

ADDIS ABABA UNIVERSITY
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**ASSESSMENT OF HMIS DESIGN AND IMPLEMENTATION IN ETHIOPIA:
THE CASE OF SELCTED PUBLIC HEALTH FACILITIES
IN ADDIS ABABA HEALTH BUREAU**

BY:

MESSAY KITANBO GELANEH (BSc)

ADVISORS:

Dr MESFIN ADDISE AND Ato ERMIAS ABEBE

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ADDIS ABABA, ETHIOPIA

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IN ADDIS ABABA HEALTH BUREAU**



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MESSAY KITANBO GELANEH (BSc)

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Declaration

I Messay Kitanbo Gelaneh do here by declare that this assessment report has not been submitted to Addis Ababa University or any other Universities for any an academic award.

Dedication

This paper was dedicated to my beloved mother, **W/ro Ayelech G/Hana.**

Acknowledgement

I owe my deepest gratitude to almighty God for having given me life and the strength to go through and finish my master's course. I am also indebted to my advisors Dr Mesfine Addise and Ato Ermias Abebe for all the effort and time they put into getting my ideas focused and presentable on paper. I would like to pass my deepest thanks for Addis Ababa University school of public Health and Information science for covering the cost required for this thesis. Many thanks also go to the study participants and my beloved parents, family and for those who had helped me while data collection. Finally I wish to thank all my friends who continuously encouraged and made it possible for me to finish this paper.

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Acronyms

ART	Anti-Retroviral Therapy
BPR	Business Processes Reengineering
CDMA	Code Division Multiple Access
CSO	Central Statistical Office
DHIS	District Health Information System
EAC	East African Community
eHMIS	electronic Health Management Information System
FGD	Focus Group Discussion
FMOH	Federal Ministry of Health (of Ethiopia)
GIS	Geographic Information System
HC	Health Center
HF	Health Facility
HI	Health Institution
HIS	Health Information System
HISP	Health Information System Program
HIV/AIDS	Human Immuno Virus/ Aquired Immuno Deficiency Syndrome
M&E	Monitoring and Evaluation
HMIS	Health Management Information System
HMN	Health Metrics Network
HO	Health Office
HP	Health Post
HSD	Health Service Delivery
HSDP III	Health Sector Development Programme III

IDSR	Integrated Disease Surveillance and Response
IPD	Inpatient Department
IT/ICT	Information Technology/Information Communication Technology
LGAs	Local Government Areas
LQAS	Lots Quality Assurance Sampling
MOH	Ministry of Health (of Zambia)
NGOs	Non-Governmental Organizations
OPD	Outpatient Diagnosis
OR	Operating Room
PATHS	Partnership for Transforming Health System
PMPTCT	Prevention Mother To Child Transmission
PPD	Planning and Program Department
RHB	Regional Health Bureau
SNNPR	Southern, Nations, Nationalities and Peoples Region
VCT	Voluntary Counseling and Testing
WHO	World Health Organization
WoHo	Woreda Health Office

Abstract

Background: To facilitate informed local decision-making it is necessary to implement health management information system to timely and accurately provide each level of the health sector with the necessary information. In the interests of improving health sectors, the Ethiopian government has engaged in the sector reform, including a process of decentralizing decision-making and budgetary power to the district levels.

Objectives: The purpose of this study was to assess HMIS Design and Implementation in selected Public Health facilities of Addis Ababa Health Bureau, Ethiopia. The study attempted to determine the status of HMIS implementation and the use of HMIS generated information for health care delivery planning and decision making at different level of the health sector.

Methodology: In this study, a cross-sectional study was conducted at Addis Ababa, Ethiopia from December to June 2012. The research methods used were both qualitative and quantitative. The sample size of the study was 258. Data was collected through open and closed-ended questionnaires, observation and analysis of certain documents, and secondary data from selected reports of facilities obtained from Addis Ababa health bureau. SPSS version16 software was used to analyze quantitative data. Correlation was used as a statistical method to identify the association between selected variables and quality of HMIS data and Pearson's correlation coefficient with two tailed test of significance was used to determine the strength of association.

Results: The general implementation of HMIS in the study area covered all (100%) of health facilities and administrative units. Availability of adequate HMIS unit staff at health facilities was not up to the need of health facilities. The use of HMIS generated information for health care delivery planning and decision making in the study area was found to be 78%.

The major identified problems related with the design of the current system used for HMIS were; Prevention Mother To Child Transmission (PMTCT) and Volunteer Counseling and Testing (VCT) for 1 to 4 age was not included, the analysis part of the existing system doesn't include further statistical analysis it only show charts, blank space for unregistered diseases was not available, the recently included HMIS indicators for some disease were not included, and problem of registration by the professionals due to inconveniency of the HMIS formats.

The study also identified the major problems of the current HMIS data collection and reporting tools. It was found that data collection tools at Outpatient Department (OPD) and Antiretroviral Therapy (ART) were not quite adequate, work burden on the professionals due to most of the tools had similar attributes, data collection using tally sheets was not suitable for professionals, and the line spacing of data collection tools was not suitable were reported as the major problems of the existing HMIS data collection and reporting tools.

Knowledge of HMIS concept, frequency of training and accountability of concerned bodies has a statistically significant association with quality of HMIS data. The finding of the study also identified that duration of supervision and availability of HMIS focal person did not have a statistically significant association with quality of HMIS data.

Conclusions: The study concludes that; health facilities need to be furnished with adequate HMIS resources, and qualified human resources required at HMIS unit. The design of the existing system used for HMIS and the data collection tools needs to be modified and customized to support the needs of the professionals by incorporating the problems identified by this research. Duration of supervision, followed by availability of HMIS focal person, did not result into a significant improvement of the quality of HMIS data, thus guideline for capacity building program of the staff have to be developed by following the strength of association identified by this and other related studies with quality of HMIS data.

Keywords

Health Management Information system, Implementation, Design, Data quality

CHAPTER ONE

1. Introduction

1.1. Background of the study

Many low- and middle-income countries have developed ambitious health policies and strategies to improve Health Service Delivery (HSD) and attain the health-related Millennium Development Goals, but have difficulty in matching implementation with their aspirations Sameh et al [1]. Ethiopia is one of many low-income countries that have implemented several strategies of significant scale in recent years to improve HSD.

Health management information system (HMIS) is a process whereby health data are recorded, stored, retrieved and processed for decision-making to improve the management and optimum use of resources of programme and to make timely decisions to resolve constraints and problems of implementation. Health Management Information System and Monitoring and Evaluation (HMIS/M&E) is one of seven components of the Health Sector Development Program (HSDPIII) of Ethiopia, HMIS/ M& E strategic plan, [2].

The objectives of HMIS and M&E in HSDP III were to develop and implement a comprehensive and standardized national HMIS and M&E, and to ensure the use of information for evidence-based planning and management of health services. The specific objectives were to achieve 80% completeness and timeliness of routine health administrative reports and 75% evidence-based planning by 2010 as Woldemariam et al discussed Health Sector Strategic Plan 2005/06-2009/10 [3].

World Health Organization (WHO) argues that investment in HMIS now could reap multiple benefits, including: helping decision makers to detect and control emerging and endemic health problems, monitor progress towards health goals, and promote equity; empowering individuals and communities with timely and understandable health-related information, and drive improvements in quality of services; strengthening the evidence base for effective health policies, permitting evaluation of scale-up efforts, and enabling innovation through research; improving governance, mobilizing new resources, and ensuring accountability in the way they are used Cindy [4].

The implementation of HMIS in Ethiopia was scheduled for 2008-2010 GC. During the first 18 months all health institutions in seven regions, covering 90% of the population, will convert to the reformed HMIS/M&E; during the next 18 months, the remaining regions will be converted and the reformed systems will be strengthened and refined to create a firm foundation for continuous improvement of data quality and information use. Budget for the implementation during the first 18 months is estimated at 17-19 million USD, depending on the training modality selected. Annual running costs for consumables (primarily stationery and technology operations) and logistics may be estimated at 5-6 million USD, HMIS/ M& E strategic plan, [2].

FMOH/ Planning and Program Department (PPD) are accountable for implementation. Regional responsibilities are delegated to the HMIS Departments/Units at the respective regions. Implementation activities are the responsibilities of the HMIS Units at zones and woredas. It is anticipated that development partners and Non Governmental Organizations (NGOs) will also be involved in implementation, HMIS/ M& E strategic plan, [2].

Implementation activities will be monitored at least quarterly by the responsible bodies. A complete evaluation will be undertaken during the half of 2010 to assess the improvements in performance of the reformed HMIS/M&E, HMIS/ M& E strategic plan, [2].

Data delivered through the HMIS come from service delivery and administrative records kept as part of routine transactions at health facilities and management offices. In a well-performing HMIS, data should come from every Health Institution (HI) in the country. In FMOH HIs HMIS/M&E is weak, with the exception of some local and regional institutions where HMIS/M&E performance provides benchmark and best practice examples. At other governmental HIs and private sector for-profit and not-for-profit institutions, HMIS/M&E is weak to non-existent, again with the exception of some best performers , HMIS/ M& E strategic plan, [2].

These gaps in completeness compromise Health Institutions (HI's) direct management of public facilities and collaboration with other Ministries and the private sector to improve health status and use of health resources, HMIS/ M& E strategic plan, [2].

According to 2002/03-2004/5 FMOH HSDP II (Health Sector Development Program II) report there is lack of coordination in leadership, strategy, policy, and of having skilled human resources and of guidelines, timeliness, and completeness of health information system. Result of the research by Gashaw [5] showed that health information system remains poor and these problems contribute to the failure to use data as the basis for informed decision-making in planning and other management functions.

This study was carried out to assess HMIS design and implementation in the public health facilities of Addis Ababa Health Bureau, Ethiopia.

1.2. Statement of the problem

There is a big concern for the improvement of the health care services delivery system, which is widely seen to be attributed to the shortcomings of HMIS in the developing countries; where WHO calls for reform? Despite the credible use of HMIS for evidence based decision making (strategic planning, improved patient care, efficient allocation of scarce resources and effective targeting of intervention to those in greatest need leading for better outcome), as Alganesh discussed Health Metrics Network journal in her research, [6] countries with the highest burden of ill health and the most acute needs for good data have the weakest HMIS in the vast majority world's poorest countries.

Information system is used to improve services and for evidence based decision making, concern is rising that how it is going to be maintained and upgraded to incorporate the needs of the stakeholders.

According to Jorn et al [7] inappropriate design as related to the needs and context of use represent a major reason for information system failures in developing countries. Thus, design and development need to be grounded in the context of use and the capability for local improvisation.

Ethiopia is also one among developing countries. To improve the health care services delivery Ethiopia has been implementing HMIS since 2008. Its HMIS is by no means different from the feature of other developing countries.

HMIS progress assessment was conducted in three regions of Ethiopia: Benishangul-Gumuz, Gambela and Harari that are implementing the new HMIS. The assessment was conducted in 2009, by FMOH in collaboration with Health Metrics Network (HMN) to document and share lessons and to help guide the next steps. Data were collected from three regions, one city administration, eight woredas (districts) and 20 health facilities (HF), including 4 hospitals, 8 Health Centers (HC) and 8 Health Posts (HP), through observation, interviews, and focus group discussions (FGD) using structured guidelines Woldemariam et al [3].

The assessment revealed that availability of the HMIS registers, forms and tools was not up to the needs of the health facilities included in the study. Only half of the 20 HF's had the required registers and 60% had the required forms during the time of assessment; this was also a major issue raised as a problem during the FGDs. Yet these supplies were available at regional health bureau and woreda or health office levels, indicating the need to strengthen follow up and support from upper levels. Interruption of supply of forms and registers may frustrate the health staff in HF's, compromising the attention paid to successful application of the system. Most of the HMIS and M&E standard guidelines were not available at various levels. At least one copy of the required technical standards was found in 3 of the 20 HF's assessed. Lack of disease classification list at Outpatient Department (OPD) level was reported to have affected the quality of recording and reporting in some cases.

Some deficiencies were noted in the new HMIS registers and forms in terms of presentations and contents, including tracking priority services, like voluntary counseling and testing (VCT), and environmental health services and specialist services at hospital level. This was also observed during the evaluation of the design and pilot testing as Woldemariam et al discussed design and implementation of HMIS and M&E in Ethiopia 2007 [3], indicating the need to systematically document deficiencies and to address them during the future revisions.

Most of the respondents and participants of the FGD mentioned that there was still parallel reporting due to demands from programs and donors against the principles of the unified HMIS, with single reporting channel, agreed by all partners. This created a huge work burden for the staff and compromised the appreciation and commitment of the staff towards the new recording and reporting system. In some cases the health workers viewed the new system as an additional burden to their regular work and they did not see the added value of the new unified and simplified HMIS on work load and motivation.

The Studies conducted on HMIS in different regions of Ethiopia showed, there are different problems with the existing HMIS as compared with its objective defined in HSDPIII. The result of studies conducted so far mostly show the status of HMIS design and implementation. They don't more generally document the problem related with the design and implementation of the system to address them during future revision of the system.

Addis Ababa is the urban center of Ethiopian and Major budget of FMOH is also allocated in the urban center, which accounts for about 70% of its budget. Despite such budget absorption; the research by Alganesh [6] disclosed that quality and access of health care delivery to the needy is questionable. Therefore assessing the design and implementation of HMIS at Addis Ababa health bureau helps to systematically document the weakness of the existing system.

1.3. The purpose of the study

The main purpose of the study was to:

- Document the weakness of HMIS implemented in the health sector,
- Disclose the factors affecting HMIS data quality, and
- Prioritize the factors affecting the implementation.
- Describe the communication channel through which data and routine reports delivered to the higher levels.

1.4. Significance of the study

Even though, the research was targeted to fulfill academic requirement; it can serve as a good starting point for reviewing the current HMIS situation in the region so as to address the problem area.

The most pressing need of the assessment was to construct standard documentations for the existing HMIS.

The finding of the study would help the concerned bodies to

- Revise the design of the existing system used for HMIS, and the data collection and reporting tolls according to context of the problem or adapt other system,
- Take action on the factors affecting the quality of data and implementation of the system based on the pre-identified priority, and
- Strength the communication channel for timely delivery of data and routine reports.

Moreover, the findings of the study would help to improve the quality of health care delivery in the country by investing a minimum cost to strength the system. The main beneficiaries of the result will be the public as a whole and other beneficiaries include; Health facilities, policy makers, and researchers.

1.5. Objectives of the study

1.5.1. General objective

The general objective of this study was to assess HMIS design and implementation in the public health facilities of Addis Ababa Health Bureau, Ethiopia

1.5.2. Specific objectives

1. To evaluate the design of HMIS routine data collection and reporting instruments, registers, and forms in terms of layout, comprehensiveness, clarity, accessibility.
2. To describe the process of data transformation, processing and communications in the HMIS and routine reporting system;
3. To determine the factors affecting HMIS data quality
4. To assess the status of the current HMIS in decision making and situation of supporting high technology systems in the future.

1.6. Research questions

- Is the current HMIS comprehensive, easy to use, user friendly and interactive?
- Does the system generate the appropriate report in timely manner?
- Does the system generate the required information to support planners to address the health problem at various levels?
- What is the weakness of the system and which part of the system needs to be improved to support the needs of the staff and stakeholders?
- What are the factors that affect the quality of data?

And hence, the study was aimed at answering the above research questions. Thus, depending on the findings of this study, implications that need to be considered while reviewing the system were forwarded. If the possible recommendations are considered and applied, the researcher expects that the health service delivery will be improved.

1.7. Scope of the study

The study takes into account and limited its execution as per the following scopes:-

(a) The Implementation Scope

The study was focused on evaluating the design of the system used for HMIS in terms of completeness, user-friendly, layout, report generation, and the status of using information generated by the system and the likes.

(b) The Subject Scope

The study concentrates on the whole HMIS particularly with routine data collection instruments, registers, forms and reporting systems and also communication channel through which the system related information flow to the higher levels. Besides, the study concentrates on the stakeholders who are responsible to collect or register HMIS data, compile the data, record the data, analyze the data, and use HMIS generated information for health care planning and decision making at both health service providers and administrative units.

(c) The Geographical Scope

The assessment was restricted geographically to public health facilities at Addis Ababa Health Bureau, Ethiopia.

1.8. Limitations of the study

- Awareness of the respondents and higher officials in the study area toward the research,
- Availability of limited literatures, and
- Scarcity of resource (financial and material constraints)
- Experience of the principal investigator on conducting related researches, was found to be the major limitations of the study.

CHAPTER TWO

2. Literature review

2.1. HMIS - Basic Concepts

System is a collection of components that work together to achieve a common objective. Information System; is a system that provides information support to the decision-making process at each level of an organization. Health Information System; is a system that integrates data collection, processing, reporting, and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services. Health Management Information System; is an information system specially designed to assist in the management and planning of health programmes, as opposed to delivery of care, Developing health management information systems; practical guide for developing countries, [8].

Health Information Systems helps globally to develop the culture of evidence based policy making to identify issues; inform the design and choice of policy; forecast the future; monitor policy implementation; and evaluation policy impact. These needs go far beyond information from, and on, the health system itself, including information on the socioeconomic, demographic, environmental, and behavioral determinants of health outcomes. Health policies and outcomes are also linked to policies and outcomes in other sectors, such as education, and to more general development framework such as poverty reduction strategies and monitoring of the millennium development Goals, HMIS; practical guide for developing countries, [8].

It is widely recognized that interventions in the arena of Health Management Information System design and implementation are “a very cost effective technical and financial investment” Campbel et al [9]. However, few countries have a HMIS that provides beneficiaries (individual clients, community members, service providers, managers, planners and policy makers) with timely and relevant information necessary to formulate policy, plan, implement, monitor, supervise and evaluate individual and public health program activities.

2.2. Major subsystems of health information system

To provide optimal care, healthcare institutions need timely patient information from various sources at the point-of-care, and need a comprehensive, complete and fully functional system to fulfill all these needs. One way to achieve this is through the use of ICT in health care, the research was supported by Archngel [10].

ICT is defined in this research as a tool that facilitates communication, the processing and transmission of information and the sharing of knowledge by electronic means. This encompasses the full range of electronic digital and analogue ICT, from radio and television to telephones (fixed and mobile), computers, electronic-based media such as digital text and audio-video recording, and the Internet, but excludes the non-electronic technologies. However this does not lessen the importance of non-electronic technologies such as paper-based text for sharing information and knowledge or communicating about health, Priority Intervention for Strengthening National Health Information System, [11].

The use of ICT into existing health systems according to Chetley et al. (2006) has helped to improve the delivery of health care in a number of ways. These include the use of telemedicine to improve diagnosis and enhance patient care, improvements in the continuing professional development of health workers and better sharing of research findings through e-health, and the use of health systems as an effort to extend the reach and coverage of health care to make an impact on specific conditions Archngel [10].

Assessment of Health Information System is essentially a measurement of the performance of selected components or subsystems of the information system to support and improve health care delivery and management of the health service system at various levels. In most countries, the following subsystems of health information systems are found, Steve [12].

1. Epidemiological surveillance for noticeable infectious diseases, certain environmental conditions and risk factors.
2. Routine service reporting from basic health services at community level, health center, dispensaries, first level hospitals, referral hospitals, and special and tertiary hospitals.

3. Special program reporting system such as tuberculosis control, leprosy control, malaria control, maternal and child health and family planning, Expanded Program on Immunization, And AIDS prevention.
4. Administrative systems, including health program budget management, health financing systems, health training programs, health research management, health documentation management, and managing external resources for health.
5. Vital registration birth, death, and migration.

In addition, managers can choose to focus on all health information system components as defined above for the assessment, or to select only a few. For the purpose of such assessments, health information system components have been categorized as follows Steve [12].

- Data input: validity and completeness of data recording and collection, including surveillance, routine case and activity data, surveys, data emerging from administrative process, and registration data.
- Data analysis, transmission and reporting: efficiency, completeness, and quality of data analysis, processing and presentation, at all levels of the health system, in order to produce actionable information.
- Use of information: decisions and actions taken for patient/client, community, health unit, programme, and executive management;
- Information systems resources: availability, sufficiency, and use of critical resources to support: the health information system budget; staff with necessary training and expertise; facilities such as space for record storage, records, and formats, and necessary equipments for data communication, storage, analysis, and document presentation (faxes, computers, printers, photocopy machines, etc.);
- Information system management: organization and coordination mechanisms for assuring that data and information are properly defined, standardized, produced, maintained, shared and reported.

2.3. HMIS in developing countries

Health Management Information System is one of the priority areas in strengthening the health care delivery system in majority of the world countries. The health care delivery and ways of handling patient record in majority of developing country is under question. To improve the health of population developing countries were investing on HMIS. Strengthening HMIS is considered as improving the health care delivery of a country. HMIS is considered as source of information for the health sector, since it incorporates all the data needed by policy makers, clinicians, and health service users as a whole. Thus, every developing country in the world must take actions on strengthening HMIS. Few countries in the world today have effective and comprehensive systems in place to gather this data. There is a big concern for the improvement of the health care services delivery system, which is widely seen to be attributed to the shortcomings of HMIS in the developing countries. Countries with the highest burden of ill health and the most acute needs for good data have the weakest HMIS in the vast majority of the world's poorest countries Bodavala et al [13]. In the following subsections review of some relevant works done in developing countries as presented:

2.3.1. HMIS development in Nigeria

Health Information Systems Program (HISP) has been providing assistance in the development of Health Management Information System in Nigeria since 2003 as part of the Partnership for Transforming Health Systems (PATHS) programme, Health system case study, [14]. This includes work across six states in Nigeria with a population in excess of 30 million people.

Initially the HMIS system was piloted in a small number of Local Government Areas (LGAs) and associated health facilities in Benue, Enugu and Jigawa states, before scaling up across other LGAs in the same states. During this process the international team worked with Nigerian colleagues (national consultants and state-employed HMIS officers) to develop appropriate tools in the form of registers and monthly reports, a small but manageable essential dataset, and to adapt and customize District Health Information System (DHIS) software for the Nigerian context. Once the model and the process of rolling it out were well developed and tested, they could then be introduced across each of the six states.

The process of strengthening the HMIS involved a partnership between the state Ministry of Health and the consultants. This was complemented by intense training of staff at all levels lasting more than three years, to gradually increase their capacity and develop their expertise in a sustainable manner. One result of this partnership has been the development of a local organization in Nigeria, HISP Nigeria, to support the work.

Jigawa and Kano states held quarterly Health Information Reviews for reviewing information submitted from LGAs, which proved a successful mechanism for the sharing of experiences. At these meetings staff from hospitals and clinics (usually HMIS officers and primary health care coordinators at LGA level, and record officers or medical officers from hospitals) were presented with printouts of their data from the DHIS, and given 45 minutes to review the data and prepare a presentation on it. The aim was to look at the completeness, consistency and accuracy of the data. Participants were instructed to focus on the attendance and Out Patient Department (OPD) data; and maternity and antenatal care data. Each facility then presented their data, and debated the findings with colleagues and Ministry of Health officials. This led to intense sharing of experiences and best practices, followed by the development of solutions, which were then adopted and followed up at subsequent meetings. Information officers from the hospital brought along their original data, so that they could compare what had been captured on the DHIS.

While significant success has been achieved (for instance reporting rates across the first five PATHS states has risen from less than 25 percent to approximately 60 percent coverage of facilities), efforts to strengthen the HMIS have still a long way to go before they can be said to be truly locally sustainable. Particular issues that still require support relate to: The institutionalization of training in information systems with the aim of developing a stock of information workers that are suitably trained in modern information management technique, lack of adequate infrastructure in many rural areas, in particular telephone lines and a regular electricity supply, and lack of regular supplies of paper, which is needed for data collection and reporting.

2.3.2. HMIS development in Zambia

HISP in Zambia worked on an HMIS strengthening project funded by the European Union, Health systems case study, [14]. The first part of this project began in February 2007. The existing HMIS database of Zambian MOH was a rigid, hard-coded access database that had been in use since 1998; it could not easily be adjusted to accommodate new reporting needs presented by, for instance the HIV/AIDS programmes.

Therefore, the first three months of the project involved customizing the District Health Information System (DHIS) software for the Zambian context. As part of the process, the indicator set has been revised for Zambia, and the data collection tools adjusted to accommodate the increased reporting needs. New data was also added, for instance census data was obtained from the Central Statistics Office (CSO) and imported so as to provide denominator data for many of the indicators. The new HMIS database is called the “Integrated HMIS” database, and serves as a “data warehouse” for a variety of data related to the health services.

Once this initial work had been completed, the revised system was piloted in the Copper belt Province in August 2007. Training materials were developed and tested during an initial training workshop in Ndola, which included representatives from national level, from each of the provinces, some programme managers, and representatives from the training institutions. These people were then able to support the roll-out of the work to other provinces once the materials had been finalized. In September 2007, another training workshop was held for the Copper belt district information officers, and data that had been collected in facilities during August was captured in the Integrated HMIS database. Each district information officer received a brand-new, state of the art computer and printer funded by the EU. This roll out of the revised HMIS and associated training was completed in 2008.

2.3.3. East Africa regional integrated e-HMIS

The East African Regional Integrated e-Health Management Information System (e-HMIS), Geographic Information System (GIS) and its accompanying ICT infrastructure for e-Health and telemedicine practice is a collaborative effort of the national Ministries of Health of Kenya, Tanzania and Uganda as well as national health research and academic institutions in both the private and public health sectors throughout East Africa, Towards establishment of an East African community regional integrated e-HMIS, [15].

An important aspect of this regional integrated e-Health management information and geographical information system (GIS) network is to enhance the quality of health data in order to facilitate timely flow and sharing of information to improve the health of the entire East African population. As per the relevant provisions of Article 118 of the Treaty for the Establishment of the East African Community (EAC) with regard to regional integration in the health sector, the objectives of this regional eHealth and GIS network are to, among others; 1) enhance and strengthen cross-country and cross-institutional collaboration through regional coordination of health activities; 2) promote the exchange and dissemination of appropriate information on health systems development and services provision as well as health research activities; 3) harmonize national Integrated Disease Surveillance and Response (IDSR) systems in the region; 4) strengthen regional capacity for implementing disease surveillance and control activities for both communicable and non-communicable diseases; 5) ensure continuous regional exchange of expertise and best practices for disease surveillance and control; and 6) enhance e-health and telemedicine practice as part of increasing access to quality health care provision and research in both the public and private sector throughout East Africa.

2.4. Framework for HMIS assessment

This part presents a framework for Health Management Information System assessment used in a number of countries. The framework encourages the selection of subsystems and domains for assessment. It provides a comprehensive review of the Health Management Information System from different perspective (e.g. Use of information, resource support of the subsystems, managerial support, outputs, and organizational aspects). Generally, using a specific guideline or framework for Health Information System assessment helps the evaluation to yield useful finding and it is also essential for recording the issues to be addressed during the assessment. The next section discusses some of the frameworks used to assess Health Management Information System.

2.4.1. Conceptual framework for assessment of HMIS

The framework was first developed by Haazen et al [16] who advocated a three axes framework for HMIS assessment comprising of system Dimension, system uses, and system sector/stakeholders. The proposed framework was applied in Latvia to evaluate a system that supports national Health Insurance in 2004.

The conceptual framework describes the system in terms of its placement a Systems Hierarchy and the Health Management Information System uses a taxonomy described by Streveler, and the specific sectors and uses which the Health Management Information System is designed to serve. The framework examines both the level of complexity and scope of coverage of the Health Management Information System.

The framework has three axes; the first axis describes “system dimension”, a measure of the complexity of the underlying technologies used, and an attempt to (somewhat) linearly describe how progress in Health Management Information System can best be produced.

The second axis describes “system uses”. This is the general taxonomy of Health Management Information System applications described by Streveler. Each category of “system use” can be further decomposed to whatever level desired. For example, patient management systems are composed of clinic information systems, hospital information systems, laboratory information systems, radiology information systems, and so on. The third and final axis, contributed by Haazen, categories users and stakeholders who will be impacted by the implementation – either

by directly impacting their job duties, or possibly by changing the outputs which result from those duties.

Figure 1

Framework applied in Latvia to evaluate a system that supports national Health Insurance in 2004, Haazen et al [16].

System Dimensions	System Uses	System Sectors/ Stakeholders
8 Advanced Technologies	A. Patient Management	i. Ministry of Health (national/regional)
7 Electronic Record Keeping	B. Population Management	ii. Health Insurance Agency
6 Health Insurance Systems	C. Disease State Management	iii. Secondary Health Care/Hospitals
5 Clinical Venue Systems	D. Resource Management	iv. Specialist Ambulatory Care
4 Management & Planning Tools	E. Utilization Management	v. Primary Health Care
3 Resource Management	F. Financial Management	vi. Emergency Medical Services
2 Accounting & Inventory	G. Quality Management	vii. Pharmacies
1 Health Statistics		viii. Public Health
0 Standard Setting and Master Planning		

The conceptual framework as applied to Latvia, from the “systems dimensions” axis of our framework one can glean several important points. First, the focus on health insurance, management and planning, resource management, and health statistics indicates that the system will not likely be applying much in the way of innovation or advanced technology. The project uses well-established (presumably less-risky) approaches. The same general conclusions can be deduced from the “system uses” dimension, which also focuses on the simpler (and possibly less controversial) uses. There is one possible exception however in that it is hoped that there will be an impact on quality management, an area which remains challenging. Finally, the involvement of essentially all health sector stakeholders (see “system sectors/stakeholders” axis in Figure 1) suggests a serious level of complexity in the project resulting from the need for coordination of all these disparate users, and the need to address different service delivery modalities simultaneously. Overall, the framework predicts one should expect problems given the wide scope of users and the inclusion of quality measurement functionality, but other areas should be fairly straightforward.

2.4.2. Framework for evaluation of computerized HMIS

This framework was used for evaluation of Computerized Health Management Information System for Primary Health Care in Rural India. Haazen et al [16] advocated a tri-axis framework for HMIS. However Krishnan et al [17] adapted a framework for describing HMIS in rural India from the Performance of Routine Information System Management (PRISM) framework which uses a systems framework of inputs (technical, organizational and behavioral factors), processes, outputs, outcomes and impact.

Krishnan et al [17] used a simplified framework for describing HMIS in rural India in terms of Technology, Human Resource and Output of the system.

Technology: These can be broadly divided into the software being used and the hardware on which the system is operational. Furthermore, the hardware can be described in terms of the specification of computers used like storage capacity, size of Random Access Memory (RAM), processor speed and manufacture. The software can be described in term of the core database, the user interface and the operating system (OS).

Human Resources: can be described in terms of the availability of data entry operator who updates the data within the specified time.

Output: the output part of the framework describes the main output of the HMIS. The main output of the HMIS in rural India is the work plan generated each month after the data has been updated. The work plan lists the monthly activities by house and contains updated information about all the individuals including the under-five children, pregnant women, eligible couples, and geriatric age-group in the house.

2.4.3. Readiness matrix for assessing HMIS

The Readiness Matrix aims at evaluating/measuring the level of readiness of each specific state/district with respect to use of information for action. Walsham [18] developed the assessment matrix and pilot tested for Indian states the matrix is based on 6 dimensions of readiness each with 3 sub dimensions, each sub dimension then has to be rated on a 4 level scale signifying different degree of readiness.

The first dimension of the readiness matrix for Health Management Information System assessment is technology. This dimension emphasizes on all the technological aspects of Health Information System. The sub-dimensions of the technology include software customization requests, server capacity, and internet access.

The second dimension of the readiness matrix is Information Systems processes. The main goal of an information system is to make information circulate vertically both upwards to different levels of the hierarchy and also the feed back down the level. Further, the information system should also strengthen the circulation of information horizontally at the same administrative level from the unit dealing with the health information systems to the other health programme managers. This can then potentially support staff at each level to take ownership of their respective data, and establish processes to encourage its systematic and regular use for supporting everyday action. The sub-dimensions include; regularity of upward reports, practice of feedback reports, and procedure for data verification

The third dimension of the readiness matrix is Data Quality. It is the foundation for an effective and functional Health Information System. Action at various levels from the development of health policies to state and district management and the support to the field functionaries all rely on reliable data. Thus, within the context of readiness for the use of “information for action”, the data quality dimension reflects the state’s ability to circulate quality data which can be trusted, used and thus help in the overall strengthening of health service delivery. The sub-dimensions of data quality are completeness, accuracy, and verification procedures in place.

The fourth dimension of the readiness matrix is about the Human Capacity. Human capacity is a central element in institutionalizing the Health Information Systems and indicates whether the state has the human resources in place in order to use “information for action”. The dimension has the following sub-dimensions: adequacy of team, adequacy of training, and advocacy on information for action.

The fifth dimension of the readiness matrix is about Institutional Collaboration. Various programs and missions must collaborate to gain a holistic and complete system of information, both to improve results, and also reduce the potential for conflict. In a deeply institutionalized

system, institutions of cooperation need to be in place so to ensure effective integration and decentralization of systems. The dimension has the following sub-dimensions: Involvement of program management, HMIS budget in place, and Integration of systems.

The sixth and the final dimension of the readiness matrix for assessment of Health Management Information System is “Use of Information for Action”. This dimension relates to evidence of information being generated from the health information system being used for specific kinds of action. The various sub dimensions include: data analysis, feedback reports being generated, action taken.

2.4.4. Framework for identifying critical issues affecting the introduction of HMIS

Archangel [10] developed framework for identifying critical issues affecting the introduction of HMIS. This framework was developed by integrating the factors and issues affecting the introduction of Health Management Information System from different literatures. The framework used to analyze the documents and interviews of the cases at International Institute for Communication and Development. The developed framework is used for identifying critical issues affecting the introduction of HMIS in developing countries in Africa.

This framework was developed by Nicole Archangel, October 2007. The framework is depicted as a matrix where horizontally the framework, shows the different phases the project can be in and vertically the factors which have a positive correlation with the introduction of an HMIS. The rows then show the different phases the project is in, and the columns depict the factors and their issues concerned per phase. The framework can be found in the next part of this paper, the way this tool is to work is by walking through each phase separately depending on the level of implementation the project is in. The walkthrough consists of each phase and the issues that should be considered here. By using this framework depending on the phase the project is in and the positive correlation between the issues and the HMIS each phase the project is in and issue at hand can be assessed with the use of this framework.

Table 1

Framework applied in developing countries in Africa (Zambia, Uganda, Mali and Tanzania) to identify critical issues affecting to introduction of HMIS in 2007, Archangel [10]

	Phase 1: Planning	Phase: 2 Implementation	Phase3: After Implementation
Objectives	Define objectives	Check objectives	Monitor objectives
Planning and strategy	Define planning and Strategy	Implement strategy	Monitor strategy
Stakeholders roles And responsibilities	Responsibilities and Communication flow	Register & check role and responsibilities	Monitor & check roles and responsibilities
Social and cultural Aspects	Identify participation	Check participation	Monitor participation
Technology	Identify: tools; Connectivity; design	Implement technology needed	Maintenance
Human capacity Development	Identify capacities; Develop needed training	Give training	Achieve long term sustainability
Participation and awareness	Identify needed participation and awareness	Do awareness raising get participation	Monitor participation
Financial aspects, Sustainability	Identify financial input	Guard input and Output	Monitor input and Output

For example, for the factor strategy and planning the following questions are asked in phase 1 as being critical for this phase:

1. Has the planning for the implementation of the HMIS been developed?
2. If YES, is a document of this planning available?
3. What type of planning is it?(year/months)
4. Where is the planning document stored?

For phase 2 the following question is asked:

5. Is the planning for the HMIS being monitored and implemented?

And for phase 3:

6. Is there a long term monitoring and evaluation process in place for the HMIS?

2.5. HMIS reviews conducted

The following section of this paper presents assessment of Health Management Information System conducted in developing countries in Africa. Generally, in this part the researcher has tried to show some of the major points in the assessment including the year the assessment conducted, by whom it was conducted, the methods used, the sample selected, and the general findings of the assessments.

2.5.1. Factors influencing quality of HMIS data in Tanzania

This research was conducted by Simba et al [19] the study was therefore aimed to assess quality of data collected through the HMIS and explore possible associated factors. A cross-sectional study was conducted in Kinondoni Municipality, Dar es Salaam region, Tanzania. Kinondoni Municipality was conveniently selected since it is within Dar es Salaam where the researchers are based.

The study picked a random sample of 41 private health facilities that represented 25% of all private health facilities (4), while all public and parastatal facilities were selected since their numbers were relatively smaller compared to private facilities. Altogether a total of 69 facilities were covered in this study.

Data collection was done using a structured questionnaire which was administered to the in-charges from the 69 health facilities. Using an observation schedule, quality of data was determined from records found in registers, data books and reports for the year 2001.

A pre-test was done in four health facilities to check on the relevance of data collection tools and the overall research approach. The results of the pre test were used in the preparation of the final and more refined data collection tools.

A number of factors that are likely to affect the quality of Health Management Information System data were examined. The result of the assessment disclosed that knowledge on HMIS basic concept was found to be associated with improved quality of data; training in HMIS did not seem to correspond with improved quality of data. Regardless of duration, supervision had no relationship with quality of data thus raising serious doubts on its quality. Presence of a focal person, responsible for day to day HMIS activities, had a positive influence on the quality of data

where facilities with a focal person had a higher data completion rate (69.9%) compared to those without (44.7%). Accountability as measured by queries reportedly made by Municipal authorities on data inaccuracies was associated with better quality of data. However, queries on delay in sending report had no influence in quality of data.

2.5.2. Implementation of an integrated HMIS and Monitoring & Evaluation in Ethiopia

Woldemariam et al [3] conducted an assessment of Integrated Health Management Information System and Monitoring & Evaluation assessment.

The assessment was conducted using a multiple study design with **Qualitative** and **Quantitative** methods. It was conducted in three regions and one city administration that are currently implementing the new HMIS: Benishangul-Gumuz, Gambella and Harari Regions, and Dire Dawa City Administration.

Data collection was conducted from 13 to 20 September 2009. The RHBs, 8 Woredas, 4 hospitals, 8 health centers (HC) and 8 health posts (HP) were selected through purposive sampling. A total of 133 staff of Health Facilities, Woreda Health Offices (WoHo) and RHBs were involved in the Focus Group Discussions (FGD).

Data were collected by observation and interviews of key staff of HMIS and planning teams, heads of the selected offices and HFs using a structured format. Document reviews were also carried out. Qualitative data, collected through FGD involving staff in the key programs, were used mainly to enrich and explain the quantitative data. Quantitative data were analyzed using SPSS version 16.0. For selected indicators, comparison was made with the results of the “as-is analysis” data.

As the result of the assessment show availability of resources of all types was inadequate as compared to the recommended standards set by the new system, duration of trainings was considered short and insufficient to transfer adequate skills and understanding of the new HMIS, availability of the HMIS registers, forms and tools was not up to the expectations too, lack of disease classification list at Outpatient Department (OPD) level was reported to have affected the

quality of recording and reporting in some cases, some of the forms and registers of the new HMIS and M&E system showed deficiencies and key indicators may be missed in the current HMIS list. Parallel reporting was compromising the acceptability of the new system, HFs implementing the new HMIS and M&E achieved considerably high improvements in data quality, information management, reporting and use, training and skills development required tailoring, while review meetings and supervision that could have filled the gaps were not conducted regularly, It can be considered that, even in constrained settings, the new system can lead to better data quality and information use, contributing to improve efficiency and quality of health services.

2.5.3. BPR assessment of HMIS in Ethiopia

The study was done in Southern Nations Nationalities and Peoples of Ethiopia by the regional Health Bureau in collaboration with USAID/HMIS scale-up project between June and September 2006, Health management information system facilitators guide for training of trainers, [20].

This study was conducted to assess the performance of Health Management Information System in terms of information use, data quality, data burden, human resource, Information Communication Technology, and finance or resource.

Both **Quantitative** and **Qualitative** assessment methods were used. From the assessment a number of results were found. The results from the above listed point of view include there is more collection and reporting of data to higher level, no information use for performance and service delivery improvement at the periphery level and decision making was highly centralized, there was a poor quality of data that leads to erroneous conclusion and improper decision making, there is additional work of late error detection, important data items often missed, Significant discrepancy between data reported and recorded in registers in the facilities, too much data is collected woredas report 500 data items, hospitals 450 data items and health centers 400 data items special programs such as HIV/AIDS, TB/Leprosy, and malaria add more burdens.

There was a duplicate effort; different partners require independent data collection, non compatibility; different definitions of indicators among different partners and across regions, skills in interpreting information & Problem solving appeared weak at all levels, only 23% of HMIS staff reported receiving in-service training, expanding and improving use of ICT is a recommended BPR process, 75% of WoHos have no HMIS budget.

CHAPTER THREE

3. Methodology of the study

3.1. Study area description

The study was conducted at Addis Ababa city administration, which is the capital city of the country. With Average Elevation of 2500m above sea level, the city administration has a geographic and territorial possession with an area of 540 sq. km and a total population of about 3 million [21].

The City of Addis Ababa has three administrative levels: the City Government of Addis Ababa is the first level. The second level of the City includes ten sub-cities. The third level includes kebeles, which are units of sub-cities. There are currently ninety nine kebeles. Sub-cities and kebeles like the City of Addis Ababa itself have elected councils [22].

The distribution of public health facilities in the city administration are; Hospitals; owned by Addis Ababa Health Bureau 6, Ministry of Health 4, Addis Ababa University 1, Ministry of defense 2, and Police force 1 total government Hospitals 15. Total governmental Health Centers owned by Addis Ababa Health Bureau 32 [22].

The study area was selected because of two main reasons. Primarily due to its convenience to the researcher and secondly, the area is the urban center of Ethiopia, and is composed of variety of health organizations, different level of health management units and HMIS implementation covered all public health facilities.

3.2. Study population and sample

The study population involves the stakeholders in the public health service providers, and health service administration units who are working and have responsibility on HMIS at different level in Addis Ababa health Bureau. The public health service providers and administrative units were 6 Hospitals, 32 Health centers, and 1 regional health bureau, 10 sub city/woreda health offices respectively.

3.3. Study design

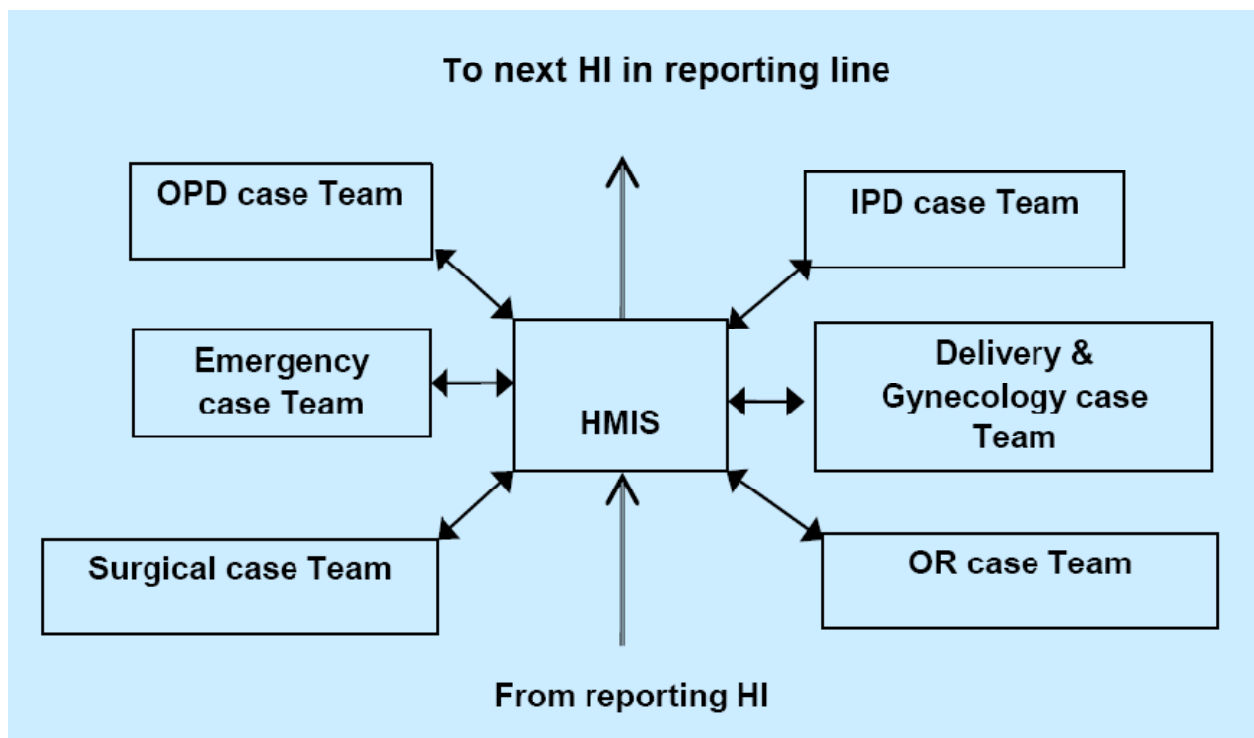
A cross-sectional study was conducted in Addis Ababa, Ethiopia, to assess the Design and Implementation of HMIS in the Public Health Facilities of Addis Ababa Health Bureau. The study was carried out from December 2011- June 2012

3.4. HMIS data flow in the various case teams with in health institution

The flow of HMIS data and its management setup within the health institution, Health management information system facilitators guide for training of trainers [23] was shown in fig2.

Figure 2

Flow of HMIS data in the various case teams of public health facilities in Addis Ababa Health Bureau, HMIS facilitators guide for training of trainers [23].



Sample was taken from stakeholders under study from the different categories of the study population. Ten, twelve, and fourteen stakeholders were assumed to exist at each administrative unit, health centers, and hospitals respectively. This assumption was based on the fact that most of HMIS data flow to the HMIS unit after it was registered and compiled by these stakeholders and also had direct responsibility to process, compile, and generate routine HMIS reports. The stakeholders included were listed in Table 2;

Table 2

The study units from the sample units included in the study, at Addis Ababa health bureau, in 2012.

Administrative unit/level	Service Provider unit/level
RHB and Sub-city/WoHo	Hospital/ HC level
HPPD (Head of Program & Planning Department)	HMIS unit/case team/ on behalf
Head of Epidemiology	Medical director
Head of Family Health	General OPD
Head of HMIS unit/officer	Delivery room/operation room
Statistical personnel	Laboratory, Dispensary
Supervisors	Statistician, data clerk,
Other relevant respondents	Other relevant respondents

3.5. Sample size determination

The sample size was calculated using single population proportion with the following assumptions.

P = 20% assumed that the proportion of population utilizing HMIS generated information for decision making at various level.

D = 5% degree of precision, 95% Confidence Interval, and $\alpha = 5\%$.

$$n = \frac{(Z_{\alpha/2})^2 P (1-P)}{D^2}$$

Based on the above assumptions, and adding 5 % non-response rate was added. And hence, the total calculated sample size was 258 stakeholders from the different categories.

The above assumption was made particularly based on researches conducted so far on assessment of utilization of Health Information System at district level with particular emphasis to HIV/AIDS program in North Gondar Zone Amhara National Regional State by GASHAW ANDARGIE in June, 2006. The result of the research by Gashaw [5] shows 22.5% utilized health information system for decision making.

3.6. Sampling procedure

Since it was very difficult to include all the service providers and administrative units found in the study area within the time and resources available for the study, private and Non-governmental health facilities were excluded from the study.

Private and Non-governmental health facilities were excluded due to the fact that, their services were very expensive and not affordable by majority of the population. Thus, a decision was made only to include those facilities whose services consider the economic status of the population, affordability, equity and accessible by majority of the population in the community. Hence, only public health facilities were included in the study.

Even though, the private and Non-governmental health facilities were excluded it was also difficult to include all the public health facilities and administrative units found the in the study area within the time and resource available for this study. Thus, a decision was made to randomly select 16 health service providers which account (42.1%) and 5 administrative units which is (45.5%). A total of 21 or 42.9% sample units were included in the study from the study population.

The sample units included in the study were selected separately from the two categories of the study population. This was because of the assumption that sampling from homogeneous population reduces sampling error, and hence the study populations are grouped in to different levels according to the service they are providing, the tasks performed by their respective HMIS units, and management and utilization of HMIS related data. The sample unit comprises of 13 or 40.6% Health Centers, 3 or 50% Hospitals, and 1 or 100% Regional Health Bureau, and 4 or 40% Woreda Health offices. The Regional Health Bureau was directly included in the study because there is only one Regional Health Bureau in the study population.

From the first category (Health service providers), all case team leaders, HMIS focal person, and head of the service providers of the selected health service providers (Hospitals & Health centers), were directly communicated to fill the questionnaire. The other respondents included in the study were stakeholders which are available at the hospital or health center at the time of data collection.

From the second category (administrative units), head of the bureau or office, HMIS focal person, supervisor, and statistical personnel of the selected administrative units (RHB & WoHo), were directly communicated to fill the questionnaire. The rest respondents were stakeholders which are available at the bureau or office at the time of data collection.

Figure 3

Schematic presentation of sampling procedure from the study populations in the study area

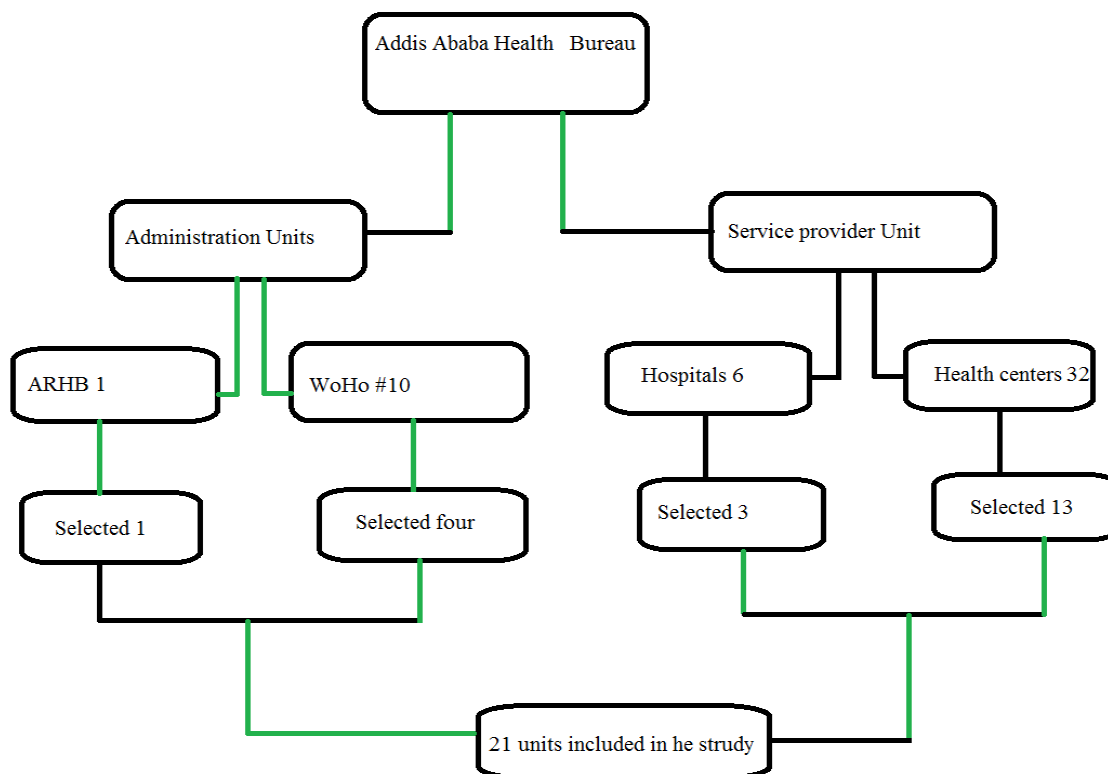


Table 3

Sample units included in the study for assessment of HMIS design and implementation, at Addis Ababa health bureau, in 2012.

Study units	Type	Number	Ownership
Regional Health Bureau	Administrative	1	Government
Woreda/district Health Bureau	Administrative	4	Government
Hospitals	Service provider	3	Government
Health Centers	Service provider	13	Government
Total		21	

3.7. Recruitment and training of data collectors and supervisors

Five data collectors and two supervisors were recruited. The supervisors were responsible to lead the whole data collection process. They were dedicated to check the data collected for consistency, completeness, editing, and suspicious of irregularity. The data collectors were responsible for administering and collecting data collection tools, clarifying unclear and ambiguous things. Training was given for both data collectors and the supervisors for three days before the pretest and a day after the pretest. The training includes a briefing on the general objective of the study; a discussion on the methodology in relation to reaching the intended goals.

3.8. Assessment framework

Before developing the data collection tool extensive review of relevant literatures were conducted to identify the variables included in the study and set a standard or framework for the assessment. The identified factors and their issues in literature would be used for integration into the framework developed for this research. The assessment framework used and variables for this research was adapted from frameworks developed by different scholars and used by different researchers to assess HMIS in different countries [10, 16, 17, 18]. The adaption was made with the consideration to respond the research question and objective stated in this research. The assessment framework for this research was depicted as shown below in Table 4.

Table 4

Framework applied at Addis Ababa health bureau, in Ethiopia for assessment of HMIS design and Implementation, in 2012

Technical	Organizational	Behavioral	Human capacity	Information system process
Data collection tools	Organizational structure	Knowledge	Adequacy of HMIS team	Regularity of upward reports
Reporting tool	Functions	Skill	Availability of HMIS focal person	Practice of feedback reports
Technology	Management	Values	Availability of supervisor	Procedure for data verification
	Roles and responsibilities	Motivation	Adequacy of training	Data analysis
	Information culture		Advocacy on information for action	

The adapted framework for this research was used to describe the design and implementation of HMIS in the public health facilities at Addis Ababa Health Bureau in terms of Technical, Organizational, Behavioral, Human capacity and Information system process.

Technical determinant: these can be described in terms of data collection and reporting tools and technology. Since these was used to assess the overall design of the system used for HMIS (whether manual or computerized) and the communication method used to transfer reports to the higher levels by this it was related with the design of HMIS.

The other part of the developed framework was used to develop data collection tools that helps to identify availability of separate HMIS unit, adequate functionality of the unit, availability of adequate resources both in material and qualified man power, availability of capacity building programs for the staff and also helps to identify the status of using the generated information from the existing system for health care planning and decision making by higher levels they are related with assessment of HMIS implementation in the study area.

3.9. Data collection Instruments and procedures

Data were collected by the use of open-ended questionnaires for qualitative data collection, closed-ended questionnaires for quantitative data collection; analysis of certain documents and secondary data obtained from Addis Ababa RHB (average data quality Lots Quality Assurance Sampling (LQAS) scores found on the service delivery reports of the year 2003 EFY of the facilities included in the study) were the methods used for data collection. The secondary data from service delivery reports of the facilities included in the study was used as a proxy for measuring quality of HMIS data. This was selected due to the fact that service delivery report was the major report prepared by health facilities monthly and it was the only one that includes data quality (LQAS) score computed by HMIS focal person at the facility and also it was easily accessible as secondary data from the reports of the facilities at Addis Ababa health bureau. The questionnaire for this research was developed by following the framework developed for this purpose.

3.10. Data entry and analysis

Data was entered, cleaned, and analyzed using SPSS version 16.0 software. Descriptive statistics were computed for most of the study variables and frequency distribution tables were used to describe most of the findings.

Missing values for categorical data was handled by replacing with modal values of the data and mean was used to avoid missing values of numerical data. Correlation and Pearson's correlation coefficient with two tailed test of significance was used as a statistical method to determine the association and level of significance between the variables.

Average HMIS data quality (LQAS) scores of the included health facilities obtained from Addis Ababa regional health bureau as secondary data was coded into SPSS as the value for quality of HMIS data. The dependent variable quality of HMIS data was then analyzed in harmony with responses of the respondents for the selected variables in a way to identify the association and average quality of HMIS data.

For-example to identify the association between knowledge of HMIS concept and quality of HMIS data, the responses of six questions which are used as proxy for measuring the knowledge of respondent's about HMIS concept was used and analysis was done and the average quality of HMIS data for those respondents who correctly answered fifty percent and above (three or more) and those correctly answered below fifty percent (two or below) of the questions was identified along with the respective values of Pearson's correlation coefficient (r) and level of significance (p -value).

3.11. Study variables

Dependent variable: Quality of HMIS data

Independent variables:

- Technical determinants (data collection and reporting tools, Maintenance, communication, Hardware)
- Organizational determinants (organizational structure, functions, management, roles and responsibilities, information culture)
- Behavioral determinants (Knowledge, Skill, values, motivation)
- Human capacity (Adequacy of team, HMIS focal person, availability of supervisors, adequacy of training, advocacy on information for action)
- Information system process (regularity of upward reports, practice of feedback reports, procedure for data verification, data analysis)

The independent variables included in this study include points which are used to determine the design of HMIS, implementation of HMIS and quality of HMIS data.

3.12. Data quality assurance

All collected data were checked for completeness, accuracy and consistency by the supervisors and principal investigator. At the time of data collection anything, which was unclear and ambiguous, was corrected by the data collectors. On daily bases 10% of collected samples were rechecked by the investigator to ensure proper implementation of the data collection process.

3.13. Operational definitions

Quality of data: Quality of data refers to the degree to which the data or statistics measures what was intended to be measured when the data collection system was designed. Data quality is multidimensional with every step from designing to decision making having the ability to affect the level of quality Krishnan [17].

Design of HMIS

Design of HMIS in this research can be described in terms of the technology used and related problems.

Technology: can be further explained by the system used for HMIS and the communication means used to transfer reports to their respective higher levels. Furthermore, the system used for HMIS can be described in terms of: comprehensiveness (includes all the required indicators), usability, user-friendliness, report generation and the problems observed on the system as a whole and on routine HMIS data collection and reporting tools.

Implementation of HMIS

In this study implementation of HMIS can be illustrated by general coverage of HMIS in the study area, quality of HMIS data and factors affecting the quality of HMIS data and their associations. Moreover, it can be described by the status of using the information generated from the existing system for health care planning and decision making, availability of separate unit for HMIS and adequate functionality of the unit, availability of adequate resources both in material and qualified man power at the unit, capacity building programs for the staff, availability and use of communication technologies like Local Area Network and internet and existence of data quality checking technique.

Thin client network: Ernest discusses Hinkle work in his research [24] a thin client network is a server-based network where the majority, if not all, of the processing is done by the server rather than by the individual client machines. Software applications and programs are held and run on the server, and displayed on the client machine. The term thin is derived from the small or "thin" amount of processing done on the client and this is opposed to a "fat" client where most of the processing is carried out on the client machine.

Administrative Units: - regional Health Bureau and sub-city Health offices (Woreda Health Office)

Service provision units or Health facilities: - Hospitals and Health centers

Decision making - is defined as the capacity to formulate alternatives, estimate effects, and make choices using information at all units and departments

Stakeholders: - Health professionals, data clerks, statistics personnel, and data collectors of the health sector.

Operating room: a facility that is equipped for performing surgery. Abbreviated OR.

3.14. Ethical clearance

The study was carried out after getting permission from the Research and Ethics Review committee of Addis Ababa University School of public health. Data was then collected after getting written consent from Addis Ababa Regional Health Bureau. Informed verbal consent was obtained from all study participants. Each study subjects was discussed about the objective of the study and privacy was maintained during data collection.

CHAPTER FOUR

4. Findings of the study

The findings of the study were presented in an incorporated manner of qualitative and quantitative data. The quantitative results on each outcome measure used in the assessment are reported and explored by the qualitative results. This approach in reporting the results helps in understanding the results of the study and especially that the two methods (quantitative and qualitative) were designed in such a way that the results would be complementary.

From the administration category out of 10 sub-city Health offices and 1 Regional Health Bureau, and from service providers category out of 6 Hospitals and 32 Health Centers available in Addis Ababa Health Bureau, 5 administration units (4 sub-city health offices and 1 RHB) which accounts about (45.5%) of the administration units, and 16 service providers (3 Hospitals and 13 Health centers) corresponding to (42.1%) were included in the study. Within these categories, administration and service providers 247 respondents were identified and included in the study.

The sex distribution of respondents in the study units showed that 185 (74.9 %) were males while 62 (25.1 %) were females. Among the total majority of the respondents or 134 (54.3 %) were within the age of 21 to 30 years old and 95 (38.5 %) of them had 3 to 5 year of services.

Distribution of respondent's level of education showed that diploma constituted 80 (32.4 %) Bachelor holders 155 (62.8 %), Masters Holders 4 (1.6%), and Doctorate constitute 8 (3.2 %).

Table 5

Socio-demographic characteristics of respondents in both administrative and service provider category, at Addis Ababa Regional health Bureau, 2012

		Frequency	Percent (%)
Gender	Male	185	74.9
	Female	62	25.1
	Total	247	100
Age	21-30	134	54.3
	31-40	100	40.5
	41-50	10	4.0
	51-60	3	1.2
	Total	247	100
Year of Service	Below 3 years	52	21.1
	3-5 years	95	38.5
	6-10 years	56	22.7
	11-15 years	24	9.7
	16-20 years	5	2.0
	Above 20years	15	6.1
	Total	247	100
Level of Education	Diploma	80	32.4
	Bachelors	155	62.8
	Masters	4	1.6
	Doctorate	8	3.2
	Total	247	100

Two hundred forty seven (247) respondents were expected to collect data in the study areas, 197 from service provider category comprising of 41 from Hospitals, and 156 from Health centers, and 50 from administration category corresponding 6 from Regional Health Bureau and 44 from Sub-City/Woreda Health Office.

Table 6

Distribution of respondent from the included sample units by category, at Addis Ababa health bureau, 2012

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	RHB	6	2.4	2.4	2.4
	WoHo	44	17.8	17.8	20.2
	Hospital	41	16.6	16.6	36.8
	HC	156	63.2	63.2	100.0
	Total	247	100.0	100.0	

Availability of separate HMIS unit

Results from the study revealed that 13(81.7 %) of service providers had separate HMIS unit which were responsible to analyze and collect data registered by the health professionals from different case teams. All (5) of the administrative categories included in the study had a separate personnel specifically assigned for HMIS data collection from their respective service providers and to process the collected data. But 3(18.2%) of the visited service providers did not have separate HMIS unit at the time data was collected for this study. Availability of separate HMIS unit was higher for hospitals 100% as compared to health centers (76.9%).

However, these finding was based on 5 administrative units (1 RHB and 4 WoHo) and 16 public health service providers from 3 hospitals and 13 health centers. From the service providers included in the study, all the 3(100%) of Hospitals had a separate responsible unit for HMIS and 10(76.9%) of Health centers.

Table 7

Separate HMIS unit at service providers included in the study, at Addis Ababa health bureau, 2012

Service providers	Existence of separate HMIS unit at Health Facility		Total
	Yes	No	
Hospital (N=3)	3(100%)	0(0%)	3(100%)
HC (N=13)	10 (76.9%)	3(23.1%)	13(100%)
Total	13(81.7%)	3(18.2%)	16(100%)

Distribution of HMIS staff at health facilities

Health facilities were expected to have one HMIS officer/ focal person, one Data encoder and one statistician as per the HMIS guideline. Results from the study revealed that the distribution of HMIS unit staff in the in charged health facilities was not adequate. Only (39.6%) of health facilities had HMIS officer/focal person, (22.3%) data encoder, (21.8%) statistician and (16.2%) secretary plus data encoder with responsibility of both secretary of the facility and data encoder.

Table 8

Distribution of HMIS unit staffs at public health facilities from the included sample units, at Addis Ababa health bureau, in 2012.

	Position of the staff at the unit	Frequency	Frequency %
Staffs at the HMIS unit	HMIS officer	78	39.6%
	Data encoder	44	22.3%
	Statistician	43	21.8%
	Secretary and data encoder	32	16.2%
	Total	197	100.0%

Availability of computer for routine HMIS data processing

The availability of computers that can be used for routine HMIS data processing and its adequacy were assessed from the in charged facilities and the study revealed that no changes observed on the existence of computers in the study units with separate unit for HMIS and without. All (100%) administrative and service provider category had computer for routine HMIS data processing, but 56.9% of respondents agree that the available computer was not adequate, since the computers are used for other purpose in addition to HMIS data processing.

Availability of internet connection and its use

Using communication technologies like the internet and LAN to transfer reports to the higher levels was very important and the information culture of the responsible stakeholders were improved and motivated by their work since it reduces time, and the cost invested for buying resources. Currently FMOH was providing CDMA (Code Division Multiple Access) wireless internet connection device for all administrative and service providers. All the administrative units included in the study have got the device, but only 14 (87.5%) of health facilities had the device and access to internet connection, and 2 (12.5%) do not. From health facilities which had an internet access (91.8%) use the connection to transfer reports to their respective higher level, (5.3%) and (2.9%) use the connection to search for electronic documents and to share patient records in addition to transferring reports respectively.

Availability of LAN

Availability of Local area network at the health facilities was assessed in the facilities included in the study. It was found that majority of the service providers 10(62.5%) do not have local area network at their facility.

Availability of automated HMIS software

An assessment was done on availability of automated health management information system software. The study revealed that (100%) of both administrative and service provider category had automated eHMIS software which was developed and deployed by Tulane University in collaboration with FMOH.

Besides, the opinions of the respondents were assessed on whether the current system was enough to support the needs of the health facility and higher levels. The qualitative finding of the study revealed 105 (53.3%) of the respondents from service providers responded it was enough to support the needs of the health facility and higher levels, and 92 (46.7%) of the respondents did not agree and identified some problems. The problems identified by the groups those who did not agree were the current eHMIS software does not include PMTCT and VCT for 1 to 4 age, the analysis part of the existing system doesn't include further statistical analysis it only shows charts, blank space was not available for unregistered diseases instead it says others. In addition, problem of registration by the professionals due to inconveniency of the HMIS formats, and the recently included HMIS indicators for some diseases were not included, were reported as the major problems of the current eHMIS.

Furthermore, Shortage of capacity building program, parallel reporting, and professionals doesn't accept the system they saw as additional work burden are among the observed problems reported by the respondents.

Although, respondents were asked about the design of the current system and analysis was done. The qualitative result of the study showed that (76.6%) the current system was easy to use, (19.8%) it is comprehensive, (3.6%) difficult to operate, and nothing was said about user friendliness of the system.

Table 9

Opinions of respondent's included in the study towards the existing system used for HMIS, at Addis Ababa health bureau, in 2012.

		Frequency	Frequency %
Respondents opinion towards the current system	Comprehensive	39	19.8%
	User friendly	0	0%
	Easy to use	151	76.6%
	Difficult to operate	7	3.6%
	Total	197	100.0%

Capability of existing system to generate report

The capability of the current system to generate the appropriate and required report, and the problems that may limit the system performance was assessed and analysis was done. The qualitative result of the study showed that (92.9 %) no problem at all (the current system generate the appropriate and required report in timely manner). The major problem of the system to generate the report was found to be the skill of the system users (7.1%).

Table 10

Capability of the existing system to generate the appropriate and required report in timely manner and the problems reported by the respondents included in the study, at Addis Ababa health bureau, in 2012

		Percent (%)	Total (%)
Problems to generate the appropriate report in timely manner	The skill of the system users	7.1%	7.1%
	The design of the system and skill of the users	0 %	0 %
	No problem at all	92.9%	92.9%
	Total	100%	100%

About availability of IT/ICT staff at health facilities and their responsibility

IT/ICT staffs at health facilities had a vital role for the implementation of new technologies related with computer system. Currently majority of health facilities were using a computer system to facilitate their work and to provide better service for the clients/patients. Eventually, IT/ICT staffs at health facilities could have different responsibilities.

Thus, availability of ICT/IT staff and their responsibility at health facility from 197 respondents was asked and analyzed. The result showed that majority, (69.5%) of health facilities had IT/ICT staff. 138(70.1%) of the respondent's from service provides included in the study reported IT/ICT staffs at their health facility, were responsible to manage patient data, manage network, support health professional and maintain and upgrade computer hardware and software and 59(29.9%) of the respondents did not identify the responsibilities of IT/ICT staffs. From the respondents who identified, managing patient data (51.8%) was reported as the major responsibility of IT/ICT staffs.

Table 11

Responses of respondents included in the study on responsibilities of IT/ICT staffs, at Addis Ababa health bureau, in 2012.

		Frequency	Frequency %
Responsibility of ICT staff	Maintain and upgrade computer hardware and software	5	2.5%
	Support the health professionals	11	5.6%
	Manage network	20	10.2%
	Manage patient data	102	51.8%
	Total yes's from 197 respondents	138	70.1%

Adequate availability of HMIS data collection and reporting tools and related problems

The adequate availability of HMIS data collection and reporting tools and the problems with the existing HMIS tools was assessed. The result of the study revealed 79.2% respondents from the in charged facilities agreed the adequate availability of HMIS data collection and reporting tools. 16.8% of the respondents did not agree and identified the inadequate tools with the respective case teams and related problems.

However, HMIS data collection tools at OPD and ART was reported as inadequate tools. In addition, repetition of registration due to most of the tools have similar attributes, data collection using tally sheets was not suitable for users because it was not written in bold leading professionals to register inaccurate data, and the line spacing of data collection tools was not suitable for registration since it was very squeezed were reported as the major problems with HMIS data collection and reporting tools.

Data quality checking mechanism and frequency done

HMIS officer/focal person has different roles at the health facility these were conducting random data accuracy check, collect all the records from different case teams and compile into one complete format, make sure all the records are readable, facilitate review of compiled data by the performance review team of the facility, and send approved report data to the next level. Assessment was done to identify the existence of data quality checking mechanism and the how often done.

The result from the study showed that all or 100% of facilities had data quality check mechanisms and perform the quality check monthly. The mechanism used to check the data quality by all of the in charged facilities was LQAS (Lots Quality Assurance Sampling) technique.

Factors affecting the quality of HMIS data

Factors that affect the quality of HMIS data and decision making was assessed from **197** respondents of the in charged facilities and analyzed. The result showed that 176(89.3%) of the respondents reported availability of adequate material, knowledge of HMIS, availability of HMIS focal person, accountability and responsibility of concerned bodies, the system used, availability and adequacy of training, and availability of supervision as factors that affect quality of HMIS data and decision making. Knowledge of HMIS concept 16.8% and availability and adequacy of training 13.7% was reported as the major factors that affect the quality of HMIS data-see Table 12.

Table 12

Factors affecting quality of HMIS data and decision making reported by the respondents from the service providers included in the study, at Addis Ababa health bureau, in 2012 .

		Frequency	Frequency N %
Factors affecting HMIS data quality	Availability of adequate material	25	12.7%
	Knowledge of HMIS	33	16.8%
	Availability of HMIS focal person	22	11.2%
	Accountability and responsibility	25	12.7%
	The system used	19	9.6%
	Availability and adequacy of training	27	13.7%
	Availability of supervision	25	12.7%
	Total yes's from 197 respondents	176	89.3%

Implementation of HMIS

Assessment was done at the administrative category of the health sector at Addis Ababa health bureau to identify the availability of training guideline and job description, capacity building program, and the adequate functionality of HMIS unit at their office and analysis was done.

The study showed that implementation of HMIS in both administrative and service provider category covered (100%), but the adequate functionality of the HMIS unit was not agreed by all of the respondents, only (64%) of respondents agreed with adequate functionality of HMIS unit, (8%) disagreed, and (6%) strongly disagreed.

However, Availability of integrated data store, implementation of eHMIS, availability of internet connection, and availability of training were the major reasons of the respondents who had agreed on the adequate functionality of the unit. The reasons for those who disagreed and strongly disagreed was found to be staff turnover, poor commitment, lack of motivation, workload of the staff, lack of adequate man power, and shortage of resources like computers was reported as the major once.

Table 13

Functionality of HMIS unit reported by the respondents of administrative categories included in the study, at Addis Ababa health bureau, in 2012.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	11	22.0	22.0	22.0
	Agree	32	64.0	64.0	86.0
	Disagree	4	8.0	8.0	94.0
	strongly disagree	3	6.0	6.0	100.0
	Total	50	100.0	100.0	

(80%) and (88%) of the respondents from administrative category agreed that availability of capacity building program and clearly defined training and job description guideline of the staffs at their respective office respectively and (61.5%) of the respondents identified the major capacity building programs. The major capacity building programs identified by the respondents were (38.5%) short term training, (16%) supervision and (8%) high level training.

Report preparation of health facilities and problems observed on the reports of facilities

The respondents from administrative categories included in study were asked about report preparation of the health facilities, and the problems observed on the reports. The qualitative result of the study revealed that (76%) of the health facilities prepare their reports in timely manner as it was planned. 98% of the respondents from the administrative category included in the study reported report delay, incompleteness and inconsistency as a problem of health facilities. The major problems observed on the reports of health facilities were found to be incompleteness which accounts (56%) of the problems observed on reports of health facilities.

Table 14

The problems observed on the reports of health facilities, reported by the respondents included in the study, at Addis Ababa regional health bureau, in 2012

		Frequency	Frequency %
Problems observed on the reports of health facilities	Report delay	14	28%
	Incompleteness	28	56%
	Inconsistency	7	14%
	Total Yes's from 50 Respondents	49	98%

The frequency and use of reports for health care delivery decision making and planning

Although, the frequency of using reports for planning and decision making was assessed and analysis was done. The study revealed (78%) of the respondents in the in charged administrative units always use the reports of health facilities for health care delivery decision making and planning, (18%) rarely, and (4%) of the respondents said do not totally use the reports for health care delivery decision making and planning.

The frequency and assistance received for higher levels and NGOs

The frequency and assistance received from higher levels was assessed from the administrative category and analysis was done. It was found that mostly (96%) of the assistance received was rarely and only (4%) had regular program. The major assistance received was found to be training (44%)-See Table 15.

Table 15

Assistance received from higher levels and NGOs to strength HMIS reported by the respondents included in the study, at Addis Ababa health bureau, in 2012.

		Frequency	Frequency %
Assistance received from higher levels	Training	22	44%
	Feedback	14	28%
	Research	0	0%
	Supervision	14	28%
	Total	50	100.0%

The major HMIS logistics which are in scarce

The in charged administrative category respondents were questioned about shortage of HMIS logistics at health facilities and to identify the major once. The result of the assessment revealed that majority (86%) of the respondents agreed the adequate availability of HMIS logistics at health facilities. (14%) of the respondents reported there is a shortage of logistics and identified computer, OPD tally sheets, HMIS formats, HMIS manual, and ART registration books as the major once.

Table 16

Shortage of logistic at the HMIS unit of health facilities included in the study, at Addis Ababa health bureau, in 2012

		Frequency	Frequency %
Valid	Yes	7	14.0
	No	43	86.0
	Total	50	100.0

The result of the assessment conducted about the availability of regular program for supervision, and its frequency, availability of check list, and the responsible units for supervision on the respondents of the administrative category showed that (66%) of the respondents said there is a regular program for supervision.

However, the frequency of supervision most of the time (56%) was found to be quarterly, (60%) of the respondents agreed on the availability of supervision check list, and (78%) of supervisions were conducted by organized teams from each department of the bureau.

The relationship between selected variables and quality of HMIS data

An assessment was conducted to determine the average data quality (LQAS) score of the visited health facilities and it was found that the average data quality LQAS score of 2003 was (70.05%). See Table 17. Data quality LQAS score was higher for Hospitals (87.7%) compared to health centers (52.4%).

However, these findings are based on 16 randomly selected health facilities representing (42.1%) of health facilities in Addis Ababa regional health bureau. That includes 3 hospitals and 13 health centers.

Table 17

Data quality (LQAS) score of health facilities included in the study, at Addis Ababa health bureau, in 2012

Health facilities	Data quality (LQAS) score
Hospital (N=3)	87.7%
Health center (N=13)	52.4%
Total/Average (N=16)	70.05%

Relationship between knowledge of HMIS concepts and quality of HMIS data

The relationship between knowledge of HMIS concepts and data quality (LQAS) score was determined by describing understanding of six HMIS concepts or definitions that include long form of HMIS, Indicator, numerator, denominator, threshold, and the number of indicators in the reformed HMIS.

The average answer of the above questions by the respondents was taken as a proxy for measuring knowledge of HMIS concepts. It was revealed that those respondents who correctly defined fifty percent and above (defined three or more of the concepts) had lower data quality LQAS score in both hospitals with average of (87.4%) as well as health centers (52.3%) compared to those defined below fifty percent of the questions (88%) for hospitals and (52.4) for health centers as shown in Table 18. Pearson's correlation coefficient for hospitals ($r = -0.913$) shows that there is a strong statistically significant negative association between knowledge of HMIS concept and quality of HMIS data with ($p = 0.000$) at $\alpha = 0.05$ and also for health centers ($r = 0.77$) shows there is a strong statistically significant ($p = 0.000$) positive association between the variables at $\alpha = 0.05$.

Table 18

The relationship between knowledge of HMIS concepts and data quality LQAS score

	Data quality (LQAS) score		Test result
	Hospitals N = 3	HC N = 13	
Defined 50% and above	87.4 %	52.3%	$r_{Hos} = -0.913, r_{HC} = 0.77$
Defined below 50%	88 %	52.4%	P=0.000

Influence of frequency of training in HMIS on quality of HMIS data

Analysis was done to determine the association of frequency of training on HMIS and HMIS data quality using HMIS training status of the health facility. Assumption was made that where the staffs in the in charge of the facility is trained on HMIS more than once, the facility would be able to have higher data quality (LQAS) scores, compared to data quality (LQAS) score for those trained once would be small.

The result of the study revealed that (87.8%) of the in charged facilities received training in 2003 EFY and the data quality of health facilities who receive training more than once had higher average data quality score (68.3%) as compared with facilities who received training once (57.3%) –see Table 19. There is a positive association among the variables with correlation coefficient ($r = 0.77$) and ($p = 0.000$) showing that there is a statistically significant moderately strong association between the two variables at $\alpha = 0.05$. This shows that as the frequency of training on HMIS increases quality of HMIS data increases and as frequency of training decreases quality of HMIS data would also decrease.

Table 19

The influence of training frequency on data quality LQAS score

	Data quality (LQAS) score	Test result
Trained once	57.3%	$r = 0.77$
Trained more than once	68.3%	$p = 0.000$

Association between supervision and quality of HMIS Data

74.6% of health facilities reported to have been supervised in the past one year. Comparison was made between facilities supervised for half an hour and less compared to those supervised for more than half an hour. The data quality (LQAS) score for facilities supervised for more than half an hour was higher (62.7%) than those supervised for half an hour or less (53%) - see Table 20. Pearson's correlation coefficient ($r= 0.071$) and $p=0.32$ shows that r was not statistically different from 0 at $\alpha= 0.05$, it means that there is no association between the two variables. Conversely, there is no enough evidence to say the two variables are associated and the observed value of r might be due to chance.

Table 20

The association between duration of supervision and data quality (LQAS) score

	Data quality (LQAS) score	Test result
Half an hour and less	53%	$r=0.071$
More than half an hour	62.7%	$p=0.32$

Influence of HMIS focal persons on quality of HMIS data

A focal person is health staffs who has been appointed to deal with the day to day issues related to the HMIS. However, health facilities and sub-city health offices were at liberty to select one among members of staff to deal with HMIS on daily basis. Analysis was done to assess whether the presence of HMIS focal person had an influence on the quality of HMIS data or not. It was found that (70.6%) of facilities had HMIS focal person and the average data quality of facilities having HMIS focal person had a lower average data quality LQAS score (59.3%) compared to those without HMIS focal person (60.8%) as shown in Table 21. Pearson's correlation coefficient ($r= 0.049$) and $p=0.495$ shows that r was not statistically different from 0 at $\alpha= 0.05$, it means that there is no association between the two variables. However, there is no enough evidence to say the two variables are associated and the observed value of r might be due to chance.

Table 21

Presence of HMIS Focal Person on data quality (LQAS) score among Facilities

	Data quality (LQAS) score	Test result
HMIS focal person	59.3%	r=0.049
No HMIS focal person	60.8%	p=0.495

Accountability as a factor on quality of data

The respondents from the in charged health facilities were asked on whether they had been queried by the higher level for delay in sending reports and inaccuracies found in reports sent to the higher level. These questions were used as indicators for measuring accountability of health facility workers to the higher authorities. Queries on data inaccuracies and delays in reporting were analyzed against data quality (LQAS) score. Table 22 shows that average data quality LQAS score (52.6%) for those facilities queried for inaccuracies and (61.3%) for those not queried. Analysis could not be done for delay of reports due to no facility was queried for delay in sending reports for higher levels. The association between accountability of concerned bodies and quality of HMIS data was found to be positive and statistically significant with coefficient of correlation ($r=0.225$) and $p=0.002$ at $\alpha = 0.005$, indicating accountability was one of the factors affecting the quality of HMIS data.

Table 22

Facilities queried for inaccuracy and not queried on data quality LQAS score

	Data quality (LQAS) score	Test result
Queried for in accuracies	52.6%	r=0.225
Not queried for in accuracies	61.3%	p=0.002

4.1. Discussions

This study has tried to assess HMIS design and implementation in public health facilities at Addis Ababa health bureau. In addition the study also tried to show the association between quality of HMIS data and selected variables or important key factors which may affect the quality of HMIS data such as knowledge of HMIS concept, frequency of training, HMIS focal person, duration of supervision, and accountability of concerned bodies.

This study has shown that implementation of HMIS in the study area covered all (100%) the health facilities and health sector administrative units. The finding of this study was higher as compared with result reported by the research by Andargie [5] as identified (12%), yet this reference was a bit older. Besides, the study tried to identify the status of administrative units on using the reports of health facilities for health care delivery decision making and planning, the finding of this study showed majority (78%) of administrative units use the reports of health facilities for health care delivery planning and decision making and this shows an improvement in information utilization as compared with the finding of Alganesh [6] as identified 55.2%, and Andargie [5] identified 22.5%.

In this study the average quality of HMIS data in 2011 was found to be 70.05%, this shows that data quality was improved by implementing eHMIS. The average quality of HMIS data at hospitals was higher (87.7%) as compared to health centers (52.4%). The finding of this study showed that the average quality of HMIS data was slightly higher as compared with the results reported as poor quality by BPR assessment of HMIS in Ethiopia as discussed on HMIS facilitator guide for training of trainers [20] and Simba et al [19] as identified (64.2%).

All the hospitals included in the study had separate HMIS unit, but 23.1% of health centers included in the study does not have separate HMIS unit. This might be availability of separate HMIS unit was associated with better quality of HMIS data. This study also tried to show the adequate functionality of HMIS unit, and found that majority (64%) of the administrative units agreed on the adequate functionality of the unit at their respective office by supporting their agreement with reasons. Few of the administrative unit who did not agree also supported their disagreement by forwarding their reasons.

This study has shown that HMIS staffs distribution at health facilities was not adequate and also the staffs were mostly overloaded. In 16.2% of health facilities secretary overtake the task of data encoder in addition to its regular duty. All the administrative and service providers under study had computers for routine HMIS data processing, but the available computers which are used only for HMIS data processing was not adequate. It has showed that HMIS data collection and reporting tools at OPD and ART was reported as inadequate. Besides, the study also identified the problems related with the existing data collection tools. More generally, the resources available both in material and qualified manpower in the study area was not adequate this was also observed by Woldemariam et al [3].

The study has also shown that, majority of the health facilities in the study area had an internet connection and those of health facilities which had internet access use the connection to transfer reports to the higher levels 91.8%, and few of them use the connection to search for electronic documents 5.3% and to share patient records 2.9%. Besides, the study tried to identify the availability of LAN and found that, in most (62.5%) of the health facilities the computers were not connected in LAN.

Currently, all public health facilities and administrative units included in the study had automated eHMIS software which was developed by Tulane University in collaboration with FMOH. This shows the use of computerized system in the health sector was becoming prominent and has an immense benefit for improved health care delivery. Moreover, the study also tried to assess the capability of the existing system and found that, the existing eHMIS software was more or less enough to support the needs of the health facility and higher levels. However, some problems were identified on the design of the existing eHMIS software.

Furthermore, the result of the study showed that the design of the current system used for HMIS was easy to use and comprehensive. However, some of the respondents assumed the system as it was difficult to operate this depends on the skill of the users and acceptance of the system by the professionals.

The study showed that majority 92.9% of the respondents agreed that the system used for HMIS generates the appropriate and required reports in timely manner. However, the major limiting factor to generate the required report was found to be the skill of the system users, this might be due to shortage of training on the system.

In addition, the result from the administrative unit included in the study has shown that majority of health facilities prepare their reports timely as planned in the standard and also the problems observed on the reports of the health facilities were identified. Incompleteness was found to be the major problem observed on the reports of the health facilities.

The study has showed that, majority of the health facilities had IT/ICT staff and they were mostly responsible to manage patient data at the facility.

Although, the study has tried to identify the part of the current system that needs to be modified and customized and the study disclosed the parts which needs to be modified to full fill the needs of the users and the health facility.

The study showed that all health facilities under study perform data quality checking every month by using LQAS (Lot Quality Assurance Sampling) technique as data quality checking mechanism.

The study has shown that availability of adequate material, knowledge of HMIS, and availability of HMIS focal person, accountability and responsibility of concerned bodies, the system used, availability and adequacy of training, and availability of supervision were the factors that affect quality of HMIS data and decision making.

This study has disclosed that knowledge of HMIS concept, frequency of training on HMIS and accountability of concerned bodies has an association with quality of HMIS data, but duration of supervision and availability of HMIS focal person was found to be not associated. The result of the finding by Simba et al [19] also showed Knowledge of HMIS concept and accountability has an association with better quality of HMIS data.

Supervision, regardless of the reported duration and availability of HMIS focal person has shown in this study to have no association with improved data quality. This shows that, there is no enough evidence to say the two variables were associated and the value of Pearson's correlation coefficient r might be due to chance so that, to identify the association between the variables it needs further investigation.

This study has established that Knowledge of HMIS concepts, frequency of training, and accountability earmarked to deal with HMIS issues in daily basis and had an influence of improving quality of HMIS data. In fact more emphasis has to be given for the frequency of training and accountability of concerned bodies respectively.

CHAPTER FIVE

5. Conclusions and recommendations

5.1. Conclusions

In this part of the study conclusions obtained from the study was made.

- Majority of public health facilities in Addis Ababa regional health bureau have a separate HMIS unit responsible to collect and analyze data registered by professionals at the various case teams of the facility. Those facilities having separate HMIS unit have separate computer specifically assigned to perform the task of the unit only and those facilities that do not have a separate HMIS unit, the available computers are used for different task in addition to HMIS data processing. This shows that there is a scarcity of computers for HMIS data processing at the facilities which do not have separate unit for HMIS as compared with those having separate unit.
- Generally, the computers available at the health facilities in Addis Ababa regional health bureau were not as desired and expected. And also the human resource required at the HMIS unit of the health facilities was not up to the standard.
- All of health service providers and administrative units included in the study were using eHMIS software to manage patient data. Furthermore, majority of the respondents said the current system was easy to use and it was enough to support the needs of the health facility and higher levels. And few respondents identified some problems with the existing system related with its design and recommended to be modified or customized. The skill of the system users was found to be the major limiting factor to generate the appropriate and required reports by the system.
- Some of HMIS data collection and reporting tools was not up to the needs of the health facilities. Scarcity of HMIS data collection and reporting tools observed in some departments, in addition problems on HMIS data collection and reporting tools were identified.

- The design of the existing system used for HMIS was reported by majority of the respondents as it was easy to use. Besides, some problems were identified on the system. Thus, generally we can say the design of the system was not comprehensive and complete.
- HMIS data quality checking at the facility was conducted by the HMIS focal person on behalf at the end of every month. The quality checking was performed using LQAS (Lot Quality Assurance Sampling) technique. Some of the factors that affect quality of HMIS data were identified.
- Majority of the respondents responded the adequate functionality of the HMIS unit at their respective office by supporting their agreement with reasons. The result from respondents of administrative unit showed, majority of health facilities prepare their reports with the specified time on the standard. Incompleteness was the major problem observed on the reports of health facilities.
- The association between selected variables and quality of HMIS data was identified and it was found that knowledge of HMIS concept, frequency of training, and accountability of concerned bodies had a statistically significant association. In the other hand duration of supervision and availability of HMIS focal person did not have association with quality of HMIS data.

5.2. Recommendations

From the findings of this study, the following recommendations are forwarded.

- It is important to identify the capacity requirement of the HMIS unit at all levels, the resource needed and staff requirement including qualification should be up to the standard developed to improve and insure the data collection and information generation of the unit.
- The functional support of health professionals and health managers was indispensable to minimize the recording of inaccurate data and build accountability to exploit the potential opportunity that exists and reduce the undermining of the importance of HMIS. Thus, health professionals and health managers at various levels need to be motivated and encouraged in order to make them committed and accountable to their work.
- Furthermore, the skills of the system users should be improved through frequent and continuous training, developing their awareness and knowledge of HMIS.
- The problems related with the design of the existing system used for HMIS and HMIS data collection and reporting tools should have to be solved by incorporating the requirement of the users. Duplicate registration of data on different data collection tools have to be avoided to minimize time spent to fill too much forms and minimize the workload of health professionals.
- In this research, secondary data from service delivery reports of the included health facilities was used as a proxy measure for quality of HMIS data. Thus, the researcher recommends conducting related research by using the data quality result of other reports.
- Before implementing this technology, this study recommends conducting research to identify the component of thin client network and to model a thin client network intra health facility based on thin client technology using the identified components, and in addition, assessing the potential of the workers in the health sector on the use of basic computer application.

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Annexes

Questionnaires

Dear respondent,

This questionnaire is designed to collect data for a research entitled “The assessment of HMIS Design and Implementation in Ethiopia: the Case of Selected Public Health facilities in Addis Ababa Health Bureau”. The researcher kindly requests your participation in filling this questionnaire because your participation (by giving clear and accurate answer) is very important for the realization of this study. Please be sure that all the information provided in this questionnaire will be used for the research purpose only and treated with at most confidentiality, you are not obliged to answer any questionnaire item that you do not want to answer. Your participation in this study does not involve any direct risk or benefit for you but it is very useful since your answers, and those of other participants will help to improve the problem related to HMIS in health sectors.

NOTE: The questionnaire is divided in to three parts, **PART I:** to be filled by all of the respondents, **PART II:** administrative level only to be filled by the respondents who belong to Regional Health Bureau and/or Woreda/District offices, and **PART III:** service provider level questionnaires to be filled by respondents who are from Hospitals and/or Health Centers. Please do not write your name.

PART I:

BACKGROUND INFORMATION (FILLED BY ALL OF THE RESPONDENTS)

1. Sex: Male Female
2. Age: below 20 21-30 31-40 41-50
 51-60 Above 60
3. How long have you worked in the Health sector?
 Below 3 years 11-15 years
 3-5 years 16-20 years
 6-10 years above 20
4. Your current level of academic education:
 Certificate Masters
 Diploma Doctorate
 Bachelors Others Specify) _____
5. Your field of study _____
6. Your current department _____
7. your position in the department _____
8. To which administrative category do you belong?
 Regional Health Bureau Woreda/District
9. To which service provider category do you belong?
 Hospitals Health Centers

PART II:

QUESTIONNAIRE COMPLETED AT ADMINISTRATIVE LEVEL (BY THE RESPONDENTS WHO ARE FROM REGIONAL HEALTH BUREAU AND/OR WOREDA OR DISTRICT LEVEL)

1. Do you have a responsible unit for HMIS at your bureau or office?

Yes No

2. Is there any HMIS staff capacity building program?

Yes No

3. If the answer for question 2 is “Yes”, list the major once.

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

4. Is there a clearly defined and written guideline on training and job description of the staffs in HMIS unit?

Yes No

5. Do you think the HMIS unit in your bureau functions adequately?

Strongly Agree Agree Disagree Strongly Disagree

6. For your answer at question number 5, mention the top five reasons, if any

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

7. Do health facilities prepare the required report as planned and in timely manner?

Yes No

8. What problems are observed on reports of health facilities?

Delay Incompleteness/missing some indicators Inconsistency

9. How often do you use the reports for planning and decision making?

Always Rarely Not at all

10. What assistance have you received from FMOH or higher levels to make your HMIS unit strong and meet its objective? How frequent?

	Regularly	Often/frequently	Rarely
Training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Feed back	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Research	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Supervision	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. Where does most of the data collection, and data analysis made?

At the sub city level At health facility level
 At regional level Not included

12. Do HMIS units of Health facilities have a shortage of logistics like: registers, forms, data books, computers, and/or other relevant materials?

Yes No

13. If the answer for question 12 is “yes”, specify the major four logistics.

a. _____
b. _____
c. _____
d. _____

14. Do your bureau have supervision check list?

Yes No

15. Do you have regular programs for supervision?

Yes No

16. How often supervision conducted by your bureau?

Monthly Quarterly Yearly Not included

17. Who performs supervision?

Organized team HMIS experts Supervisors Not included

PART III:

QUESTIONNAIRE COMPLETED AT SERVICE PROVIDER LEVEL (BY THE RESPONDENTS WHO ARE FROM HOSPITALS AND/OR HEALTH CENTERS)

1. Do you have a responsible unit for HMIS at your health facility?
Yes No
2. Does your health facility have computer that can be used only for routine HMIS task processing?
 Yes No
3. If the answer for question number 2 is “Yes”, do you think the computers are adequate?
Yes No
4. For what purpose do you use the computers?
 To record or register patient visits To schedules or appoint patients
 For Administration and finance routines Not included in the choice
 To store and retrieve electronic patient information
5. Are the computers networked in a Local Area Network?
 Yes No
6. If the answer for question No. 5 is “Yes”, for what purpose do you use the Local Area Network?
 File and printer sharing To access stored patient record
 Sharing Internet connection Not included in the choice
7. Do you have Internet connection at the HMIS unit?
 Yes No
8. If the answer for question No. 7 is “yes”, for what purpose do you use the Internet?
 E-mail Search electronic documents
 Browse the World Wide Web (WWW) To share patients record
 To transfer reports to higher levels Not included in the choice
9. Do you have automated health management information system software in your health institution?
 Yes No

10. Do you think the current system you are using for HMIS enough to support the needs of the health facility and higher levels like Federal Ministry of Health, Regional Health Bureau, and Woreda Health Office?

Yes No

11. If the answer for question number 10 is “No”, specify the major problems with the existing system.

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

12. How do you see the current HMIS system you are using?

It is comprehensive It is easy to use Not included
 It is user friendly Difficult to operate

13. Does the current system generate the appropriate and required reports in timely manner?

Yes No

14. If the answer for question number 13 is “No”, what is the problem to generate the required report in timely manner?

The design of the system The skill of the system users Not included

15. Do you have IT / ICT staff in your health facility?

Yes No

16. If the answer for question number 15 is “Yes”, what is his/her responsibility?

To maintain and upgrade computers hardware and software
 To support the health professionals while using HMIS software
 To manage network Not included in the choice

17. What type of communication technology your health facility use to transfer reports to higher levels?

Telephone E-mail
 FTP (File Transfer Protocol) Web based applications
 Postal Service Not included in the choice

18. Is there any problem with the existing data collection and reporting tools?

Yes No

19. If the answer for question number 18 is “Yes”, write the major problems with their respective tools.

Name of the tool	The observed problem
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

20. Which part of the system your are using for HMIS, need to be customized or modified to support the needs of the health facility and Other higher authorities write your opinion

21. Is there a shortage of HMIS logistics like, Registers, Forms, data books, reports etc in your Health facility?

Yes No

22. If the answer for question number 21 is “Yes”, write the major once and the departments that use the tool.

Name of the tool	Department
_____	_____
_____	_____
_____	_____
_____	_____

23. Is there data quality checking method at your health facility? If “Yes” how often if “No” go to the next question?

Monthly Quarterly Annually Not included in the choice

24. If the answer for question number 23 is “Yes”, write the technique used to check HMIS data quality if any?

25. Which of the following factors are expected to affect quality of HMIS data and decision making?

- Availability adequate material for HMIS The system used
- Knowledge of HMIS Availability and adequacy of training
- Availability of HMIS focal person Availability of supervision
- Accountability and responsibility of concerned bodies
- Not included in the choice

26. Write the long form of HMIS

27. How many indicators are included in the reformed HMIS to understand the performance of the health system and status of the health resources? _____

28. Write the definition of what indicator is?

29. What is numerator? _____

30. What is denominator? _____

31. What is threshold value? _____

32. Is there a staff who trained on HMIS in 2003 E.C from your health institution?

- Yes No

33. If the answer for question number 32 is “yes” how many times?

- Once more than once

34. Do your HMIS unit supervised by higher levels in 2003 E.C?

- Yes No

35. If the answer for question number 34 is “Yes”, for how long in time?

- For half an hour and less For more than half an hour

36. Is there HMIS focal person in your health facility?

- Yes No

37. Is there a delay on transferring report to the higher level?

Yes No

38. If the answer for question number 37 is “Yes”, does your health facility questioned by higher authorities about delay of reports in 2003 E.C?

Yes No

39. Does Inaccuracies found in your reports sent to the higher levels in 2003 E.C?

Yes No

40. If the answer for question number 39 is “Yes”, does your health facility questioned by higher authorities about inaccuracies observed in your reports in 2003 E.C?

Yes No

Sample HMIS data collection tools

Sample HMIS reporting tools