,2018). This allows physicians, labs, hospitals, pharmacies, and patients to share data regardless of application or market source, making it easier to digest information about a person and improving overall healthcare coordination and delivery. Establishing a comprehensive set of agreed and linked technical standards for health information basic for HIS implematation.

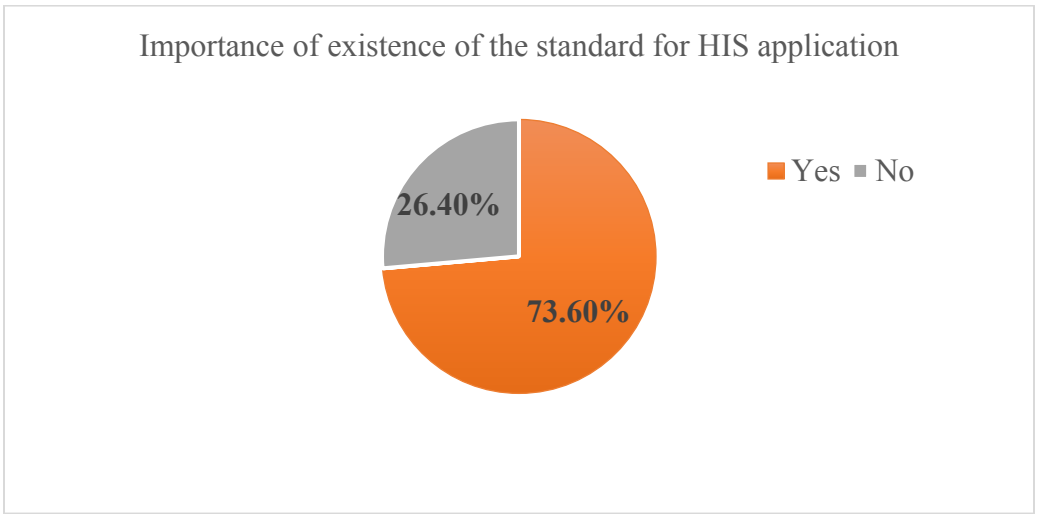

Figure 4.7: distribution of the standard for HIS application respondent

According to above figure 4.7, out of 512respondent, 73.60% of the respondents responded that "yes" of there was believe importance of existence of the standard for HIS applicationand 42.5% of them responded that "no" as they didn't much morebelieve importance of existence of the standard for HIS application. From thiswe concluded that the employee in hospital and MOE staff were believe importance of existence of the standard for HIS application. Since there is no interoperability without sets of standards ,so it is prerequisite in order to implement HIS.

4.1.7. Descriptive of the Component of HIS and Challenge of HIS

By outlining the connections between variables in a sample or population, descriptive statistics can be used to organize data into a concise summary.Descriptive statistics are a critical part of initial data analysis and provide the foundation for comparing variables with inferential statistical tests.Prior to performing inferential statistical comparisons, descriptive statistics should always be computed(Kaur, Stoltzfus and Yellapu, 2018). This is an essential initial step in conducting research.In essence, a small standard deviation indicates that a statistical data set's values are close to its mean (or average), whereas a big standard deviation indicates that the data set's values are further from the mean.

Table 4:13 Mean and Standard Deviation of component of HIS and challenge of HIS

Descriptive Statistics			
	N	**Mean**	**Std. Deviation**
Current Challenges Existing	512	1.2129	.40975
Interoperability Between eHealth	512	1.8184	.38593
Suitability Of Existing HIS	512	1.4180	.49371
Standards For HIS	512	1.4481	.49779
Valid N (listwise)	512		

The above table 4.13 shown that, descriptive statistics clearly indicates the corresponding arithmetic mean and standardDeviation of every construct totals (total of every individual categorical construct). Thus, current challenges existingcategorical total has a mean of 1.2129 and a standard deviation of .40975, interoperability between eHealthcategorical total has a mean of 1.8184 and a standard deviation of .38593,suitability of existing HIScategorical total has a mean of 1.4180 and a standard deviation of .49371, standards for HIScategorical total has a mean of 1.4481 and a standard deviation of .49779 which shows that majority of the respondents have good perception on interoperability between eHealthcompare to other items.

This analysis of mean of categorical constructs showed that with the exception of current challenges existing, Suitability of existing HIS, standards for HIS has a mean value less than the average interoperability between eHealth. This implies that the standards for HIS; Suitability of existing HIS is weak and employees are moderately satisfied with. While employee current challenges Existing HIS categorical total has a mean of 1.2129 and a standard deviation of .40975, this implies that the component of HIS affected Employee challenge existing of HIS in the health center and it is revealed that the major HIS components had a greater influence on employee current challenge of HIS.

Correlation is a measure of association between two variables. According to Kothari (2004), positive values of r indicate positive correlation between the two variables (i.e., changes in both variables take place in the stated direction), whereas negative values of "r" indicate negative correlation i.e., changes in the two variables taking place in the opposite directions. A zero value of "r" indicates that there is no association between the two variables.

When r = (+) 1, it indicates perfect positive correlation and when it is (–) 1, it indicates perfect negative correlation. As Warokka et al.(2012),description interpreted the coefficient of correlation between 0 and 1 as in the following manner. The correlation coefficient (r) ranging from 0.10 to 0.29 may be regarded as indicating a low degree of correlation, r ranging from 0.30 to 0.49 may be considered as a moderate degree of correlation, and r ranging from 0.50 to 1.00 may be regarded as a high degree of correlation.

In this study determines the strengths of relationship between (investigating of challenge of health information system and standard and challenge HIS satisfaction).

Table 4.14: Distribution of Correlations analysis

		Current Challenges Existing	Interoperability Between eHealth	Suitability Of Existing HIS	Standards for HIS
Current Challenges Existing	Pearson Correlation	**1**	.245**	.614**	.578**
	Sig. (2-tailed)		.000	.000	.000
	Sum of Squares and Cross-products	85.795	19.799	63.441	60.153
	Covariance	.168	.039	.124	.118
	N	512	512	512	511
Interoperability Between eHealth	Pearson Correlation	.245**	**1**	.399**	.422**
	Sig. (2-tailed)	.000		.000	.000
	Sum of Squares and Cross-products	19.799	76.107	38.871	41.229
	Covariance	.039	.149	.076	.081
	N	512	512	512	511
Suitability Of Existing HIS	Pearson Correlation	.614**	.399**	**1**	.942**
	Sig. (2-tailed)	.000	.000		.000
	Sum of Squares and Cross-products	63.441	38.871	124.555	118.098
	Covariance	.124	.076	.244	.232
	N	512	512	512	511
Standards for HIS	Pearson Correlation	.578**	.422**	.942**	**1**
	Sig. (2-tailed)	.000	.000	.000	
	Sum of Squares and Cross-products	60.153	41.229	118.098	126.376
	Covariance	.118	.081	.232	.248
	N	511	511	511	511

**. Correlation is significant at the 0.01 level (2-tailed).

Correlation results presented in Table 4.14, shown that there is significant positive relation between

Standard setting in current challenges existing, interoperability between eHealth, suitability of existing HISandStandards for HIS. (Sig=.000, r= .118).

- There is significant positive relation between Current Challenges ExistingandStandards for HIS(sig=.000, r=.578).
- There is significant positive relation between interoperability Between eHealth and confidence Standards for HIS (sig=.000, r= .422).
- There is significant positive relation between Suitability of Existing HISandStandards for HIS (sig=.000, r=.942).

From the analysis, it is noted that current challenges existing, interoperability between eHealth, suitability of existing HIS, standards for HISis positively correlated with job satisfaction.

Regression analysis helps in order to measure the relative strength of independent variable on dependent variable. Hence, the regression between the major components of challenges of health information systems and challenge of HISis analyzed.

Table 4.15:distributionofmodel summary analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.854[a]	.729	.727	.38818

a. Predictors: (Constant), Current Challenges Existing, Interoperability Between eHealth, Suitability Of Existing HIS, Standards for HIS

The above table 4.15 shown that, model summary shows the Adjusted R Square R which is the degree of association between major components of Current Challenges Existing, Interoperability Between eHealth, Suitability of Existing HIS, Standards for HISandchallenges of health information systemsis 0.727. This implies 72.7%, of variation in challenges of health information systems is explained by major components of challenge HISwhere as27.3% of variance is explained by other factors.

Table 4.16: Distribution of ANOVA[a] analysis

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	205.350	4	51.337	340.688	.000[b]
	Residual	76.399	507	.151		
	Total	281.748	511			

a. Dependent Variable: challenges of HIS

b. Predictors: (Constant), Current Challenges Existing, Interoperability Between eHealth, Suitability of Existing HIS ,Standards for HIS

The below table 4.17 shows the extent to which each independent variables influence the dependent variable. The relative importance of (independent variables) in contributing to the variance of the (dependent variable) is explained by the standardized beta coefficient.

Table 4.17: Distribution of Coefficients[a] analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.561	.101		15.522	.000
	Current challenges existing	-.094	.052	-.052	-1.790	.074
	Interoperability between eHealth	.268	.049	.303	5.521	.000
	Suitability of existing HIS	.251	.081	.130	3.099	.002
	Standards for HIS	.331	.038	.488	8.640	.000

a. Dependent Variable: challenges of HIS

The above table 4.17 shows the extent to which each independent variables influence the dependent variable. The relative importance of (independent variables) in contributing to the variance of the (dependent variable) is explained by the standardized beta coefficient.

The beta value is positive that means a higher positive effect of challenges of HISassociated with standards of HIS among the independent variables, explaining rating decision is more significant

and statistically meaningful. This can be interpreted as a certain improvement on the explaining rating decision will increase challenges of HIS33%. Thus, Explaining rating decision has a greater rate of change than other variables.

4.2. Interviewfinding

The purpose of this interview question is to acquire additional information that consolidates the research study and collect questions of responses that are not included in the questionnaires. Accordingly one of the interview questions raisedon the eHealth initiatives networksexist for hospital.This is critical challenge for researcher to get appointments for interview. Most them refuse to be interviewed. Lastly they agreed to respond with group to interviewed researcher open endeded questionnaires. The interview finding discussed as followed.

Key respondents selected from MOE participants were interviewed: from FMoH (eHealth experts in particular for EHR focal person and monitoring and evaluation experts) and from EHNRI- (LIS project manager and system implementer). They stated that, there is a draft eHealth Policy and Strategy designed by FMoH. The draft document should be finalized and workable in order to make effective and efficient data exchange interoperability.The health sector's five-year strategy runs from 2020/2021 through 2024/2025 and is outlined in this health information systems strategic plan. As this interview strategic plan 2016-2020 encouraging results were registered during this period in terms of improving data quality, data use for evidence-based decision-making, digitalization of priority health information systems and governance of HIS.The respondents clearly stressed that, ..”*there are more than nine eHealth applications exist at national level..”.* The respondents also focused that Most of eHealth applications are not supported by national eHealth policy and strategy that linked with the national Health policy and ICT policy. They recommended that the overall administration of eHealth applications should take into account harmonization and alignment, such as developing effective monitoring and evaluations systems; preventing duplications and duplicating eHealth projects at the Hospital levels.

Another concern brought up by the respondents is that the FMoH's five-year strategic plan document, which incorporates some of the eHealth applications that FMoH is aware of, serves as working papers rather than eHealth policy and strategy. The eHealth policy and strategy create

harmonization and alignment for all eHealth applications in the country. Finally respondents stated that because of the absence of eHealth policy and strategy or any monitoring and evaluations system most partners implemented eHealth projects in Hospitals by their own without asking recommendations from FMoH just by simply making negotiations with Hospital managers.

HIS applications are technically sound and well built, yet significant restrictions still exist, according to some experts. They also said that, HIS is designed based on the clinical work flow of hospitals and HIS software divided in to five module: in the entry point there is registration module which capture patient demographic data and send to the appropriate department based on the patient's type of complain; then the physician will enter required data to the respective OPD module and other services in the Hospital and fill then send laboratory and drug request on laboratory and pharmacy module respectively (if any); the lab result will be send back to OPD(out patientdepartment) from the laboratory. Opposite idea was raised by two respondents, that health system is very complex and multidisciplinary in nature, thus it requires detail analysis before the design and development of eHealth applications with the involvement of clinical staffs.

From the developers' side, Tulane University and CDC were asked about the technologies used; they reported that, both applications are developed using C# and backend SQL data base. Most of the designed attribute and data type are the same but exist in different naming and styles.

When asked immediately if there is safe-installation for partners involved in the implementation eHealth initiatives processsuch maintainable services, one of therespondents said, "All services are installed without keeping the rule of HIS implementationprocess; there is no as such safe handling of system or framework"

Regarding the availability of implement these eHealth initiativesmanagement system, all responded that there is no system where each of the information system services are tracked from registration toimplementation. For example "*There is no a web-based application that is accessible by the allstaffs, where can see which service are under the keeping of each user whilemonitoring the users and service status*."

Among the main factors affecting information system implementation and use in developingcountries is lack of skill in the daily interaction with HIS services. Accordingly one of theinterview questions raised during the interview session was, if theirchallenges in implementation HIS application in hospitalsuch as retire energy inefficient systems, enforcementwork management, server virtualization, information system devices optimization, internetdown systems and etc.*Accordingly the responses show that the organization is trying to provide technical trainingsto its staffs but there are some observations in the need for providing additional trainings.*

One interviewee interestingly put his observation and articulates it this way "…*in our field monitoring visits (document reviewing), we sometimes observe HIS servicesmarked as un functional systems, yet with a miner maintenance they can be less used or theirparts can be utilized, this indicates there is a need for skill enhancement*."

Also noting the need of training is also due to "…where new staffneeds to be capacitated immediately". Other respondent noting that "Capacity building aspart of skill enhancement is needed as it should be a continuous process….".The finalquestion asked was a question to involved during the implementation of the HIS applications (e.g. Training, design and installation. One of the respondent said "Everythingwe do should be governed by policies and guidelines…..as a national office; we need toinclude environmental criteria when assessing our HIS services and infrastructure such thatinformation sharing efficiency, idle time reduction and network management are looked at.

These things have to be incorporated in the infrastructure assessment check list.*Also there are needs for leveraging our design intranets to inform users on proper and efficient useof services to raise their awareness and skills*…"

4.3. Proposed framework

The proposed Framework model of investigate the challenges ofhealth information systems standard and interoperability on health centers activities, is described below according to the order of its challenges on investigationHISsystems standard and interoperability on health centersactivities are environmental factor, organizational factor, and technological factor respectively.

HIS competitiveness of an organization in health center: which indicates that the factors have been identified as competitiveness of an organizationhealth center. An organization with a competitive or/and partnership sense has more probability in HIS implementation. In this case, competitiveness is expressed in a sense of coping up with an international partner organization. Therefore, to be able to work with their partners that are more advanced in the health information systems standard and interoperability on health centers activities. In the environmental theme, three major factors have been identified as influential for successful HIS implementation, these are Infrastructure and resource support, competition inter hospital and governmental regulations and support.

Challenges of management support and user involvement of the suitability of HIS: the major factors have been identified as influential for successful HIS adoption, these are top management support and user involvement. For organizational theme, top management support is found to be more important and need to have leadership commitment and support and should base on policies and guidelines support, unless and otherwise the support can be biased and lead to adoption of HIS that does not meet users requirement. In the other major factors of which is user involvement is also found to be more important when skill enhancement in giving system training for other user's that will have positive perception towards system's usefulness, when user's knowledge of HIS is available, experience and users active participation is needed.

Technological compatibility and simplicity interoperability and standard: The proposed framework is technological challenges and in the technological factor the technology to be adopted has two attributes and these should have characteristics of compatibility and simplicity. These characteristics will help users' perceive the system as easy to use and as useful in their work operation and knowledge. User's positive perception on the technology in regard to perceived ease of use and perceived usefulness will make positive impact on user's attitude

towards usage of the system, which is the final and ultimate goal of the technological attribute of HIS. To get positive perceived ease of use or perceived usefulness both the HIS Implementation must have both compatibility and simplicity character. The framework also shows perceived ease of use and perceived usefulness both are dependent on each other while attitude towards usage is dependent factors and the result of positive perception of both perceived ease of use and perceived usefulness.

Generally, the framework forHIS standard and interoperability of the for successful health center activities in hospital and MOE, the relationship can be expressed as, the independent variables which are challenges of HIS competitiveness of an organization in health center, challenges of management support and user involvement of the suitability of HIS, and technological compatibility and simplicity interoperability and standard respectively. Furthermore, developing more advanced framework and solving the causes of attributes ofeach framework is contributed for successful investigation of the challenges ofHI standard and interoperability on health centers activities.

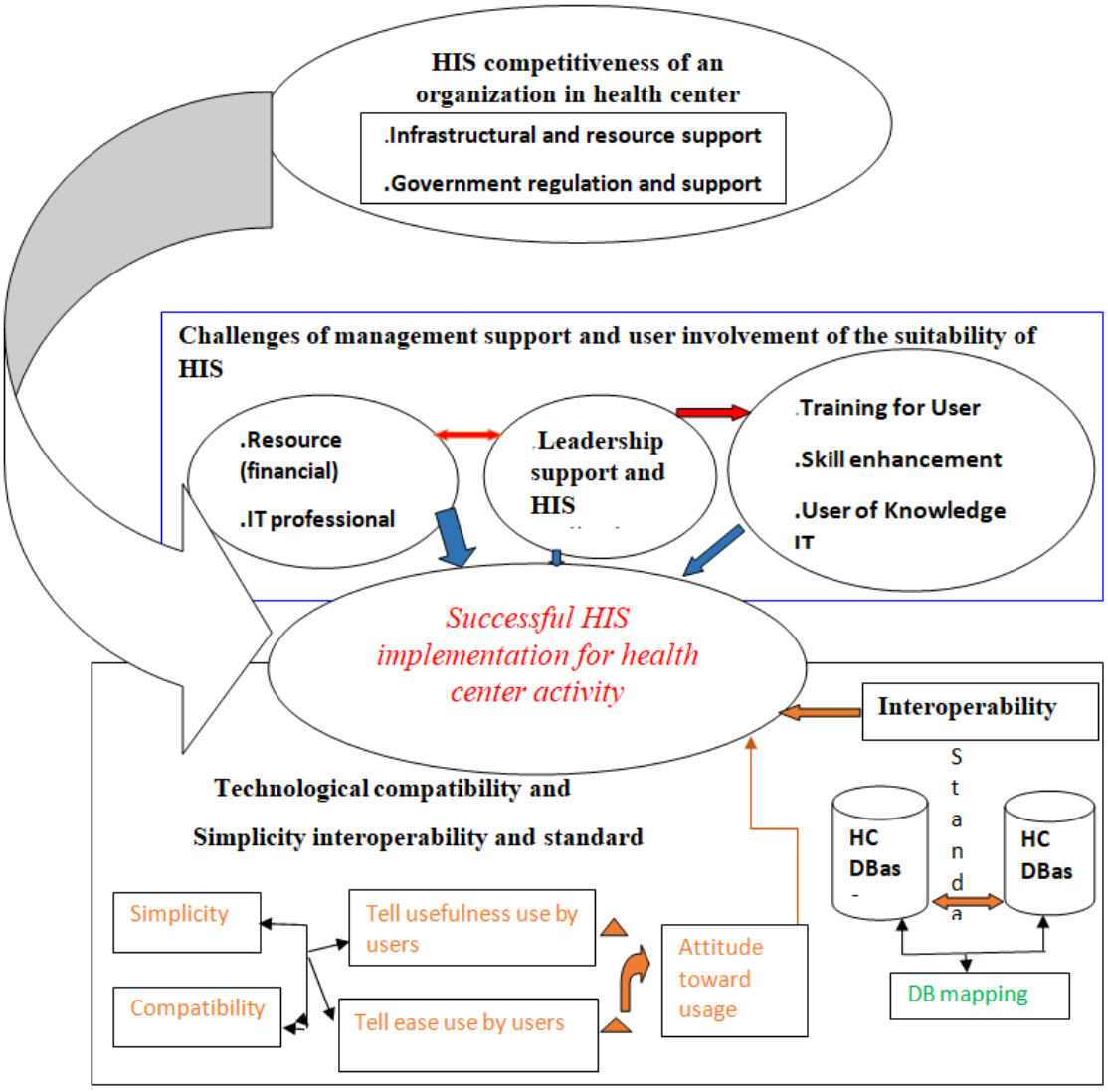

Figure4.9: Proposed HIS implementation framework

4.2.Discussion of the finding

This section addressed several challenges, suitability, interoperability and standards of HIS identified as use and implement of HIS application and technologies in the hospitals and MOE processes. The challenges comprise the fears that available due to lack of training, regarding leadership support and HIS application problem, ICT infrastructure challenges to implement HIS, skilled human resource limitation challenges, level HIS application acceptance by health professionals, technical support challenges for HIS applications, and believe importance of existence of the standard for HIS application. More than 65% of the health center in the organizations have no training on HIS application as required.

From the correlation analysis, it is noted that component of the challenges of HIS is positively correlated with health information system. Moreover, from the correlation analysis there is a significant positive relationship between the challenges of HIS and health information system of employees' hospital and MOE. From the Regression analysis, the degree of association between major components of challenges of HIS and health information system is 0.737. This implies 73.7%, of variation in health information system is explained by major components of challenges of HIS system where as 27.3% of variance is explained by other factors.

As per the interview and document reviewing, key findings are discussed herebelow against the research questions set out at the beginning of the study. The findings of thestudy and elements for the construction of a framework are grouped in toHIS competitiveness of an organization in health center, challenges of management support and user involvement of the suitability of HIS, technological compatibility and simplicity interoperability and standard.There are also foundattributes such as, infrastructure and financial support, government regulations support, needof IT professionals, and training on these HIS applications and guidelines support.

There are multiple current challenges of HISpractice at the organization.Moreover, one of the major findings in both qualitative assessment has beenlack of comprehensive challenges regarding leadership support and HIS application problemHIS adoption and use of HIS services and also skilled human resource limitation challenges.

The findings showed that there is no HIS acceptable use policy in the organization yet whichinclude issues like requiring employees to use HIS services and procurement of energy efficientservices. There is no a data center with a policy. While communication of available

policies,procedures/guidelines for HIS service use and implementation is also an area of improvement. Daniel, (2018) also identified lack of policy as an important factor hampering HIS implementation and use,although he didn't provide the list of policies required.

Interoperability is the ability of two or more systems to exchange health information and use the information in effective wayand use in theorganization; in relation to this the most notable point has been failure on laying thefoundation of service use and implementation in a lack of the interoperability between HIS applications in your hospitalofenvironmentalconsiderations in procurement of HIS service and lack of strategic implementation plans by your hospitalunits. Hence, this issue shall be addressed through an inclusive procedure. Philipson (2011) pointsoutHIS re-new procedure, HIS operations and service procedure and HIS sourcing Procedure as policies to beincorporated in good HIS. Therefore, this procedures set out by doctors should be prepared in theorganization.

The other HIS implementation suitability and standards for HIS application in hospitalsuse is the incomplete infrastructure and resourcecheck in the health center as it doesn't consider current HIS applications suitable for daily activities of health professionals'criteria's. Henceincomplete infrastructure and resource check in the health center theexisting physical equipment and services helps to establish what equipment/service is in place and what services it delivers and accordingly identifies inefficient devices, hazardousmaterials, HIS equipment/services that need to be decommissioned. An infrastructure and resource check in the health center of employee'sawareness/training, practice, and skill in light of environmental perspectives is also critical componentlacking in the organization.Thiscould be awareness/training creation, skill enhancement or providing technical support.

In Ethiopia, Korea hospital, Black Lion specialized, Jimma University Medical Center, ST.Peter specialized, and St. Paul specialized hospital is among the largest health organization in the country. It has made it clear that the use of Inforamtion system is imperative to the organization's success. Hence much is being invested in IT there is a need to improve information and communication exchange in the hospital in order to accelerate health activites and increase access to information. The implementation of health information system has shown to improve health-care serices since HIS is known as a tool that improves health-care system competitiveness (Niang 2009).

The researcher addressed no interoperability in Hospitals and suggest data exchange interoperability, no communication of the hospital each other is the problem identified.These eHealth applications give hope for some hospitals in Ethiopia to increase access to health care records, decrease cost and improving quality in the hospitals and particularly on data exchange interoperability problems still exist for example surveyed hospitals by researcher such as in all selected Hospitals for the study. But, all selected hospitals are using health system for recording patient information, share data with in hospital within staff but most of time the patient can not access it.

From physicical observation, there are multiple ICT infrastructure investments in those listed hospitals while some equipments operation skill gab.Most ICT infrastructure not functional due different reason. Carelessness from ICT professionals visible toward data center protectetions.Some hospital such as Black Lion Hospital,ST.Peter specialized and St. Paul specialized hospital are smart card sytem patient can have and access information.According to physicial observation, interview and work done during this study most of them not as much as far on implematation HIS applications. But relatively Black Lion Hospital have high activity to make all services to be smart with technology. Blacklion and St. Paul Hospitals well established infrastructure while all identified challenges already exists. These two hospitals highest performance using technology in their service regarding relativery compared to those government hospitals.

CHAPTER FIVE
CONCLUSION AND RECOMMENDATION

5.1.Conclusion

As finding indicates there are many challenges exists for HISimplematation currently. These challenges are standard for HIS,interoperability between eHealth,suitability of HIS application,leadersip support challenges,HIS competitive in organization,techninical support challenges,technicalcompatability and simplicity ,infrastructure and human resource skill limitation some identified challenges.From these factors of HIS implemataton standard for HIS, interoperability between eHealth,suitability of HIS application and current existing HIS applications are mojar components of challenges for HIS.

Interoperability limitation between HIS application one of the greater hinderance identified.Interoperability which allows different health information systems to work together within and across organizations to improve people's health and the effective delivery of health**.**Health professionals believe and understood the enhancements of HIS for health services its good to fix other challenges in order to improve health services.HIS is required by health professionals in order to efficient implematation of their work. Other identified in this research about standard guideline,whichexpelianed in WHO(2008) for all developing counries while practical implemation limitation exists. Since there is no interoperability without sets of standards .so it is prerequisite in order to implement HIS effectively for quality health services.

The loss of management control over system connectivity and application integration challenges for hospitals change requirements hidden costs of enterprise computing scalability, reliability and security while it is part of the solution for it to enable health sector to decrease the resource intensity in health sector society.The finding showed that *(>65%)*skill enhancement programs or periodic trainings are not being given and there is no periodic training on proper use of HIS in the health center activities, which is essential to both users and ICT staffs.There were 81.8% respondent identified as unexistance of interoperability between HIS activities.

Additionallthe finding of this study, HIS application helpful for efficiency of health professional'sworkwhen get attension by higer officials and developers for suitable work environments. Accordingly, the factors were identified these are lack of skill gaps, lack of

management commitment, lack of implementation plans by health sector units, lack of user involvement, and absence of financial support. Hence, to solve the identified investigating the challenges, the study proposed a framework for HIS implementation for effective health sector service that can be used as a guide. As the factors identified were different in impact and need every staff engagement, the solution needed to be framed accordingly to address it. Therefore, the design of the framework was rigorously done to attain that objective.

5.2. Recommendation

Based on the finding of the study following recommendations were forwarded by the researcher

Recommendation for each hospital management and FMOH

- HIS implemataton standard, interoperability between eHealth and policies enhance quality implementation of HIS continuous monitoring and evaluation.
- HIS Policies implematation follow up
- There are training, skill and practices gaps among user on the issue, tosuccessfuly overcome the challenge of HIS, so, provide on the job training and continuous follow up for users on both HIS Implementation.

Recommendation for developers

- While HIS service, developers should consider the applications interoperable and interfacing that also clearly indicated in the draft eHealth strategy should be considered for interoperability between HIS applications in the hospitals.
- Increase the use involvements in the development and implementation of eHealth applications.
- For users create virtual team to support the sustainability of HIS in the Hospitals.

In future there is a need to work on Smartcards and also options in the EHR systems in eHealth fields. Researcher also identified a study area on data exchange in trans-institutional among Hospitals eHealth applications just to facilitate referral system and comparative study between HIS modular software applications in terms of usability testing. HIS implementation for health center activities is a fairly new concept and as many health sector which are capital intensive started working in Ethiopia, their willingness assessment need to be conducted.

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Appendix A: Questionnaire

Dear Study Participant,

My name is Amsalu Workineh, I am MSc student at Jimma University and I am conducting my thesis entitled "investigate the challenges of health information systems standard and interoperability on health centers activities".

Health information system standard and interoperability challenges on health center's daily activities was identified in this study. This study will identify the way in which challenge in HIS standard and interoperability will managed for successful health service across multiple eHealth application in hospitals.Participant for interview purposively selected in order to get required knowledge on specified title. Observation also takes place in order to identify current HIS applications on eHealth services to get additional knowledge on system for quality of my study finding.

Since the success of the study, largely, depends on your genuine, frank and timely responses, please read the instruction given to each item and give your response accordingly. If you have any question or need clarification please feel free to contact me at my address below:

Name: AmsaluWorkneh Tel. No. +*251912431299* E-mail: amsaluwork23@gmail.com

Thank you!

GENERAL INSTRUCTION

- For each question item where alternative options are given, please put sign "√" in the box against the option that best suits your choice.
- For questions that alternative options are not given, please write your answer clearly and neatly in the blank space provided against each question.
- Please follow the specific instruction at the beginning of each section and try to read each before attempting to complete.
- When you fill that you change your response, please make sure that you have cancelled your original ones.
- In any part of the questionnaire you are not required to write your name.

Part I: PERSONAL Information

Please put sign "√" in the box against the option most appropriate answer based on information.

1. Sex: A. Male ☐ B. Female ☐
2. Age: A. 20-25 ☐ B. 26-30 ☐ C. 31-35 ☐ D. 35 and above ☐
3. Marital status: A. Married ☐ B. Single ☐ C. Widow ☐ D. Divorce ☐
4. Educational level: A. College certificate ☐ B. Diploma ☐ C. BSC ☐ D. MSC ☐ E. MD ☐ F. PhD ☐ G.Other_____
5. Select your institutions or hospitals

   A. MOE. ☐
   B. JU specialized hospital ☐
   C. Black lion specialized hospital ☐
   D. St.Paul, specialized hospital ☐
   E. St.Peter, specialized hospital ☐
   F. Korean Hospital ☐

6. What is your specific job in the hospital?_____
7. For how long have done in this Hospitals?

   A. less than a year ☐ B. 1-4 years ☐ C. 5-9 years ☐

D.10-14 years ☐ E. 16 years and above ☐

PART II: **THE CHALLENGES OF Health Information System**

These questions are related to the challenges of Health Information System. A health information system (HIS) refers to a system designed to manage healthcare data.Systems that gather, store, manage, and transmit a patient's electronic medical record (EMR), a hospital's operational administration, or a system that supports healthcare policy decisions are all examples of this.

5. Are there HIS application such as eHMIS,EHR, LIS, IPFSMISt, IFMIS, HRIS, ePHEM and other application for eHealth services? A. Yes ☐ B.No ☐
6. Have you got training on these HIS applications ?A. Yes ☐ B.No ☐
7. There are challenges regarding leadership support and HIS application problem?
   A.Strongly Disagree ☐ B.Disagree ☐ Neutral D.Agree ☐ E.Strongly Agree ☐
8. Are there ICT infrastructure challenges to implement HIS?
   A.Strongly Disagree ☐ B.Disagree ☐ Neutral D.Agree ☐ E.Strongly Agree ☐
9. Are there skilled human resource limitation challenges? A. Yes ☐ B.No ☐
10. What is the level HIS application acceptance by health professionals?
    A. Poor ☐ B. Fair ☐ C. Good ☐ D. Very Good ☐ E.Excellent ☐
11. Are there technical support challenges for HIS applications?
    A.Strongly Disagree ☐ B.Disagree ☐ C.Neutral ☐ D.Agree ☐ E.Strongly Agree ☐

PART III: Interoperability Between eHealth In Health Centers

Interoperability is the ability of two or more systems to exchange health information and use the information in effective way.

12. Is there interoperability between HIS applications in your hospital? A. Yes ☐ B. No ☐
13. If question 14 is yes, are HIS applications interoperable between hospitals? A. Yes ☐ B.No ☐
14. If no is your answer for question 15, what is the main challenge for interoperability?
    A. HIS application ☐ B.Management issues ☐ C.Other specify_____
15. How your organization concern about HIS interoperability implementation?
    A. Poor ☐ B. Fair ☐ C. Good ☐ D. Very Good ☐ E.Excellent ☐

PART IV: **HIS Implementation Suitability in Hospitals**

16. Are current HIS applications suitable for daily activities of health professionals? A.Yes ☐ B.NO ☐
17. If you say yes for question 18, are these HIS suitable for patient health service delivery? A.Yes ☐ B.NO ☐
18. If you say yes for question 19, is applied for all departments in your hospitals? A.Yes ☐ B.NO ☐
19. How the speed HIS application when compared with manual system?
    A. Poor ☐ B.fair ☐ C. Good ☐ D.Very Good ☐ E.Excellent ☐
20. How the quality of health services using HIS application?
    A. Poor ☐ B.Fair ☐ C. Good ☐ D.Very Good ☐ E. Excellent ☐
21. How HIS application helpful for efficiency of health professionals work?
    A. Poor ☐ B. fair ☐ C. Good ☐ D.Very good ☐ E.Excellent ☐

PART IV: **Standards for HIS Application in Hospitals**

Standards are agreed-upon methods for connecting HIS systems together. Standards may pertain to security, data transport, data format or structure, or the meanings of codes or terms.

22. Do you believe importance of existence of the standard for HIS application? A. Yes ☐ B. No ☐
23. If you say yes for question 24, is there standard for HIS application in your hospital? A. Yes ☐ B. No ☐
24. If you say yes for question 23,what kind of HIS standards are followed in developing health system in your hospital_____

THANK YOU FOR TAKING YOUR TIME TO FILL THIS QUESTIOANNIRE

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Appendix B: Interview

I am Amsalu Workineh, a master's student in information and knowledge management at Jimma University. I am conducting a research on investigate the challenges of health information systems standard and interoperability on health centers activities. You have been purposively selected to interview in this research by responding to this interview questions intended for this research. Findings from the study will help to explore the challenges of health information system.

1. What is your specific role in hospitals?
2. How many eHealth initiatives exist for hospital?
3. Where did you implement these eHealth initiatives?
4. Which partners involved in the implementation eHealth initiatives process?
5. What are the challenges in implementation HIS application in hospital?
6. What techniques help to remove HIS application challenges?
7. Are there interoperability problems between HIS applications in hospitals?
8. How HIS suitable for health service delivery?(health professionals, patient)
9. What standard followed for implementation HIS application in hospitals?
10. What policy or strategy you have followed during the period of identification and implementation of eHealth initiatives in the Hospital?
11. Are you involved during the implementation of the HIS applications (eg. training, design and installation, etc)?

12. In your view; is the current HIS well-designed and technically sounds with smooth data exchange? If not, what do you think the system looks like?
13. What are the main challenges of e-Health applications during implementation at national level in terms of technology, human resource and project management?
14. Did you aware in the issue related to data exchange between different eHealth applications?
15. What were the main challenges exist for the operational of eHealth applications at Hospitals?
16. How it affected the Health information reporting system at organization?